



**GOVERNMENT COLLEGE OF ENGINEERING, SALEM**  
(NAAC Accredited with A<sup>+</sup>, An Autonomous Institution, Affiliated to Anna University, Chennai)

**UNDERGRADUATE CURRICULUM**

*(Applicable to the students admitted in B.E. Programme, from the Academic Year 2026-2027)*

**Programme:** B.E. Electrical and Electronics Engineering (Full Time)

**Regulations:** 2026

**Overview of Credits**

| Sem                  | BS    | HM   | ES(G) | ES(PC) | ES(PE) | OE   | SD    | MC   | Total |
|----------------------|-------|------|-------|--------|--------|------|-------|------|-------|
| <b>I</b>             | 12    | 3    | 8     |        |        |      | 2     |      | 25    |
| <b>II</b>            | 7     | 3    | 4     | 8      |        |      |       |      | 22    |
| <b>III</b>           | 3     | 2    |       | 19     |        |      |       |      | 24    |
| <b>IV</b>            |       |      |       | 16     |        |      | 1     | 6    | 23    |
| <b>V</b>             |       |      |       | 19     | 3      |      | 1     |      | 23    |
| <b>VI</b>            |       |      |       | 8      | 9      | 3    | 3     |      | 23    |
| <b>VII</b>           |       |      |       | 14     | 6      |      |       |      | 20    |
| <b>VIII</b>          |       |      |       |        |        |      | 10    |      | 10    |
| <b>Total</b>         | 22    | 8    | 12    | 84     | 18     | 3    | 17    | 6    | 170   |
| <b>% of Category</b> | 12.94 | 4.71 | 7.06  | 49.41  | 10.59  | 1.76 | 10.00 | 3.53 | 100   |

**Abbreviations:**

**Course Type:**

**T** - Theory  
**L** - Laboratory  
**LIT** -Laboratory Integrated Theory  
**CDP** - Capstone Design Project  
**PW** - Project Work  
**IOC** – Industry Oriented Course

**Category :**

**BS** - Basic Science  
**HM**- Humanities  
**ES** - Engineering Science [General (**G**)  
Programme Core (**PC**)  
Programme Elective (**PE**)]  
**OE** - Open Elective  
**SD** -Skill Development  
**MC** - Mandatory Course

**Others :**

**L** - Lecture  
**T** - Tutorial  
**P** - Practical  
**SL** - Term work (TW) + Self Learning (SL)  
**TH** - Total Number of Teaching – Learning Hours per Semester

| Semester I |             |                                               |             |                    |    |    |    |     |         |          |           |      |       |
|------------|-------------|-----------------------------------------------|-------------|--------------------|----|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.    | Course Code | Course Name                                   | Course Type | Hours per Semester |    |    |    |     | Credits | Category | Weightage |      |       |
|            |             |                                               |             | L                  | T  | P  | SL | TH  |         |          | CA %      | ES % | Total |
| 1.         | 26ENC01     | Communicative English                         | T           | 45                 | 0  | 0  | 15 | 60  | 2       | HM       | 40        | 60   | 100   |
| 2.         | 26MA101     | Matrices, Calculus and Differential Equations | T           | 45                 | 15 | 0  | 60 | 120 | 4       | BS       | 40        | 60   | 100   |
| 3.         | 26CM101     | Basic Civil and Mechanical Engineering        | T           | 60                 | 0  | 0  | 60 | 120 | 4       | ES(G)    | 40        | 60   | 100   |
| 4.         | 26HMC01     | Heritage of Tamils / தமிழர்மரபு               | T           | 15                 | 0  | 0  | 15 | 30  | 1       | HM       | 40        | 60   | 100   |
| 5.         | 26PHC01     | Applied Physics                               | LIT         | 45                 | 0  | 45 | 30 | 120 | 4       | BS       | 50        | 50   | 100   |
| 6.         | 26CYC01     | Applied Chemistry                             | LIT         | 45                 | 0  | 45 | 30 | 120 | 4       | BS       | 50        | 50   | 100   |
| 7.         | 26CSC01     | C Programming                                 | LIT         | 45                 | 0  | 30 | 45 | 120 | 4       | ES(G)    | 50        | 50   | 100   |
| 8.         | 26MEC02     | Engineering Practices Laboratory              | L           | 0                  | 0  | 45 | 15 | 60  | 2       | SD       | 60        | 40   | 100   |
| 9.         | 26MCC01     | Induction Programme                           | -           | -                  | -  | -  | -  | -   | 0       | MC       | -         | -    | -     |
| Total      |             |                                               |             |                    |    |    |    | 750 | 25      |          |           |      |       |

| Semester II |             |                                                     |             |                    |    |    |    |     |         |          |           |      |       |
|-------------|-------------|-----------------------------------------------------|-------------|--------------------|----|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.     | Course Code | Course Name                                         | Course Type | Hours per Semester |    |    |    |     | Credits | Category | Weightage |      |       |
|             |             |                                                     |             | L                  | T  | P  | SL | TH  |         |          | CA %      | ES % | Total |
| 1.          | 26MA201     | Fourier Series and Transforms                       | T           | 45                 | 15 | 0  | 60 | 120 | 4       | BS       | 40        | 60   | 100   |
| 2.          | 26PHC02     | Materials Science                                   | T           | 45                 | 0  | 0  | 45 | 90  | 3       | BS       | 40        | 60   | 100   |
| 3.          | 26MEC01     | Engineering Graphics                                | T           | 30                 | 45 | 0  | 45 | 120 | 4       | ES(G)    | 40        | 60   | 100   |
| 4.          | 26EE201     | Electric Circuit Analysis                           | T           | 30                 | 15 | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 5.          | 26EE202     | Electronic Devices and Circuits                     | T           | 30                 | 15 | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 6.          | 26HMC02     | Tamils and Technology / தமிழரும் தொழில்நுட்பமும்    | T           | 15                 | 0  | 0  | 15 | 30  | 1       | HM       | 40        | 60   | 100   |
| 7.          | 26ENC02     | Professional English                                | LIT         | 30                 | 0  | 15 | 15 | 60  | 2       | HM       | 50        | 50   | 100   |
| 8.          | 26EE203     | Electric Circuits and Electronic Devices Laboratory | L           | 0                  | 0  | 45 | 15 | 60  | 2       | ES(PC)   | 60        | 40   | 100   |
| 9.          | 26MCS01     | Engineering Sprints                                 | L           | 0                  | 0  | 15 | 15 | 30  | 0       | SD       | 100       | -    | 100   |
| 10.         | 26NCC01     | NCC Course -I*                                      | T           | 30                 | 0  | 0  | 30 | 60  | 2*      | -        | 40        | 60   | 100   |
| Total       |             |                                                     |             |                    |    |    |    | 750 | 22      |          |           |      |       |

\*< Only for NCC Students, it is not considered for CGPA Calculation >

| Semester III |             |                                                   |             |                    |    |    |    |            |           |          |           |      |       |
|--------------|-------------|---------------------------------------------------|-------------|--------------------|----|----|----|------------|-----------|----------|-----------|------|-------|
| Sl. No.      | Course Code | Course Name                                       | Course Type | Hours per Semester |    |    |    |            | Credits   | Category | Weightage |      |       |
|              |             |                                                   |             | L                  | T  | P  | SL | TH         |           |          | CA %      | ES % | Total |
| 1.           | 26MA302     | Statistics and Numerical Methods                  | T           | 45                 | 15 | 0  | 30 | 90         | 3         | BS       | 40        | 60   | 100   |
| 2.           | 26EE301     | Electromagnetic Theory                            | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 3.           | 26EE302     | Signals and Systems                               | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 4.           | 26EE303     | DC Machines and Transformers                      | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 5.           | 26EE304     | Analog and Digital Integrated Circuits            | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 6.           | 26EE305     | Measurements and Instrumentation                  | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 7.           | 26EE306     | DC Machines and Transformers Laboratory           | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 8.           | 26EE307     | Analog and Digital Integrated Circuits Laboratory | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 9.           | 26ENC03     | Placement and Soft Skills Laboratory              | L           | 0                  | 0  | 45 | 15 | 60         | 2         | HM       | 60        | 40   | 100   |
| 10.          | 26MCS02     | Innovation Sprints                                | L           | 0                  | 0  | 15 | 15 | 30         | 0         | SD       | 100       | -    | 100   |
| 11.          | 26NCC02     | NCC Course -II*                                   | T           | 30                 | 0  | 0  | 30 | 60         | 2*        | -        | 40        | 60   | 100   |
| <b>Total</b> |             |                                                   |             |                    |    |    |    | <b>810</b> | <b>24</b> |          |           |      |       |

\*< Only for NCC Students, it is not considered for CGPA Calculation >

| Semester IV  |             |                                                        |             |                    |    |    |    |            |           |          |           |      |       |
|--------------|-------------|--------------------------------------------------------|-------------|--------------------|----|----|----|------------|-----------|----------|-----------|------|-------|
| Sl. No.      | Course Code | Course Name                                            | Course Type | Hours per Semester |    |    |    |            | Credits   | Category | Weightage |      |       |
|              |             |                                                        |             | L                  | T  | P  | SL | TH         |           |          | CA %      | ES % | Total |
| 1.           | 26EE401     | Synchronous and Induction Machines                     | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 2.           | 26EE402     | Power Generation, Transmission and Distribution System | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 3.           | 26EE403     | Power Electronics                                      | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 4.           | 26EE404     | Industrial Management and Economics                    | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 5.           | 26EE405     | Synchronous and Induction Machines Laboratory          | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 6.           | 26EE406     | Power Electronics Laboratory                           | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 7.           | 26MCC02     | Environmental Science and Engineering                  | T           | 45                 | 0  | 0  | 45 | 90         | 3         | MC       | 40        | 60   | 100   |
| 8.           | 26MCC03     | Universal Human Values                                 | T           | 45                 | 0  | 0  | 45 | 90         | 3         | MC       | 40        | 60   | 100   |
| 9.           | 26EEICXX    | Industry Oriented Course - I                           | IOC         | 15                 | 0  | 0  | 15 | 30         | 1         | SD       | 100       | -    | 100   |
| 10.          | 26MCS03     | Design Sprints                                         | L           | 0                  | 0  | 15 | 15 | 30         | 0         | SD       | 100       | -    | 100   |
| <b>Total</b> |             |                                                        |             |                    |    |    |    | <b>720</b> | <b>23</b> |          |           |      |       |

| Semester V   |             |                                               |             |                    |    |    |    |            |           |          |           |      |       |
|--------------|-------------|-----------------------------------------------|-------------|--------------------|----|----|----|------------|-----------|----------|-----------|------|-------|
| Sl. No.      | Course Code | Course Name                                   | Course Type | Hours per Semester |    |    |    |            | Credits   | Category | Weightage |      |       |
|              |             |                                               |             | L                  | T  | P  | SL | TH         |           |          | CA %      | ES % | Total |
| 1.           | 26EE501     | Control Systems                               | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 2.           | 26EE502     | Electrical Machine Design                     | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 3.           | 26EE503     | Power System Analysis and Stability           | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 4.           | 26EE504     | Microprocessor and Microcontroller            | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 5.           | 26EE505     | Electric Drives and Control                   | T           | 30                 | 15 | 0  | 45 | 90         | 3         | ES(PC)   | 40        | 60   | 100   |
| 6.           | 26EEPEXX    | Programme Elective - I                        | T           | 45                 | 0  | 0  | 45 | 90         | 3         | ES(PE)   | 40        | 60   | 100   |
| 7.           | 26EE506     | Control and Instrumentation Laboratory        | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 8.           | 26EE507     | Microprocessor and Microcontroller Laboratory | L           | 0                  | 0  | 45 | 15 | 60         | 2         | ES(PC)   | 60        | 40   | 100   |
| 9.           | 26EEICXX    | Industry Oriented Course - II                 | IOC         | 15                 | 0  | 0  | 15 | 30         | 1         | SD       | 100       | -    | 100   |
| 10.          | 26MCC04     | Disaster Management and Preparedness          | T           | 30                 | 0  | 0  | 30 | 60         | 0         | MC       | 100       | -    | 100   |
| 11.          | 26MCC05     | Indian Constitution                           | T           | 15                 | 0  | 0  | 15 | 30         | 0         | MC       | 100       | -    | 100   |
| 12.          | 26MCS04     | Ideation Sprints                              | L           | 0                  | 0  | 15 | 15 | 30         | 0         | SD       | 100       | -    | 100   |
| <b>Total</b> |             |                                               |             |                    |    |    |    | <b>810</b> | <b>23</b> |          |           |      |       |

| Semester V         |             |                                |             |                    |   |    |    |     |         |          |           |      |       |
|--------------------|-------------|--------------------------------|-------------|--------------------|---|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.            | Course Code | Course Name                    | Course Type | Hours per Semester |   |    |    |     | Credits | Category | Weightage |      |       |
|                    |             |                                |             | L                  | T | P  | SL | TH  |         |          | CA %      | ES % | Total |
| For Honours Degree |             |                                |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EED01     | Capstone Design ProjectLevel-I | CDP         | 0                  | 0 | 90 | 90 | 180 | 6       | SD       | 60        | 40   | 100   |
| OR                 |             |                                |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEHXX     | Honours Elective - I           | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 2.                 | 26EEHXX     | Honours Elective - II          | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| For Minor Degree   |             |                                |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEMXX     | Minor Elective - I             | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| 2.                 | 26EEMXX     | Minor Elective - II            | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| Total              |             |                                |             |                    |   |    |    | 180 | 6       |          |           |      |       |

| Semester VI |             |                                         |             |                    |   |    |    |     |         |          |           |      |       |
|-------------|-------------|-----------------------------------------|-------------|--------------------|---|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.     | Course Code | Course Name                             | Course Type | Hours per Semester |   |    |    |     | Credits | Category | Weightage |      |       |
|             |             |                                         |             | L                  | T | P  | SL | TH  |         |          | CA %      | ES % | Total |
| 1.          | 26EE601     | Power System Protection and Switch Gear | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 2.          | 26EE602     | Power System Operation and Control      | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 3.          | 26EEPEXX    | Programme Elective - II                 | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 4.          | 26EEPEXX    | Programme Elective - III                | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 5.          | 26EEPEXX    | Programme Elective - IV                 | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 6.          | 26XXOEXX    | Open Elective - I                       | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| 7.          | 26EE603     | Electric Drives and Control Laboratory  | L           | 0                  | 0 | 45 | 15 | 60  | 2       | ES(PC)   | 60        | 40   | 100   |
| 8.          | 26EE604     | Mini Project                            | PW          | 0                  | 0 | 45 | 45 | 90  | 3       | SD       | 100       | -    | 100   |
| Total       |             |                                         |             |                    |   |    |    | 690 | 23      |          |           |      |       |

| Semester VI        |             |                                  |             |                    |   |    |    |     |         |          |           |      |       |
|--------------------|-------------|----------------------------------|-------------|--------------------|---|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.            | Course Code | Course Name                      | Course Type | Hours per Semester |   |    |    |     | Credits | Category | Weightage |      |       |
|                    |             |                                  |             | L                  | T | P  | SL | TH  |         |          | CA %      | ES % | Total |
| For Honours Degree |             |                                  |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EED02     | Capstone Design Project Level-II | CDP         | 0                  | 0 | 90 | 90 | 180 | 6       | SD       | 60        | 40   | 100   |
| OR                 |             |                                  |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEHXX     | Honours Elective - III           | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 2.                 | 26EEHXX     | Honours Elective - IV            | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| For Minor Degree   |             |                                  |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEMXX     | Minor Elective - III             | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| 2.                 | 26EEMXX     | Minor Elective - IV              | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| Total              |             |                                  |             |                    |   |    |    | 180 | 6       |          |           |      |       |

| Semester VII |             |                                         |             |                    |    |    |    |     |         |          |           |      |       |
|--------------|-------------|-----------------------------------------|-------------|--------------------|----|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.      | Course Code | Course Name                             | Course Type | Hours per Semester |    |    |    |     | Credits | Category | Weightage |      |       |
|              |             |                                         |             | L                  | T  | P  | SL | TH  |         |          | CA %      | ES % | Total |
| 1.           | 26EE701     | High Voltage Engineering                | T           | 30                 | 15 | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 2.           | 26EE702     | Smart Grid                              | T           | 45                 | 0  | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 3.           | 26EE703     | Solar and Wind Energy Conversion System | T           | 45                 | 0  | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 4.           | 26EE704     | Electric Vehicles                       | T           | 45                 | 0  | 0  | 45 | 90  | 3       | ES(PC)   | 40        | 60   | 100   |
| 5.           | 26EEPEXX    | Programme Elective - V                  | T           | 45                 | 0  | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 6.           | 26EEPEXX    | Programme Elective - VI                 | T           | 45                 | 0  | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 7.           | 26EE705     | Power Systems Laboratory                | L           | 0                  | 0  | 45 | 15 | 60  | 2       | ES(PC)   | 60        | 40   | 100   |
| Total        |             |                                         |             |                    |    |    |    | 600 | 20      |          |           |      |       |

| Semester VII       |             |                                   |             |                    |   |    |    |     |         |          |           |      |       |
|--------------------|-------------|-----------------------------------|-------------|--------------------|---|----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.            | Course Code | Course Name                       | Course Type | Hours per Semester |   |    |    |     | Credits | Category | Weightage |      |       |
|                    |             |                                   |             | L                  | T | P  | SL | TH  |         |          | CA %      | ES % | Total |
| For Honours Degree |             |                                   |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EED03     | Capstone Design Project Level-III | CDP         | 0                  | 0 | 90 | 90 | 180 | 6       | SD       | 60        | 40   | 100   |
| OR                 |             |                                   |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEHXX     | Honours Elective - V              | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| 2.                 | 26EEHXX     | Honours Elective - VI             | T           | 45                 | 0 | 0  | 45 | 90  | 3       | ES(PE)   | 40        | 60   | 100   |
| For Minor Degree   |             |                                   |             |                    |   |    |    |     |         |          |           |      |       |
| 1.                 | 26EEMXX     | Minor Elective - V                | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| 2.                 | 26EEMXX     | Minor Elective - VI               | T           | 45                 | 0 | 0  | 45 | 90  | 3       | OE       | 40        | 60   | 100   |
| Total              |             |                                   |             |                    |   |    |    | 180 | 6       |          |           |      |       |

| Semester VIII                   |             |              |             |                    |   |     |    |     |         |          |           |      |       |
|---------------------------------|-------------|--------------|-------------|--------------------|---|-----|----|-----|---------|----------|-----------|------|-------|
| Sl. No.                         | Course Code | Course Name  | Course Type | Hours per Semester |   |     |    |     | Credits | Category | Weightage |      |       |
|                                 |             |              |             | L                  | T | P   | SL | TH  |         |          | CA %      | ES % | Total |
| 1.                              | 26EE801     | Project Work | PW          | 0                  | 0 | 300 | 0  | 300 | 10      | SD       | 60        | 40   | 100   |
| Total                           |             |              |             |                    |   |     |    | 300 | 10      |          |           |      |       |
| Total Credits of the Programmes |             |              |             |                    |   |     |    |     | 170     |          |           |      |       |

**Programme Electives**

| Sl. No.                               | Course Code | Course Name                           | Course Type | Hours per Semester |   |   |    |    | Credits | Category | Weightage |      |       |
|---------------------------------------|-------------|---------------------------------------|-------------|--------------------|---|---|----|----|---------|----------|-----------|------|-------|
|                                       |             |                                       |             | L                  | T | P | SL | TH |         |          | CA %      | ES % | Total |
| Programme Elective - I (V Semester)   |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| Streams : Advanced Control            |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| 1.                                    | 26EEPE01    | Advanced Control Systems              | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 2.                                    | 26EEPE02    | Nonlinear Control Systems             | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 3.                                    | 26EEPE03    | Optimal Control Systems               | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 4.                                    | 26EEPE04    | Adaptive Control Systems              | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 5.                                    | 26EEPE05    | Biomedical Instrumentation            | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 6.                                    | 26EEPE06    | Network Analysis and Synthesis        | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| Programme Electives II (VI Semester)  |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| Streams : Power Engineering           |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| 7.                                    | 26EEPE07    | HVDC Transmission Systems             | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 8.                                    | 26EEPE08    | Flexible AC Transmission Systems      | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 9.                                    | 26EEPE09    | Power System Transients               | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 10.                                   | 26EEPE10    | Power System Dynamics and Control     | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 11.                                   | 26EEPE11    | Substation Engineering and Automation | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 12.                                   | 26PSC01     | Applied Design Thinking               | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| Programme Electives III (VI Semester) |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| Streams : Embedded Systems            |             |                                       |             |                    |   |   |    |    |         |          |           |      |       |
| 13.                                   | 26EEPE12    | Digital Signal Processing             | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 14.                                   | 26EEPE13    | Embedded System Design                | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 15.                                   | 26EEPE14    | Soft Computing Techniques             | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 16.                                   | 26EEPE15    | MEMS and NEMS                         | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 17.                                   | 26EEPE16    | Embedded Processors                   | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |
| 18.                                   | 26PSC02     | Startup Fundamentals                  | T           | 45                 | 0 | 0 | 45 | 90 | 3       | ES(PE)   | 40        | 60   | 100   |

| <b>Programme Electives IV (VI Semester)</b><br>Streams: Power Electronic Converters and Drives |          |                                                            |   |    |   |   |    |    |   |        |    |    |     |
|------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------|---|----|---|---|----|----|---|--------|----|----|-----|
| 19.                                                                                            | 26EEPE17 | Special Electrical Machines                                | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 20.                                                                                            | 26EEPE18 | Modern Power Converters                                    | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 21.                                                                                            | 26EEPE19 | Distributed Generation and Micro Grid                      | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 22.                                                                                            | 26EEPE20 | Power Quality                                              | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 23.                                                                                            | 26EEPE21 | SMPS and UPS                                               | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 24.                                                                                            | 26EEPE22 | Control of Power Electronic Systems                        | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| <b>Programme Electives V (VII Semester)</b><br>Streams: Energy Engineering                     |          |                                                            |   |    |   |   |    |    |   |        |    |    |     |
| 25.                                                                                            | 26EEPE23 | Utilization and Conservation of Electrical Energy          | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 26.                                                                                            | 26EEPE24 | Energy Management and Auditing                             | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 27.                                                                                            | 26EEPE25 | Energy Storage Systems                                     | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 28.                                                                                            | 26EEPE26 | Hybrid Energy Technology                                   | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 29.                                                                                            | 26EEPE27 | Hydrogen and Fuel Cell Technology                          | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 30.                                                                                            | 26EEPE28 | Electrical Safety                                          | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| <b>Programme Electives VI : (VII Semester)</b><br>Streams: Electric Vehicle Technology         |          |                                                            |   |    |   |   |    |    |   |        |    |    |     |
| 31                                                                                             | 26EEPE29 | e-Mobility                                                 | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 32.                                                                                            | 26EEPE30 | Electric Vehicle Architecture                              | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 33.                                                                                            | 26EEPE31 | Design of Motor and Power Converters for Electric Vehicles | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 34.                                                                                            | 26EEPE32 | EV Charging Infrastructure                                 | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 35.                                                                                            | 26EEPE33 | Safety and Testing of Electric Vehicles                    | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |
| 36.                                                                                            | 26EEPE34 | Battery Management Systems                                 | T | 45 | 0 | 0 | 45 | 90 | 3 | ES(PE) | 40 | 60 | 100 |

### Open Electives

| Sl. No.                                                                        | Course Code | Course Name                                    | Course Type | Hours per Semester |   |   |    |    | Credits | Category | Weightage |      |       |
|--------------------------------------------------------------------------------|-------------|------------------------------------------------|-------------|--------------------|---|---|----|----|---------|----------|-----------|------|-------|
|                                                                                |             |                                                |             | L                  | T | P | SL | TH |         |          | CA %      | ES % | Total |
| Courses Offered by the Department of Civil Engineering                         |             |                                                |             |                    |   |   |    |    |         |          |           |      |       |
| 1.                                                                             | 26CEOE01    | Environmental Management                       | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 2.                                                                             | 26CEOE02    | Repair and Rehabilitation of Building Elements | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 3.                                                                             | 26CEOE03    | Mechanics of Deformable Bodies                 | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| Courses Offered by the Department of Computer Science and Engineering          |             |                                                |             |                    |   |   |    |    |         |          |           |      |       |
| 1.                                                                             | 26CSOE01    | Object Oriented Programming Concepts           | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 2.                                                                             | 26CSOE02    | Operating Systems Principles                   | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 3.                                                                             | 26CSOE03    | Python Programming                             | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 4.                                                                             | 26CSOE04    | Fundamentals of Java Programming               | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 5.                                                                             | 26CSOE05    | Data Structures using C                        | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 6.                                                                             | 26CSOE06    | Introduction to Artificial Intelligence        | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 7.                                                                             | 26CSOE07    | Cloud Computing Fundamentals                   | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| Courses Offered by the Department of Electronics and Communication Engineering |             |                                                |             |                    |   |   |    |    |         |          |           |      |       |
| 1.                                                                             | 26ECOE01    | Fundamentals of Electron Devices               | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 2.                                                                             | 26ECOE02    | Principles of Modern Communication Systems     | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 3.                                                                             | 26ECOE03    | Microcontrollers and Its Applications          | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 4.                                                                             | 26ECOE04    | Basics of Embedded Systems                     | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |
| 5.                                                                             | 26ECOE05    | Basics of Internet of Things                   | T           | 45                 | 0 | 0 | 45 | 90 | 3       | OE       | 40        | 60   | 100   |

| Courses Offered by the Department of Electrical and Electronics Engineering |          |                                               |   |    |   |   |    |    |   |    |    |    |     |
|-----------------------------------------------------------------------------|----------|-----------------------------------------------|---|----|---|---|----|----|---|----|----|----|-----|
| 1.                                                                          | 26EEOE01 | Renewable Energy Systems                      | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 2.                                                                          | 26EEOE02 | Industrial Drives                             | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 3.                                                                          | 26EEOE03 | Electrical Energy Conservation and Management | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 4.                                                                          | 26EEOE04 | Fundamentals of Electric Vehicle              | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 5.                                                                          | 26EEOE05 | Electrical Safety and Energy Auditing         | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 6.                                                                          | 26EEOE06 | Energy Storage Systems and its Applications   | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| Courses Offered by the Department of Mechanical Engineering                 |          |                                               |   |    |   |   |    |    |   |    |    |    |     |
| 1.                                                                          | 26MEOE01 | Design of Machine Elements and Machining      | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 2.                                                                          | 26MEOE02 | Internal Combustion Engines                   | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 3.                                                                          | 26MEOE03 | Refrigeration and Air conditioning            | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 4.                                                                          | 26MEOE04 | Power Plant Engineering                       | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 5.                                                                          | 26MEOE05 | Hydraulics and Pneumatics                     | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 6.                                                                          | 26MEOE06 | Industrial Engineering and Management         | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 7.                                                                          | 26MEOE07 | Renewable Energy Sources                      | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 8.                                                                          | 26MEOE08 | Robotics and Automation                       | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 9.                                                                          | 26MEOE09 | Total Quality Management                      | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 10.                                                                         | 26MEOE10 | Automotive Systems                            | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| Courses Offered by the Department of Metallurgical Engineering              |          |                                               |   |    |   |   |    |    |   |    |    |    |     |
| 1.                                                                          | 26MTOE01 | Foundry and Welding Technology                | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 2.                                                                          | 26MTOE02 | Surface Engineering                           | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 3.                                                                          | 26MTOE03 | Design and Selection of Materials             | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 4.                                                                          | 26MTOE04 | Nano Science and Technology                   | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 5.                                                                          | 26MTOE05 | Materials for Automobile Components           | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |
| 6.                                                                          | 26MTOE06 | Metallurgy for Non-metallurgist               | T | 45 | 0 | 0 | 45 | 90 | 3 | OE | 40 | 60 | 100 |

### List of Honours Courses

| Sl. No. | Course Code | Course Name                                              |
|---------|-------------|----------------------------------------------------------|
| 1.      | 26EEH01     | Smart System Automation                                  |
| 2.      | 26EEH02     | Building Cyber-Physical Systems                          |
| 3.      | 26EEH03     | Restructured Power Market                                |
| 4.      | 26EEH04     | Design and Modelling of Renewable Energy Systems         |
| 5.      | 26EEH05     | Grid Integration Techniques                              |
| 6.      | 26EEH06     | Power Electronics for Renewable Energy Systems           |
| 7.      | 26EEH07     | System Identification Techniques                         |
| 8.      | 26EEH08     | VLSI Design                                              |
| 9.      | 26EEH09     | Machine Learning                                         |
| 10.     | 26EEH10     | Drone Technologies                                       |
| 11.     | 26EEH11     | EMI and EMC                                              |
| 12.     | 26EEH12     | Connected Vehicle                                        |
| 13.     | 26EEH13     | Model based Control                                      |
| 14.     | 26EEH14     | Process Control                                          |
| 15.     | 26EEH15     | Factory Automation                                       |
| 16.     | 26EEH16     | Condition Monitoring and Testing of Electrical Equipment |

### List of Minors Courses

| Sl. No. | Course Code | Course Name                                    |
|---------|-------------|------------------------------------------------|
| 1.      | 26EEM01     | Linear and Digital Electronics Circuits        |
| 2.      | 26EEM02     | Basics of Microprocessors and Microcontrollers |
| 3.      | 26EEM03     | Linear Control Systems                         |
| 4.      | 26EEM04     | Electrical Measurements and Instrumentation    |
| 5.      | 26EEM05     | Electrical Machines                            |
| 6.      | 26EEM06     | Electrical Drives                              |
| 7.      | 26EEM07     | Fundamentals of Electric Vehicles              |
| 8.      | 26EEM08     | Electrical Energy Conservation and Auditing    |
| 9.      | 26EEM09     | Switched Mode Power Conversion                 |
| 10.     | 26EEM10     | Distributed Generation                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                  |                                  |                 |                |          |           |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------|----------------|----------|-----------|-----------|
| <b>26ENC01</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>COMMUNICATIVE ENGLISH<br/>B.E. (Common to All Branches)</b>                                                                   |                                  | <b>SEMESTER</b> |                |          |           | <b>I</b>  |
| <b>Prerequisites</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                  | <b>Category</b>                  | <b>HM</b>       | <b>Credits</b> |          |           | <b>2</b>  |
| Basic language skills listening, speaking, reading and writing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                  | <b>Hours/<br/>Semester</b>       | <b>L</b>        | <b>T</b>       | <b>P</b> | <b>SL</b> | <b>TH</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                  |                                  | 45              | -              | -        | 15        | 60        |
| <b>COURSE OBJECTIVES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                  |                                  |                 |                |          |           |           |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | To develop integrated Listening, Speaking, Reading, and Writing (LSRW) skills for academic and professional communication.       |                                  |                 |                |          |           |           |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | To enable learners to comprehend, interpret, and respond to spoken and written texts in technical and workplace contexts.        |                                  |                 |                |          |           |           |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | To strengthen the use of grammar, vocabulary, and language structures for accurate communication.                                |                                  |                 |                |          |           |           |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | To enhance learners' oral communication skills for discussions, presentations, interviews, and workplace interactions.           |                                  |                 |                |          |           |           |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | To develop learners' ability to analyze, summarize, report, recommend, and interpret information from texts and real-world data. |                                  |                 |                |          |           |           |
| <b>UNIT - I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                  | <b>COMMUNICATION BASICS</b>      |                 |                |          |           | <b>9</b>  |
| Listening: Listening to simple conversations, Understanding tone and intent.<br>Speaking: Narrating personal experience and events, Expressing opinions.<br>Reading: Reading for comprehension and specific information, Understanding notices, messages, timetables, graphs etc.<br>Writing: Dialogue writing in a business context.<br>Grammar: Parts of speech - Nouns, Pronouns, Verbs – Main verbs, auxiliary verbs, modal verbs, Adverbs.                                                                                                   |                                                                                                                                  |                                  |                 |                |          |           |           |
| <b>UNIT - II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                  | <b>WORKPLACE COMMUNICATION</b>   |                 |                |          |           | <b>9</b>  |
| Listening: Listening to short speeches and TED talks, Extracting information.<br>Speaking: Informal conversation between office colleagues, asking for information to fill details in a form.<br>Reading: Reading technical texts from journals, newspapers and technical blogs.<br>Writing: Writing checklists, Writing recommendations.<br>Grammar: Parts of speech – Adjectives, Conjunctions, Prepositions, Interjections.                                                                                                                    |                                                                                                                                  |                                  |                 |                |          |           |           |
| <b>UNIT - III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                  | <b>INTERACTIVE COMMUNICATION</b> |                 |                |          |           | <b>9</b>  |
| Listening: Listening to debates and discussions, Different viewpoints on an issue.<br>Speaking: Role play - customer and sales manager, team leader and team member, interviewer and applicant.<br>Reading: Reading technical description of gadgets – learning the different parts of devices.<br>Writing: Writing instructions, Writing E-mails - Attending workshops, Paper submission for conferences, Arranging a meeting.<br>Grammar: Synonyms, Antonyms, Redundancies, Collocations.                                                       |                                                                                                                                  |                                  |                 |                |          |           |           |
| <b>UNIT - IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                  | <b>PROFESSIONAL WRITING</b>      |                 |                |          |           | <b>9</b>  |
| Listening: Listening to documentaries depicting a technical problem and suggesting solutions.<br>Speaking: Giving a speech, Describing given data, Discussing company information, Summarizing an article.<br>Reading: Reading longer technical texts, Reading biographies and travelogues.<br>Writing: Paragraph writing – Different types of paragraphs, Report Writing – Status reports, Feasibility reports and event reports.<br>Grammar: Conditional statements, Compound words, Sentence completion, Negation in statements and questions. |                                                                                                                                  |                                  |                 |                |          |           |           |

| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                  | INTERPRETATION |                       | 9               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------|-----------------|
| Listening: Listening to informal communication and longer technical talks.<br>Speaking: Qualities required for employability, Improving employee’s productivity, teamwork, creativity and leadership quality.<br>Reading: Reading brochures, telephone messages, social media messages relevant to technical contexts.<br>Writing: Mind maps, Charts - interpreting statistical data, charts, graphs and tables.<br>Grammar: One word substitution, Abbreviations and acronyms in technical context, Technical vocabulary, Idioms. |                                                                                                                                                                  |                |                       |                 |
| L:45, SL :15, Total:60 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                  |                |                       |                 |
| Weightage:<br>Continuous Assessment - 40%<br>End Semester Examinations - 60%                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                  |                |                       |                 |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                  |                |                       |                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Sharma, S., and B. Mishra. <i>Communication Skills for Engineers and Scientists</i> . 2nd ed., PHI Learning, 2024.                                               |                |                       |                 |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Miller, Katherine Q., and Susan T. Wahl. <i>Business and Professional Communication: KEYSfor Workplace Excellence</i> . 5th ed., SAGE Publications, 2023.        |                |                       |                 |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Viswamohan, Aysha. <i>English for Technical Communication</i> . McGraw-Hill Education, 2013.                                                                     |                |                       |                 |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Raman, Meenakshi, and Sangeeta Sharma. <i>Technical Communication: Principles and Practice</i> . 3rd ed., Oxford University Press, 2015.                         |                |                       |                 |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Rizvi, M. Ashraf., <i>Effective Technical Communication</i> . McGraw Hill Education India, 2017.                                                                 |                |                       |                 |
| E-RESOURCES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                  |                |                       |                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://learnenglish.britishcouncil.org/">https://learnenglish.britishcouncil.org/</a>                                                                  |                |                       |                 |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.bbc.co.uk/learningenglish/">https://www.bbc.co.uk/learningenglish/</a>                                                                      |                |                       |                 |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.ted.com/talks">https://www.ted.com/talks</a>                                                                                                |                |                       |                 |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.cambridgeenglish.org/">https://www.cambridgeenglish.org/</a>                                                                                |                |                       |                 |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.toastmasters.org/">https://www.toastmasters.org/</a>                                                                                        |                |                       |                 |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                  |                | Mapping<br>POs        | Mapping<br>PSOs |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Explain the fundamentals of listening, speaking, reading, and writing (LSRW) skills for effective academic and workplace communication.                          |                | PO9,<br>PO11          |                 |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Apply appropriate grammar, vocabulary, sentence structures, and language conventions to communicate accurately in technical and professional contexts.           |                | PO9,<br>PO11          |                 |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Demonstrate effective oral communication skills through discussions, presentations, interviews, debates, and workplace interactions with confidence and clarity. |                | PO9,<br>PO11          | PSO1            |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Analyze technical and professional texts, reports, charts, and workplace documents to interpret, summarize, and present relevant information effectively.        |                | PO9,<br>PO11          |                 |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Develop professional writing skills for drafting reports, emails, proposals, status reports, feasibility reports, and other workplace documents.                 |                | PO9,<br>PO10,<br>PO11 | PSO3            |

[illegible]

|                                    | <b>(v) Problem-Solving Case Study Presentation:</b><br>Analyze real-time workplace or ethical case studies and present solutions collaboratively using leadership, communication, and decision-making skills. |           |                                                                                                                |                                                                     |                                                                                |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>Rubrics for evaluation: CO5</b> |                                                                                                                                                                                                               |           |                                                                                                                |                                                                     |                                                                                |
| Sl. No.                            | Criterion                                                                                                                                                                                                     | Marks     | Excellent (3)                                                                                                  | Good(2)                                                             | Satisfactory (1)                                                               |
| 1.                                 | Understanding of Purpose and Audience                                                                                                                                                                         | 10        | Clearly identifies the purpose, context, and target audience; content is highly relevant                       | Purpose and audience are identified with minor gaps in relevance    | Purpose and audience are inadequately addressed                                |
| 2.                                 | Content Development and Organization                                                                                                                                                                          | 10        | Content is comprehensive, logically organized, and professionally structured                                   | Content is organized with minor omissions or inconsistencies        | Content lacks organization and completeness                                    |
| 3.                                 | Professional Writing and Communication                                                                                                                                                                        | 10        | Uses appropriate tone, style, and workplace conventions effectively                                            | Generally appropriate tone and style with minor errors              | Tone, style, or workplace conventions are inappropriate or unclear             |
| 4.                                 | Language, Formatting, and Accuracy                                                                                                                                                                            | 10        | Excellent grammar, vocabulary, formatting, and document presentation with no significant errors                | Minor grammatical, formatting, or language errors                   | Frequent errors in grammar, formatting, and presentation affecting readability |
|                                    | <b>Total</b>                                                                                                                                                                                                  | <b>40</b> |                                                                                                                |                                                                     |                                                                                |
| <b>Rubrics for evaluation: CO6</b> |                                                                                                                                                                                                               |           |                                                                                                                |                                                                     |                                                                                |
| Sl. No.                            | Criterion                                                                                                                                                                                                     | Marks     | Excellent (3)                                                                                                  | Good(2)                                                             | Satisfactory (1)                                                               |
| 1.                                 | Communication Skills                                                                                                                                                                                          | 10        | Communicates ideas clearly, confidently, and effectively using appropriate verbal and non-verbal communication | Communicates ideas adequately with minor clarity or delivery issues | Communication is unclear, hesitant, or ineffective                             |
| 2.                                 | Interpersonal and Teamwork Skills                                                                                                                                                                             | 10        | Demonstrates excellent collaboration, active listening, respect for others, and conflict resolution skills     | Participates effectively in teamwork with occasional guidance       | Limited participation and difficulty in working with others                    |
| 3.                                 | Leadership and Decision-Making                                                                                                                                                                                | 10        | Shows initiative, responsibility, problem-solving ability, and effective leadership in group activities        | Demonstrates leadership qualities with minor limitations            | Shows limited initiative and leadership ability                                |

|    |                                                  |           |                                                                                                         |                                                                   |                                                                        |
|----|--------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------|
| 4. | Ethical, Social, and Professional Responsibility | 10        | Consistently demonstrates ethical behaviour, professionalism, accountability, and social responsibility | Demonstrates responsibility and professionalism with minor lapses | Shows inadequate awareness of ethical or professional responsibilities |
|    | <b>Total</b>                                     | <b>40</b> |                                                                                                         |                                                                   |                                                                        |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------|----|---------|---|----|-----|
| 26MA101                                                                                                                                                                                                                                                                                                                                                                              | MATRICES, CALCULUS AND DIFFERENTIAL EQUATIONS<br>(B.E. – EEE Programme)                                                                                                                            |                                                 | SEMESTER           |    |         |   | I  |     |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                    |                                                 | Category           | BS | Credits |   |    | 4   |
| Basic 12th level Matrices, Differential Calculus and Integral Calculus.                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                    |                                                 | Hours/<br>Semester | L  | T       | P | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |                                                 |                    | 45 | 15      | - | 60 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                   | To understand the fundamental concepts of matrices, eigen values, eigen vectors, diagonalization and quadratic forms for solving algebraic and engineering problems.                               |                                                 |                    |    |         |   |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                   | To develop analytical skills in multivariable calculus including optimization techniques, multiple integrals, coordinate transformations and applications to area and volume calculations.         |                                                 |                    |    |         |   |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                   | To acquire knowledge of higher order ordinary differential equations and apply suitable methods for solving linear differential equations arising in scientific and engineering applications.      |                                                 |                    |    |         |   |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                   | To formulate and solve partial differential equations using standard methods such as Lagrange’s method, operator techniques and separation of variables for mathematical modeling problems.        |                                                 |                    |    |         |   |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                   | To understand and apply vector calculus concepts, vector differential and integral operations and Green’s, Gauss divergence, Stoke’s theorems in the analysis of physical and engineering systems. |                                                 |                    |    |         |   |    |     |
|                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                    | MATRICES                                        |                    |    |         |   |    | 9+3 |
| Symmetric, Skew Symmetric and Orthogonal Matrices – Characteristic equation of a Matrix – Eigen values and Eigen vectors – Properties – Cayley-Hamilton theorem (excluding proof) – Diagonalization of Matrices - Gauss elimination technique - Reduction of quadratic form to canonical form by orthogonal transformation.                                                          |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                    | MULTI VARIABLE CALCULUS                         |                    |    |         |   |    | 9+3 |
| Maxima, Minima and Saddle point- – Method of Lagrangian multipliers- Multiple integrals- Double integrals – Change of order of integration in double integrals – Change of variables (Cartesian to Polar) – Application to Areas – Evaluation of Triple integrals – Application to volumes.                                                                                          |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    | ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER |                    |    |         |   |    | 9+3 |
| Second order linear differential equations with constant and variable coefficients –Cauchy-Euler equation and Cauchy- Legendre’s linear equation - Method of variation of parameters –Simultaneous first order linear equations with constant coefficients.                                                                                                                          |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                    | PARTIAL DIFFERENTIAL EQUATIONS                  |                    |    |         |   |    | 9+3 |
| Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second and higher order with constant coefficients - Solution of Laplace equation by method of separation of variables. |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                    | VECTOR CALCULUS                                 |                    |    |         |   |    | 9+3 |
| Vector differentiation- Gradient- Directional derivative - Divergence - Curl, Vector integration- Line integration-work done – Surface and Volume integrals - Green’s theorem, Gauss divergence and Stoke’s theorem (without proof) – Simple applications involving cubes and rectangular parallelopipeds.                                                                           |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| L:45, T:15, SL:60, Total:120 Hours                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| Continuous Assessment: 40%                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |
| End Semester Examinations: 60%                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                    |                                                 |                    |    |         |   |    |     |

| TEXT BOOKS:                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                 |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|
| 1.                                                                                         | Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 <sup>th</sup> Edition, New Delhi, 2020.                                                                                                                                                                                                                                                                                                                                                                                            |                |                 |
| 2.                                                                                         | Veerarajan T, "Engineering Mathematics for Semester I & II", 3 <sup>rd</sup> Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.                                                                                                                                                                                                                                                                                                                                                            |                |                 |
| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                 |
| 1.                                                                                         | James Stewart, "Essential Calculus", 2 <sup>nd</sup> Edition, Cengage Learning, New Delhi, 2013.                                                                                                                                                                                                                                                                                                                                                                                                        |                |                 |
| 2.                                                                                         | P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Engineering Mathematics For I year B.E. /B. Tech", 9 <sup>th</sup> Edition, S. Chand & Co. Ltd. New Delhi, 2010.                                                                                                                                                                                                                                                                                                                                       |                |                 |
| 3.                                                                                         | Erwin Kreyszig, "Advanced Engineering Mathematics", 10 <sup>th</sup> Edition, John Wiley & Sons, 2011.                                                                                                                                                                                                                                                                                                                                                                                                  |                |                 |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |                 |
| 1.                                                                                         | NPTEL, "Engineering Mathematics-I", National Programme on Technology Enhanced Learning, <a href="https://www.nptel.ac.in/courses/111105121">https://www.nptel.ac.in/courses/111105121</a>                                                                                                                                                                                                                                                                                                               |                |                 |
| 2.                                                                                         | MIT Open Courseware, "Single Variable Calculus and Multivariable Calculus", Massachusetts Institute of Technology, <a href="https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/">https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/</a>                                                                                                                                                                                                                            |                |                 |
| 3.                                                                                         | Khan Academy, "Linear Algebra and Multivariable Calculus", <a href="https://www.khanacademy.org/math/linear-algebra">https://www.khanacademy.org/math/linear-algebra</a> , <a href="https://www.khanacademy.org/math/multivariable-calculus">https://www.khanacademy.org/math/multivariable-calculus</a>                                                                                                                                                                                                |                |                 |
| 4.                                                                                         | Paul's Online Math Notes, "Calculus III and Linear Algebra", Lamar University, <a href="https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx">https://tutorial.math.lamar.edu/Classes/CalcIII/CalcIII.aspx</a>                                                                                                                                                                                                                                                                                  |                |                 |
| 5.                                                                                         | Wolfram Math World, "Mathematics Resource", Wolfram Research, <a href="https://mathworld.wolfram.com/topics/VectorCalculus.html">https://mathworld.wolfram.com/topics/VectorCalculus.html</a>                                                                                                                                                                                                                                                                                                           |                |                 |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mapping<br>POs | Mapping<br>PSOs |
| CO1                                                                                        | Remember and understand the fundamental concepts, principles and methods in matrices, multivariable calculus, ordinary differential equations, partial differential equations and vector calculus including eigen values and eigen vectors, diagonalization, quadratic forms, optimization techniques, multiple integrals, higher order differential equations, Lagrange's linear equations, Laplace equations, vector differentiation and integration, Green's, Gauss divergence and Stoke's theorems. | --             | --              |
| CO2                                                                                        | Apply the concepts and techniques of matrices, multivariable calculus, ordinary differential equations, partial differential equations and vector calculus to solve mathematical and engineering problems involving matrix transformations, optimization, evaluation of multiple integrals, solutions of differential equations, formation and solution of partial differential equations and computation of line, surface, and volume integrals using vector integral theorems.                        | PO1            | PSO1            |
| CO3                                                                                        | Analyze mathematical and engineering problems using matrices, multivariable calculus, ordinary differential equations, partial differential equations and vector calculus by interpreting matrix properties, examining extrema and multiple integrals, selecting suitable methods for solving differential equations, analyzing PDE models and investigating vector fields through divergence, curl, and integral theorems.                                                                             | PO2            | PSO2            |

|            |                                                                                                                                                                                                                                                 |     |      |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| <b>C04</b> | Develop mathematical models and solution strategies using matrices, differential equations, multivariable calculus, partial differential equations and vector calculus techniques for solving engineering and applied science problems.         | PO3 | PSO2 |
| <b>C05</b> | Utilize mathematical tools and analytical techniques from matrices, calculus, differential equations and vector calculus to investigate and solve real-world engineering problems with logical reasoning and computational accuracy.            | PO5 | PSO2 |
| <b>C06</b> | Communicate mathematical concepts, solution procedures and results effectively through proper mathematical notation, graphical representation, computational output and structured report writing for engineering and applied science problems. | P10 | --   |

### The Course Articulation Matrix (CAM) for defined COs:

|            | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|--------------|--------------|--------------|--------------|
| <b>C01</b> |            |            |            |            |            |            |            |            |            |              |              |              |              |              |
| <b>C02</b> | 3          |            |            |            |            |            |            |            |            |              |              | 3            |              |              |
| <b>C03</b> |            | 2          |            |            |            |            |            |            |            |              |              |              | 2            |              |
| <b>C04</b> |            |            | 1          |            |            |            |            |            |            |              |              |              | 2            |              |
| <b>C05</b> |            |            |            |            | 3          |            |            |            |            |              |              |              | 2            |              |
| <b>C06</b> |            |            |            |            |            |            |            |            |            | 3            |              |              |              |              |
| <b>Avg</b> | <b>3</b>   | <b>2</b>   | <b>1</b>   |            | <b>3</b>   |            |            |            |            | <b>3</b>     |              | <b>3</b>     | <b>2</b>     |              |

### Activities:

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Students shall solve selected engineering-oriented problems from matrices, multivariable calculus, ordinary differential equations, partial differential equations and vector calculus using suitable mathematical/computational tools such as Python, GeoGebra or any open-source software. The activity may include eigen values computation, matrix diagonalization, Gauss elimination, optimization of two-variable functions, solution of ODEs and PDEs, visualization of vector fields and evaluation of line, surface and volume integrals. This activity develops the ability to apply mathematical tools and analytical techniques to solve real-world engineering problems with logical reasoning and computational accuracy. |
| 2. | Students shall prepare a structured report or presentation on selected application-oriented problems from matrices, multivariable calculus, ordinary differential equations, partial differential equations or vector calculus. The activity may include mathematical formulation, step-by-step solution, use of proper notation, graphical or computational representation, interpretation of results and conclusion. This activity develops the ability to communicate mathematical concepts, solution procedures and results effectively through clear explanation, appropriate diagrams, computational output and organized report writing.                                                                                         |

**Rubrics for evaluation:CO5**

| Sl. No. | Criterion                              | Marks     | Excellent (7-8)                                                                          | Good (4-6)                                                            | Satisfactory (1-3)                                          |
|---------|----------------------------------------|-----------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------|
| 1.      | Selection and formulation of problem   | 8         | Engineering-oriented problem is clearly selected and mathematically formulated correctly | Problem is selected properly, but formulation needs minor improvement | Problem selection is basic and formulation is incomplete    |
| 2.      | Application of mathematical method     | 8         | Correct mathematical method is applied with clear step-by-step procedure                 | Method is mostly correct with minor errors                            | Method is unclear or contains major errors                  |
| 3.      | Use of computational/ analytical tool  | 8         | Tool or analytical technique is used effectively and results are accurate                | Tool/technique is used properly, but with minor mistakes              | Tool/technique usage is limited or not clearly demonstrated |
| 4.      | Accuracy and interpretation of results | 8         | Results are accurate and clearly interpreted with engineering relevance                  | Results are mostly correct, but interpretation needs improvement      | Results are inaccurate or interpretation is weak            |
| 5.      | Presentation and documentation         | 8         | Report/ presentation is well organized, clear and professionally presented               | Presentation is good with minor formatting or clarity issues          | Presentation is satisfactory but lacks consistency          |
|         | <b>Total</b>                           | <b>40</b> |                                                                                          |                                                                       |                                                             |

**Rubrics for evaluation:CO6**

| Sl. No. | Criterion                                              | Marks | Excellent (7-8)                                                                                         | Good (4-6)                                                           | Satisfactory (1-3)                              |
|---------|--------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------|
| 1.      | Clarity of mathematical explanation                    | 8     | Concepts, formulae and solution steps are explained clearly and correctly                               | Explanation is understandable, but needs minor improvement           | Explanation is incomplete or unclear            |
| 2.      | Proper use of mathematical notation and representation | 8     | Correct mathematical notation, equations, diagrams, graphs or tables are used effectively               | Notation and representation are mostly correct with minor errors     | Notation is poor or representations are missing |
| 3.      | Organization of report/ presentation                   | 8     | Report/ Presentation is well-structured with problem statement, method, solution, result and conclusion | Report/presentation is organized, but some sections need improvement | Report/presentation is poorly organized         |

|    |                                             |           |                                                                                      |                                                                  |                                                    |
|----|---------------------------------------------|-----------|--------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------------|
| 4. | Interpretation and communication of results | 8         | Results are interpreted clearly and communicated effectively with logical conclusion | Results are communicated properly, but interpretation is limited | Result interpretation and communication are weak   |
| 5. | Overall presentation and professionalism    | 8         | Work is neat, professional and demonstrates excellent academic presentation          | Presentation quality is good with minor issues                   | Presentation is satisfactory but lacks consistency |
|    | <b>Total</b>                                | <b>40</b> |                                                                                      |                                                                  |                                                    |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        | -          | -           | 24                    | 3                |
| <b>CO3</b>   | 16        | 16        | -          | -           | 16                    | 2                |
| <b>CO4</b>   | 8         | 8         | -          | -           | 8                     | 1                |
| <b>CO5</b>   | -         | -         | 40         | -           | 25                    | 3                |
| <b>CO6</b>   | -         | -         | -          | 40          | 25                    | 3                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------|-------|---------|---|----|-----|
| 26CM101                                                                                                                                                                                                                                                                                                                                                                                                                              | BASIC CIVIL AND MECHANICAL ENGINEERING                                                                                                                             |                                              | SEMESTER           |       |         |   | I  |     |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                    |                                              | Category           | ES(G) | Credits |   |    | 4   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                    |                                              | Hours/<br>Semester | L     | T       | P | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                    |                                              |                    | 60    | 0       | 0 | 60 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To provide fundamental knowledge of Civil Engineering materials, mechanics of materials, surveying principles, and their applications in construction engineering. |                                              |                    |       |         |   |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To familiarize students with building components, structural systems, dams, and sustainable infrastructure concepts used in Civil Engineering practice.            |                                              |                    |       |         |   |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To study various types of boilers, turbines, and pumps, along with their working mechanisms and key components.                                                    |                                              |                    |       |         |   |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To understand IC engines and their working cycles, and to study turbines, pumps, and hybrid engines with applications.                                             |                                              |                    |       |         |   |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To understand refrigeration systems and study domestic refrigerators and air conditioners.                                                                         |                                              |                    |       |         |   |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    | CIVIL ENGINEERING MATERIALS AND SURVEYING    |                    |       |         |   |    | 12  |
| Mechanics: Mechanical properties of materials- stress- strain- types of stresses and stain. Elasticity- Hooke's law- stress strain Curve of ductile material. Civil Engineering Material: Bricks- Stones – Sand- Cement – Concrete – Steel. Surveying: Objects Principles- Classification- Measurement of distances.                                                                                                                 |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                    | BUILDING COMPONENTS AND STRUCTURES           |                    |       |         |   |    | 12  |
| Foundation: Functions of foundation- Types. Superstructure: Brick Masonry – Stone Masonry – Beams – Columns – Lintels – Roofing- Flooring- Plastering. Dams: Types of Dams – Cross section details of Gravity Dam. Introduction to Green Building Concept.                                                                                                                                                                           |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                    | BOILERS, TURBINES AND PUMPS                  |                    |       |         |   |    | 12  |
| Introduction of Boilers – Classification – Working principle of various types of boilers – Horizontal boiler – Vertical boiler – Description of: Lancashire boiler, Locomotive boiler, Babcock and Wilcox boiler, Cochran boiler – Boiler mountings and accessories.<br>Classification of Turbines, Working principle of impulse and reaction turbines -Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps. |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                    | INTERNAL COMBUSTION ENGINES AND POWER PLANTS |                    |       |         |   |    | 12  |
| Classification of IC engine - Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Concept of hybrid engines<br>Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Industrial safety practices and protective devices.     |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    | REFRIGERATION AND AIR CONDITIONING SYSTEM    |                    |       |         |   |    | 12  |
| Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system– Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air – water mixture, concepts of psychometric and its process.                                                                                                                                                           |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| L:60, SL:60, Total : 120 Hours                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |
| Weightage:<br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                    |                                              |                    |       |         |   |    |     |

**REFERENCE BOOKS:**

|    |                                                                                                                               |
|----|-------------------------------------------------------------------------------------------------------------------------------|
| 1. | Shanmugam G and Palanichamy M.S, "Basic Civil and Mechanical Engineering" , McGraw Hill Education India, 2018.                |
| 2. | Ramamrutham.S, "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P), Ltd, 2013.                                          |
| 3. | Vijayan V, Vaishnavi R, and Prabhakaran V, "Basic Civil and Mechanical Engineering", Revised Edition, S Chand & Co Ltd, 2026. |

**E-RESOURCES:**

|    |                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------|
| 1. | National Programme on Technology Enhanced Learning (NPTEL)<br><a href="https://nptel.ac.in">https://nptel.ac.in</a> |
| 2. | SWAYAM Online Courses<br><a href="https://swayam.gov.in">https://swayam.gov.in</a>                                  |

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                                                                                          |                                                  |               |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------|
| <b>CO1</b> | Explain the fundamental concepts, scope, and applications of Civil and Mechanical Engineering in addressing societal and industrial needs.                                                                               | ---                                              | ---           |
| <b>CO2</b> | Identify and classify construction materials, understand basic surveying principles, and explain the functions of various building components and structures.                                                            | PO1, PO2,<br>PO3, PO6,<br>PO7                    | PSO1          |
| <b>CO3</b> | Explain the working principles of IC engines, pumps, turbines, and various power plants along with their applications.                                                                                                   | PO1, PO2,<br>PO3, PO4,<br>PO5                    | PSO1,<br>PSO2 |
| <b>CO4</b> | Understand refrigeration and air conditioning systems, including their components, working principles, and psychrometric processes.                                                                                      | PO1, PO2,<br>PO3, PO4,<br>PO5                    | PSO1,<br>PSO2 |
| <b>CO5</b> | Prepare and present a study report on civil engineering materials, building components, surveying instruments, or sustainable infrastructure practices through field observation, case study, or technical presentation. | PO1, PO2,<br>PO3, PO5,<br>PO7, PO8,<br>PO9, PO10 | PSO1,<br>PSO3 |
| <b>CO6</b> | Demonstrate understanding through field study, report preparation, or technical presentation on civil and mechanical engineering topics.                                                                                 | PO1, PO2,<br>PO3, PO5,<br>PO7, PO8,<br>PO9, PO10 | PSO2,<br>PSO3 |

**The Course Articulation Matrix (CAM) for defined COs**

|            | <b>PO1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> | -          | -           | -           | -           | -           | -           | -           | -           | -           | -            | -            | -            | -            | -            |
| <b>CO2</b> | 3          | 2           | 2           | -           | -           | 1           | 2           | -           | -           | -            | -            | 3            | -            | -            |
| <b>CO3</b> | 3          | 2           | 1           | 2           | 1           | -           | -           | -           | -           | -            | -            | 2            | 3            | -            |
| <b>CO4</b> | 3          | 2           | 1           | 2           | 2           | -           | -           | -           | -           | -            | -            | 2            | 3            | -            |
| <b>CO5</b> | 2          | 2           | 1           | -           | 1           | -           | 2           | 2           | 1           | 1            | -            | 2            | -            | 3            |
| <b>CO6</b> | 2          | 2           | 1           | -           | 1           | -           | 2           | 2           | 1           | 2            | -            | -            | 2            | 3            |

**Activities:**

|    |                                                                                                                                                                                                                                               |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Prepare and present a study report on civil and mechanical engineering materials, building components, surveying instruments, or sustainable infrastructure practices through field observation, case study, or technical presentation. (CO5) |
| 2. | Observe a real-life system like a water pump or engine in your surroundings. Explain its working principle and identify its main components. (CO6)                                                                                            |

**Rubrics for evaluation : CO5**

| Sl. No. | Criterion                                                  | Marks      | Excellent (3)                                        | Good(2)                       | Satisfactory(1)         |
|---------|------------------------------------------------------------|------------|------------------------------------------------------|-------------------------------|-------------------------|
| 1.      | Understanding of civil and mechanical engineering concepts | 20         | Clearly explains concepts and applications           | Explanation needs improvement | Limited understanding   |
| 2.      | Sustainability & societal considerations                   | 30         | Clearly discusses sustainability and societal impact | Moderate discussion           | Poor explanation        |
| 3.      | Evidence of self-learning                                  | 30         | Uses journals, standards and technical references    | Limited references used       | Very limited references |
| 4.      | Presentation & communication                               | 20         | Clear and professional presentation                  | Moderate presentation         | Poor presentation       |
|         | <b>Total</b>                                               | <b>100</b> |                                                      |                               |                         |

**Rubrics for evaluation : CO6**

| Sl. No. | Criterion                     | Marks      | Excellent (3)                            | Good(2)                       | Satisfactory(1)                   |
|---------|-------------------------------|------------|------------------------------------------|-------------------------------|-----------------------------------|
| 1.      | Understanding of Concept      | 20         | Clearly explains concept with accuracy   | Minor errors in explanation   | Basic or unclear understanding    |
| 2.      | Application Ability           | 20         | Applies concept correctly to real system | Partially correct application | Poor or incorrect application     |
| 3.      | Technical Explanation         | 20         | Well-structured and detailed explanation | Adequate explanation          | Limited or incomplete explanation |
| 4.      | Identification of Components  | 20         | Identifies all components correctly      | Identifies some components    | Unable to identify components     |
| 5.      | Presentation / Report Quality | 20         | Neat, clear, and well-organized          | Acceptable presentation       | Poor presentation                 |
|         | <b>Total</b>                  | <b>100</b> |                                          |                               |                                   |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| <b>CO</b>    | <b>Test I</b> | <b>Test II</b> | <b>Activity I</b> | <b>Activity II</b> | <b>Percentage Allocation</b> | <b>Mapping Strength</b> |
|--------------|---------------|----------------|-------------------|--------------------|------------------------------|-------------------------|
| <b>C01</b>   | 10            | 10             |                   |                    | 10                           | 2                       |
| <b>C02</b>   | 20            | 20             |                   |                    | 20                           | 2                       |
| <b>C03</b>   | 20            | 10             |                   |                    | 15                           | 2                       |
| <b>C04</b>   | 10            | 20             |                   |                    | 15                           | 2                       |
| <b>C05</b>   |               |                | 40                |                    | 20                           | 2                       |
| <b>C06</b>   |               |                |                   | 40                 | 20                           | 3                       |
| <b>Total</b> | <b>60</b>     | <b>60</b>      | <b>40</b>         | <b>40</b>          | <b>100</b>                   |                         |

Note: Purely as an Example : Strength = 3 (if percentage>20%);Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                          |                                                                       |                    |    |         |   |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------|----|---------|---|----|----|
| 26HMC01                                                                                                                                                                                                                                                                                                                                                                                                                                                               | HERITAGE OF TAMILS<br>B.E. (Common to all Branches)                                      |                                                                       | SEMESTER           |    | I       |   |    |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                          |                                                                       | Category           | HM | Credits |   | 1  |    |
| Basics of Tamil Language and Literature.                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                          |                                                                       | Hours/<br>Semester | L  | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                          |                                                                       |                    | 15 | -       | - | 15 | 30 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                          |                                                                       |                    |    |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To obtain the knowledge of Tamil Language and Literature.                                |                                                                       |                    |    |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To familiarize with painting and Sculpture.                                              |                                                                       |                    |    |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To know about the folks and martial arts.                                                |                                                                       |                    |    |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To understand the Thinaï concept of Tamils.                                              |                                                                       |                    |    |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To know about the contribution of Tamils to Indian National Movement and Indian Culture. |                                                                       |                    |    |         |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                          |                                                                       |                    |    |         |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                          | LANGUAGE AND LITERATURE                                               |                    |    |         |   |    | 3  |
| Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan. |                                                                                          |                                                                       |                    |    |         |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                          | HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE               |                    |    |         |   |    | 3  |
| Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.                                                                                                                               |                                                                                          |                                                                       |                    |    |         |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                          | FOLK AND MARTIAL ARTS                                                 |                    |    |         |   |    | 3  |
| Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.                                                                                                                                                                                                                                                                                                                    |                                                                                          |                                                                       |                    |    |         |   |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                          | THINAI CONCEPT OF TAMILS                                              |                    |    |         |   |    | 3  |
| Lora and Fauna of Tamils, Aham and Puram Concepts from Tholkappiyam and Sangam Literature-Aram Concept of Tamils, Education and Literacy during the Sangam Age. Ancient Cities and Ports of the Sangam Age, Export and Import during the Sangam Age Overseas Conquests of the Cholas.                                                                                                                                                                                 |                                                                                          |                                                                       |                    |    |         |   |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                          | CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE |                    |    |         |   |    | 3  |
| Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.                                                                                                                                                                                                   |                                                                                          |                                                                       |                    |    |         |   |    |    |
| L:15, SL:15, Total:30 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                          |                                                                       |                    |    |         |   |    |    |
| Weightage:<br>Continuous Assessment: 40%<br>End Semester Examinations: 60%                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                          |                                                                       |                    |    |         |   |    |    |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                  |         |         |         |         |         |         |         |         |          |                |                 |          |          |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------------|-----------------|----------|----------|
| 1.                                                                                         | Dr. K. K. Pillay,, "Social Life of Tamils" A joint publication of TNTB & ESC and RMRL – (in print)                                                                               |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 2.                                                                                         | Dr. S. Singaravelu., "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies Publications.                                                  |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 3.                                                                                         | "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu.                                          |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 4.                                                                                         | "Keeladi-Sangam City Civilization on the banks of river Vaigai", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Publications, Tamil Nadu. |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 5.                                                                                         | "Heritage of Tamils", Muthuramalingam S and Dr Saravanakumar. M, Yes Dee Publication, 2023.                                                                                      |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| E-RESOURCES:                                                                               |                                                                                                                                                                                  |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 1.                                                                                         | <a href="https://en.wikipedia.org/wiki/Dravidian_languages">https://en.wikipedia.org/wiki/Dravidian_languages</a>                                                                |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 2.                                                                                         | <a href="https://www.tamilvu.org/courses/degree/">https://www.tamilvu.org/courses/degree/</a>                                                                                    |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 3.                                                                                         | <a href="https://www.scribd.com/document/802136891/Heritage-of-Tamils">https://www.scribd.com/document/802136891/Heritage-of-Tamils</a>                                          |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 4.                                                                                         | <a href="https://www.scribd.com/document/718189396/AKAM-AND-PURAM">https://www.scribd.com/document/718189396/AKAM-AND-PURAM</a>                                                  |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| 5.                                                                                         | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/">https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/</a>                                                              |         |         |         |         |         |         |         |         |          |                |                 |          |          |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                  |         |         |         |         |         |         |         |         |          | Mapping<br>POs | Mapping<br>PSOs |          |          |
| CO1                                                                                        | Acquire knowledge of Tamil language, literature and the Thinaì concepts that reflect the cultural and ecological wisdom of the Tamils.                                           |         |         |         |         |         |         |         |         |          | PO9            | -               |          |          |
| CO2                                                                                        | Familiarize with the artistic heritage of the Tamils through the study of painting, sculpture, folk traditions and martial arts.                                                 |         |         |         |         |         |         |         |         |          | PO9            | -               |          |          |
| CO3                                                                                        | Understand the contributions of Tamils to Indian culture, society and the national movement.                                                                                     |         |         |         |         |         |         |         |         |          | PO9            | PSO1            |          |          |
| CO4                                                                                        | Develop an appreciation of Tamil civilization, its cultural practices, artistic achievements, and enduring values in shaping Indian heritage.                                    |         |         |         |         |         |         |         |         |          | PO9            | -               |          |          |
| CO5                                                                                        | Examine the traditional scientific knowledge, technological achievements, and cultural heritage of the Tamils and understand their historical and contemporary significance.     |         |         |         |         |         |         |         |         |          | PO9, PO11      | PSO3            |          |          |
| CO6                                                                                        | Demonstrate the applications and relevance of Tamil scientific, technological and cultural contributions through practical activities, case studies and project-based work.      |         |         |         |         |         |         |         |         |          | PO9, PO11      | PSO3            |          |          |
| The Course Articulation Matrix (CAM) for defined COs                                       |                                                                                                                                                                                  |         |         |         |         |         |         |         |         |          |                |                 |          |          |
|                                                                                            | PO<br>1                                                                                                                                                                          | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11       | PSO<br>1        | PSO<br>2 | PSO<br>3 |
| CO1                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          |                |                 |          |          |
| CO2                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          |                |                 |          |          |
| CO3                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          |                | 2               |          |          |
| CO4                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          |                |                 |          |          |
| CO5                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          | 2              |                 |          | 2        |
| CO6                                                                                        |                                                                                                                                                                                  |         |         |         |         |         |         |         | 3       |          | 2              |                 |          | 2        |

Activities:

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>CO5:</b> Examine the traditional scientific knowledge, technological achievements, and cultural heritage of the Tamils, and understand their historical and contemporary significance.<br>1. <b>Seminar Presentation</b> on ancient Tamil scientific and technological achievements (e.g., irrigation systems, architecture, metallurgy, maritime trade).<br>2. <b>Group Discussion</b> on the relevance of traditional Tamil knowledge systems in modern society.<br>3. <b>Case Study Analysis</b> of Tamil cultural heritage sites, monuments, and engineering marvels.<br>4. <b>Heritage Exhibition</b> displaying charts, models, and photographs related to Tamil cultural and technological contributions, Quiz and Debate on Tamil literary, scientific, and cultural achievements.<br>5. <b>Field Visit</b> to museums, heritage sites, temples or archaeological locations and submission of a report.                                                                |
| 2. | <b>CO6:</b> Demonstrate the applications and relevance of Tamil scientific, technological, and cultural contributions through practical activities, case studies, and project-based work.<br>1. <b>Mini Project</b> on traditional Tamil technologies such as water management, agricultural practices, or indigenous architecture.<br>2. <b>Model Making Activity</b> depicting Tamil engineering achievements (e.g., Kallanai Dam, temple architecture, ancient ships).<br>3. <b>Case Study Presentation</b> comparing ancient Tamil technologies with contemporary technologies.<br>4. <b>Practical Demonstration</b> of traditional arts, crafts, folk practices, or indigenous techniques.<br>5. <b>Community-Based Project</b> documenting local traditional knowledge, folk practices, or cultural heritage and presenting the findings, Digital PortfolioDevelopment showcasing project outcomes, photographs, reports, and reflections on Tamil heritage and technology. |

Rubrics for evaluation: CO5

| Sl. No. | Criterion                   | Marks | Excellent (7-8)                                                                                                           | Good(4-6)                                                               | Satisfactory (1-3)                                    |
|---------|-----------------------------|-------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------|
| 1.      | Knowledge of Tamil Heritage | 8     | Demonstrates comprehensive understanding of Tamil scientific, technological, and cultural heritage with accurate details. | Demonstrates good understanding with minor omissions.                   | Demonstrates basic understanding with limited details |
| 2.      | Historical Understanding    | 8     | Clearly explains historical context and significance with relevant examples.                                              | Explains historical context with some supporting examples.              | Provides limited explanation of historical context.   |
| 3.      | Contemporary Relevance      | 8     | Effectively relates traditional knowledge and achievements to present-day applications and issues.                        | Relates traditional knowledge to modern applications with some clarity. | Identifies a few modern connections.                  |

|    |                      |           |                                                                                                   |                                                                               |                                                                                        |
|----|----------------------|-----------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 4. | Presentation Skills  | 8         | Content is well-organized, visually appealing, and presented effectively.                         | Content is organized and presented clearly                                    | Content is organized and presented clearly with minor shortcomings.                    |
| 5. | Communication Skills | 8         | Ideas are communicated clearly, confidently, and engagingly with appropriate supporting evidence. | Ideas are communicated clearly with moderate confidence and adequate support. | Communication is understandable but lacks clarity, confidence, or supporting evidence. |
|    | <b>Total</b>         | <b>40</b> |                                                                                                   |                                                                               |                                                                                        |

#### Rubrics for evaluation:CO6

| Sl. No. | Criterion                     | Marks     | Excellent (7-8)                                                                                             | Good(4-6)                                                     | Satisfactory (1-3)                                                            |
|---------|-------------------------------|-----------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1.      | Application of Knowledge      | 8         | Effectively applies Tamil scientific, technological, and cultural concepts to practical tasks and projects. | Applies concepts correctly with minor guidance.               | Applies concepts at a basic level with limited effectiveness.                 |
| 2.      | Project Execution             | 8         | Project is comprehensive, innovative, well-planned, and successfully completed.                             | Project is well-executed with minor shortcomings.             | Project meets minimum requirements but lacks depth or completeness.           |
| 3.      | Use of Evidence and Resources | 8         | Effectively uses relevant data, sources, and examples to support project outcomes.                          | Uses appropriate resources with adequate supporting evidence. | Uses limited resources and supporting evidence.                               |
| 4.      | Presentation Skills           | 8         | Presents findings clearly, professionally, and effectively.                                                 | Presents findings clearly with minor shortcomings.            | Presentation is adequate but lacks clarity, organization or professionalism.  |
| 5.      | Documentation Quality         | 8         | Documentation is comprehensive, accurate, well-organized and properly formatted.                            | Documentation is complete and organized with minor omissions. | Documentation is adequate but lacks detail, accuracy, or proper organization. |
|         | <b>Total</b>                  | <b>40</b> |                                                                                                             |                                                               |                                                                               |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| <b>CO</b>    | <b>Test I</b> | <b>Test II</b> | <b>Activity I</b> | <b>Activity II</b> | <b>Percentage Allocation</b> | <b>Mapping Strength</b> |
|--------------|---------------|----------------|-------------------|--------------------|------------------------------|-------------------------|
| <b>CO1</b>   | 12            | 12             | -                 | -                  | 12                           | 2                       |
| <b>CO2</b>   | 24            | 24             |                   |                    | 24                           | 3                       |
| <b>CO3</b>   | 12            | 12             |                   |                    | 12                           | 2                       |
| <b>CO4</b>   | 12            | 12             |                   |                    | 12                           | 2                       |
| <b>CO5</b>   |               |                | 40                |                    | 20                           | 2                       |
| <b>CO6</b>   |               |                |                   | 40                 | 20                           | 2                       |
| <b>Total</b> | <b>60</b>     | <b>60</b>      | <b>40</b>         | <b>40</b>          | <b>100</b>                   |                         |

Note: Purely as an Example: Strength = 3 (if percentage  $\geq 20\%$ );  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage  $< 10\%$ );

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                    |               |                |          |           |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|----------|-----------|-----------|
| <b>26HMC01</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>தமிழர் மரபு<br/>B.E. (Common to all Branches)</b>                                                                               | <b>பருவம்</b> | <b>I</b>       |          |           |           |
| <b>முன்னிபந்தனைகள்</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Category</b>                                                                                                                    | <b>HM</b>     | <b>Credits</b> | <b>1</b> |           |           |
| இலக்கணம் மற்றும் இலக்கியத்தின் அடிப்படைகள்                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Hours / Semester</b>                                                                                                            | <b>L</b>      | <b>T</b>       | <b>P</b> | <b>SL</b> | <b>TH</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                    | 15            | -              | -        | 15        | 30        |
| <b>பாடநெறிநோக்கங்கள்</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |               |                |          |           |           |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | தமிழ் மொழி மற்றும் இலக்கியம் பற்றிய அறிவைப் பெற முடியும்.                                                                          |               |                |          |           |           |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | பாரம்பரியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் மற்றும் சிற்பக்கலைகள் பற்றி தெரிந்து கொள்ள முடியும்.                              |               |                |          |           |           |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | நாட்டுப்புறக்கலைகள் மற்றும் வீர விளையாட்டுகள் பற்றி அறிந்து கொள்ள முடியும்.                                                        |               |                |          |           |           |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | தமிழர்களின் ஒழுக்க நெறிமுறைகளைப் பற்றி தெரிந்து கொண்டு அதன்படி நடந்து கொள்ள முடியும்.                                              |               |                |          |           |           |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | பழங்கால இந்திய தேசிய இயக்கம் பற்றியும், இந்திய மக்களின் பண்பாட்டில் தமிழர்களின் பங்களிப்பு பற்றியும் நன்கு அறிந்து கொள்ள முடியும். |               |                |          |           |           |
| <b>அலகு - I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>மொழி மற்றும் இலக்கியம்:</b>                                                                                                     |               |                |          |           | <b>3</b>  |
| இந்திய மொழிக் குடும்பங்கள் - திராவிடமொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மை கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி- தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு. |                                                                                                                                    |               |                |          |           |           |
| <b>அலகு - II</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை</b>                                                                 |               |                |          |           | <b>3</b>  |
| நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர்செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.                                                                                                                      |                                                                                                                                    |               |                |          |           |           |
| <b>அலகு - III</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>நாட்டுப்புறக்கலைகள் மற்றும் வீர விளையாட்டுகள்</b>                                                                               |               |                |          |           | <b>3</b>  |
| தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    |               |                |          |           |           |
| <b>அலகு - IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>தமிழர்களின் திணைக் கோட்பாடுகள்</b>                                                                                              |               |                |          |           | <b>3</b>  |
| தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு -சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும்- சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.                                                                                                                                              |                                                                                                                                    |               |                |          |           |           |

|                                                                                                                                                                                                                                                    |                                                                                                                                                                                                       |     |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|
| அலகு - V                                                                                                                                                                                                                                           | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு                                                                                                                            | 3   |   |
| இந்திய விடுதலை போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு. |                                                                                                                                                                                                       |     |   |
| L:15, SL:15, Total: 30 Hours                                                                                                                                                                                                                       |                                                                                                                                                                                                       |     |   |
| மதிப்பீட்டுவிதி:<br>தொடர்மதிப்பீடு: 40%<br>பருவஇறுதித்தேர்வுகள்: 60%                                                                                                                                                                               |                                                                                                                                                                                                       |     |   |
| குறிப்புநூல்கள்:                                                                                                                                                                                                                                   |                                                                                                                                                                                                       |     |   |
| 1.                                                                                                                                                                                                                                                 | தமிழகவரலாறு – மக்களும்பண்பாடும்- கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)                                                                                         |     |   |
| 2.                                                                                                                                                                                                                                                 | கணினித்தமிழ்- முனைவர் இல. சுந்தரம்(விகடன்பிரசுரம்)                                                                                                                                                    |     |   |
| 3.                                                                                                                                                                                                                                                 | கீழடி- வைகை நதிகரையில் சங்க கால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)                                                                                                                                |     |   |
| 4.                                                                                                                                                                                                                                                 | பொருளை- ஆற்றங்கரை நாகரீகம் (தொல்லியல் துறை வெளியீடு)                                                                                                                                                  |     |   |
| 5.                                                                                                                                                                                                                                                 | முத்திராமலிங்கம் சு. & சரவணகுமார் மு. "தமிழர்மரபு (Heritage of Tamils)", 2023 Yes Dee Publishing Pvt. Ltd., சென்னை.                                                                                   |     |   |
| மின்னணுவளங்கள்:                                                                                                                                                                                                                                    |                                                                                                                                                                                                       |     |   |
| 1.                                                                                                                                                                                                                                                 | <a href="https://en.wikipedia.org/wiki/Dravidian_languages">https://en.wikipedia.org/wiki/Dravidian_languages</a>                                                                                     |     |   |
| 2.                                                                                                                                                                                                                                                 | <a href="https://www.tamilvu.org/courses/degree/">https://www.tamilvu.org/courses/degree/</a>                                                                                                         |     |   |
| 3.                                                                                                                                                                                                                                                 | <a href="https://www.scribd.com/document/802136891/Heritage-of-Tamils">https://www.scribd.com/document/802136891/Heritage-of-Tamils</a>                                                               |     |   |
| 4.                                                                                                                                                                                                                                                 | <a href="https://www.scribd.com/document/718189396/AKAM-AND-PURAM">https://www.scribd.com/document/718189396/AKAM-AND-PURAM</a>                                                                       |     |   |
| 5.                                                                                                                                                                                                                                                 | <a href="https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/">https://pmc.ncbi.nlm.nih.gov/articles/PMC10357311/</a>                                                                                   |     |   |
| பாடநெறிமுடிவுகள் (COs) / இந்தப் படிப்பு முடிந்ததும், மாணவர்களால்                                                                                                                                                                                   |                                                                                                                                                                                                       |     |   |
| CO1                                                                                                                                                                                                                                                | இந்திய மொழிகள், மொழிக் குடும்பங்கள், இலக்கியத்தின் தோற்றம் மற்றும் வளர்ச்சி ஆகியவற்றை விளக்குவதோடு, தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்புகளை மதிப்பிடுவார்கள். | PO9 | - |
| CO2                                                                                                                                                                                                                                                | பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை தமிழர்களின் கலை மரபுகளை அறிந்து, தமிழர்களின் சமூக மற்றும் பொருளாதார வாழ்வில் கோவில்களின் பங்கை விளக்குவார்கள்.                                                | PO9 | - |

|            |                                                                                                                                                                                                                                                                                                 |           |      |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------|
| <b>C03</b> | தமிழர்களின் வாழ்வியல் முறைகளோடு தொடர்புடைய நாட்டுப்புறக் கலைகள், வீரவிளையாட்டுகள் மற்றும் சங்ககாலத்திணைக் கோட்பாடுகளைப் புரிந்து கொண்டு அவற்றின் பண்பாட்டு முக்கியத்துவத்தை எடுத்துரைப்பார்கள்.                                                                                                 | PO9       | PSO1 |
| <b>C04</b> | இந்திய தேசிய இயக்கத்திலும் இந்தியப் பண்பாட்டு வளர்ச்சியிலும் தமிழர்களின் பங்களிப்பை ஆய்ந்து அதன் வரலாற்றுச் சிறப்பை விளக்குவார்கள்.                                                                                                                                                             | PO9       | -    |
| <b>C05</b> | இந்திய மொழிகள், இலக்கிய வளர்ச்சி, தமிழ் இலக்கிய அறிஞர்களின் பங்களிப்புகள், சங்க காலத்திணைக் கோட்பாடுகள் ஆகியவற்றை அடிப்படையாகக் கொண்டு கருத்தரங்குகள், விளக்கவுரைகள், குழு விவாதங்கள் மற்றும் திட்டப்பணிகளை மேற்கொண்டு தங்களது பகுப்பாய்வுத்திறனை வெளிப்படுத்துவார்கள்.                         | PO9, PO11 | PSO3 |
| <b>C06</b> | தமிழர்களின் கலை, பண்பாடு, நாட்டுப்புறக்கலைகள், வீரவிளையாட்டுகள், கோவில் மரபுகள் மற்றும் தேசிய இயக்கத்தில் தமிழர்களின் பங்களிப்பு தொடர்பான கள ஆய்வு, ஆவணப்படுத்தல், படைப்பாற்றல் செயல்பாடுகள் மற்றும் வழங்கல்களின் மூலம் பண்பாட்டு விழிப்புணர்வு மற்றும் ஆய்வுத்திறன்களை வளர்த்துக் கொள்வார்கள். | PO9, PO11 | PSO3 |

**வரையறுக்கப்பட்ட பாடக் கற்றல் விளைவுகளுக்கான பாட ஒருங்கிணைப்பு அட்டவணை (CAM)**

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| <b>C01</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C02</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C03</b> |     |     |     |     |     |     |     |     | 3   |       |       | 2     |       |       |
| <b>C04</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C05</b> |     |     |     |     |     |     |     |     | 3   |       | 2     |       |       | 2     |
| <b>C06</b> |     |     |     |     |     |     |     |     | 3   |       | 2     |       |       | 2     |

**செயல்பாடுகள்:**

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>C05:</b> தமிழர்களின் பாரம்பரிய அறிவியல் அறிவு, தொழில் நுட்பச்சாதனைகள் மற்றும் பண்பாட்டு மரபுகளை ஆராய்ந்து, அவற்றின் வரலாற்று மற்றும் தற்கால முக்கியத்துவத்தைப் புரிந்து கொள்வார்கள்.</p> <p><b>செயல்பாடுகள்:</b></p> <ol style="list-style-type: none"> <li>1. பழந்தமிழர்களின் அறிவியல் மற்றும் தொழில் நுட்பச்சாதனைகள் (எ.கா., நீர்ப்பாசன அமைப்புகள், கட்டிடக்கலை, உலோகவியல், கடல்சார் வாணிபம்) குறித்த கருத்தரங்கு வழங்கல்.</li> <li>2. பாரம்பரியத் தமிழ் அறிவு முறைகளின் தற்காலப் பயன்பாடு மற்றும் முக்கியத்துவம் குறித்த குழு விவாதம்.</li> <li>3. தமிழர் பண்பாட்டு மரபுச் சின்னங்கள், வரலாற்று நினைவுச் சின்னங்கள் மற்றும் பொறியியல் அற்புதங்கள் தொடர்பான வழக்குக்கள ஆய்வு (Case Study Analysis).</li> </ol> |
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|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>4. தமிழர்களின் பண்பாட்டு மற்றும் தொழில்நுட்பப் பங்களிப்புகளை எடுத்துக்காட்டும் வகையில் விளக்கப்படங்கள், மாதிரிகள் மற்றும் புகைப்படங்களைக் கொண்டு பாரம்பரியக் கண்காட்சி நடத்துதல், தமிழர் இலக்கியம், அறிவியல் மற்றும் பண்பாட்டுச் சாதனைகள் குறித்த வினாடி வினா மற்றும் பட்டிமன்றம் / விவாதம் நடத்துதல்</p> <p>5. அருங்காட்சியகங்கள், பாரம்பரியத்தளங்கள், கோவில்கள் அல்லது தொல்லியல் தளங்களுக்கு களப்பயணம் மேற்கொண்டு ஆய்வறிக்கை சமர்ப்பித்தல்.</p> |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2. | <p><b>CO6:</b> தமிழர்களின் அறிவியல், தொழில் நுட்ப மற்றும் பண்பாட்டுப் பங்களிப்புகளின் பயன்பாடுகளையும் அவற்றின் தற்காலப் பொருத்தத்தையும் செயல் வழிக்கற்றல், வழக்குக்கள ஆய்வுகள் மற்றும் திட்டப்பணிகள் மூலம் வெளிப்படுத்துவார்கள்.</p> <p><b>செயல்பாடுகள்:</b></p> <ol style="list-style-type: none"> <li>1. தமிழர்களின் பாரம்பரியத் தொழில் நுட்பங்கள் (நீர்மேலாண்மை, வேளாண் முறைகள், பாரம்பரியக் கட்டிடக்கலை போன்றவை) தொடர்பான சிறு திட்டப்பணி (Mini Project) மேற்கொள்ளுதல்.</li> <li>2. தமிழர் பொறியியல் சாதனைகளை (எ.கா., கல்லணை, கோவில் கட்டிடக்கலை, பண்டைய கடற்படைக் கப்பல்கள்) விளக்கும் மாதிரி வடிவமைத்தல் (Model Making Activity).</li> <li>3. பண்டைய தமிழர் தொழில் நுட்பங்களையும் நவீன தொழில் நுட்பங்களையும் ஒப்பிட்டு வழக்குக் கள ஆய்வு வழங்கல் (Case Study Presentation) மேற்கொள்ளுதல்.</li> <li>4. பாரம்பரியக்கலைகள், கைவினைப் பொருட்கள், நாட்டுப்புற நடைமுறைகள் அல்லது பூர்வீகத் தொழில் நுட்பங்கள் தொடர்பான செயல் விளக்கக்காட்சி (Practical Demonstration) நடத்துதல்.</li> <li>5. தமிழர்களின் அறிவியல் மற்றும் தொழில் நுட்பப் பங்களிப்புகளை எடுத்துரைக்கும் சுவரொட்டி (Poster) மற்றும் தகவல் விளக்கப்படம் (Infographic) தயாரித்தல், உள்ளூர் பாரம்பரிய அறிவு, நாட்டுப்புறப் பழக்க வழக்கங்கள் அல்லது பண்பாட்டு மரபுகள் தொடர்பான சமூக அடிப்படையிலான ஆய்வுத்திட்டம் மேற்கொண்டு அதன் முடிவுகளை வழங்குதல்.</li> </ol> |
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#### CO5-க்கான மதிப்பீட்டு அளவு கோல்கள்

| வரி<br>சை<br>எண் | மதிப்பீட்டு<br>அளவுகோல்                   | மதிப்<br>பெண்<br>கள் | மிகச்சிறப்பு (7-8)                                                                                                                                        | சிறப்பு (4-6)                                                           | திருப்திகரம்<br>(1-3)                                                                   |
|------------------|-------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1.               | தமிழர்<br>பாரம்பரியம்<br>குறித்த<br>அறிவு | 8                    | தமிழர்களின்<br>அறிவியல்,<br>தொழில்நுட்ப<br>மற்றும் பண்பாட்டு<br>மரபுகள் குறித்து<br>துல்லியமான<br>விவரங்களுடன்<br>விரிவான புரிதலை<br>வெளிப்படுத்துகிறார். | சிறிய<br>குறைபாடுகளு<br>டன் நல்ல<br>புரிதலை<br>வெளிப்படுத்துகி<br>றார். | வரையறுக்கப்பட்<br>ட<br>விவரங்களுடன்<br>அடிப்படைய்<br>புரிதலை<br>வெளிப்படுத்துகி<br>றார் |

|    |                                |           |                                                                                                                        |                                                                                                    |                                                                                                                                     |
|----|--------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 2. | வரலாற்றுப் புரிதல்             | 8         | வரலாற்றுப் பின்னணி மற்றும் அதன் முக்கியத்துவத்தை பொருத்தமான எடுத்துக்காட்டுகளுடன் தெளிவாக விளக்குகிறார்.               | சில எடுத்துக்காட்டுகளுடன் வரலாற்றுப் பின்னணியை விளக்குகிறார்.                                      | வரலாற்றுப் பின்னணியை குறைந்த அளவில் விளக்குகிறார்.                                                                                  |
| 3. | தற்காலப் பொருத்தம்             | 8         | பாரம்பரிய அறிவு மற்றும் சாதனைகளை இன்றைய பயன்பாடுகள் மற்றும் பிரச்சினைகளுடன் திறம்பட தொடர்பு படுத்துகிறார்.             | பாரம்பரிய அறிவை நவீன பயன்பாடுகளுடன் ஓரளவு தெளிவாக தொடர்பு படுத்துகிறார்.                           | சில நவீன தொடர்புகளை மட்டுமே அடையாளம் காண்கிறார்.                                                                                    |
| 4. | வழங்கல் மற்றும் தொடர்புத்திறன் | 8         | தகவல்கள் சிறப்பாக ஒழுங்கமைக்கப்பட்டு, தெளிவாகவும் சுவாரஸ்யமாகவும் பொருத்தமான ஆதாரங்களுடன் வழங்கப்படுகின்றன             | தகவல்கள் ஒழுங்கமைக்கப்பட்டு பெரும்பாலும் தெளிவாக வழங்கப்படுகின்றன.                                 | தகவல்கள் புரிந்து கொள்ளக்கூடியதாக இருந்தாலும் தெளிவு மற்றும் ஒழுங்கமைப்பு குறைவாக உள்ளது.                                           |
| 5. | தொடர்புத்திறன்                 | 8         | கருத்துகள் தெளிவாகவும், தன்னம்பிக்கையுடனும், ஈர்க்கக்கூடிய வகையிலும், பொருத்தமான ஆதாரங்களுடன் வெளிப்படுத்தப்படுகின்றன. | கருத்துகள் தெளிவாகவும், மிதமான தன்னம்பிக்கையுடனும், போதுமான ஆதாரங்களுடனும் வெளிப்படுத்தப்படுகின்றன | கருத்துப் பரிமாற்றம் புரிந்து கொள்ளக்கூடியதாக இருந்தாலும், தெளிவு, தன்னம்பிக்கை அல்லது பொருத்தமான ஆதாரங்களின் குறைபாடுகாணப்படுகிறது |
|    | <b>மொத்தம்</b>                 | <b>40</b> |                                                                                                                        |                                                                                                    |                                                                                                                                     |

**CO6-க்கான மதிப்பீட்டு அளவு கோல்கள்**

| வ. எண் | மதிப்பீட்டு அளவு கோல்                | மதிப் பெண்கள் | மிகச்சிறப்பு (7-8)                                                                                                                     | சிறப்பு (4-6)                                                  | திருப்திகரம் (1-3)                                                                          |
|--------|--------------------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1.     | அறிவின் பயன்பாடு                     | 8             | தமிழர்களின் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டுக் கருத்துக்களை செயல் வழிப்பணிகள் மற்றும் திட்டங்களில் திறம்படப் பயன்படுத்துகிறார். | கருத்துக்களை சிறிய வழிகாட்டுதலுடன் சரியாகப் பயன்படுத்துகிறார். | கருத்துக்களை அடிப்படை அளவில் மட்டுமே பயன்படுத்துகிறார்.                                     |
| 2.     | திட்டப்பணி செயல்படுத்தல்             | 8             | திட்டப்பணி முழுமையானதாகவும், புதுமையானதாகவும்கூட, சிறந்த திட்டமிடலுடன் வெற்றிகரமாக நிறைவேற்றப்பட்டதாகவும் உள்ளது.                      | திட்டப்பணி சிறிய குறைபாடுகளுடன் நன்கு செயல்படுத்தப்பட்டுள்ளது. | திட்டப்பணி குறைந்தபட்ச தேவைகளைப் பூர்த்தி செய்கிறது; ஆனால் ஆழமும் முழுமையும் குறைவாக உள்ளன. |
| 3.     | ஆதாரங்கள் மற்றும் வளங்களின் பயன்பாடு | 8             | திட்டத்தின் முடிவுகளை ஆதரிக்க பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுகளை திறம்படப் பயன்படுத்துகிறார்.                    | போதுமான ஆதாரங்களுடன் பொருத்தமான வளங்களைப் பயன்படுத்துகிறார்.   | குறைந்த அளவிலான ஆதாரங்கள் மற்றும் வளங்களைப் பயன்படுத்துகிறார்.                              |
| 4.     | வழங்கல் மற்றும் ஆவணப்படுத்தல்        | 8             | முடிவுகளைத் தெளிவாகவும் தொழில்முறை முறையிலும் சிறப்பான ஆவணப்படுத்தலுடன் வழங்குகிறார்.                                                  | நல்ல ஆவணப்படுத்தலுடன் தெளிவாக வழங்குகிறார்.                    | வழங்கல் மற்றும் ஆவணப்படுத்தல் போதுமானதாக இருந்தாலும் தெளிவும் விவரங்களும் குறைவாக உள்ளன.    |

|   |                      |    |                                                                                                                               |                                                                                    |                                                                                                                            |
|---|----------------------|----|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 5 | ஆவணப்படுத்தலின் தரம் | 8  | ஆவணப்படுத்தல் முழுமையானதாகவும், துல்லியமானதாகவும், நன்கு ஒழுங்கமைக்கப்பட்டதாகவும், சரியான வடிவமைப்புடன் அமைந்ததாகவும் உள்ளது. | ஆவணப்படுத்தல் முழுமையாகவும், சிறிய விடுபாடுகளுடன் ஒழுங்கமைக்கப்பட்டதாகவும் உள்ளது. | ஆவணப்படுத்தல் போதுமானதாக இருந்தாலும், விவரம், துல்லியம் அல்லது சரியான ஒழுங்கமைப்பு ஆகியவற்றில் குறைபாடுகள் காணப்படுகின்றன. |
|   | மொத்தம்              | 40 |                                                                                                                               |                                                                                    |                                                                                                                            |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| CO1          | 12        | 12        | -          | -           | 12                    | 2                |
| CO2          | 24        | 24        |            |             | 24                    | 3                |
| CO3          | 12        | 12        |            |             | 12                    | 2                |
| CO4          | 12        | 12        |            |             | 12                    | 2                |
| CO5          |           |           | 40         |             | 20                    | 2                |
| CO6          |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                   |                    |    |         |    |    |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|----|---------|----|----|-----|
| 26PHC01                                                                                                                                                                                                                                                                                                                                                                                        | APPLIED PHYSICS                                                                                                       |                   | SEMESTER           |    |         |    | I  |     |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                       |                   | Category           | BS | Credits |    |    | 4   |
|                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                   | Hours/<br>Semester | L  | T       | P  | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                   |                    | 45 | -       | 45 | 30 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                       |                   |                    |    |         |    |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                             | To understand the fundamental principles of mechanics and rotational motion.                                          |                   |                    |    |         |    |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                             | To analyze ultrasonic wave production, detection, and applications.                                                   |                   |                    |    |         |    |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                             | To develop conceptual understanding of quantum mechanics and nanoscale systems.                                       |                   |                    |    |         |    |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                             | To understand the fundamental principles of laser operation, laser characteristics and different types of laser.      |                   |                    |    |         |    |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                             | To understand the principles of optical fiber transmission and communication system for high-speed data transmission. |                   |                    |    |         |    |    |     |
|                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                   |                    |    |         |    |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                       | MECHANICS         |                    |    |         |    |    | 9+9 |
| Rotation of rigid bodies: Rotational kinematics – Rotational kinetic energy and moment of inertia – Theorems of moment of inertia – Moment of inertia of diatomic molecule – Torque – Rotational dynamics of rigid bodies – Conservation of angular momentum – Rotational energy state of a rigid diatomic molecule – gyroscope – Torsional pendulum – Introduction to nonlinear oscillations. |                                                                                                                       |                   |                    |    |         |    |    |     |
| Practical:                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |                   |                    |    |         |    |    |     |
| 1. Torsional Pendulum – Determination of rigidity modulus of the given material                                                                                                                                                                                                                                                                                                                |                                                                                                                       |                   |                    |    |         |    |    |     |
| 2. Determination of moment of inertia of a rigid body                                                                                                                                                                                                                                                                                                                                          |                                                                                                                       |                   |                    |    |         |    |    |     |
| Activity: Virtual demonstration of Gyroscopic Motion                                                                                                                                                                                                                                                                                                                                           |                                                                                                                       |                   |                    |    |         |    |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                       | ULTRASONICS       |                    |    |         |    |    | 9+9 |
| Properties - Production: Magnetostriction effect - Magnetostriction generator - Piezoelectric effect – Piezoelectric generator – Detection of ultrasonic waves - Cavitation– Acoustical grating– Velocity measurement – Industrial Applications: SONAR – Non Destructive Testing: Pulse echo system through transmission and reflection modes – Medical application - Sonogram                 |                                                                                                                       |                   |                    |    |         |    |    |     |
| Practical:                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |                   |                    |    |         |    |    |     |
| 1. Ultrasonic interferometer – Determination of velocity of ultrasonic waves and compressibility of given liquid                                                                                                                                                                                                                                                                               |                                                                                                                       |                   |                    |    |         |    |    |     |
| 2. Acoustical Grating - Determination of velocity of ultrasonic waves in a given liquid                                                                                                                                                                                                                                                                                                        |                                                                                                                       |                   |                    |    |         |    |    |     |
| Activity: Virtual demonstration of SONAR.                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                       |                   |                    |    |         |    |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       | QUANTUM MECHANICS |                    |    |         |    |    | 9+9 |
| Matter waves – Experimental evidence - Davisson and Germer experiment – Schrodinger’s wave equation - Time independent and dependent equations – Physical significance of wave function – Normalization – Particle in an infinite potential well (1D) – Tunnelling effect (Qualitative) – Scanning Tunnelling Microscope (STM).                                                                |                                                                                                                       |                   |                    |    |         |    |    |     |
| Practical:                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                       |                   |                    |    |         |    |    |     |
| 1. Quantum Mechanics of Particle in a Potential Well – simulation                                                                                                                                                                                                                                                                                                                              |                                                                                                                       |                   |                    |    |         |    |    |     |
| 2. Quantum tunnelling through a potential barrier – simulation                                                                                                                                                                                                                                                                                                                                 |                                                                                                                       |                   |                    |    |         |    |    |     |
| Activity: Virtual demonstration of Scanning Tunnelling Microscope                                                                                                                                                                                                                                                                                                                              |                                                                                                                       |                   |                    |    |         |    |    |     |

|                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                      |              |             |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|--------------|
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                      | LASER        |             | 9+9          |
| Characteristics of laser light – absorption, spontaneous emission and stimulated emission – Einstein Co-efficient (derivation) – Population inversion – Pumping methods – Types of laser – Construction and working of Nd:YAG laser, CO <sub>2</sub> Laser, Semiconductor laser (homojunction and heterojunction) – Industrial and medical applications (Qualitative). |                                                                                                                                                                      |              |             |              |
| Practical:                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                      |              |             |              |
| 1. Determination of wavelength of laser using grating                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                      |              |             |              |
| 2. Determination of particle size using laser                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                      |              |             |              |
| Activity: Virtual demonstration of semiconductor laser                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                      |              |             |              |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                      | FIBRE OPTICS |             | 9+9          |
| Principle of optical fibre – Structure – Critical angle – Propagation of light through optical fibre – Numerical aperture and Acceptance angle – Classification of optical fibre – Fibre optic communication (Block diagram) – Fibre optic sensors: Displacement and Temperature Sensor - Medical Application- Fibre optic endoscope.                                  |                                                                                                                                                                      |              |             |              |
| Practical:                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                      |              |             |              |
| 1. Determination of Acceptance angle and Numerical aperture of a given fibre                                                                                                                                                                                                                                                                                           |                                                                                                                                                                      |              |             |              |
| 2. Determination of displacement using fibre optics sensor                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                      |              |             |              |
| Activity: Virtual demonstration of fibre optic sensors                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                      |              |             |              |
| L:45, P:45, SL:30, Total:120 Hours                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                      |              |             |              |
| Weightage:                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                      |              |             |              |
| Continuous Assessment 50%                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                      |              |             |              |
| End Semester Examinations 50%                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                      |              |             |              |
| TEXT BOOKS:                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                      |              |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                                     | A. Marikani, 'Engineering Physics', PHI Learning Publishers,2024.                                                                                                    |              |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                                     | M.Arumugam, 'Engineering Physics', Anuradha Publications,2014.                                                                                                       |              |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                                     | R.K. Gaur & S.L. Gupta, 'Engineering physics', Dhanpat Rai Publications, 2022.                                                                                       |              |             |              |
| 4.                                                                                                                                                                                                                                                                                                                                                                     | B.B. Laud, 'Lasers and Non-linear Optics', New Age international Publishers, 2021.                                                                                   |              |             |              |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                      |              |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                                     | H.D. Young & R.A. Freedman, 'University physics with modern physics', Pearson, 2020.                                                                                 |              |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                                     | Arthur Beiser, 'Concepts of Modern Physics', McGraw-Hill, 2017.                                                                                                      |              |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                                     | K. Thyagarajan and Ajoy Ghatak, ' <i>Lasers: Theory and Applications</i> ', Springer, 2012.                                                                          |              |             |              |
| E-RESOURCES:                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                      |              |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                                     | Ultrasonics: <a href="https://nptel.ac.in/courses/122107035">https://nptel.ac.in/courses/122107035</a>                                                               |              |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                                     | CO <sub>2</sub> Laser: <a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ph03">https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ph03</a> |              |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                                     | Quantum Mechanics: <a href="https://www.youtube.com/playlist?list=PL0F530F3BAF8C6FCC">https://www.youtube.com/playlist?list=PL0F530F3BAF8C6FCC</a>                   |              |             |              |
| 4.                                                                                                                                                                                                                                                                                                                                                                     | Optical Sensors: <a href="https://auece.digimat.in/nptel/courses/video/108106173/L02.html">https://auece.digimat.in/nptel/courses/video/108106173/L02.html</a>       |              |             |              |
| COURSE OUTCOMES (COs)                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                      |              | Mapping POs | Mapping PSOs |
| At the end of the course, the students will have the ability to                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                      |              |             |              |
| CO1                                                                                                                                                                                                                                                                                                                                                                    | Explain the fundamental principles and concepts of applied physics and their engineering applications.                                                               |              | --          |              |

|            |                                                                                                                                                                                               |          |      |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|
| <b>CO2</b> | Apply physics principles to solve problems encountered in engineering context                                                                                                                 | PO1      |      |
| <b>CO3</b> | Analyse the solution strategies for applied physics problems, selecting appropriate approaches based on theoretical and practical considerations.                                             | PO2      |      |
| <b>CO4</b> | Perform practical experiments and activity-based demonstrations in groups and present the observed results.                                                                                   | PO4, PO8 |      |
| <b>CO5</b> | Communicate emerging concepts and advancements in physics while considering environmental sustainability and societal impact through virtual laboratory activities and seminar presentations. | PO6, PO9 | PSO3 |
| <b>CO6</b> | Engage in self-learning to explore emerging physics concepts, advanced technologies, and contemporary engineering applications, fostering continuous professional development.                | PO11     |      |

### The Course Articulation Matrix (CAM) for defined COs

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|-------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> |             |             |             |             |             |            |             |             |             |              |              |              |              |              |
| <b>CO2</b> | 2           |             |             |             |             |            |             |             |             |              |              |              |              |              |
| <b>CO3</b> |             | 3           |             |             |             |            |             |             |             |              |              |              |              |              |
| <b>CO4</b> |             |             |             | 3           |             |            |             | 3           |             |              |              |              |              |              |
| <b>CO5</b> |             |             |             |             |             | 2          |             |             | 2           |              |              |              |              | 2            |
| <b>CO6</b> |             |             |             |             |             |            |             |             |             |              | 2            |              |              |              |

### Activities:

|    |                                                                                                                                        |
|----|----------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Determination of physics concepts through virtual lab. <b>(CO5)</b><br>Seminar presentation of emerging physics concepts. <b>(CO5)</b> |
| 2. | Self-learning study and presentation on emerging physics-based technologies with safety considerations. <b>(CO6)</b>                   |

### Rubrics for evaluation (CO5)

| <b>Sl. No.</b> | <b>Criterion</b>     | <b>Marks</b> | <b>Excellent (3)</b>                                                              | <b>Good (2)</b>                                     | <b>Satisfactory (1)</b>          |
|----------------|----------------------|--------------|-----------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------|
| 1              | Subject Knowledge    | 10           | Clearly explains the concept with relevant examples                               | Good explanation with minor gaps                    | Basic understanding of the topic |
| 2              | Content Organization | 10           | Information is well-organized, clear, and logically presented                     | Organization is good with minor improvements needed | Average organization of content  |
| 3              | Communication Skills | 10           | Confident presentation with clear explanation and effective response to questions | Good communication with slight hesitation           | Basic communication skills       |

|   |                           |           |                                                                                                       |                                                           |                                                                         |
|---|---------------------------|-----------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------------------------|
| 4 | Interpretation of Results | 10        | Results are accurately analyzed, clearly interpreted, and well justified using scientific principles. | Results are interpreted correctly with some justification | Basic interpretation of results with limited analysis or justification. |
|   | <b>Total</b>              | <b>40</b> |                                                                                                       |                                                           |                                                                         |

#### Rubrics for evaluation (C06)

| Sl. No. | Criterion                    | Marks     | Excellent (3)                                                                     | Good (2)                                       | Satisfactory (1)                       |
|---------|------------------------------|-----------|-----------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|
| 1       | Topic Understanding          | 10        | Clearly explains the concept and its real-world application with relevant details | Good explanation with minor gaps               | Basic understanding of the topic       |
| 2       | Literature Review            | 10        | Reviews and compares multiple relevant research articles effectively              | Reviews relevant articles with some comparison | Limited review of articles             |
| 3       | Analysis & Interpretation    | 10        | Critically analyses the product performance, advantages, and limitations          | Good analysis with minor shortcomings          | Basic analysis provided                |
| 4       | Presentation & Communication | 10        | Well-organized report/presentation with clear communication and proper references | Organized presentation with minor errors       | Average presentation and communication |
|         | <b>Total</b>                 | <b>40</b> |                                                                                   |                                                |                                        |

#### The Internal Assessment Matrix (IAM) for the defined COs:

|              | Theory Component |           |            |             | Laboratory Component   |            | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|------------------------|------------|-----------------------|------------------|
| CO           | Test I           | Test II   | Activity I | Activity II | Observation and Record | Test       |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             |                        |            | 6                     | 1                |
| <b>CO2</b>   | 24               | 24        |            |             |                        |            | 12                    | 2                |
| <b>CO3</b>   | 24               | 24        |            |             | 40                     | 40         | 32                    | 3                |
| <b>CO4</b>   |                  |           |            |             | 60                     | 60         | 30                    | 3                |
| <b>CO5</b>   |                  |           | 40         |             |                        |            | 10                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          |                        |            | 10                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>             | <b>100</b> | <b>100</b>            |                  |

Note: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                               |                          |          |         |    |    |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------|---------|----|----|-----|
| 26CYC01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | APPLIED CHEMISTRY                                                                                                                                                                                                                             |                          | SEMESTER |         |    |    | I   |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                               | Category                 | BS       | Credits |    |    | 4   |
| Basic Chemistry concepts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                               | Hours/<br>Semester       | L        | T       | P  | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                               |                          | 45       | -       | 45 | 30 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                               |                          |          |         |    |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | To understand the fundamental scientific principles related to water chemistry, electrochemical systems, polymers, acid–base equilibria, corrosion phenomena, and spectroscopic techniques used in engineering applications.                  |                          |          |         |    |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | To acquire the ability to apply chemical laws, numerical methods, and analytical reasoning for solving engineering problems involving water quality, electrochemical cells, buffer systems, corrosion, and instrumental analysis.             |                          |          |         |    |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | To examine the behaviour of chemical and material systems and interpret the influence of process parameters on performance in water treatment, electrochemical processes, corrosion control, polymers, and spectroscopy.                      |                          |          |         |    |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | To assess different engineering materials, chemical processes, and analytical techniques for selecting suitable methods in industrial and technological applications.                                                                         |                          |          |         |    |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | To develop practical laboratory skills by performing experiments related to water analysis, electrochemistry, polymers, acid–base systems, corrosion studies, and spectroscopic measurements, and to interpret experimental data effectively. |                          |          |         |    |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                               | WATER TECHNOLOGY:        |          |         |    |    | 9+9 |
| Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical problems – dissolved oxygen significance – boiler troubles (scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) – External treatment – demineralization, zeolite process – desalination of brackish water – reverse osmosis.<br><b>Practical:</b> 1. Estimation of total hardness by EDTA method.<br>2. Estimation of alkalinity of water.<br><b>Activities:</b> 1. Determination of DO by Winkler titration.<br>2. Coagulation of water by adding alum. |                                                                                                                                                                                                                                               |                          |          |         |    |    |     |
| UNIT – II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                               | ELECTROCHEMISTRY:        |          |         |    |    | 9+9 |
| Cells – types – Electrochemical cell – representation of electrochemical cell – redox reaction – single electrode potential – oxidation and reduction potential – Nernst equation for single electrode potential – numerical problems. Electrochemical series – significance and application – measurement of emf of cell – poggendorff's method. Potentiometric titrations (acid-base, redox and precipitation titrations).<br><b>Practical:</b> 1. Estimation of iron by potentiometric titration.<br>2. Estimation of strong acid by conductometric titration.<br>3. Estimation of mixture of acids by conductometric titration.<br><b>Activity:</b> Electrochemical cell demonstration                                      |                                                                                                                                                                                                                                               |                          |          |         |    |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                               | POLYMERS AND PHASE RULE: |          |         |    |    | 9+9 |
| Polymers – definition – polymerization – types – addition and condensation polymerization – mechanism of free radical addition polymerization– plastics, classification – thermosetting and thermo plastic – preparation, properties and uses of PVC, Teflon, polyurethane, nylon-6,6, PET.<br>Phase rule – Introduction, definition of terms with examples, one component system – water system.<br><b>Practical:</b> Determination of molecular weight of polymer by viscometry.<br><b>Activity:</b> Comparing biodegradable and non-biodegradable polymers.                                                                                                                                                                  |                                                                                                                                                                                                                                               |                          |          |         |    |    |     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                    |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------|
| <b>UNIT - IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>ACID BASE CONCEPTS AND CORROSION:</b>                                                                           | <b>9+9</b> |
| <p>Acids and bases – Arrhenius concept – Bronsted-Lowry concept – Lewis concept – pH and pKa – buffer solutions – types – mechanism of buffer action – Henderson–Hasselbalch equation – derivation and problems.</p> <p>Corrosion – causes – types of corrosion – chemical, electrochemical corrosion (galvanic, differential aeration) – factors influencing the rate of corrosion – electrochemical protection – sacrificial anode method and impressed current cathodic method.</p> <p><b>Practical:</b> 1. Estimation of strong acid by pH meter.<br/>2. Estimation of pKa of weak acid by pH meter.</p> <p><b>Activities:</b> 1. Using litmus paper finding out the nature (acid or base) of household substances.<br/>2. Corrosion study by weight loss method</p> |                                                                                                                    |            |
| <b>UNIT - V</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>SPECTROSCOPIC TECHNIQUES:</b>                                                                                   | <b>9+9</b> |
| <p>Beer-Lambert's law (problem) – UV visible spectroscopy: Principle, chromophore, auxochrome, electronic transitions and instrumentation (No applications). Flame photometry – principle – instrumentation – estimation of sodium by flame photometer. Atomic absorption spectroscopy – principle – instrumentation – estimation of nickel by atomic absorption spectroscopy.</p> <p><b>Practical:</b> 1. Estimation of iron by spectrophotometer.<br/>2. Estimation of copper by calorimeter.</p> <p><b>Activity:</b> Determining chlorophyll content in leaves with a spectrophotometer.</p>                                                                                                                                                                          |                                                                                                                    |            |
| <b>L:45, P:45, SL :30, Total:120 Hours</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                    |            |
| <p><b>Weightage:</b><br/>Continuous Assessment 50%<br/>End Semester Examinations 50%</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                    |            |
| <b>REFERENCE BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                    |            |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | S. S. Dara and S. S. Umare, —A Textbook of Engineering Chemistry   S. Chand & Company LTD, New Delhi, 2015         |            |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | P. C. Jain and Monika Jain, —Engineering Chemistry   Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015       |            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | S. Vairam, P. Kalyani and Suba Ramesh, —Engineering Chemistry   Wiley India PVT, LTD, New Delhi, 2013.             |            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dr.Shashi Chawla - A Textbook of Engineering Chemistry - Dhanpat Rai & Co. (Pvt.) Ltd., New Delhi - 2001           |            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Dr. O. G. Palanna - Engineering Chemistry - McGraw-Hill Education (India) Private Limited - 2009                   |            |
| <b>E-RESOURCES:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                    |            |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="http://www.onlinecourses.nptel.ac.in/">www.onlinecourses.nptel.ac.in/</a>                                 |            |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <a href="http://www.ePathshala.nic.in">www.ePathshala.nic.in</a>                                                   |            |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | eGyanKosh – IGNOU Repository ( <a href="http://egyankosh.ac.in">http://egyankosh.ac.in</a> ) – ID: 123456789/43343 |            |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Royal Society of Chemistry Education ( <a href="https://edu.rsc.org">https://edu.rsc.org</a> )                     |            |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MIT OpenCourseWare ( <a href="https://ocw.mit.edu">https://ocw.mit.edu</a> )                                       |            |

| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                                      | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| <b>CO1</b>                                                                                         | Explain the fundamental principles of water chemistry, electrochemical systems, polymers, phase equilibria, acid–base concepts, corrosion processes, and spectroscopic techniques relevant to engineering applications.                                                              | ---                    | ---                     |
| <b>CO2</b>                                                                                         | Apply chemical laws, mathematical relationships, and analytical methods to solve engineering problems related to water quality analysis, electrochemical systems, buffer solutions, corrosion, and spectroscopic measurements.                                                       | PO1                    | ---                     |
| <b>CO3</b>                                                                                         | Analyze chemical systems and engineering problems by correlating theoretical principles with material behaviour, process performance, and experimental observations in water treatment, electrochemistry, corrosion, polymers, and spectroscopy.                                     | PO2                    | ---                     |
| <b>CO4</b>                                                                                         | Perform laboratory experiments based on water quality parameters, electrochemical processes, polymer properties, acid–base equilibria, corrosion mechanisms, and spectroscopic analysis.                                                                                             | PO4, PO8               | ---                     |
| <b>CO5</b>                                                                                         | Execute activity-based investigations related to water analysis, acid–base systems, corrosion studies, polymer characterization, and spectroscopic techniques, and interpret the results using standard analytical methods.                                                          | PO5, PO8               | ---                     |
| <b>CO6</b>                                                                                         | Engage in self-learning activities to understand and explore the role of chemical principles, materials, and analytical techniques in water treatment, corrosion control, polymers, electrochemical systems, and spectroscopy, and present the findings in engineering applications. | PO9, PO11              | ---                     |

### The Course Articulation Matrix (CAM) for defined COs

|            | <b>PO<br/>1</b> | <b>PO<br/>2</b> | <b>PO<br/>3</b> | <b>PO<br/>4</b> | <b>PO<br/>5</b> | <b>PO<br/>6</b> | <b>PO<br/>7</b> | <b>PO<br/>8</b> | <b>PO<br/>9</b> | <b>PO<br/>10</b> | <b>PO<br/>11</b> | <b>PSO<br/>1</b> | <b>PS<br/>O2</b> | <b>PSO3</b> |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|-------------|
| <b>CO1</b> |                 |                 |                 |                 |                 |                 |                 |                 |                 |                  |                  |                  |                  |             |
| <b>CO2</b> | 2               |                 |                 |                 |                 |                 |                 |                 |                 |                  |                  |                  |                  |             |
| <b>CO3</b> |                 | 2               |                 |                 |                 |                 |                 |                 |                 |                  |                  |                  |                  |             |
| <b>CO4</b> |                 |                 |                 | 3               |                 |                 |                 | 3               |                 |                  |                  |                  |                  |             |
| <b>CO5</b> |                 |                 |                 |                 | 2               |                 |                 | 2               |                 |                  |                  |                  |                  |             |
| <b>CO6</b> |                 |                 |                 |                 |                 |                 |                 |                 | 2               |                  | 2                |                  |                  |             |

### Activities:

|    |                                                                                                                                                                                                                                                      |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Undertake experimental studies and virtual/self-learning activities on water treatment, acid–base systems, corrosion, polymers, and spectroscopy, and report the observations and conclusions. <b>(CO5) (Individual and Collaborative Team Work)</b> |
| 2. | Engage in self-learning and evaluated through quizzes, case studies, seminars, and presentations on the application of chemical principles, materials, and analytical techniques in engineering systems. <b>(CO6) (Independent study)</b>            |

### Rubrics for evaluation: CO5

| Sl. No | Criterion                            | Marks     | Excellent (3)                                                                                         | Good(2)                                                                         | Satisfactory (1)                                                        |
|--------|--------------------------------------|-----------|-------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1      | Understanding of Concept             | 10        | Understanding of the concept with clear explanations.                                                 | Understanding with minor errors or omissions.                                   | Shows basic understanding but with significant gaps or misconceptions.  |
| 2      | Team Participation and Collaboration | 10        | Actively contributes, collaborates effectively, and supports team members throughout the activity.    | Participates regularly and contributes to team tasks with moderate involvement. | Limited participation and contribution to team activities.              |
| 3      | Interpretation of Results            | 10        | Results are accurately analyzed, clearly interpreted, and well justified using scientific principles. | Results are interpreted correctly with some justification.                      | Basic interpretation of results with limited analysis or justification. |
| 4      | Response to Questions                | 10        | Answers questions accurately and effectively.                                                         | Answers most questions correctly.                                               | Answers questions with partial accuracy.                                |
|        | <b>Total</b>                         | <b>40</b> |                                                                                                       |                                                                                 |                                                                         |

### Rubrics for evaluation: CO6

| Sl. No | Criterion                           | Marks     | Excellent (4)                                                                                      | Good(3)                                                  | Satisfactory (2)                                             |
|--------|-------------------------------------|-----------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------|
| 1      | Conceptual Clarity and Knowledge    | 10        | Shows complete conceptual clarity with strong understanding and accurate knowledge.                | Shows good conceptual clarity with minor errors.         | Basic understanding with limited clarity and several gaps.   |
| 2      | Accuracy of Content / Answers       | 10        | All answers are correct, precise, and scientifically accurate.                                     | Most answers are correct with minor mistakes.            | Some correct answers but several errors present.             |
| 3      | Application and Analytical Thinking | 10        | Effectively applies concepts to solve problems and analyze situations.                             | Applies concepts with minor difficulty in analysis.      | Limited ability to apply concepts; mostly descriptive.       |
| 4      | Participation and Preparedness      | 10        | Fully prepared, actively participates, and demonstrates strong engagement throughout the activity. | Well prepared and participates actively with minor gaps. | Partially prepared with limited participation or engagement. |
|        | <b>Total</b>                        | <b>40</b> |                                                                                                    |                                                          |                                                              |

**The Internal Assessment Matrix (IAM) for the defined COs:**

|              | Theory Component |           |            |             | Laboratory Component   |            | Percentage allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|------------------------|------------|-----------------------|------------------|
| CO           | Test I           | Test II   | Activity I | Activity II | Observation and Record | Test       |                       |                  |
| <b>C01</b>   | 12               | 12        |            |             |                        |            | 6                     | 1                |
| <b>C02</b>   | 24               | 24        |            |             |                        |            | 12                    | 2                |
| <b>C03</b>   | 24               | 24        |            |             |                        |            | 12                    | 2                |
| <b>C04</b>   |                  |           |            |             | 100                    | 100        | 50                    | 3                |
| <b>C05</b>   |                  |           | 40         |             |                        |            | 10                    | 2                |
| <b>C06</b>   |                  |           |            | 40          |                        |            | 10                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>             | <b>100</b> | <b>100</b>            |                  |

Note:Purely as anExample: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                         |                                  |          |         |    |    |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|---------|----|----|-----|
| 26CSC01                                                                                                                                                                                                                                                                                                                                                                                         | C PROGRAMMING<br>(Common to All Branches)                                                                                                                               |                                  | SEMESTER |         |    |    | I   |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                         | Category                         | ES(G)    | Credits |    |    | 4   |
| NIL                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                         | Hours/<br>Semester               | L        | T       | P  | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                         |                                  | 45       | 0       | 30 | 45 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                         |                                  |          |         |    |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                              | To provide students with fundamental knowledge of C programming concepts, syntax, data types, operators, and control structures for developing computational solutions. |                                  |          |         |    |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                              | To develop logical thinking and problem-solving abilities through algorithm design, flowcharts, and structured programming techniques.                                  |                                  |          |         |    |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                              | To enable students to design and implement modular programs using functions, arrays, pointers, strings, and user-defined data types in C.                               |                                  |          |         |    |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                              | To enhance students' debugging, testing, and program analysis skills for developing efficient and reliable software solutions.                                          |                                  |          |         |    |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                              | To prepare students to apply C programming concepts in engineering applications, real-world problem solving, and further advanced computing courses.                    |                                  |          |         |    |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                         | C PROGRAMMING BASICS             |          |         |    |    | 9+6 |
| Introduction to C programming- C program structure- Program Compilation and Execution- Language processing systems-Problem Solving Strategies-Algorithm-Flow Chart- Character Set- Identifiers & keywords- Data Types, Enumerations- Type conversions- Input & output statements in C – Operators- Preprocessor Directives (#include and #define): Macros.                                      |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Practical Component: Develop simple C programs using basic programming constructs, input/output operations and operators. Create algorithms, flowcharts and pseudocode for problem solving.                                                                                                                                                                                                     |                                                                                                                                                                         |                                  |          |         |    |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                         | CONTROL STATEMENTS               |          |         |    |    | 9+6 |
| Making decisions: If statement- if / else statement- if/else if statement- Nested if statements- dangling else- Switch Multiple Selection Statement- Repetition: Repetition essentials- while loop- do- while Loop- for loop- Nested loops- Breaking out of a loop- continue statement- go to statement.                                                                                        |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Practical Component: Develop programs using decision-making statements, looping constructs, control transfer statements.                                                                                                                                                                                                                                                                        |                                                                                                                                                                         |                                  |          |         |    |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                         | FUNCTIONS                        |          |         |    |    | 9+6 |
| Modular Programming- Function prototypes – Defining and Calling functions: Call by Value, Call by Address- Function call stack and Activation Records- Passing Arguments to Functions- Returning a value from a function- Recursion – Recursion Vs. Iteration- Scope and life time of variables- Memory layout of a C program- Storage Classes – Auto – Static – Extern and Register Variables. |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Practical Component: Implement programs using functions, parameter passing techniques, recursive functions, storage classes.                                                                                                                                                                                                                                                                    |                                                                                                                                                                         |                                  |          |         |    |    |     |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                         | ARRAYS, POINTERS AND STRINGS     |          |         |    |    | 9+6 |
| Defining Array- Array Initialization- Accessing array elements- Processing Arrays- Multidimensional arrays- memory address calculation of an array- Row major and column major order- Pointers – Pointer Declaration- Operations on Pointer- Function pointer -Relation between pointers and arrays- String Handling                                                                            |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Practical Component: Develop programs using arrays, strings and pointers.                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                         |                                  |          |         |    |    |     |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                         | STRUCTURES, UNION AND DATA FILES |          |         |    |    | 9+6 |
| Defining and processing a structure, Nested structures, passing structure to functions – Array of structure, Pointer to structure – Union – Dynamic memory allocation – Files: Streams, Opening and closing a file, Reading and writing a file.                                                                                                                                                 |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Practical Component: Develop programs using structures, unions and file handling operations.                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                         |                                  |          |         |    |    |     |
| Total (45 L+ 30 P+ 45 SL) = 120 Hours                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                         |                                  |          |         |    |    |     |

|                                                                                                    |                                                                                                                                                                                                                         |                        |                         |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| <b>Weightage:</b><br>Continuous Assessment: 50%<br>End Semester Examinations: 50%                  |                                                                                                                                                                                                                         |                        |                         |
| <b>TEXT BOOK:</b>                                                                                  |                                                                                                                                                                                                                         |                        |                         |
| 1.                                                                                                 | H.M. Deitel and P.J. Deitel, ' <i>C: How to Program</i> '. 9th edition, Pearson, New Delhi, 2022.                                                                                                                       |                        |                         |
| 2.                                                                                                 | Herbert Schildt, ' <i>C: The Complete Reference</i> '. 4 <sup>th</sup> edition, McGraw Hill, Noida, 2017.                                                                                                               |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                         |                        |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                         |                        |                         |
| 1.                                                                                                 | Pradip Dey and Manas Ghosh, ' <i>Programming in C</i> '. Oxford University, New Delhi, 2018.                                                                                                                            |                        |                         |
| 2.                                                                                                 | Mike McGrath, ' <i>C Programming In Easy Steps Limited</i> '. 5 <sup>th</sup> edition, UnitedKingdom, 2018.                                                                                                             |                        |                         |
| 3.                                                                                                 | B.W. Kernighan and D.M. Ritchie, ' <i>The C Programming Language</i> '. 2 <sup>nd</sup> edition, Pearson, New Delhi, 2015.                                                                                              |                        |                         |
| 4.                                                                                                 | Yashavant P. Kanetkar "Let Us C", BPB Publications, 2017, 16 <sup>th</sup> edition                                                                                                                                      |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                         |                        |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                         |                        |                         |
| 1.                                                                                                 | "Introduction to C Programming", Swayam MOOC Course, -<br><a href="https://onlinecourses.swayam2.ac.in/imb25_mg71/">https://onlinecourses.swayam2.ac.in/imb25_mg71/</a>                                                 |                        |                         |
| 2.                                                                                                 | GeeksforGeeks - C Programming - <a href="https://www.geeksforgeeks.org/c-programminglanguage/">https://www.geeksforgeeks.org/c-programminglanguage/</a>                                                                 |                        |                         |
| 3.                                                                                                 | Learn - C.org - <a href="https://www.learn-c.org/">https://www.learn-c.org/</a>                                                                                                                                         |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                         |                        |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                         | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | Explain the fundamentals and core concepts of C programming.                                                                                                                                                            | --                     | PSO1                    |
| <b>CO2</b>                                                                                         | Apply programming skills to develop C programs for the given problem statement/mathematical equation.                                                                                                                   | PO1                    | PSO1                    |
| <b>CO3</b>                                                                                         | Analyze the given C program and debug/predict its output.                                                                                                                                                               | PO2                    | PSO1                    |
| <b>CO4</b>                                                                                         | Develop and execute C programs to represent, compute, and solve mathematical equations or specified parameters.                                                                                                         | PO3                    | PSO1                    |
| <b>CO5</b>                                                                                         | Illustrate the applications of C programming concepts in solving computational problems through individual learning activities.                                                                                         | PO6, PO9,<br>PO11      | PSO1                    |
| <b>CO6</b>                                                                                         | As a member of a team, identify and formulate programming problems, and develop, implement, and demonstrate appropriate solutions using suitable C programming concepts, techniques, and tools while abiding by ethics. | PO5, PO8,<br>PO11      | PSO1                    |
|                                                                                                    |                                                                                                                                                                                                                         |                        |                         |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| <b>CO1</b> | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | 3     | -     | -     |
| <b>CO2</b> | 3   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | 3     | -     | -     |
| <b>CO3</b> | -   | 3   | -   | -   | -   | -   | -   | -   | -   | -     | -     | 3     | -     | -     |
| <b>CO4</b> | -   | -   | 3   | -   | -   | -   | -   | -   | -   | -     | -     | 3     | -     | -     |
| <b>CO5</b> | -   | -   | -   | -   | -   | 2   | -   | -   | 2   | -     | 2     | 2     | -     | -     |
| <b>CO6</b> | -   | -   | -   | -   | 3   | -   | -   | 3   | -   | -     | 2     | 2     | -     | -     |

### Activities:

1. Technical Quiz /MCQ-Based Assessment (CO5)
2. Hackathon / Coding Challenge Participation/ Team-Based Activities (CO6)

### Rubrics for evaluation: CO5

| Sl. No. | Criterion                      | Marks     | Excellent                          | Good                       | Satisfactory               |
|---------|--------------------------------|-----------|------------------------------------|----------------------------|----------------------------|
| 1.      | Conceptual Understanding       | 10        | Thorough understanding of concepts | Moderate understanding     | Basic understanding        |
| 2.      | Accuracy in Responses          | 10        | Answers almost all correctly       | Answers most correctly     | Answers few correctly      |
| 3.      | Logical Reasoning Ability      | 10        | Strong analytical ability          | Moderate reasoning ability | Limited reasoning ability  |
| 4.      | Time Management                | 5         | Completes within time confidently  | Moderate reasoning ability | Unable to complete on time |
| 5.      | Participation and Preparedness | 5         | Highly active and well prepared    | Moderately prepared        | Limited participation      |
|         | <b>Total</b>                   | <b>40</b> |                                    |                            |                            |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                            | Marks | Excellent                                                           | Good                                    | Satisfactory                             |
|---------|--------------------------------------|-------|---------------------------------------------------------------------|-----------------------------------------|------------------------------------------|
| 1.      | Team Participation and Collaboration | 10    | Actively contributes and collaborates effectively with team members | Participates with moderate contribution | Limited participation in team activities |

|    |                                  |           |                                                                   |                                                 |                                                         |
|----|----------------------------------|-----------|-------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------|
| 2. | Problem Solving Ability          | 10        | Develops efficient and innovative solutions for the given problem | Develops acceptable solutions with minor issues | Unable to develop complete solutions                    |
| 3. | Coding and Implementation Skills | 10        | Writes correct, efficient, and well-structured programs           | Writes functional programs with few errors      | Programs contain major errors/incomplete implementation |
| 4. | Creativity and Innovation        | 5         | Demonstrates creative thinking and innovative ideas               | Shows moderate creativity                       | Limited creativity in approach                          |
| 5. | Presentation and Demonstration   | 5         | Clearly explains and demonstrates the solution confidently        | Provides moderate explanation and demonstration | Unable to explain or demonstrate effectively            |
|    | <b>Total</b>                     | <b>40</b> |                                                                   |                                                 |                                                         |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |             | Laboratory Component   |            | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|------------------------|------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II | Observation and Record | Test       |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             |                        |            | 6                     | 1                |
| <b>CO2</b>   | 24               | 24        |            |             | 70                     | 70         | 47                    | 3                |
| <b>CO3</b>   | 12               | 12        |            |             | 20                     | 20         | 16                    | 2                |
| <b>CO4</b>   | 12               | 12        |            |             | 10                     | 10         | 11                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             |                        |            | 10                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          |                        |            | 10                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>             | <b>100</b> | <b>100</b>            |                  |

Note: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10)

|                                                                          |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|---------|----|----|----|
| 26MEC02                                                                  | ENGINEERING PRACTICES LABORATORY                                                                                                                                                                                              | SEMESTER           |    |         |    | II |    |
| Prerequisites                                                            |                                                                                                                                                                                                                               | Category           | SD | Credits |    |    | 2  |
| Fundamental understanding of measurement tools and safety procedures     |                                                                                                                                                                                                                               | Hours/<br>Semester | L  | T       | P  | SL | TH |
|                                                                          |                                                                                                                                                                                                                               |                    | 0  | 0       | 45 | 15 | 60 |
| COURSE OBJECTIVES                                                        |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
| 1.                                                                       | To provide hands-on exposure in basic manufacturing and fabrication practices.                                                                                                                                                |                    |    |         |    |    |    |
| 2.                                                                       | To develop practical skills in carpentry, fitting, plumbing and sheet metal operations.                                                                                                                                       |                    |    |         |    |    |    |
| 3.                                                                       | To train students in machining, welding and foundry practices.                                                                                                                                                                |                    |    |         |    |    |    |
| 4.                                                                       | To develop problem solving, safety awareness and teamwork skills through laboratory activities.                                                                                                                               |                    |    |         |    |    |    |
| LIST OF EXPERIMENTS                                                      |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
| 1.                                                                       | SAFETY & WORKSHOP PRACTICES<br>Study of workshop safety measures, PPE and first aid practices.<br>Demonstration of workshop tools, measuring instruments and machine shop practices.                                          |                    |    |         |    |    | 4  |
| 2.                                                                       | FITTING AND CARPENTRY PRACTICES<br>Preparation of Half-Lap / T-Joint / Dovetail Joint using carpentry tools and wooden workpieces<br>Preparation of V-fitting Square and Curve fitting using mild steel specimen.             |                    |    |         |    |    | 14 |
| 3.                                                                       | SHEET METAL AND PLUMBING PRACTICES<br>Preparation of Square Tray / Cylinder / Conical Funnel using GI sheet. Preparation of Single Seam and Double Seam joints.<br>Preparation of PVC pipe connections and saddle connection. |                    |    |         |    |    | 14 |
| 4.                                                                       | FOUNDRY AND WELDING PRACTICES<br>Green sand preparation and mould cavity preparation using foundry tools. (Single and Split Patterns)<br>Demonstration and practice of Arc welding of Butt, Lap and T-joints.                 |                    |    |         |    |    | 14 |
| 5.                                                                       | MACHINING PRACTICES<br>Lathe operations – Facing, Turning, Chamfering, Knurling and Taper turning.<br>Drilling and Tapping operations on mild steel specimen.                                                                 |                    |    |         |    |    | 14 |
| P:45, SL:15, Total:60 Hours                                              |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
| Weightage:<br>Continuous Assessment 60%<br>End Semester Examinations 40% |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
| REFERENCE BOOKS:                                                         |                                                                                                                                                                                                                               |                    |    |         |    |    |    |
| 1.                                                                       | Bawa, H.S, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.                                                                                                                                            |                    |    |         |    |    |    |
| 2.                                                                       | Jeyachandran.K, Natarajan.K and Balasubramanian.S, "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.                                                                                               |                    |    |         |    |    |    |
| 3.                                                                       | Jeyapoovan.T, SaravanaPandian.M, and Pranitha.S, "Engineering Practices Lab Manual", Vikas Publishing House Pvt. Ltd, 2006.                                                                                                   |                    |    |         |    |    |    |
| 4.                                                                       | Dr. P.Kannan, Mr. T.Satheeskumar & Mr.K.Rajasekar, "Engineering practices laboratory" Manual first edition 2017.                                                                                                              |                    |    |         |    |    |    |
| 5.                                                                       | Dr. V. Rameshbabu "Engineering practices laboratory" VRB publication pvt Id.                                                                                                                                                  |                    |    |         |    |    |    |

### E-RESOURCES:

|                                                                                                    |                                                                                                                                                           |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------|------------|---------------------------------------------------------------|------------|------------------------------------------|------------|------------|-----------------------------|--------------|-------------------------|--------------|--------------|
| 1.                                                                                                 | Virtual Labs - NPTEL Labs for Mechanical Engineering                                                                                                      |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                           |              |                                                          |            |                                                               |            |                                          |            |            | <b>Mapping<br/>POs</b>      |              | <b>Mapping<br/>PSOs</b> |              |              |
| <b>CO1</b>                                                                                         | Explain safety procedures, workshop tools and engineering practices used in manufacturing environments.                                                   |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2, 5, 6, 7, 8, 10      |              | PSO1                    |              |              |
| <b>CO2</b>                                                                                         | Construct wooden and metal fitting joints using appropriate carpentry and fitting tools.                                                                  |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2, 3, 5, 9             |              | PSO1, PSO2              |              |              |
| <b>CO3</b>                                                                                         | Fabricate sheet metal and plumbing components using suitable tools and techniques.                                                                        |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2, 3, 5, 9             |              | PSO1, PSO2              |              |              |
| <b>CO4</b>                                                                                         | Perform welding and foundry operations to manufacture engineering components.                                                                             |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2, 3,4, 5, 9           |              | PSO1, PSO2              |              |              |
| <b>CO5</b>                                                                                         | Perform various machining operations in mild steel rod by operating lathe and drilling machines                                                           |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2,3,4, 5, 8, 9, 10, 11 |              | PSO1,2,3                |              |              |
| <b>CO6</b>                                                                                         | Develop a model product using practical engineering skills, teamwork and problem-solving ability through workshop practices and self-learning activities. |              |                                                          |            |                                                               |            |                                          |            |            | PO1, 2,3,4, 5, 8, 9, 10, 11 |              | PSO1,2,3                |              |              |
| <b>The Course Articulation Matrix (CAM) for defined COs</b>                                        |                                                                                                                                                           |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
|                                                                                                    | <b>PO1</b>                                                                                                                                                | <b>PO2</b>   | <b>PO3</b>                                               | <b>PO4</b> | <b>PO5</b>                                                    | <b>PO6</b> | <b>PO7</b>                               | <b>PO8</b> | <b>PO9</b> | <b>PO 10</b>                | <b>PO 11</b> | <b>PSO 1</b>            | <b>PSO 2</b> | <b>PSO 3</b> |
| <b>CO1</b>                                                                                         | 3                                                                                                                                                         | 2            | -                                                        | -          | 1                                                             | 2          | 2                                        | 3          |            | 1                           | -            | 1                       | -            | -            |
| <b>CO2</b>                                                                                         | 3                                                                                                                                                         | 3            | 2                                                        | -          | 2                                                             | --         | -                                        | -          | 2          | -                           | -            | 3                       | 2            | -            |
| <b>CO3</b>                                                                                         | 3                                                                                                                                                         | 3            | 3                                                        | -          | 2                                                             | -          | -                                        | -          | 2          | -                           | -            | 3                       | 2            | -            |
| <b>CO4</b>                                                                                         | 3                                                                                                                                                         | 3            | 3                                                        | 2          | 2                                                             | -          | -                                        | -          | 2          | -                           | -            | 3                       | 3            | -            |
| <b>CO5</b>                                                                                         | 3                                                                                                                                                         | 2            | 2                                                        | 1          | 3                                                             | 2          | 1                                        | -          | 1          | -                           | -            | 2                       | 3            | 1            |
| <b>CO6</b>                                                                                         | 2                                                                                                                                                         | 3            | 2                                                        | 1          | 1                                                             | -          |                                          | 2          | 3          | 3                           | 2            | 2                       | 2            | 3            |
| <b>Activities:</b>                                                                                 |                                                                                                                                                           |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
| 1.                                                                                                 | Design and Fabrication of a Multi-Utility Tool Stand                                                                                                      |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
| 2.                                                                                                 | Design and Fabrication of a Portable Study Lamp with Storage Box                                                                                          |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
| <b>Rubrics for evaluation: CO6</b>                                                                 |                                                                                                                                                           |              |                                                          |            |                                                               |            |                                          |            |            |                             |              |                         |              |              |
| <b>Sl. No.</b>                                                                                     | <b>Criterion</b>                                                                                                                                          | <b>Marks</b> | <b>Excellent (3)</b>                                     |            | <b>Good (2)</b>                                               |            | <b>Satisfactory (1)</b>                  |            |            |                             |              |                         |              |              |
| 1.                                                                                                 | Safety Practices & Discipline                                                                                                                             | 20           | Consistently follows all safety procedures independently |            | Uses tools accurately and independently with high proficiency |            | Follows safety procedures inconsistently |            |            |                             |              |                         |              |              |

|    |                                      |            |                                                                       |                                                                       |                                                           |
|----|--------------------------------------|------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------|
| 2. | Tool Handling & Technical Skills     | 20         | Uses tools accurately and independently with high proficiency         | Uses tools correctly with occasional support                          | Uses tools with frequent assistance                       |
| 3. | Execution of Practical Work          | 25         | Produces accurate work meeting specifications with excellent finish   | Produces acceptable work with minor errors                            | Produces work with noticeable errors requiring correction |
| 4. | Problem Solving & Application Skills | 15         | Identifies and solves problems independently with innovative approach | Identifies and solves problems independently with innovative approach | Requires continuous support for solving problems          |
| 5. | Teamwork & Participation             | 10         | Actively contributes and works effectively in teams                   | Participates adequately in team activities                            | Limited participation in teamwork                         |
| 6. | Documentation & Self-Learning        | 10         | Well-maintained records with additional learning inputs               | Records maintained with minor omissions                               | Incomplete records with limited learning evidence         |
|    | <b>Total</b>                         | <b>100</b> |                                                                       |                                                                       |                                                           |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Test       |                       |                  |
| <b>C01</b>   | 20                                                               |            | 10                    | 2                |
| <b>C02</b>   | 20                                                               |            | 10                    | 2                |
| <b>C03</b>   | 20                                                               |            | 10                    | 2                |
| <b>C04</b>   | 20                                                               |            | 10                    | 2                |
| <b>C05</b>   | 20                                                               |            | 10                    | 2                |
| <b>C06</b>   |                                                                  | 100        | 50                    | 2                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |                    |          |         |   |    |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|---------|---|----|-----|
| 26MA201                                                                                                                                                                                                                                                                                        | FOURIER SERIES AND TRANSFORMS<br>(B.E. - EEE Programme)                                                                                                          |                    | SEMESTER |         |   |    | II  |
| Prerequisites                                                                                                                                                                                                                                                                                  |                                                                                                                                                                  | Category           | BS       | Credits |   |    | 4   |
| Basic knowledge of calculus, differential equations, infinite series, and elementary transform techniques.                                                                                                                                                                                     |                                                                                                                                                                  | Hours/<br>Semester | L        | T       | P | SL | TH  |
|                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |                    | 45       | 15      | - | 60 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                              |                                                                                                                                                                  |                    |          |         |   |    |     |
| 1.                                                                                                                                                                                                                                                                                             | To understand the principles and applications of Fourier series, including half-range expansions and Parseval's identity for representing periodic functions.    |                    |          |         |   |    |     |
| 2.                                                                                                                                                                                                                                                                                             | To develop knowledge in solving boundary value problems involving wave and heat equations using partial differential equation techniques.                        |                    |          |         |   |    |     |
| 3.                                                                                                                                                                                                                                                                                             | To acquire proficiency in Laplace transform methods and their applications in solving differential equations and engineering problems.                           |                    |          |         |   |    |     |
| 4.                                                                                                                                                                                                                                                                                             | To understand Fourier transform techniques, their properties and applications in signal analysis and integral transforms.                                        |                    |          |         |   |    |     |
| 5.                                                                                                                                                                                                                                                                                             | To learn the concepts of Z-transforms and difference equations and apply transform techniques for solving discrete mathematical models and engineering problems. |                    |          |         |   |    |     |
|                                                                                                                                                                                                                                                                                                |                                                                                                                                                                  |                    |          |         |   |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                       | FOURIER SERIES                                                                                                                                                   |                    |          |         |   |    | 9+3 |
| Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's Identity.                                                                                                                                            |                                                                                                                                                                  |                    |          |         |   |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                      | BOUNDARY VALUE PROBLEMS                                                                                                                                          |                    |          |         |   |    | 9+3 |
| Classification of second order quasi linear partial differential equations – Solutions of one-dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Infinite plate only).                                                        |                                                                                                                                                                  |                    |          |         |   |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                     | LAPLACE TRANSFORM                                                                                                                                                |                    |          |         |   |    | 9+3 |
| Laplace Transform- Conditions for existence – Transform of elementary functions – Basic Properties – Transform of derivatives and integrals – Initial and Final value theorems- Transform of periodic Functions – Inverse Laplace Transform- statement and application of convolution theorem. |                                                                                                                                                                  |                    |          |         |   |    |     |
| UNIT - IV                                                                                                                                                                                                                                                                                      | FOURIER TRANSFORM                                                                                                                                                |                    |          |         |   |    | 9+3 |
| Statement of Fourier integral theorem – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's Identity.                                                                                                         |                                                                                                                                                                  |                    |          |         |   |    |     |
| UNIT - V                                                                                                                                                                                                                                                                                       | Z -TRANSFORM AND DIFFERENCE EQUATIONS                                                                                                                            |                    |          |         |   |    | 9+3 |
| Z-transform of simple functions and properties – Inverse Z – transform –Initial and final value theorems- Convolution theorem -Formation of difference equations – Solution of difference equations using Z – transform technique by partial fraction only.                                    |                                                                                                                                                                  |                    |          |         |   |    |     |
| L:45, T:15, SL:60, Total:120 Hours                                                                                                                                                                                                                                                             |                                                                                                                                                                  |                    |          |         |   |    |     |
| Weightage:                                                                                                                                                                                                                                                                                     |                                                                                                                                                                  |                    |          |         |   |    |     |
| Continuous Assessment: 40%                                                                                                                                                                                                                                                                     |                                                                                                                                                                  |                    |          |         |   |    |     |
| End Semester Examinations: 60%                                                                                                                                                                                                                                                                 |                                                                                                                                                                  |                    |          |         |   |    |     |

|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |  |                        |                         |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------|-------------------------|
| <b>TEXT BOOKS:</b>                                                                                 |                                                                                                                                                                                                                                                                                                                                                      |  |                        |                         |
| 1.                                                                                                 | Veerarajan T, "Engineering Mathematics For Semester III", 3 <sup>rd</sup> Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.                                                                                                                                                                                                            |  |                        |                         |
| 2.                                                                                                 | P. Kandasamy, K. Thilagavathy and K. Gunavathy, "Engineering Mathematics", Volume III, S. Chand & Company Ltd., New Delhi, 1996.                                                                                                                                                                                                                     |  |                        |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                                                                                                                                                      |  |                        |                         |
| 1.                                                                                                 | Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 45 <sup>th</sup> Edition, New Delhi, 2020.                                                                                                                                                                                                                                         |  |                        |                         |
| 2.                                                                                                 | Wylie C. Ray and Barrett Louis C., "Advanced Engineering Mathematics", 6 <sup>th</sup> Edition, McGraw-Hill, Inc., New York, 1995.                                                                                                                                                                                                                   |  |                        |                         |
| 3.                                                                                                 | Narayanan S., Manicavachagom Pillai, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, Ananda Book Depot, 2019.                                                                                                                                                                                            |  |                        |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                                                                                                                                                      |  |                        |                         |
| 1.                                                                                                 | NPTEL, "Fourier Series and Boundary Value Problems", National Programme on Technology Enhanced Learning, <a href="https://nptel.ac.in/courses/111107119">https://nptel.ac.in/courses/111107119</a>                                                                                                                                                   |  |                        |                         |
| 2.                                                                                                 | NPTEL, "Transforms and Their Applications", National Programme on Technology Enhanced Learning, <a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma56">https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma56</a>                                                                                                        |  |                        |                         |
| 3.                                                                                                 | MIT OpenCourseWare, "Differential Equations", Massachusetts Institute of Technology, <a href="https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/">https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/</a>                                                                                                       |  |                        |                         |
| 4.                                                                                                 | Paul's Online Math Notes, "Differential Equations and Fourier Series", Lamar University, <a href="https://tutorial.math.lamar.edu/classes/de/fourierseries.aspx">https://tutorial.math.lamar.edu/classes/de/fourierseries.aspx</a>                                                                                                                   |  |                        |                         |
| 5.                                                                                                 | Wolfram MathWorld, "Fourier Series, Fourier Transform, Laplace Transform and Z-Transform", Wolfram Research, <a href="https://mathworld.wolfram.com/LaplaceTransform.html">https://mathworld.wolfram.com/LaplaceTransform.html</a>                                                                                                                   |  |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |  |                        |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                                                                                                      |  | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | Remember and understand the fundamental concepts and methods of Fourier series, boundary value problems, Laplace transforms, Fourier transforms and Z-transforms including transform techniques, partial differential equations, harmonic analysis, convolution theorems and difference equations used in mathematical and engineering applications. |  | --                     | --                      |
| <b>CO2</b>                                                                                         | Apply Fourier series, boundary value problem techniques, Laplace transforms, Fourier transforms, and Z-transforms to solve mathematical and engineering problems involving heat and wave equations, signal representations and transform methods, difference equations.                                                                              |  | PO1                    | PSO1                    |
| <b>CO3</b>                                                                                         | Analyze mathematical and engineering problems using Fourier series, boundary value problems, Laplace transforms, Fourier transforms, and Z-transforms by selecting suitable analytical techniques, interpreting transform-domain representations and examining continuous and discrete system behaviours.                                            |  | PO2                    | PSO1                    |
| <b>CO4</b>                                                                                         | Develop mathematical solution strategies for boundary value problems using transform techniques and difference equations using analytical and computational methods relevant to engineering applications.                                                                                                                                            |  | PO3                    | PSO2                    |

|            |                                                                                                                                                                                                                                                                  |      |      |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| <b>CO5</b> | Investigate and solve assignment-oriented problems involving Fourier analysis, partial differential equations and transform methods to strengthen logical reasoning and problem-solving abilities in applied mathematics.                                        | PO5  | PS02 |
| <b>CO6</b> | Communicate mathematical concepts, boundary value problem solutions using transform techniques, computational results and interpretations effectively through proper mathematical notation, graphical representation, assignments and structured report writing. | PO10 | –    |

### The Course Articulation Matrix (CAM) for defined COs:

|            | PO1      | PO2      | PO3      | PO4 | PO5      | PO6 | PO7 | PO8 | PO9 | PO 10    | PO 11 | PSO 1      | PSO 2    | PSO 3 |
|------------|----------|----------|----------|-----|----------|-----|-----|-----|-----|----------|-------|------------|----------|-------|
| <b>CO1</b> |          |          |          |     |          |     |     |     |     |          |       |            |          |       |
| <b>CO2</b> | 3        |          |          |     |          |     |     |     |     |          |       | 3          |          |       |
| <b>CO3</b> |          | 2        |          |     |          |     |     |     |     |          |       | 2          |          |       |
| <b>CO4</b> |          |          | 1        |     |          |     |     |     |     |          |       |            | 2        |       |
| <b>CO5</b> |          |          |          |     | 3        |     |     |     |     |          |       |            | 2        |       |
| <b>CO6</b> |          |          |          |     |          |     |     |     |     | 3        |       |            |          |       |
| <b>Avg</b> | <b>3</b> | <b>2</b> | <b>1</b> |     | <b>3</b> |     |     |     |     | <b>3</b> |       | <b>2.5</b> | <b>2</b> |       |

### Activities:

|    |                                                                                                                                                                                                                                                                 |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Students shall solve selected problems from Fourier series, boundary value problems, Laplace transforms, Fourier transforms, Z-transforms and difference equations using systematic analytical methods to develop logical reasoning and problem-solving skills. |
| 2. | Students shall prepare a short report or presentation on selected applications of Fourier analysis, boundary value problems and transform techniques to communicate solutions, graphs, results and interpretations effectively.                                 |

### Rubrics for evaluation: CO5

| Sl. No. | Criterion                        | Marks | Excellent (7-8)                                     | Good (4-6)                                   | Satisfactory (1-3)                    |
|---------|----------------------------------|-------|-----------------------------------------------------|----------------------------------------------|---------------------------------------|
| 1.      | Selection of problem             | 8     | Suitable problem is selected and clearly understood | Problem is relevant, but needs minor clarity | Problem selection is basic or unclear |
| 2.      | Application of analytical method | 8     | Correct method is applied with proper steps         | Method is mostly correct with minor errors   | Method is incomplete or incorrect     |
| 3.      | Accuracy of solution             | 8     | Solution is accurate and well-presented             | Minor errors are present                     | Major errors in solution              |

|    |                                |           |                                                            |                                                   |                                                                                        |
|----|--------------------------------|-----------|------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------|
| 4. | Interpretation of results      | 8         | Results are clearly interpreted with conclusion            | Interpretation is limited                         | Interpretation is weak or missing                                                      |
| 5. | Presentation and documentation | 8         | Work is neatly presented with proper mathematical notation | Presentation is good with minor formatting issues | Presentation is satisfactory but lacks consistency<br>Presentation is poorly organized |
|    | <b>Total</b>                   | <b>40</b> |                                                            |                                                   |                                                                                        |

#### Rubrics for evaluation:CO6

| Sl. No. | Criterion                                  | Marks     | Excellent (7-8)                                                       | Good (4-6)                                    | Satisfactory (1-3)                    |
|---------|--------------------------------------------|-----------|-----------------------------------------------------------------------|-----------------------------------------------|---------------------------------------|
| 1.      | Clarity of explanation                     | 8         | Concepts and procedures are clearly explained                         | Explanation is understandable with minor gaps | Explanation is unclear                |
| 2.      | Use of notation, graphs and representation | 8         | Proper notation, graphs, tables, and outputs are used                 | Minor errors in notation or representation    | Poor or missing representation        |
| 3.      | Organization of report/ presentation       | 8         | Well-structured and neatly presented                                  | Organized, but needs improvement              | Poorly organized or incomplete        |
| 4.      | Communication of results                   | 8         | Results and conclusions are communicated effectively                  | Communication is adequate, but limited        | Communication is weak                 |
| 5.      | Overall presentation and academic quality  | 8         | Work demonstrates excellent academic presentation and professionalism | Academic quality is good with minor issues    | Academic presentation is satisfactory |
|         | <b>Total</b>                               | <b>40</b> |                                                                       |                                               |                                       |

#### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        | -          | -           | 24                    | 3                |
| <b>CO3</b>   | 16        | 16        | -          | -           | 16                    | 2                |
| <b>CO4</b>   | 8         | 8         | -          | -           | 8                     | 1                |
| <b>CO5</b>   | -         | -         | 40         | -           | 25                    | 3                |
| <b>CO6</b>   | -         | -         | -          | 40          | 25                    | 3                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                       |                    |          |         |   |    |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|---------|---|----|----|
| 26PHC02                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MATERIALS SCIENCE                                                                                                                                     |                    | SEMESTER |         |   |    | II |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                       | Category           | BS       | Credits |   |    | 3  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                       | Hours/<br>Semester | L        | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                       |                    | 45       | -       | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                       |                    |          |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand the fundamental concepts of semiconductor materials, carrier transport mechanisms and their applications.                               |                    |          |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To explain the polarization mechanisms, dielectric behaviour and practical applications of dielectric materials in electrical and electronic systems. |                    |          |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To analyse the properties and applications of magnetic materials and superconductors used in modern engineering technologies.                         |                    |          |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To gain knowledge of nanomaterial's, their synthesis techniques, characterization methods, properties and multidisciplinary applications.             |                    |          |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand advanced engineering materials such as metallic glasses, shape memory alloys, ceramics, composites and their applications.              |                    |          |         |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                       |                    |          |         |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SEMICONDUCTING MATERIALS                                                                                                                              |                    |          |         |   |    | 9  |
| Semiconductor materials: Intrinsic and extrinsic semiconductors - Carrier concentration(derivation) for intrinsic semiconductor, n-type and p-type semiconductor – Fermi level – Variation of carrier concentration on temperature and impurity – Direct and indirect bandgap semiconductor – Drift and diffusion currents – Hall effect – Determination of Hall coefficient – Applications – Metal–semiconductor junctions (Ohmic and Schottky junctions).               |                                                                                                                                                       |                    |          |         |   |    |    |
| Activity: Virtual demonstration of Hall effect                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                       |                    |          |         |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DIELECTRIC MATERIALS                                                                                                                                  |                    |          |         |   |    | 9  |
| Dielectric materials: Dielectric polarization – Electronic, ionic, orientational and space charge polarization – Internal fields in solids – Clausius–Mossotti relation – Frequency dependence of polarization - Application of dielectric materials (transformers and capacitors), Dielectric loss – Dielectric breakdown - Ferro and piezo electric materials.                                                                                                          |                                                                                                                                                       |                    |          |         |   |    |    |
| Activity: Virtual demonstration of ferro electric materials                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                       |                    |          |         |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MAGNETIC AND SUPERCONDUCTING MATERIALS                                                                                                                |                    |          |         |   |    | 9  |
| Magnetic Materials: Magnetic material parameters, Ferromagnetic materials – Hysteresis - Ferrites – Soft and Hard magnetic materials, GMR sensors, magnetic disk memories, Principle of magnetic recording, Materials for magnetic data storage.                                                                                                                                                                                                                          |                                                                                                                                                       |                    |          |         |   |    |    |
| Superconductivity: Properties – Type I & Type II superconductors – BCS theory – Applications – magnetic levitation – SQUID.                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                       |                    |          |         |   |    |    |
| Activity: Virtual demonstration of MAGLEV trains                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                       |                    |          |         |   |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | NANOMATERIALS                                                                                                                                         |                    |          |         |   |    | 9  |
| Nanomaterials: Introduction – Classification of nanomaterials – Top-down and bottom-up approaches – Synthesis techniques: Ball milling, Plasma arcing, Sol-Gel method – Quantum confinement effect – Quantum structures: Quantum wells, Quantum wires and Quantum dots –Band gap of nanomaterials. Carbon nanotubes – Graphene, Fullerene and Buckyballs – Structure – Properties – Applications. Nanodevices: Quantum dot LEDs (QLEDs), Nanosensors and Nano-transistors |                                                                                                                                                       |                    |          |         |   |    |    |
| Activity: Virtual demonstration of QLED                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                       |                    |          |         |   |    |    |

|                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                   |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------|
| UNIT - V                                                                                                                                                                                                                                                                                                                                                    | ADVANCED ENGINEERING MATERIALS                                                                                                                                                    |             | 9            |
| Metallic Glasses: Preparation – Properties – Applications. Shape Memory Alloys (SMA): Types – Properties – Applications. Ceramic Materials: Classification – Properties – Traditional and advanced ceramics – Applications. Composite Materials: Classification – Fibre reinforced composites – Particle reinforced composites – Properties – Applications. |                                                                                                                                                                                   |             |              |
| Activity: Virtual demonstration of melt-spinning process                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                   |             |              |
| L:45, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                   |             |              |
| Weightage:<br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                   |             |              |
| TEXT BOOKS:                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                   |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                          | M. Arumugam, 'Materials Science', Anuradha Publications, Kumbakonam, 2018.                                                                                                        |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                          | V. Rajendran and A. Marikani, 'Materials Science', Tata McGraw Publications, New Delhi, 2012.                                                                                     |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                          | S.O. Pillai, 'Solid State Physics', New Age International Publishers, New Delhi, 2026.                                                                                            |             |              |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                   |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                          | Charles Kittel, 'Introduction to Solid state Physics', John Wiley and Sons, 7 <sup>th</sup> Edition, Singapore, 2019.                                                             |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                          | Charles P. Poole and Frank J. Owens, 'Introduction to Nanotechnology', Wiley India, 2007.                                                                                         |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                          | S. O. Kasap, 'Principles of electronic materials and devices', McGrawHill Education, 2007.                                                                                        |             |              |
| E-RESOURCES:                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                   |             |              |
| 1.                                                                                                                                                                                                                                                                                                                                                          | Hall Effect: <a href="https://ssp-amrt.vlabs.ac.in/exp/hall-effect-chargecarrier/simulation.html">https://ssp-amrt.vlabs.ac.in/exp/hall-effect-chargecarrier/simulation.html</a>  |             |              |
| 2.                                                                                                                                                                                                                                                                                                                                                          | Hysteresis curve: <a href="https://em-amrt.vlabs.ac.in/exp/quinckes-method">https://em-amrt.vlabs.ac.in/exp/quinckes-method</a>                                                   |             |              |
| 3.                                                                                                                                                                                                                                                                                                                                                          | Magnets and Electromagnets: <a href="https://phet.colorado.edu/en/simulations/magnets-and-electromagnets">https://phet.colorado.edu/en/simulations/magnets-and-electromagnets</a> |             |              |
| COURSE OUTCOMES (COs)<br>At the end of the course, the students will have the ability to                                                                                                                                                                                                                                                                    |                                                                                                                                                                                   |             |              |
| CO1                                                                                                                                                                                                                                                                                                                                                         | Explain the preparation, properties and applications of various materials.                                                                                                        | Mapping POs | Mapping PSOs |
| CO2                                                                                                                                                                                                                                                                                                                                                         | Apply the principles of various materials to identify suitable materials for diverse applications.                                                                                | PO1         |              |
| CO3                                                                                                                                                                                                                                                                                                                                                         | Analyse the properties and performance of different materials suitable for specific applications.                                                                                 | PO2         |              |
| CO4                                                                                                                                                                                                                                                                                                                                                         | Perform experimentations as a group and interpret the results.                                                                                                                    | PO4, PO8    |              |
| CO5                                                                                                                                                                                                                                                                                                                                                         | Communicate the societal, environmental and technological impacts of engineering materials in solving real-world problems.                                                        | PO6, PO9    | PSO3         |
| CO6                                                                                                                                                                                                                                                                                                                                                         | Analyse emerging engineering materials to address modern industrial and societal needs in engineering applications through self-learning activities.                              | PO11        |              |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| <b>CO1</b> |     |     |     |     |     |     |     |     |     |       |       |       |       |       |
| <b>CO2</b> | 3   |     |     |     |     |     |     |     |     |       |       |       |       |       |
| <b>CO3</b> |     | 3   |     |     |     |     |     |     |     |       |       |       |       |       |
| <b>CO4</b> |     |     |     | 2   |     |     |     | 2   |     |       |       |       |       |       |
| <b>CO5</b> |     |     |     |     |     | 2   |     |     | 2   |       |       |       |       | 2     |
| <b>CO6</b> |     |     |     |     |     |     |     |     |     |       | 2     |       |       |       |

#### Activities:

|    |                                                                                                                                                                                                                                                                                  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | a. Experimental determination of Hall coefficient / Hysteresis loop for a ferromagnetic material <b>(CO4)</b><br>b. Seminar / Poster presentation on dielectric materials in renewable energy systems / Economic, Environmental and Social issues of material usage <b>(CO5)</b> |
| 2. | a. Literature review on nanomaterial product for real-world problems <b>(CO6)</b><br>b. Seminar/Poster presentation on emerging concepts and advancements in materials science, considering the economic, environmental, and societal impacts of material usage. <b>(CO5)</b>    |

#### Rubrics for evaluation: CO4

| Sl. No. | Criterion               | Marks     | Excellent (3)                                                                       | Good (2)                                       | Satisfactory (1)                                |
|---------|-------------------------|-----------|-------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------|
| 1       | Formula / Theory        | 5         | Clearly explains the concept with correct formula                                   | Explains the concept with minor errors         | Limited understanding of theory and formula     |
| 2       | Procedure & Observation | 5         | Clearly performs and explains the experimental procedure with accurate observations | Performs the procedure with minor mistakes     | Procedure and observations are poorly explained |
| 3       | Result & Interpretation | 10        | Correctly calculates and correlates the result with theoretical concepts            | Result is obtained with partial interpretation | Incorrect or incomplete result interpretation   |
|         | <b>Total</b>            | <b>20</b> |                                                                                     |                                                |                                                 |

#### Rubrics for evaluation: CO5

| Sl. No. | Criterion            | Marks | Excellent (3)                                                 | Good (2)                                            | Satisfactory (1)                 |
|---------|----------------------|-------|---------------------------------------------------------------|-----------------------------------------------------|----------------------------------|
| 1       | Subject Knowledge    | 5     | Clearly explains the concept with relevant examples           | Good explanation with minor gaps                    | Basic understanding of the topic |
| 2       | Content Organization | 5     | Information is well-organized, clear, and logically presented | Organization is good with minor improvements needed | Average organization of content  |

|   |                              |           |                                                                                   |                                           |                                      |
|---|------------------------------|-----------|-----------------------------------------------------------------------------------|-------------------------------------------|--------------------------------------|
| 3 | Poster / Presentation Design | 5         | Attractive, creative, and easy-to-understand design with effective visuals        | Good design with minor issues             | Adequate design with limited visuals |
| 4 | Communication Skills         | 5         | Confident presentation with clear explanation and effective response to questions | Good communication with slight hesitation | Basic communication skills           |
|   | <b>Total</b>                 | <b>20</b> |                                                                                   |                                           |                                      |

#### Rubrics for evaluation: CO6

| Sl. No. | Criterion                    | Marks     | Excellent (3)                                                                     | Good (2)                                       | Satisfactory (1)                       |
|---------|------------------------------|-----------|-----------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|
| 1       | Topic Understanding          | 5         | Clearly explains the concept and its real-world application with relevant details | Good explanation with minor gaps               | Basic understanding of the topic       |
| 2       | Literature Review            | 5         | Reviews and compares multiple relevant research articles effectively              | Reviews relevant articles with some comparison | Limited review of articles             |
| 3       | Analysis & Interpretation    | 5         | Critically analyses the product performance, advantages, and limitations          | Good analysis with minor shortcomings          | Basic analysis provided                |
| 4       | Presentation & Communication | 5         | Well-organized report/presentation with clear communication and proper references | Organized presentation with minor errors       | Average presentation and communication |
|         | <b>Total</b>                 | <b>20</b> |                                                                                   |                                                |                                        |

#### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO4</b>   |           |           | 20         |             | 10                    | 2                |
| <b>CO5</b>   |           |           | 20         | 20          | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 20          | 10                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |                    |       |         |   |    |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|--------------------|-------|---------|---|----|-----|
| 26MEC01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ENGINEERING GRAPHICS                                                    | SEMESTER           |       |         |   | II |     |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                         | Category           | ES(G) | Credits |   |    | 4   |
| Basic geometry and Usage of drawing instrument                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                         | Hours/<br>Semester | L     | T       | P | SL | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |                    | 30    | 45      | 0 | 45 | 120 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                         |                    |       |         |   |    |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To impart knowledge on dimensions and drawing standards.                |                    |       |         |   |    |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To explore the projection of points, lines, planes and solids.          |                    |       |         |   |    |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To explore the section of solids with various cutting planes            |                    |       |         |   |    |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To provide the understanding of orthographic and isometric views.       |                    |       |         |   |    |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To provide the understanding of perspective views and its applications. |                    |       |         |   |    |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | PLANE CURVES, PROJECTION OF POINTS AND LINES                            |                    |       |         |   |    | 15  |
| <b>Fundamentals:</b> Drawing instruments, Drawing standards (BIS), Lettering in engineering, Sheet layout, elements of dimensioning, Systems of dimensioning.<br><b>Construction of curves</b> - ellipse, parabola, and hyperbola (eccentricity method only), Construction of cycloids, involutes - Drawing of tangents and normal to the above curves.<br><b>Projection of points and Lines</b> – Projections points in all four quadrants, Projections of straight lines located in first quadrant – parallel and inclined to both planes - determination of true length and true inclinations by rotating line method. |                                                                         |                    |       |         |   |    |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PROJECTION OF PLANES AND PROJECTION OF SOLIDS                           |                    |       |         |   |    | 15  |
| <b>Projections of plane surfaces</b> - polygonal lamina and circular lamina, located in the first quadrant and inclined to both reference planes.<br><b>Projection of simple solids</b> - prism, pyramid, cylinder and cone. Drawing views when the axis of the solid is inclined to one reference plane.                                                                                                                                                                                                                                                                                                                 |                                                                         |                    |       |         |   |    |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES                           |                    |       |         |   |    | 15  |
| <b>Sectioning of simple solids</b> - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.<br><b>Development</b> of lateral surfaces of truncated prisms, pyramids, cylinders and cones.                                                                                                                                                                                                                                                                                                                |                                                                         |                    |       |         |   |    |     |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ORTHOGRAPHIC PROJECTION                                                 |                    |       |         |   |    | 15  |
| <b>Orthographic Projection:</b> First angle projection, Visualization concepts - Representation of three-dimensional objects - layout of views - Different views of inclined, curved and simple objects.                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                         |                    |       |         |   |    |     |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ISOMETRIC AND PERSPECTIVE PROJECTION                                    |                    |       |         |   |    | 15  |
| <b>Isometric projection</b> , Isometric scale, Isometric views of simple solids, truncated prisms, pyramids, cylinders, cones and simple objects. (For Exam)<br><b>Perspective Projection:</b> Simple solids - Prism and Pyramid by visual ray method. (For practice only)                                                                                                                                                                                                                                                                                                                                                |                                                                         |                    |       |         |   |    |     |
| L:30, T:45, SL :45, Total:120 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                         |                    |       |         |   |    |     |
| <b>Weightage:</b><br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |                    |       |         |   |    |     |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                                                                                                                                        |                                |                  |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------|
| 1.                                                                                         | Natarajan K.V., Engineering Drawing and Graphics, Dhanalakshmi Publisher, Chennai, 2005.                                                                                                                                                                                                                               |                                |                  |
| 2.                                                                                         | Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing, Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition, 2005.                                                                                                                                                                         |                                |                  |
| 3.                                                                                         | Gopalakrishna K.R., Engineering Drawing (Vol. I & II), Subhas Publications, 2001.                                                                                                                                                                                                                                      |                                |                  |
| 4.                                                                                         | Basant Agrawal and CM Agrawal, Engineering Drawing, McGraw-Hill, New Delhi, First Edition, 2008.                                                                                                                                                                                                                       |                                |                  |
| 5.                                                                                         | Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, New Delhi, 2008.                                                                                                                                                                                                             |                                |                  |
|                                                                                            |                                                                                                                                                                                                                                                                                                                        |                                |                  |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                                                                                                                                        |                                |                  |
| 1.                                                                                         | Online Resources (Open sources):<br>1. <a href="https://nptel.ac.in/courses/112102304">nptel.ac.in/courses/112102304</a><br>2. <a href="https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed52">https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed52</a>                                       |                                |                  |
| 2.                                                                                         | Engineering Drawing and Computer Graphics, Prof. Rajaram Lakkaraju (IIT Kharagpur) – <a href="https://onlinecourses.nptel.ac.in/noc22_me105/preview">https://onlinecourses.nptel.ac.in/noc22_me105/preview</a>                                                                                                         |                                |                  |
| 3.                                                                                         | MIT Design Handbook: Engineering Drawing and Sketching – <a href="https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/">https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/</a> |                                |                  |
|                                                                                            |                                                                                                                                                                                                                                                                                                                        |                                |                  |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                                                                                                                                        | Mapping POs                    | Mapping PSOs     |
| CO1                                                                                        | Explain the fundamentals of engineering drawing, BIS standards, dimensioning methods, and standard drawing practices.                                                                                                                                                                                                  | --                             | --               |
| CO2                                                                                        | Construct engineering curves such as ellipse, parabola, hyperbola, cycloid, and involute, using standard drafting techniques.                                                                                                                                                                                          | PO1, PO2, PO3, PO5, PO10, PO11 | PSO1, PSO2, PSO3 |
| CO3                                                                                        | Apply the principles of projection to construct the projections of points, lines, planes, solids, sectional views, and surface developments.                                                                                                                                                                           | PO1, PO2, PO3, PO5, PO10, PO11 | PSO1, PSO2, PSO3 |
| CO4                                                                                        | Apply projection principles to create orthographic, isometric, and perspective views of engineering objects using standard drawing practices.                                                                                                                                                                          | PO1, PO2, PO3, PO5, PO10, PO11 | PSO1, PSO2, PSO3 |
| CO5                                                                                        | Construct engineering drawings of curves, projections, sectional views, and surface developments of simple solids using standard drafting instruments and BIS conventions.                                                                                                                                             | PO1, PO2, PO3, PO5, PO10, PO11 | PSO1, PSO2, PSO3 |
| CO6                                                                                        | Create orthographic, isometric, and perspective drawings of engineering components and physical models to effectively communicate design and improve spatial visualization skills.                                                                                                                                     | PO1, PO2, PO3, PO5, PO10, PO11 | PSO1, PSO2, PSO3 |
|                                                                                            |                                                                                                                                                                                                                                                                                                                        |                                |                  |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 01 | PSO 02 | PSO 03 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|--------|--------|--------|
| <b>CO1</b> |      |      |      |      |      |      |      |      |      |       |       |        |        |        |
| <b>CO2</b> | 3    | 2    | 2    |      | 2    |      |      |      |      | 2     | 1     | 3      | 2      | 1      |
| <b>CO3</b> | 3    | 3    | 2    |      | 2    |      |      |      |      | 1     | 1     | 3      | 2      | 1      |
| <b>CO4</b> | 3    | 2    | 3    |      | 2    |      |      |      |      | 1     | 1     | 3      | 3      | 1      |
| <b>CO5</b> | 3    | 3    | 2    |      | 2    |      |      |      |      | 1     | 1     | 3      | 2      | 1      |
| <b>CO6</b> | 3    | 2    | 3    |      | 2    |      |      |      |      | 2     | 1     | 3      | 3      | 2      |

#### Activities:

|    |                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Construct conic sections, cycloids, involutes, and spirals using drawing instruments and demonstrate their formation using physical models or CAD tools.                                                  |
| 2. | <b>Mini Design Project</b> – Create the complete drawing of a simple engineering component (e.g., bracket, machine block, pipe support) including orthographic, isometric, sectional view and dimensions. |

#### Rubrics for evaluation: CO5

| Sl. No. | Criterion                                      | Marks     | Excellent (3)                                                                  | Good (2)                                            | Satisfactory (1)                          |
|---------|------------------------------------------------|-----------|--------------------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|
| 1.      | Accuracy of Engineering Curves                 | 8         | Curves are constructed accurately with correct dimensions and geometry         | Minor errors in construction or dimensions          | Noticeable errors affecting accuracy      |
| 2.      | Projection and Sectional View Construction     | 10        | Projections and sectional views are complete, correct, and clearly represented | Minor mistakes in views or missing details          | Incomplete or incorrect representation    |
| 3.      | Surface Development of Solids                  | 8         | Developments are accurate with correct geometry and layout                     | Minor dimensional or layout errors                  | Significant errors in development         |
| 4.      | Use of Drawing Instruments and Standards       | 6         | Proper use of instruments with BIS standards followed throughout               | Small deviations from standards or instrument usage | Improper use of standards and instruments |
| 5.      | Neatness, Presentation, and Sheet Organization | 8         | Excellent line quality, lettering, dimensioning, and sheet layout              | Acceptable presentation with few inconsistencies    | Poor presentation and organization        |
|         | <b>Total</b>                                   | <b>40</b> |                                                                                |                                                     |                                           |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                                     | Marks     | Excellent (3)                                                                           | Good (2)                                                         | Satisfactory (1)                                                  |
|---------|-----------------------------------------------|-----------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------|
| 1       | Accuracy of Orthographic Views                | 10        | Produces complete and accurate orthographic views with correct dimensions and alignment | Produces views with minor dimensional or projection errors       | Produces basic views with noticeable errors or incomplete details |
| 2       | Quality of Isometric Representation           | 10        | Drawings are accurate, proportionate, and clearly represent the object                  | Drawings are mostly accurate with minor proportional issues      | Drawings show limited accuracy and representation                 |
| 3       | Perspective Drawing Skills                    | 8         | Applies perspective principles correctly with realistic depth and proportions           | Applies perspective concepts with minor errors                   | Demonstrates basic perspective drawing with several inaccuracy    |
| 4       | Visualization and Interpretation Skills       | 8         | Easily visualizes and converts objects into multiple graphical views accurately         | Demonstrates good visualization with few interpretation mistakes | Shows limited visualization and interpretation ability            |
| 5.      | Drawing Standards, Neatness, and Presentation | 4         | Excellent line quality, dimensioning, lettering, and neat presentation                  | Presentation is clear with minor issues in neatness or standards | Presentation is acceptable but lacks consistency and neatness     |
|         | <b>Total</b>                                  | <b>40</b> |                                                                                         |                                                                  |                                                                   |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 10        | 10        |            |             | 10                    | 2                |
| <b>CO2</b>   | 10        |           |            |             | 5                     | 1                |
| <b>CO3</b>   | 40        | 20        |            |             | 30                    | 2                |
| <b>CO4</b>   |           | 30        |            |             | 15                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 3                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 3                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                         |                                                                                 |                                                       |                    |        |        |   |    |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------------------------------------|--------------------|--------|--------|---|----|----|
| 26EE201                                                                                                                                                                                                                                                                                                                                                 | ELECTRIC CIRCUIT ANALYSIS                                                       |                                                       | SEMESTER           |        |        |   | II |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                           |                                                                                 |                                                       | Category           | ES(PC) | Credit |   |    | 3  |
|                                                                                                                                                                                                                                                                                                                                                         |                                                                                 |                                                       | Hours/<br>Semester | L      | T      | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                         |                                                                                 |                                                       |                    | 30     | 15     | 0 | 45 | 90 |
| COURSE OBJECTIVES:                                                                                                                                                                                                                                                                                                                                      |                                                                                 |                                                       |                    |        |        |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                      | To introduce electric circuits and its analysis                                 |                                                       |                    |        |        |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                      | To provide key concepts to analyze and understand electrical circuits           |                                                       |                    |        |        |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                      | To impart knowledge on solving circuit equations using network theorems         |                                                       |                    |        |        |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                      | To educate on obtaining the transient response of circuits                      |                                                       |                    |        |        |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                      | To introduce the phenomenon of resonance in coupled circuits                    |                                                       |                    |        |        |   |    |    |
| 6.                                                                                                                                                                                                                                                                                                                                                      | To introduce Phasor diagrams and analysis of single and three phase AC circuits |                                                       |                    |        |        |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                         |                                                                                 |                                                       |                    |        |        |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                |                                                                                 | BASIC CIRCUITS ANALYSIS                               |                    |        |        |   |    | 9  |
| Fundamentals concepts of R, L and C elements-Energy Sources- Ohm’s Law -Kirchhoff ’s Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram - Real and Reactive Power, Power Factor, Energy –Mesh current and node voltage methods of analysis D.C and A.C Circuits |                                                                                 |                                                       |                    |        |        |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                               |                                                                                 | NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS |                    |        |        |   |    | 9  |
| Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin’s and Norton’s Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem- Tellegen’s Theorem-Statement, application to DC and AC Circuits                                                   |                                                                                 |                                                       |                    |        |        |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                              |                                                                                 | TRANSIENT RESPONSE ANALYSIS                           |                    |        |        |   |    | 9  |
| Introduction – Laplace transforms and inverse Laplace transforms- standard test signals –Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.                                                                                                                                        |                                                                                 |                                                       |                    |        |        |   |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                               |                                                                                 | RESONANCE AND COUPLED CIRCUITS                        |                    |        |        |   |    | 9  |
| Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits.                                                                                                                                                 |                                                                                 |                                                       |                    |        |        |   |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                |                                                                                 | THREE PHASE CIRCUITS                                  |                    |        |        |   |    | 9  |
| Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations                                                                                                                        |                                                                                 |                                                       |                    |        |        |   |    |    |
| L:30, T:15, SL :45, Total:90 Hours                                                                                                                                                                                                                                                                                                                      |                                                                                 |                                                       |                    |        |        |   |    |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                              |                                                                                 |                                                       |                    |        |        |   |    |    |
| Continuous Assessment 40%                                                                                                                                                                                                                                                                                                                               |                                                                                 |                                                       |                    |        |        |   |    |    |
| End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                           |                                                                                 |                                                       |                    |        |        |   |    |    |

|                                                                                                    |                                                                                                                                                                                                                                                                                        |                                     |                         |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------|
| <b>TEXT BOOKS:</b>                                                                                 |                                                                                                                                                                                                                                                                                        |                                     |                         |
| 1.                                                                                                 | William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9 <sup>th</sup> edition, New Delhi, 2020.                                                                                                                          |                                     |                         |
| 2.                                                                                                 | Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.                                                                                                                                                                      |                                     |                         |
| 3.                                                                                                 | Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.                                                                                                                                                                             |                                     |                         |
|                                                                                                    |                                                                                                                                                                                                                                                                                        |                                     |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                                                                                        |                                     |                         |
| 1.                                                                                                 | Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai & Sons, New Delhi, 2020.                                                                                                                                                                                         |                                     |                         |
| 2.                                                                                                 | Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, First Edition, 2019                                                                                                                                                                            |                                     |                         |
| 3.                                                                                                 | M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015.                                                                                                                                                                                               |                                     |                         |
| 4.                                                                                                 | Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018                                                                                                                                                                     |                                     |                         |
| 5.                                                                                                 | Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGrawHill, 2015.                                                                                                                                                                                       |                                     |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                                                                                        |                                     |                         |
| 1.                                                                                                 | <a href="https://nptel.ac.in/courses/117106108">https://nptel.ac.in/courses/117106108</a>                                                                                                                                                                                              |                                     |                         |
|                                                                                                    |                                                                                                                                                                                                                                                                                        |                                     |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                                        | <b>Mapping<br/>POs</b>              | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | Explain circuit's behaviour using fundamental laws and theorems                                                                                                                                                                                                                        | --                                  | --                      |
| <b>CO2</b>                                                                                         | Apply mesh analysis/ nodal analysis / network theorems to determine behavior of the given DC and AC circuit                                                                                                                                                                            | PO1                                 | PSO1                    |
| <b>CO3</b>                                                                                         | Compute the transient response of first order and second order systems to step and sinusoidal inputs                                                                                                                                                                                   | PO2, PO3,<br>PO4                    | PSO1, PSO2              |
| <b>CO4</b>                                                                                         | Compute the frequency response of series/ parallel RLC circuits and coupled circuits. Compute power, line/ phase voltage and currents of the given three phase circuit.                                                                                                                | PO2, PO3,<br>PO4                    | PSO1, PSO2              |
| <b>CO5</b>                                                                                         | Study and simulate the behaviour of DC / AC circuits, transient response, resonance, and three-phase circuits using MATLAB or open-source circuit simulation software through self-learning activities and interpret the results while considering practical engineering applications. | PO5, PO6,<br>PO7, PO8,<br>PO9, PO11 | PSO2, PSO3              |
| <b>CO6</b>                                                                                         | Study circuit analysis techniques and practical electrical network applications through case studies, self-learning activities, and technical presentations while considering societal and economic impacts.                                                                           | PO5, PO6 PO7,<br>PO8, PO9,<br>PO11  | PSO3                    |
|                                                                                                    |                                                                                                                                                                                                                                                                                        |                                     |                         |

### The Course Articulation Matrix (CAM) for defined COs

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO2 | 3   |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO3 |     | 3   | 3   | 2   |     |     |     |     |     |      |      |      |      |      |
| CO4 |     | 3   | 3   | 2   |     |     |     |     |     |      |      |      |      |      |
| CO5 |     |     |     |     | 3   | 3   | 2   | 2   | 2   |      | 3    |      |      |      |
| CO6 |     |     |     |     | 3   | 3   | 2   | 2   | 2   |      | 3    |      |      |      |

#### Activities:

|    |                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------|
| 1. | Perform simulation of DC / AC circuits and transient response using MATLAB or open-source software (CO5) |
| 2. | Analyze practical electrical circuit problems through case study and software simulation (CO6)           |

#### Rubrics for evaluation:CO5

| Sl. No. | Criterion                                                                     | Marks      | Excellent (3)                                                                   | Good(2)                                                             | Satisfactory(1)                                                   |
|---------|-------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
| 1.      | Problem formulation, circuit modeling, and selection of simulation parameters | 20         | Correctly formulates the problem with appropriate circuit design and parameters | Formulates the problem with minor errors in circuit/model selection | Basic problem formulation with incomplete or incorrect parameters |
| 2.      | Development of simulation circuit and generation of accurate results/plots    | 30         | Simulation executed correctly with accurate plots/results                       | Simulation completed with minor errors in results/plots             | Simulation partially completed with inadequate results            |
| 3.      | Analysis and interpretation of simulation results with engineering relevance  | 20         | Clearly interprets results with proper engineering justification                | Provides acceptable interpretation with limited explanation         | Gives basic interpretation with insufficient analysis             |
| 4.      | Report preparation, presentation, and documentation of findings               | 10         | Well-organized report with clear presentation and proper formatting             | Report is adequate with minor presentation issues                   | Report lacks clarity and proper organization                      |
|         | <b>Total</b>                                                                  | <b>100</b> |                                                                                 |                                                                     |                                                                   |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                                                                               | Marks      | Excellent (3)                                                                    | Good(2)                                                            | Satisfactory(1)                                               |
|---------|-----------------------------------------------------------------------------------------|------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------|
| 1.      | Understanding of circuit analysis concepts and identification of practical applications | 20         | Demonstrates strong understanding with relevant practical applications           | Demonstrates moderate understanding with limited application       | Demonstrates basic understanding with minimal applications    |
| 2.      | Case study analysis considering technical, societal, and economic aspects               | 30         | Provides detailed technical analysis with clear societal/economic considerations | Provides acceptable analysis with partial consideration of impacts | Provides basic analysis with minimal consideration of impacts |
| 3.      | Evidence of self-learning, problem-solving, and independent study                       | 30         | Shows extensive self-learning with additional references and insights            | Shows moderate self-learning with adequate references              | Shows limited self-learning with minimal references           |
| 4.      | Quality of presentation, communication, and report documentation                        | 20         | Presents ideas clearly with effective communication and documentation            | Presentation is understandable with minor communication issues     | Presentation lacks clarity and effective communication        |
|         | <b>Total</b>                                                                            | <b>100</b> |                                                                                  |                                                                    |                                                               |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24               |           |            |             | 12                    | 2                |
| <b>CO3</b>   | 24               | 24        |            |             | 24                    | 3                |
| <b>CO4</b>   |                  | 24        |            |             | 12                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                 |                                     |                    |        |        |   |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|--------------------|--------|--------|---|----|----|
| 26EE202                                                                                                                                                                                                                                                                                                                                                                                            | ELECTRONIC DEVICES AND CIRCUITS                                                                 |                                     | SEMESTER           |        |        |   | II |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                 |                                     | Category           | ES(PC) | Credit |   | 3  |    |
| Engineering Physics                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                 |                                     | Hours/<br>Semester | L      | T      | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                 |                                     |                    | 30     | 15     | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                 |                                     |                    |        |        |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                 | To understand the operation and characteristics of semiconductor diodes and rectifier circuits. |                                     |                    |        |        |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                 | To analyse the characteristics and biasing of BJT, JFET, MOSFET, and UJT devices.               |                                     |                    |        |        |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                 | To analyse and design small signal and large signal amplifier circuits.                         |                                     |                    |        |        |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                 | To understand the principles and applications of feedback in amplifier circuits.                |                                     |                    |        |        |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                 | To design and analyse sinusoidal oscillator circuits using transistors.                         |                                     |                    |        |        |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                 |                                     |                    |        |        |   |    |    |
| UNIT – I                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                 | DIODES                              |                    |        |        |   |    | 9  |
| Structure-Equilibrium conditions- Energy Band Concepts-Zero bias-Forward Bias-Reverse bias- Junction capacitances -one sided and Non- uniformly doped junctions- Ideal PN junction current, P-N junction diode, V-I characteristics of a diode, review of half-wave and full-wave rectifiers, Zener diodes, voltage regulator using zener diode, clamping and clipping circuits.                   |                                                                                                 |                                     |                    |        |        |   |    |    |
| UNIT – II                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                 | TRANSISTORS                         |                    |        |        |   |    | 9  |
| Physical behaviour of a BJT -Ebers - Moll model. Modes of transistor operation - Common base, common emitter and common collector configurations, Input and output characteristics, Early effect, regions of operation. AC and DC load lines - Need for stability of Q-Point. Bias stability -fixed bias, collector to base bias, self-bias. JFET, MOSFET, and UJT: Structure and Characteristics. |                                                                                                 |                                     |                    |        |        |   |    |    |
| UNIT – III                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                 | SMALL SIGNAL AMPLIFIER CIRCUITS     |                    |        |        |   |    | 9  |
| Single stage BJT and FET amplifiers, Analysis at low, medium and high frequencies -BJT and FET differential amplifiers, Differential and Common mode gain with resistive load and active load, CMRR - Cascode and Darlington Amplifiers.                                                                                                                                                           |                                                                                                 |                                     |                    |        |        |   |    |    |
| UNIT – IV                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                 | LARGE SIGNAL AMPLIFIER CIRCUITS     |                    |        |        |   |    | 9  |
| Power amplifiers -Classification, Single ended and Push-pull Configuration, Power dissipation, Output power and Conversion efficiency, Complementary symmetry power amplifiers, Class AB operation, Class C and Class D amplifiers, thermal considerations.                                                                                                                                        |                                                                                                 |                                     |                    |        |        |   |    |    |
| UNIT – V                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                 | FEEDBACK AMPLIFIERS AND OSCILLATORS |                    |        |        |   |    | 9  |
| Advantages of negative feedback, voltage/current series and shunt feedback-positive feedback-condition for oscillations, phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.                                                                                                                                                                                                      |                                                                                                 |                                     |                    |        |        |   |    |    |
| L:30, T:15, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                 |                                     |                    |        |        |   |    |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                 |                                     |                    |        |        |   |    |    |
| Continuous Assessment 40%                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                 |                                     |                    |        |        |   |    |    |
| End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                 |                                     |                    |        |        |   |    |    |

|                                                                                                    |                                                                                                                                                                                                                                                                      |                                 |                         |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------|
| <b>TEXT BOOKS:</b>                                                                                 |                                                                                                                                                                                                                                                                      |                                 |                         |
| 1.                                                                                                 | Millman J, Halkias C, SatyaBrata JIT, "Electronic Devices & Circuits", Tata McGraw-Hill, New Delhi, 2010.                                                                                                                                                            |                                 |                         |
| 2.                                                                                                 | David.Bell, "Electronic Devices and Circuits", New Delhi: Oxford University Press, 5 <sup>th</sup> Edition, 2008.                                                                                                                                                    |                                 |                         |
| 3.                                                                                                 | Boylestead L R, and Nashelsky L, "Electronic Devices and Circuit Theory", Pearson Education, New Delhi, 2009.                                                                                                                                                        |                                 |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                                                                      |                                 |                         |
| 1.                                                                                                 | Rashid, "Micro Electronic Circuits", Thomson Publications, 1999.                                                                                                                                                                                                     |                                 |                         |
| 2.                                                                                                 | Donald L.Schilling and Charles Belove, "Electronic Circuits", 3 <sup>rd</sup> Edition, Tata McGraw Hill, 2010.                                                                                                                                                       |                                 |                         |
| 3.                                                                                                 | Adel Sedra, Kenneth. C Smith, "Microelectronics Circuits", Oxford University Press, New Delhi, 2010                                                                                                                                                                  |                                 |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                                                                      |                                 |                         |
| 1.                                                                                                 | <a href="https://electronicsforu.com/resources/electronic-devices-and-circuit-theory">https://electronicsforu.com/resources/electronic-devices-and-circuit-theory</a>                                                                                                |                                 |                         |
| 2.                                                                                                 | NPTEL – Electronic Circuits Course                                                                                                                                                                                                                                   |                                 |                         |
|                                                                                                    |                                                                                                                                                                                                                                                                      |                                 |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                      | <b>Mapping<br/>POs</b>          | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | <b>Recall</b> the fundamental concepts, operating principles and characteristics of electronic devices and circuits.                                                                                                                                                 | --                              | ---                     |
| <b>CO2</b>                                                                                         | <b>Apply</b> the characteristics, models and operating principles of electronic devices to solve problems in electronic circuits.                                                                                                                                    | PO1, PO2,<br>PO5                | PSO1, PSO2              |
| <b>CO3</b>                                                                                         | <b>Analyse</b> the performance of electronic circuits under specified operating conditions using appropriate circuit parameters and techniques.                                                                                                                      | PO1, PO2,<br>PO5                | PSO1, PSO2              |
| <b>CO4</b>                                                                                         | <b>Design</b> electronic circuits using appropriate device configurations and circuit techniques to meet specified performance requirements.                                                                                                                         | PO1, PO2,<br>PO3, PO5           | PSO1, PSO2              |
| <b>CO5</b>                                                                                         | Apply appropriate <b>engineering tools and techniques</b> to investigate application-oriented electronic circuit problems through simulation, programming-based assignments, problem solving, field study, case study and technical report preparation.              | PO2, PO4,<br>PO5, PO9           | PSO2                    |
| <b>CO6</b>                                                                                         | <b>Develop and communicate</b> innovative solutions to electronic engineering problems through mini projects, seminars, model demonstrations, publications, project expos, market surveys, hackathons, coding challenges and other experiential learning activities. | PO3, PO8,<br>PO9, PO10,<br>PO11 | PSO2, PSO3              |
|                                                                                                    |                                                                                                                                                                                                                                                                      |                                 |                         |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| <b>CO1</b> |     |     |     |     |     |     |     |     |     |       |       |       |       |       |
| <b>CO2</b> | 3   | 2   |     |     | 2   |     |     |     |     |       |       | 3     | 2     |       |
| <b>CO3</b> | 3   | 3   |     | 2   | 2   |     |     |     |     |       |       | 3     | 3     |       |
| <b>CO4</b> | 3   | 3   | 3   |     | 3   |     |     |     |     |       |       | 3     | 3     |       |
| <b>CO5</b> |     | 3   |     | 3   | 3   |     |     |     | 2   |       |       |       | 3     |       |
| <b>CO6</b> |     |     | 3   |     |     |     |     | 3   | 3   | 2     | 3     |       | 2     | 3     |

### Activities:

|    |                                                                                                                                                    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Simulation and analysis of electronic circuits using modern software tools <b>(CO5) (Self-learning activity)</b>                                   |
| 2. | Technical seminar / mini project presentation on amplifier, oscillator, or semiconductor device applications <b>(CO6) (Self-learning activity)</b> |

### Rubrics for evaluation: CO5

| Sl. No. | Criterion                                              | Marks      | Excellent (3)                                                                                              | Good(2)                                                                  | Satisfactory (1)                                                                    |
|---------|--------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1.      | Circuit modelling and simulation                       | 30         | Circuit is correctly modelled and simulated.                                                               | Circuit is simulated with minor errors.                                  | Circuit is partially simulated. The technology is identified but it is conventional |
| 2.      | Understanding the applications and circuit performance | 30         | Demonstrates strong understanding of device operation and circuit applications                             | Demonstrates moderate understanding of device operation and applications | Demonstrates limited understanding of device operation and applications             |
| 3.      | Analysis and interpretation of results                 | 20         | Results are accurately analysed and clearly interpreted using appropriate parameters, graphs or waveforms. | Results are adequately analysed with minor errors.                       | Results are partially analysed and interpreted.                                     |
| 4.      | Seminar / Technical report presentation                | 20         | Presentation / Report is clear, technically sound, and well structured                                     | Presentation / Report is structured, but needs improvement               | Poorly structured presentation / report                                             |
|         | <b>Total</b>                                           | <b>100</b> |                                                                                                            |                                                                          |                                                                                     |

| Rubrics for evaluation: CO6 |                                                             |            |                                                                                            |                                                                  |                                                         |
|-----------------------------|-------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------|
| Sl. No.                     | Criterion                                                   | Marks      | Excellent (3)                                                                              | Good(2)                                                          | Satisfactory (1)                                        |
| 1.                          | Identifying the application area and recent technology      | 30         | Identification of latest applications in amplifiers, oscillators, or semiconductor devices | The application is identified, but it is not recent              | The application identified is conventional              |
| 2.                          | Understanding the design and operation                      | 30         | Demonstrates strong understanding of circuit design, operation, and performance            | Demonstrates moderate understanding of circuit operation         | Demonstrates limited understanding of circuit operation |
| 3.                          | Development / analysis of mini project or technical content | 20         | Mini project / technical work is well developed with proper analysis and interpretation    | Mini project / technical work is developed with partial analysis | Limited development and poor analysis of technical work |
| 4.                          | Seminar / Project presentation                              | 20         | Presentation / Report is clear, technically sound, and well structured                     | Presentation / Report is structured, but needs improvement       | Poorly structured presentation / report                 |
|                             | <b>Total</b>                                                | <b>100</b> |                                                                                            |                                                                  |                                                         |

| The Internal Assessment Matrix (IAM) for the defined COs:                                                                                  |                  |           |            |             |                       |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------|------------|-------------|-----------------------|------------------|
| CO                                                                                                                                         | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|                                                                                                                                            | Test I           | Test II   | Activity I | Activity II |                       |                  |
| CO1                                                                                                                                        | 12               | 12        |            |             | 12                    | 2                |
| CO2                                                                                                                                        | 24               | 24        |            |             | 24                    | 3                |
| CO3                                                                                                                                        | 12               | 12        |            |             | 12                    | 2                |
| CO4                                                                                                                                        | 12               | 12        |            |             | 12                    | 2                |
| CO5                                                                                                                                        |                  |           | 20         | 20          | 20                    | 2                |
| CO6                                                                                                                                        |                  |           | 20         | 20          | 20                    | 2                |
| <b>Total</b>                                                                                                                               | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |
| Note:Purely as anExample: Strength = 3 (if percentage >20%);<br>Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%); |                  |           |            |             |                       |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------|--|--|--------------------|----|---------|----|----|----|
| 26HMC02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                               | TAMILS AND TECHNOLOGY<br>B.E. (Common to All Branches) |  |  | SEMESTER           |    |         | II |    |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                               |                                                        |  |  | Category           | HM | Credits |    |    | 1  |
| Basics of Tamil Language and Literature.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                               |                                                        |  |  | Hours/<br>Semester | L  | T       | P  | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                               |                                                        |  |  |                    | 15 | -       | -  | 15 | 30 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To obtain the knowledge of weaving and ceramic technology.                                    |                                                        |  |  |                    |    |         |    |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To familiarize about design and construction technology during Sangam age and British period. |                                                        |  |  |                    |    |         |    |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To know about the manufacturing technologies.                                                 |                                                        |  |  |                    |    |         |    |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To obtain the knowledge of agriculture and irrigation technology.                             |                                                        |  |  |                    |    |         |    |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | To know about the development of Scientific Tamil and Tamil computing.                        |                                                        |  |  |                    |    |         |    |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                               | WEAVING AND CERAMIC TECHNOLOGY                         |  |  |                    |    |         |    |    | 3  |
| Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                               | DESIGN AND CONSTRUCTION TECHNOLOGY                     |  |  |                    |    |         |    |    | 3  |
| Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period                                                                                                                    |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                               | MANUFACTURING TECHNOLOGY                               |  |  |                    |    |         |    |    | 3  |
| Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.                                                                                                                                                                                                                                                                        |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                               | SCIENCE, TECHNOLOGY AND KNOWLEDGE SYSTEMS OF TAMILS    |  |  |                    |    |         |    |    | 3  |
| Agriculture and Irrigation Technology – Dam, Tank, Ponds and Sluice Systems – Significance of KumizhiThoompu of the Chola Period – Animal Husbandry and Wells Designed for Cattle Use – Agriculture and Agro-Processing – Knowledge of Sea and Ocean – Fisheries, Pearl and Conch Diving – Knowledge-Specific Society – Development of Scientific Tamil – Tamil Computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.                                                             |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                               | ACTIVITY AND PROJECT WORK                              |  |  |                    |    |         |    |    | 3  |
| Prepare of models/charts related to ancient Tamil technologies such as irrigation systems – shipbuilding - weaving, pottery – temples - and coin minting. Document and present on Tamil scientific and technological heritage based on literary – archaeological - and historical sources - undergo a Field visit to heritage sites – museums – temples - archaeological sites - handicraft centre’s - or traditional industries and submission of a field report. Study and digitally document of Tamil inscriptions - hero stones – temples - traditional occupations -or local heritage resources. |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |
| L:15, SL:15, Total:30 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                               |                                                        |  |  |                    |    |         |    |    |    |

|                                                                                                    |                                                                                                                                                                                                                                                         |  |                        |                         |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------|-------------------------|
| <b>Weightage:</b><br>Continuous Assessment: 40%<br>End Semester Examinations: 60%                  |                                                                                                                                                                                                                                                         |  |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                                                         |  |                        |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                                                         |  |                        |                         |
| 1.                                                                                                 | "History of the Tamils", P.T. Srinivasa Iyengar, Gyan Publishing House, 2020.                                                                                                                                                                           |  |                        |                         |
| 2.                                                                                                 | "Sangam Literature: Its Cults and Cultures", K.A. Nilakanta Sastri, Swathi Publications, 2006.                                                                                                                                                          |  |                        |                         |
| 3.                                                                                                 | "History and Culture of Tamil Nadu", Chitra Madhavan, D.K. Print world, 2005.                                                                                                                                                                           |  |                        |                         |
| 4.                                                                                                 | "Tamil Computing", R. Ponnusamy, Allied Publishers Pvt. Ltd, 2025.                                                                                                                                                                                      |  |                        |                         |
| 5.                                                                                                 | "Tamils and Technology", S Muthuramalingam, M Saravanakumar, Vijay Nicole Imprints Pvt. Ltd., 2024.                                                                                                                                                     |  |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                                                         |  |                        |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                                                         |  |                        |                         |
| 1.                                                                                                 | <a href="https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518">https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518</a>                       |  |                        |                         |
| 2.                                                                                                 | <a href="https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEACAAJ&amp;redir_esc=y">https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEACAAJ&amp;redir_esc=y</a> |  |                        |                         |
| 3.                                                                                                 | <a href="https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu">https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu</a>                                                                                         |  |                        |                         |
| 4.                                                                                                 | <a href="https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055">https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055</a>                                                                                       |  |                        |                         |
| 5.                                                                                                 | <a href="https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307">https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307</a>                                                                           |  |                        |                         |
|                                                                                                    |                                                                                                                                                                                                                                                         |  |                        |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                         |  | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | Obtain the knowledge about weaving and ceramic technology.                                                                                                                                                                                              |  | PO9                    | -                       |
| <b>CO2</b>                                                                                         | Familiarize about design and construction technology during Sangam age and British period.                                                                                                                                                              |  | PO9                    | -                       |
| <b>CO3</b>                                                                                         | Understanding about the manufacturing technologies.                                                                                                                                                                                                     |  | PO9                    | PSO1                    |
| <b>CO4</b>                                                                                         | Acquire the skills in agriculture and irrigation technology.                                                                                                                                                                                            |  | PO9                    | -                       |
| <b>CO5</b>                                                                                         | Acquire the knowledge about the development of Scientific Tamil and Tamil computing.                                                                                                                                                                    |  | PO9,<br>PO11           | PSO3                    |
| <b>CO6</b>                                                                                         | Develop an understanding of Tamil heritage through field-based and digital learning activities.                                                                                                                                                         |  | PO9,<br>PO11           | PSO3                    |
|                                                                                                    |                                                                                                                                                                                                                                                         |  |                        |                         |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 1 | PS O2 | PSO 3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|
| <b>C01</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C02</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C03</b> |     |     |     |     |     |     |     |     | 3   |       |       | 2     |       |       |
| <b>C04</b> |     |     |     |     |     |     |     |     | 3   |       |       |       |       |       |
| <b>C05</b> |     |     |     |     |     |     |     |     | 3   |       | 2     |       |       | 2     |
| <b>C06</b> |     |     |     |     |     |     |     |     | 3   |       | 2     |       |       | 2     |

### Activities:

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>C05:</b> Acquire the knowledge about the development of Scientific Tamil and Tamil Computing <ol style="list-style-type: none"> <li>1. Prepare a report on the evolution of Scientific Tamil, highlighting key milestones and contributors.</li> <li>2. Create a PowerPoint presentation on Tamil computing tools, including Tamil software, fonts, and digital platforms.</li> <li>3. Demonstrate the use of online Tamil dictionaries, Tamil Virtual Academy, and Tamil Digital Library.</li> <li>4. Conduct a hands-on activity on typing and formatting Tamil text using Unicode tools.</li> <li>5. Group discussion on the role of Tamil in modern science and technology communication.</li> </ol>                                                                                      |
| 2. | <b>C06:</b> Develop an understanding of Tamil heritage through field-based and digital learning activities <ol style="list-style-type: none"> <li>1. Organize a field visit to heritage sites, museums, temples and submit a detailed report with photographs.</li> <li>2. Prepare a documentation project on local cultural heritage (architecture, crafts, inscriptions, or traditions).</li> <li>3. Create a poster or chart on Tamil technological achievements (irrigation systems, shipbuilding, metallurgy)</li> <li>4. Conduct a group seminar on Sangam age scientific and technological practices.</li> <li>5. Develop a digital scrapbook or e-portfolio showcasing Tamil heritage elements, present a case study on any one ancient Tamil technology or knowledge system.</li> </ol> |

### Rubrics for evaluation: C05

| Sl. No. | Criterion                   | Marks | Excellent (7-8)                                                                                                 | Good(4-6)                                             | Satisfactory (1-3)                                    |
|---------|-----------------------------|-------|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| 1.      | Knowledge of Tamil Heritage | 8     | Demonstrates and understanding of Tamil scientific, technological, and cultural heritage with accurate details. | Demonstrates good understanding with minor omissions. | Demonstrates basic understanding with limited details |

|    |                          |           |                                                                                                    |                                                                               |                                                                                        |
|----|--------------------------|-----------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 2. | Historical Understanding | 8         | Clearly explains historical context and significance with relevant examples.                       | Explains historical context with some supporting examples.                    | Provides limited explanation of historical context.                                    |
| 3. | Contemporary Relevance   | 8         | Effectively relates traditional knowledge and achievements to present-day applications and issues. | Relates traditional knowledge to modern applications with some clarity.       | Identifies a few modern connections.                                                   |
| 4. | Presentation Skills      | 8         | Content is well-organized, visually appealing, and presented effectively.                          | Content is organized and presented clearly with minor shortcomings.           | Content is organized and presented clearly with minor shortcomings.                    |
| 5. | Communication Skills     | 8         | Ideas are communicated clearly, confidently, and engagingly with appropriate supporting evidence.  | Ideas are communicated clearly with moderate confidence and adequate support. | Communication is understandable but lacks clarity, confidence, or supporting evidence. |
|    | <b>Total</b>             | <b>40</b> |                                                                                                    |                                                                               |                                                                                        |

#### Rubrics for evaluation: CO6

| Sl. No. | Criterion                     | Marks | Excellent (7-8)                                                                                             | Good(4-6)                                                     | Satisfactory (1-3)                                                            |
|---------|-------------------------------|-------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1.      | Application of Knowledge      | 8     | Effectively applies Tamil scientific, technological, and cultural concepts to practical tasks and projects. | Applies concepts correctly with minor guidance.               | Applies concepts at a basic level with limited effectiveness.                 |
| 2.      | Project Execution             | 8     | Project is comprehensive, innovative, well-planned, and successfully completed.                             | Project is well-executed with minor shortcomings.             | Project meets minimum requirements but lacks depth or completeness.           |
| 3.      | Use of Evidence and Resources | 8     | Effectively uses relevant data, sources and examples to support project outcomes.                           | Uses appropriate resources with adequate supporting evidence. | Uses limited resources and supporting evidence.                               |
| 4.      | Presentation Skills           | 8     | Presents findings clearly, professionally, and effectively.                                                 | Presents findings clearly with minor shortcomings.            | Presentation is adequate but lacks clarity, organization, or professionalism. |

|    |                       |           |                                                                                  |                                                               |                                                                               |
|----|-----------------------|-----------|----------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------|
| 5. | Documentation Quality | 8         | Documentation is comprehensive, accurate, well-organized and properly formatted. | Documentation is complete and organized with minor omissions. | Documentation is adequate but lacks detail, accuracy, or proper organization. |
|    | <b>Total</b>          | <b>40</b> |                                                                                  |                                                               |                                                                               |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                                              |        |         |   |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------|--------|---------|---|----|----|
| 26HMC02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | தமிழரும் தொழில் நுட்பமும்<br>(B.E. – அனைத்து துறைகளுக்கும்<br>பொதுவானது)                               |                                              | பருவம் |         |   | II |    |
| முன்தேவைகள்:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                        | Credits                                      | HM     | Credits |   | 1  |    |
| தமிழ் மொழி மற்றும் இலக்கியத்தின்<br>அடிப்படைகள்                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        | Hours/<br>Semester                           | L      | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                                              | 15     | -       | - | 15 | 30 |
| பாட நோக்கங்கள்                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                        |                                              |        |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | நெசவுத் தொழில் நுட்பம் மற்றும் மட்பாண்டத் தொழில் நுட்பம் குறித்த அறிவைப் பெறுதல்.                      |                                              |        |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | சங்ககாலம் மற்றும் ஆங்கிலேயர் ஆட்சிக்கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில் நுட்பங்களை அறிதல். |                                              |        |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | உற்பத்தித் தொழில் நுட்பங்களைப் பற்றிய புரிதலை வளர்த்தல்.                                               |                                              |        |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்ப அறிவைப் பெறுதல்.                                            |                                              |        |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சியை அறிதல்.                                             |                                              |        |         |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                        |                                              |        |         |   |    |    |
| அலகு- I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                        | நெசவு மற்றும் பானை தொழில் நுட்பம்            |        |         |   |    | 3  |
| சங்ககாலத்தில் நெசவுத் தொழில் – பானை தொழில் நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                        |                                              |        |         |   |    |    |
| அலகு- II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                        | வடிவமைப்பு மற்றும் கட்டிடத் தொழில் நுட்பம்   |        |         |   |    | 3  |
| சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழி பொட்டுத்தலங்கள் – நாயக்கர் காலக்கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோசாரோ செனிக் கட்டிடக்கலை. |                                                                                                        |                                              |        |         |   |    |    |
| அலகு- III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                        | உற்பத்தித் தொழில் நுட்பம்:                   |        |         |   |    | 3  |
| கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலொற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல் மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.                                                                                                                                                                               |                                                                                                        |                                              |        |         |   |    |    |
| அலகு- IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                        | வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம் |        |         |   |    | 3  |
| வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம் அணைகள், ஏரிகள், குளங்கள் மற்றும் மதகு அமைப்புகள் சோழர் கால குமிழித்தூம்பின் முக்கியத்துவம் கால் நடை வளர்ப்பு மற்றும் கால்நடைகளுக்கான கிணறு வடிவமைப்புகள் வேளாண்மை மற்றும் வேளாண் செயலாக்கம் கடல் மற்றும் பெருங்கடல் அறிவு மீன் பிடித்தல், முத்துக்குளித்தல் மற்றும் சங்கு மூழ்குதல் அறிவு சார்ந்த சமூக அமைப்பு அறிவியல் தமிழின் வளர்ச்சி தமிழ்                                                                                                                                |                                                                                                        |                                              |        |         |   |    |    |

கணினியியல் தமிழ் நூல்களின் மின்னாக்கம் தமிழ் மென் பொருள் வளர்ச்சி தமிழ் இணையக் கல்விக்கழகம் தமிழ் மின்னணு நூலகம் இணையத்தமிழ் அகராதிகள் சொற்குவைத்திட்டம்.

|         |                                    |   |
|---------|------------------------------------|---|
| அலகு- V | அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: | 3 |
|---------|------------------------------------|---|

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத்திட்டம்.

|                             |
|-----------------------------|
| L:15, SL:15, Total:30 Hours |
|-----------------------------|

|                                                                                  |
|----------------------------------------------------------------------------------|
| <b>மதிப்பீட்டு பங்கு:</b><br>தொடர் மதிப்பீடு: 40%<br>பருவ இறுதித் தேர்வுகள்: 60% |
|----------------------------------------------------------------------------------|

|                         |
|-------------------------|
| <b>குறிப்புநூல்கள்:</b> |
|-------------------------|

|    |                                                                                                                                                    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | பி. டி. சீனிவாச அய்யங்கார், தமிழர்களின் வரலாறு (History of the Tamils), கியான் பப்ளிஷிங் ஹவுஸ், 2020.                                              |
| 2. | கே. ஏ. நீலகண்டசாஸ்திரி, சங்க இலக்கியம்: அதன் சமயங்களும் பண்பாடுகளும் (Sangam Literature: Its Cults and Cultures), ஸ்வாதி பப்ளிகேஷன்ஸ், 2006.       |
| 3. | சித்ராமாதவன், தமிழ்நாட்டின் வரலாறும் பண்பாடும் (History and Culture of Tamil Nadu), டி.கே. பிரிண்ட்வேர்ல்ட், 2005.                                 |
| 4. | ஆர். பொன்னுசாமி, தமிழ்கணினியியல் (Tamil Computing), அலைட் பப்ளிஷர்ஸ் பிரைவேட் லிமிடெட், 2025.                                                      |
| 5  | எஸ். முத்தூராமலிங்கம் & மு. சரவணகுமார், தமிழர்களும் தொழில்நுட்பமும் (Tamils and Technology), விஜய் நிக்கோல் இம்பிரிண்ட்ஸ் பிரைவேட் லிமிடெட், 2024. |

|                        |                                                                                                                                                                                                                                                           |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>மின்னணுவளங்கள்:</b> |                                                                                                                                                                                                                                                           |
| 1.                     | <a href="https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518">https://atlanticbooks.com/products/history-of-the-tamils-from-the-earliest-times-to-600-a-d-9788121235518</a>                         |
| 2.                     | <a href="https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEA-CAAJ&amp;redir_esc=y">https://books.google.co.in/books/about/Sangam_Literature_Its_Cults_and_Cultures.html?id=j1ZsnQEA-CAAJ&amp;redir_esc=y</a> |
| 3.                     | <a href="https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu">https://books.google.co.in/books/about/History_and_Culture_of_Tamil_Nadu</a>                                                                                           |
| 4.                     | <a href="https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055">https://www.booksamillion.com/p/Tamil-Computing/R-Ponnusamy/9789390951055</a>                                                                                         |
| 5.                     | <a href="https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307">https://www.amazon.in/Tamils-Technology-English-S-Muthuramalingam/dp/8119243307</a>                                                                             |

| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                 | Mapping<br>POs | Mapping<br>PSOs |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------|-----------------|
| CO1                                                                                        | நெசவு மற்றும் மட்பாண்டத் தொழில் நுட்பம் பற்றிய அறிவைப் பெறுவர். | PO9            | -               |

|            |                                                                                                       |              |      |
|------------|-------------------------------------------------------------------------------------------------------|--------------|------|
| <b>C02</b> | சங்ககாலம் மற்றும் ஆங்கிலேயர்கால கட்டிட வடிவமைப்பு மற்றும் கட்டுமானத் தொழில்நுட்பங்களை அறிந்திருப்பர். | PO9          | -    |
| <b>C03</b> | உற்பத்தித் தொழில் நுட்பங்களைப் புரிந்து கொள்வர்.                                                      | PO9          | PSO1 |
| <b>C04</b> | வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத் திறன்களைப் பெறுவர்.                                       | PO9          |      |
| <b>C05</b> | அறிவியல் தமிழ் மற்றும் தமிழ் கணினியியல் வளர்ச்சி குறித்த அறிவைப்பெறுவர்.                              | PO9,<br>PO11 | PSO3 |
| <b>C06</b> | களப்பணி மற்றும் மின்னணு சுற்றல் நடவடிக்கைகள் மூலம் தமிழ் பாரம்பரியத்தைப் புரிந்து கொள்வர்.            | PO9,<br>PO11 | PSO3 |

**The Course Articulation Matrix (CAM) for defined COs**

|            | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|-----|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| <b>C01</b> |     |      |      |      |      |      |      |      | 3    |       |       |       |       |       |
| <b>C02</b> |     |      |      |      |      |      |      |      | 3    |       |       |       |       |       |
| <b>C03</b> |     |      |      |      |      |      |      |      | 3    |       |       | 2     |       |       |
| <b>C04</b> |     |      |      |      |      |      |      |      | 3    |       |       |       |       |       |
| <b>C05</b> |     |      |      |      |      |      |      |      | 3    |       | 2     |       |       | 2     |
| <b>C06</b> |     |      |      |      |      |      |      |      | 3    |       | 2     |       |       | 2     |

**செயல்பாடுகள்:**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>C05:</b> <ol style="list-style-type: none"> <li>அறிவியல் தமிழின் வளர்ச்சி வரலாற்றை விளக்கும் அறிக்கை தயாரித்தல்.</li> <li>தமிழ் மென்பொருட்கள், எழுத்துருக்கள் மற்றும் மின்னணு தளங்கள் குறித்த Power Point வழங்கல் தயாரித்தல்.</li> <li>இணையத்தமிழ் அகராதி, தமிழ் இணையக்கல்விக்கழகம் மற்றும் தமிழ் மின்னணு நூலகப் பயன் பாட்டை விளக்குதல்.</li> <li>Unicode கருவிகளைப் பயன்படுத்தி தமிழ் தட்டச்சு மற்றும் வடிவமைப்பு செயல்முறை பயிற்சி.</li> <li>நவீன அறிவியல் மற்றும் தொழில்நுட்பத் தகவல் பரிமாற்றத்தில் தமிழின் பங்கு குறித்த குழு விவாதம்.</li> </ol> |
| 2. | <b>C06:</b> <ol style="list-style-type: none"> <li>பாரம்பரியத் தளங்கள் / அருங்காட்சியகங்கள் / கோயில்களுக்கு களப்பயணம் செய்து புகைப்படங்களுடன் அறிக்கை சமர்ப்பித்தல்.</li> <li>உள்ளூர் கலாச்சாரப் பாரம்பரியம் குறித்த ஆவணத்திட்டம் தயாரித்தல்.</li> <li>தமிழ் தொழில் நுட்ப சாதனைகள் குறித்த போஸ்டர் அல்லது விளக்கப்படம் உருவாக்குதல்.</li> </ol>                                                                                                                                                                                                           |

|  |                                                                                                                                                                                                                                                                                                                          |
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|  | <p>4. சங்ககால அறிவியல் மற்றும் தொழில்நுட்ப நடைமுறைகள் குறித்த கருத்தரங்கு நடத்துதல்.</p> <p>5. தமிழ் பாரம்பரிய அம்சங்களை வெளிப்படுத்தும் மின்னணு ஸ்கிராப்புத்தகம் அல்லது e-Portfolio உருவாக்குதல், பண்டைய தமிழ் தொழில்நுட்பம் அல்லது அறிவு அமைப்புகளில் ஏதேனும் ஒன்றை அடிப்படையாகக் கொண்ட வழக்குக் கூற்று வழங்குதல்.</p> |
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**C05 மதிப்பீட்டு அளவுகோல்கள்:**

| வரி<br>சை<br>எண் | அளவுகோ<br>ல்                | மதிப்<br>பெண்<br>கள் | சிறப்பு (7-8)                                                                                                                       | நல்லது (4-6)                                                                               | திருப்திகரமானது<br>(1-3)                                                                        |
|------------------|-----------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1.               | தமிழ்<br>பாரம்பரிய<br>அறிவு | 8                    | தமிழ் அறிவியல்,<br>தொழில்நுட்ப<br>மற்றும்<br>பண்பாட்டு<br>பாரம்பரியத்தை<br>முழுமையாகவும்<br>துல்லியமாகவும்<br>விளக்குகிறது.         | நல்ல புரிதலை<br>வெளிப்படுத்துகி<br>றது, சில சிறிய<br>விடுபாடுகள்<br>இருக்கலாம்.            | அடிப்படை<br>அறிவை மட்டுமே<br>காட்டுகிறது;<br>விவரங்கள்<br>குறைவாக<br>உள்ளன.                     |
| 2.               | வரலாற்றுப்<br>புரிதல்       | 8                    | வரலாற்றுப்<br>பின்னணி மற்றும்<br>அதன்<br>முக்கியத்துவத்<br>தை<br>பொருத்தமான<br>எடுத்துக்காட்டுக<br>ளுடன் தெளிவாக<br>விளக்குகிறது.   | வரலாற்றுப்<br>பின்னணியை<br>சில<br>எடுத்துக்காட்டுக<br>ளுடன்<br>விளக்குகிறது.               | வரலாற்றுப்<br>பின்னணி குறித்த<br>விளக்கம் மிகவும்<br>வரையறுக்கப்<br>பட்டுள்ளது.                 |
| 3.               | தற்காலப்<br>பொருத்தம்       | 8                    | பாரம்பரிய<br>அறிவையும்<br>சாதனைகளையும்<br>தற்போதைய<br>பயன்பாடுகளுடன்<br>திறம்பட<br>இணைக்கிறது.                                      | பாரம்பரிய<br>அறிவை நவீன<br>பயன்பாடுகளுட<br>ன் ஓரளவு<br>தெளிவாக<br>தொடர்புபடுத்துகி<br>றது. | சில நவீன<br>தொடர்புகளை<br>மட்டுமே<br>அடையாளம்<br>காட்டுகிறது.                                   |
| 4.               | வழங்கல்<br>திறன்            | 8                    | உள்ளடக்கம்<br>சிறப்பாக ஒழுங்கு<br>படுத்தப்பட்டு,<br>காட்சிப்பூர்வமாக<br>கவர்ச்சிகரமாகவு<br>ம்<br>பயனுள்ளதாகவும்<br>வழங்கப்படுகிறது. | உள்ளடக்கம்<br>நன்கு<br>ஒழுங்குபடுத்தப்ப<br>ட்டு, சில<br>குறைகளுடன்<br>வழங்கப்படுகிறது<br>. | வழங்கல்<br>அடிப்படை<br>நிலையில் உள்ளது;<br>தெளிவு மற்றும்<br>ஒழுங்கமைப்பு<br>குறைவாக<br>உள்ளது. |

|    |                 |           |                                                                           |                                                                    |                                                                                             |
|----|-----------------|-----------|---------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 5. | தொடர்புத் திறன் | 8         | கருத்துக்கள் தெளிவாகவும் நம்பிக்கையுடனும் ஆதாரங்களுடன் விளக்கப்படுகின்றன. | கருத்துக்கள் போதுமான ஆதாரங்களுடன் தெளிவாக வெளிப்படுத்தப்படுகின்றன. | கருத்துக்கள் புரியும் வகையில் இருந்தாலும் தெளிவு, நம்பிக்கை அல்லது ஆதாரங்கள் குறைவாக உள்ளன. |
|    | <b>மொத்தம்</b>  | <b>40</b> |                                                                           |                                                                    |                                                                                             |

**CO6 மதிப்பீட்டு அளவுகோல்கள்:**

| வரி<br>சை<br>எண் | அளவு<br>கோல்                         | மதிப்<br>பெண்<br>கள் | சிறப்பு (7-8)                                                                                               | நல்லது (4-6)                                                                 | திருப்திகரமானது (1-3)                                                                         |
|------------------|--------------------------------------|----------------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 1.               | அறிவின் பயன்பாடு                     | 8                    | தமிழ் அறிவியல், தொழில்நுட்ப மற்றும் பண்பாட்டு கருத்துக்களை செயல்முறைப் பணிகளில் திறம்படப் பயன்படுத்துகிறது. | கருத்துக்களை சரியாகப் பயன்படுத்துகிறது; குறைந்த வழிகாட்டுதல் தேவைப்படுகிறது. | அடிப்படை அளவில் மட்டுமே கருத்துக்களைப் பயன்படுத்துகிறது.                                      |
| 2.               | திட்ட செயல்படுத்தல்                  | 8                    | திட்டம் முழுமையானதாகவும் புதுமையானதாகவும் நன்கு திட்டமிடப்பட்டு வெற்றிகரமாக நிறைவேற்றப்பட்டுள்ளது.          | திட்டம் நன்றாக செயல்படுத்தப்பட்டுள்ளது; சில சிறிய குறைகள் உள்ளன.             | குறைந்தபட்ச தேவைகளை பூர்த்தி செய்கிறது; ஆனால் ஆழம் மற்றும் முழுமை குறைவாக உள்ளது.             |
| 3.               | ஆதாரங்கள் மற்றும் வளங்களின் பயன்பாடு | 8                    | பொருத்தமான தரவுகள், ஆதாரங்கள் மற்றும் எடுத்துக்காட்டுகளை திறம்படப் பயன்படுத்துகிறது.                        | பொருத்தமான வளங்களைப் பயன்படுத்தி போதுமான ஆதாரங்களை வழங்குகிறது.              | குறைந்த அளவிலான வளங்கள் மற்றும் ஆதாரங்களை மட்டுமே பயன்படுத்துகிறது.                           |
| 4.               | வழங்கல் திறன்                        | 8                    | கண்டறிவுகளை தெளிவாகவும் தொழில் முறையாகவும் திறம்படவும் வழங்குகிறது.                                         | கண்டறிவுகள் தெளிவாக வழங்கப்படுகின்றன; சில சிறிய குறைகள் உள்ளன.               | வழங்கல் போதுமானதாக இருந்தாலும் தெளிவு, ஒழுங்கமைப்பு அல்லது தொழில்முறைத் தன்மை குறைவாக உள்ளது. |

|    |                    |    |                                                                                            |                                                                              |                                                                                       |
|----|--------------------|----|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 5. | ஆவணப்படுத்தல் தரம் | 8  | ஆவணங்கள் முழுமையாகவும் துல்லியமாகவும் ஒழுங்குபடுத்தப்பட்டும் சரியான வடிவமைப்புடனும் உள்ளன. | ஆவணங்கள் முழுமையாகவும் ஒழுங்காகவும் உள்ளன; சில சிறிய விடுபாடுகள் இருக்கலாம். | ஆவணங்கள் போதுமானதாக இருந்தாலும் விவரம், துல்லியம் அல்லது ஒழுங்கமைப்பு குறைவாக உள்ளது. |
|    | மொத்தம்            | 40 |                                                                                            |                                                                              |                                                                                       |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| C01          | 12        | 12        | -          | -           | 12                    | 2                |
| C02          | 24        | 24        |            |             | 24                    | 3                |
| C03          | 12        | 12        |            |             | 12                    | 2                |
| C04          | 12        | 12        |            |             | 12                    | 2                |
| C05          |           |           | 40         |             | 20                    | 2                |
| C06          |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note:Purely as anExample: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                |                               |          |         |    |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|---------|----|----|----|
| 26ENC02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PROFESSIONAL ENGLISH<br>B.E. (Common to all Branches)                                                                                          |                               | SEMESTER |         |    |    | II |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                | Category                      | HM       | Credits |    |    | 2  |
| Basic language skills listening, speaking, reading and writing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                | Hours/<br>Semester            | L        | T       | P  | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                |                               | 30       | -       | 15 | 15 | 60 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                |                               |          |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | To develop learners' overall communication competence through integrated listening, reading, speaking, and writing activities.                 |                               |          |         |    |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | To enhance learners' reading fluency and comprehension with appropriate pronunciation, intonation, and expression across different text types. |                               |          |         |    |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | To build learners' oral communication skills for narration, speeches, presentations, and professional interactions.                            |                               |          |         |    |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | To equip learners with organizational and presentation skills required for academic, technical, and event-based communication.                 |                               |          |         |    |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | To enable learners to describe processes, ideas, and technical activities clearly and confidently in real-life contexts.                       |                               |          |         |    |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                |                               |          |         |    |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                | FUNDAMENTALS OF COMMUNICATION |          |         |    |    | 9  |
| Listening: Interview with personal assistant, An interview with a business consultant, Describing changes in a company.<br>Reading: Reading a short story – learning pronunciation, intonation, splitting of sentences to form meaningful units.<br>Speaking: Self-introduction, name, home background, study details, area of interest, hobbies, strengths and weaknesses, etc.<br>Writing: Communication and its types - Technical Communication, Review of a favourite movie or a book.<br>Grammar: Tenses – Present tense, Past tense, Future tense. Voices – Active voice, Passive voice. |                                                                                                                                                |                               |          |         |    |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                | PRESENTATION SKILLS           |          |         |    |    | 9  |
| Listening: An interview about a production process, Telephone conversations, Making and changing appointments.<br>Reading: Reading a poem – learning the skill of reciting, appreciate rhyme and music, change in tone etc.<br>Speaking: Power point presentation on a general topic.<br>Writing: Essay writing – Descriptive and narrative essays, Precise writing.<br>Grammar: Common errors in English – Subject Verb agreement, Articles.                                                                                                                                                  |                                                                                                                                                |                               |          |         |    |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                | PUBLIC SPEAKING               |          |         |    |    | 9  |
| Listening: Conversation between two employees, Interview about change in job and corporate gift giving.<br>Reading: Reading newspaper article – learning vocabulary and language pattern of official communication.<br>Speaking: Oral presentation on a topic from basic engineering related to their branch.<br>Writing: Writing a news article, Minutes of meetings.<br>Grammar: Prefix and suffix, Phrasal verbs, Degrees of comparison.                                                                                                                                                    |                                                                                                                                                |                               |          |         |    |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                | ORGANIZING EVENTS             |          |         |    |    | 9  |
| Listening: Working in an international team, Statistical information, Interview with investor relations.<br>Reading: Company profiles, Statement of Purpose (SOP), An excerpt of interview with professionals.<br>Speaking: Proposing welcome address, vote of thanks and organizing events.<br>Writing: Letter Writing – Formal Letters and Informal Letters, Job Application, Cover letter with resume.<br>Grammar: Reported speech, Question tags, Simple, Compound and Complex sentences.                                                                                                  |                                                                                                                                                |                               |          |         |    |    |    |

| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                | PROCESS DESCRIPTION                                                                                                                                                                          | 9              |                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|
| Listening: An interview with recruitment agent, Meeting extracts, Description of how a product is advertised.<br>Reading: Reading advertisements, gadget reviews, user manuals.<br>Speaking: Describing a process – taking print outs, purchasing equipment for a company, booking a hall for meeting etc.<br>Writing: Process description, Designing advertisements.<br>Grammar: Cloze test, Homophones, Cause and effect expressions. |                                                                                                                                                                                              |                |                 |
| L:30, P:15, SL:15, Total:60 Hours                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                              |                |                 |
| Weightage:<br>Continuous Assessment - 50%<br>End Semester Examinations - 50%                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                              |                |                 |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                              |                |                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Beare, Kenneth, "Reading Skills Success in 20 Minutes a Day", 4 <sup>th</sup> Edition, LearningExpress, 2017.                                                                                |                |                 |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Hewings, Martin, "Advanced English Grammar", 3 <sup>rd</sup> Edition, Cambridge University Press, 2019.                                                                                      |                |                 |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Koneru, Aruna, "English Language Skills for Engineers", McGraw Hill Education, 2020.                                                                                                         |                |                 |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Murphy, Raymond. "English Grammar in Use", 5 <sup>th</sup> Edition, Cambridge University Press, 2019.                                                                                        |                |                 |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                      | Guffey, Mary Ellen, and Dana Loewy, "Essentials of Business Communication", 12 <sup>th</sup> Edition, Cengage Learning, 2021                                                                 |                |                 |
| E-RESOURCES:                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                              |                |                 |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="https://learnenglish.britishcouncil.org/">https://learnenglish.britishcouncil.org/</a>                                                                                              |                |                 |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="https://www.futurelearn.com/">https://www.futurelearn.com/</a>                                                                                                                      |                |                 |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="https://www.ted.com/">https://www.ted.com/</a>                                                                                                                                      |                |                 |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="https://www.cambridgeenglish.org/">https://www.cambridgeenglish.org/</a>                                                                                                            |                |                 |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                      | <a href="https://www.coursera.org/">https://www.coursera.org/</a>                                                                                                                            |                |                 |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                              | Mapping<br>POs | Mapping<br>PSOs |
| CO1                                                                                                                                                                                                                                                                                                                                                                                                                                     | Demonstrate effective listening, reading, speaking, and writing (LSRW) skills in academic and professional communication contexts.                                                           | PO9, PO11      |                 |
| CO2                                                                                                                                                                                                                                                                                                                                                                                                                                     | Apply appropriate grammar, vocabulary, pronunciation, and language conventions to ensure accurate, fluent, and effective communication across various contexts.                              | PO9, PO11      |                 |
| CO3                                                                                                                                                                                                                                                                                                                                                                                                                                     | Deliver oral presentations, speeches, and self-introductions confidently using suitable verbal and non-verbal communication strategies.                                                      | PO9, PO11      | PSO1            |
| CO4                                                                                                                                                                                                                                                                                                                                                                                                                                     | Analyze and interpret different forms of written texts such as stories, poems, newspaper articles, company profiles, advertisements, and technical documents.                                | PO9, PO11      | PSO2            |
| CO5                                                                                                                                                                                                                                                                                                                                                                                                                                     | Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements.             | PO9, PO10      | PSO3            |
| CO6                                                                                                                                                                                                                                                                                                                                                                                                                                     | Organize and participate effectively in workplace and social communication activities by demonstrating presentation, event management, interpersonal, and professional communication skills. | PO8, PO9, PO11 | PSO3            |

## The Course Articulation Matrix (CAM) for defined COs

|            | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| <b>CO1</b> |      |      |      |      |      |      |      |      | 3    |       | 2     |       |       |       |
| <b>CO2</b> |      |      |      |      |      |      |      |      | 3    |       | 2     |       |       |       |
| <b>CO3</b> |      |      |      |      |      |      |      |      | 3    |       | 2     | 1     |       |       |
| <b>CO4</b> |      |      |      |      |      |      |      |      | 3    |       | 2     |       | 1     |       |
| <b>CO5</b> |      |      |      |      |      |      |      |      | 3    | 2     |       |       |       | 2     |
| <b>CO6</b> |      |      |      |      |      |      |      | 2    | 3    |       | 2     |       |       | 2     |

### Activities:

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <p><b>CO5: Develop professional writing skills for drafting reviews, essays, news articles, minutes of meetings, letters, resumes, cover letters, process descriptions, and advertisements.</b></p> <p><b>(i) Review Writing Activity:</b><br/>Write a critical review of a favorite book, movie, gadget, or product by analyzing its features, strengths, weaknesses, and overall impact on the audience.</p> <p><b>(ii) News Article and Meeting Minutes Preparation:</b><br/>Attend a mock event, seminar, club activity, or classroom discussion and prepare a news article and formal minutes of the meeting following standard format.</p> <p><b>(iii) Professional Correspondence Portfolio:</b><br/>Prepare a portfolio consisting of formal letters, informal letters, job application letters, resumes, and cover letters for different academic and professional scenarios.</p> <p><b>(iv) Process Description:</b><br/>Develop a step-by-step process description for technical and administrative activities such as online registration, booking a meeting hall, purchasing equipment, printing documents, or conducting an event.</p> <p><b>(v) Advertisement and Creative Writing Project:</b><br/>Design print or digital advertisements for products, services, technical events, or social awareness campaigns highlighting their purpose and target audience.</p> |
| 2. | <p><b>CO6: Organize and participate effectively in workplace and social communication activities by demonstrating presentation, event management, interpersonal, and professional communication skills.</b></p> <p><b>(i) Professional Presentation Activity:</b><br/>Prepare and deliver an individual or group PowerPoint presentation on a technical, social, or current-affairs topic, demonstrating effective verbal and non-verbal communication skills.</p> <p><b>(ii) Organizing Events:</b><br/>Plan and organize a mock academic or professional event by assigning roles, preparing schedules, coordinating tasks, and delivering welcome addresses and vote of thanks.</p> <p><b>(iii) Workplace Communication Role Play:</b><br/>Participate in role-play activities involving interviews, telephone conversations, appointment scheduling, team discussions, client interactions, and workplace problem-solving situations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                         |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>(iv) Public Speaking and Group Discussion Activity:</b><br/>Engage in extempore speeches, group discussions, debates, and seminar presentations on engineering, social, or professional topics to improve confidence and interpersonal communication.</p> <p><b>(v) Professional Interaction and Team Collaboration Project:</b><br/>Work collaboratively in teams to conduct meetings, coordinate event-related tasks, prepare communication plans, and demonstrate leadership, teamwork, and professional etiquette in achieving common objectives.</p> |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Rubrics for evaluation: C05**

| Sl. No. | Criterion                          | Marks     | Excellent (3)                                                           | Good(2)                                           | Satisfactory (1)                                            |
|---------|------------------------------------|-----------|-------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------|
| 1.      | Content Relevance and Completeness | 10        | Content is highly relevant, complete, and fully meets task requirements | Mostly relevant and complete with minor omissions | Adequate content but lacks depth or some key points missing |
| 2.      | Organization and Format            | 10        | Excellent adherence to format                                           | Proper format with minor structural issues        | Basic structure present but inconsistent formatting         |
| 3.      | Clarity and Coherence              | 10        | Ideas are very clear, logically sequenced, and easy to follow           | Generally clear with minor lapses in flow         | Understandable but lacks smooth transitions                 |
| 4.      | Language Use                       | 10        | Excellent grammar, precise vocabulary, no errors                        | Minor grammatical / spelling errors               | Noticeable errors but meaning is clear                      |
|         | <b>Total</b>                       | <b>40</b> |                                                                         |                                                   |                                                             |

**Rubrics for evaluation: C06**

| Sl. No. | Criterion                          | Marks     | Excellent (3)                                                                        | Good(2)                                           | Satisfactory (1)                              |
|---------|------------------------------------|-----------|--------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| 1.      | Presentation Skills                | 10        | Highly confident, clear articulation, excellent eye contact, and engaging delivery   | Clear and confident with minor issues in delivery | Adequate presentation with some hesitation    |
| 2.      | Communication Effectiveness        | 10        | Excellent verbal & non-verbal communication; ideas conveyed clearly and persuasively | Good communication with minor gaps                | Understandable communication but lacks impact |
| 3.      | Interpersonal Skills and Teamwork  | 10        | Excellent collaboration, leadership, and positive interaction with team members      | Good teamwork and cooperative behavior            | Works with team but limited engagement        |
| 4.      | Event/Activity Organization Skills | 10        | Excellent planning, coordination, and execution of tasks/events                      | Good organization with minor gaps in execution    | Basic organization with limited efficiency    |
|         | <b>Total</b>                       | <b>40</b> |                                                                                      |                                                   |                                               |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |             | Laboratory Component   |            | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|------------------------|------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II | Observation and Record | Test       |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             | 10                     | 10         | 11                    | 2                |
| <b>CO2</b>   | 24               | 24        |            |             | 20                     | 20         | 22                    | 3                |
| <b>CO3</b>   | 12               | 12        |            |             | 30                     | 30         | 21                    | 3                |
| <b>CO4</b>   | 12               | 12        |            |             | 20                     | 20         | 16                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             | 10                     | 10         | 15                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          | 10                     | 10         | 15                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>             | <b>100</b> | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                     |                                                                                                                            |                    |          |   |         |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------|----------|---|---------|
| 26EE203                             | ELECTRIC CIRCUITS AND ELECTRONIC DEVICES<br>LABORATORY                                                                     |                    | SEMESTER |   | II      |
| Prerequisites                       |                                                                                                                            | Category           | ES(PC)   |   | Credits |
| Engineering Physics                 |                                                                                                                            | Hours/<br>Semester | L        | T | P       |
|                                     |                                                                                                                            |                    | -        | - | 45      |
|                                     |                                                                                                                            |                    |          |   | 15      |
|                                     |                                                                                                                            |                    |          |   | 60      |
| COURSE OBJECTIVES                   |                                                                                                                            |                    |          |   |         |
| 1.                                  | To verify the fundamental laws and network theorems of electric circuits through experiments.                              |                    |          |   |         |
| 2.                                  | To analyze the transient and frequency response characteristics of electrical circuits.                                    |                    |          |   |         |
| 3.                                  | To study the characteristics of semiconductor devices such as diodes, BJTs, and JFETs.                                     |                    |          |   |         |
| 4.                                  | To design and implement basic electronic circuits including rectifiers, regulators, clippers, clampers and Oscillator.     |                    |          |   |         |
| 5.                                  | To develop practical skills in testing, measurement, and interpretation of electrical and electronic circuit behaviour.    |                    |          |   |         |
| LIST OF EXPERIMENTS                 |                                                                                                                            |                    |          |   |         |
| I. ELECTRIC CIRCUITS                |                                                                                                                            |                    |          |   |         |
| 1.                                  | Verification of Ohm's law and Kirchoff's laws.                                                                             |                    |          |   |         |
| 2.                                  | Verification of Thevenin's / Norton's theorem.                                                                             |                    |          |   |         |
| 3.                                  | Verification of Superposition theorem.                                                                                     |                    |          |   |         |
| 4.                                  | Verification of Maximum Power transfer theorem.                                                                            |                    |          |   |         |
| 5.                                  | Frequency response of series / parallel resonance circuits.                                                                |                    |          |   |         |
| 6.                                  | Transient response of RL, RC and RLC circuit with DC inputs.                                                               |                    |          |   |         |
| II. ELECTRONIC DEVICES AND CIRCUITS |                                                                                                                            |                    |          |   |         |
| 1.                                  | Static Characteristics of PN Junction Diode and Clippers / Clampers.                                                       |                    |          |   |         |
| 2.                                  | Design and Implementation of Voltage regulators using Zener Diode.                                                         |                    |          |   |         |
| 3.                                  | Design and Implementation of Single-phase half-wave rectifier / Single-phase full-wave rectifier with and without filters. |                    |          |   |         |
| 4.                                  | Static Characteristics of BJT under CE / CB / CC configuration.                                                            |                    |          |   |         |
| 5.                                  | Static characteristics of JFET.                                                                                            |                    |          |   |         |
| 6.                                  | Design and Implementation of RC phase shift / Wien bridge Oscillators.                                                     |                    |          |   |         |
| P:45, SL:15, Total: 60 Hours        |                                                                                                                            |                    |          |   |         |

**Weightage:**

Continuous Assessment 60%

End Semester Examinations 40%

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                                            |                |            |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|
| <b>CO1</b> | <b>Apply</b> electrical circuit laws and network theorems to verify the performance of electrical circuits experimentally.                                                 | PO1, PO4, PO5  | PSO1, PSO2 |
| <b>CO2</b> | <b>Analyse</b> the transient, and frequency response of electrical circuits using experimental measurements.                                                               | PO2, PO4, PO5  | PSO1, PSO2 |
| <b>CO3</b> | <b>Analyse</b> the static characteristics of electronic devices using experimental measurements.                                                                           | PO2, PO4, PO5  | PSO1, PSO2 |
| <b>CO4</b> | <b>Design and implement</b> basic electronic circuits such as rectifiers, regulators, clippers, clampers and oscillators to meet specified requirements.                   | PO3, PO4, PO5  | PSO1, PSO2 |
| <b>CO5</b> | <b>Simulate</b> and analyse electrical and electronic circuits using appropriate <b>simulation tools</b> and compare the simulated results with experimental observations. | PO2, PO4, PO5  | PSO2       |
| <b>CO6</b> | Demonstrate and communicate laboratory outcomes through <b>technical documentation</b> , presentations, teamwork and other experiential learning activities.               | PO8, PO9, PO11 | PSO3       |

**The Course Articulation Matrix (CAM) for defined COs**

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PS O1</b> | <b>PS O2</b> | <b>PS O3</b> |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> | 2           |             |             | 2           | 2           |             |             |             |             |              |              | 3            | 2            |              |
| <b>CO2</b> |             | 3           |             | 3           | 3           |             |             |             |             |              |              | 3            | 3            |              |
| <b>CO3</b> |             | 3           |             | 3           | 3           |             |             |             |             |              |              | 3            | 3            |              |
| <b>CO4</b> |             |             | 3           | 3           | 3           |             |             |             |             |              |              | 3            | 3            |              |
| <b>CO5</b> | 3           | 2           |             | 3           | 3           |             |             |             |             |              | 2            |              | 3            |              |
| <b>CO6</b> |             |             | 2           |             |             |             |             | 3           | 3           | 2            | 3            |              | 2            | 3            |

**Activities:**

|    |                                                                                                                                                                                                                                                                                     |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Simulate</b> and analyse electrical circuits to verify network theorems or / Design of electronic circuits (rectifiers, regulators, clippers, clampers) using appropriate <b>simulation tools</b> and compare the simulated results with experimental observations. <b>(CO5)</b> |
| 2. | Demonstrate and communicate laboratory outcomes through <b>technical documentation, presentations</b> , teamwork and other experiential learning activities <b>(CO6)</b>                                                                                                            |

### Rubrics for evaluation: CO5 : Simulation Model of Electrical / Electronic Devices and Circuits

| Sl. No. | Criterion                                           | Marks      | Excellent (3)                                                         | Good (2)                                                       | Satisfactory (1)                                           |
|---------|-----------------------------------------------------|------------|-----------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------|
| 1.      | Design Specifications and Design calculation        | 20         | Design specification and design calculation are clearly done          | Design specification is done but design calculation is unclear | Design specification and design calculation are inadequate |
| 2.      | Simulation Model (Electrical / Electronic Circuits) | 30         | Simulation model is aligned with application                          | Simulation is correct and not aligned with application         | Requires guidance to complete the simulation               |
| 3.      | Performance Analysis & Interpretation of results    | 30         | Accurately analyzes / results and provides meaningful interpretations | Analyses / results are interpreted but limited justification   | Limited analysis and interpretation                        |
| 4.      | Report presentation                                 | 20         | Report is clear and well structured                                   | Report is structured, but needs improvement                    | Incomplete or Poorly structured report                     |
|         | <b>Total</b>                                        | <b>100</b> |                                                                       |                                                                |                                                            |

### Rubrics for evaluation: CO6 :Technical Report Preparation

| Sl. No. | Criterion                           | Marks      | Excellent (3)                                                                                | Good (2)                                                 | Satisfactory (1)                                       |
|---------|-------------------------------------|------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 1.      | Team work and Participation         | 40         | Actively contributes, collaborates effectively and demonstrate leadership in team activities | Participates regularly and Contributes to team tasks.    | Limited Participation and contribution                 |
| 2.      | Documentation Preparation           | 30         | Well-organized, accurate, and comprehensive Documentation                                    | Documentation is complete with minor errors              | Documentation is incomplete or lacks of clarity        |
| 3.      | Reflective learning & Communication | 30         | Demonstrates deep learning insights and effective communication skills.                      | Shows reasonable understanding and communication ability | Limited reflective learning and communication ability. |
|         | <b>Total</b>                        | <b>100</b> |                                                                                              |                                                          |                                                        |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>CO1</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO2</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO3</b>   | 30                                                               |            | 15                    | 2                |
| <b>CO4</b>   | 30                                                               |            | 15                    | 2                |
| <b>CO5</b>   |                                                                  | 40         | 20                    | 2                |
| <b>CO6</b>   |                                                                  | 60         | 30                    | 3                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

Note:Purely as anExample: Strength = 3 (if percentage >20%);Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------|--|--|--------------------|----|---------|----|----|----|
| 26MCS01                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                 | ENGINEERING SPRINTS             |  |  | SEMESTER           |    |         | II |    |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                 |                                 |  |  | Category           | SD | Credits |    |    | 0  |
| Basic knowledge of calculus, differential equations, complex numbers and elementary integration techniques.                                                                                                                                                                                                                                                                |                                                                                                                 |                                 |  |  | Hours/<br>Semester | L  | T       | P  | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |                                 |  |  |                    | 0  | 0       | 15 | 15 | 30 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                         | To strengthen conceptual understanding of fundamental engineering concepts.                                     |                                 |  |  |                    |    |         |    |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                         | To spark curiosity in students’ Minds.                                                                          |                                 |  |  |                    |    |         |    |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                         | To focus on teaching through a problem-solving approach using Street Fight Engineering principles pioneered.    |                                 |  |  |                    |    |         |    |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                         | To foster the growth of functional independence and self-driven learning habits                                 |                                 |  |  |                    |    |         |    |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                         | To maximize the interest levels toward learning - as students aspire to create meaningful changes in the world. |                                 |  |  |                    |    |         |    |    |    |
|                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 | STREET FIGHTING ENGINEERING     |  |  |                    |    |         |    |    | 3  |
| Why Street fight engineering - How to street fight engineering - Decode real-world problems - Observe key patterns - Relationship study - Derive actionable inferences - Perform data driven insights- Generate concepts and case studies                                                                                                                                  |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                 | PROGRAMMING PARADIGM            |  |  |                    |    |         |    |    | 3  |
| Need for programming - Outside box thinking to solve problems - Need for algorithms and data structures -Flowcharts & Algorithms - Memory Allocation - Conditions and loops - Creating effective functions - Case studies - Visual Programming - Types of programming languages& paradigms - Getting started with development - Build & test an algorithm - best practices |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 | BRAINS OF MACHINES              |  |  |                    |    |         |    |    | 3  |
| Key Innovations in Tesla Electric car - Case study - Brains of Electric cars - Transdisciplinary systems - Adapting Transdisciplinary systems to Accelerate innovation - Idea Hexagon - Exercise to think new innovations using Idea Hexagon - Brains of Digital camera                                                                                                    |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                 | MACHINES THAT MAKE-UP THE WORLD |  |  |                    |    |         |    |    | 3  |
| Basic of Electronics Passive Components -Need for sensors & Actuators - Analyzing & Understanding electronic circuits - How to Build a Basic Custom Hardware - Bootloader& its purpose                                                                                                                                                                                     |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                 | ENGINEERING THE REAL WORLD      |  |  |                    |    |         |    |    | 3  |
| Real-world as systems - Introduction to Systems Thinking - Stock and Flow Diagrams - System Traps - Intervening in System - Living in a World of Systems                                                                                                                                                                                                                   |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| Total:30 Hours                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |
| Continuous Assessment 100%                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 |                                 |  |  |                    |    |         |    |    |    |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                  |                |                 |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|
| 1.                                                                                         | Learning to code: How to think like a programmer                                                                                                                                                 |                |                 |
| 2.                                                                                         | How to find innovative ideas: Ramesh Raskar’s note                                                                                                                                               |                |                 |
| 3.                                                                                         | Case study: How Tesla changed the auto industry                                                                                                                                                  |                |                 |
| 4.                                                                                         | Ultimate Guide: How to develop a new electronic hardware product                                                                                                                                 |                |                 |
| 5.                                                                                         | Think like a programmer: An introduction to creative problem solving                                                                                                                             |                |                 |
|                                                                                            |                                                                                                                                                                                                  |                |                 |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                  |                |                 |
| 1.                                                                                         | Coursera, “Design Thinking for Innovation”, University of Virginia, <a href="https://www.coursera.org">https://www.coursera.org</a>                                                              |                |                 |
| 2.                                                                                         | “Engineering Systems and Innovation”, Massachusetts Institute of Technology, <a href="https://www.edx.org">https://www.edx.org</a>                                                               |                |                 |
| 3.                                                                                         | MIT OpenCourseWare, “Engineering Systems Analysis for Design”, Massachusetts Institute of Technology, <a href="https://ocw.mit.edu">https://ocw.mit.edu</a>                                      |                |                 |
| 4.                                                                                         | Stanford Online, “Design Thinking and Innovation”, Stanford University, <a href="https://online.stanford.edu">https://online.stanford.edu</a>                                                    |                |                 |
| 5.                                                                                         | NPTEL, “Problem Solving Through Programming in C”, National Programme on Technology Enhanced Learning (NPTEL), <a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a> |                |                 |
|                                                                                            |                                                                                                                                                                                                  |                |                 |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                  | Mapping<br>POs | Mapping<br>PSOs |
| CO1                                                                                        | Remember and understand the concepts of Street Fighting Engineering, programming paradigms, innovation tools, basic electronics and systems thinking used in engineering applications.           | -              | -               |
| CO2                                                                                        | Apply Street Fighting Engineering principles, algorithms and programming concepts to solve engineering problems.                                                                                 | PO1            | PSO1            |
| CO3                                                                                        | Analyze engineering problems using innovation methodologies, transdisciplinary systems and systems thinking approaches                                                                           | PO2            | PSO1            |
| CO4                                                                                        | Investigate engineering systems involving electronics, sensors, actuators and hardware design through assignments and case studies.                                                              | PO3            | PSO2            |
| CO5                                                                                        | Solve real-world engineering problems by applying analytical thinking, data-driven insights and systematic problem-solving techniques.                                                           | PO5            | PSO2            |
| CO6                                                                                        | Communicate engineering concepts, innovative ideas, solutions and findings effectively through reports, presentations and technical documentation.                                               | PO10           | -               |

### The Course Articulation Matrix (CAM) for defined Cos

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PSO 01 | PSO 02 | PSO 03 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|-------|--------|--------|--------|
| <b>CO1</b> | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | -      | -      | -      |
| <b>CO2</b> | 2   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     | 2      | -      | -      |
| <b>CO3</b> | -   | 2   | -   | -   | -   | -   | -   | -   | -   | -     | -     | 2      | -      | -      |
| <b>CO4</b> | -   | -   | 1   | -   | -   | -   | -   | -   | -   | -     | -     | -      | 1      | -      |
| <b>CO5</b> | -   | -   | -   | -   | 3   | -   | -   | -   | -   | -     | -     | -      | 1      | -      |
| <b>CO6</b> | -   | -   | -   | -   | -   | -   | -   | -   | -   | 3     | -     | -      | -      | -      |

### Activities:

|    |                                                                                                                                                                                                                                                                                  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Students shall analyse a real-world engineering problem using Street Fighting Engineering principles, systems thinking concepts and appropriate analytical tools. The activity may include problem identification, pattern analysis, inference generation and solution proposal. |
| 2. | Students shall prepare a structured report or presentation on an innovative engineering product, programming application, electronic system or engineering case study highlighting methodology, findings and engineering significance.                                           |

### Rubrics for evaluation: CO5

| Sl. No. | Criterion                           | Marks     | Excellent (3)                                          | Good (2)                            | Satisfactory (1)                |
|---------|-------------------------------------|-----------|--------------------------------------------------------|-------------------------------------|---------------------------------|
| 1.      | Problem Identification              | 10        | Real-world problem clearly identified and justified    | Problem identified with minor gaps  | Problem selection lacks clarity |
| 2.      | Analytical Thinking                 | 10        | Strong analysis and logical reasoning                  | Analysis adequate with minor errors | Limited analysis                |
| 3.      | Application of Engineering Concepts | 10        | Concepts applied effectively and correctly             | Mostly correct application          | Weak application                |
| 4.      | Solution Development                | 10        | Innovative and feasible solution proposed              | Solution acceptable                 | Solution incomplete             |
| 5.      | Interpretation of Results           | 10        | Results clearly interpreted with engineering relevance | Interpretation adequate             | Weak interpretation             |
|         | <b>Total</b>                        | <b>50</b> |                                                        |                                     |                                 |

**Rubrics for evaluation: CO6**

| <b>Sl. No.</b> | <b>Criterion</b>                      | <b>Marks</b> | <b>Excellent (3)</b>                          | <b>Good (2)</b>             | <b>Satisfactory (1)</b>         |
|----------------|---------------------------------------|--------------|-----------------------------------------------|-----------------------------|---------------------------------|
| 1.             | Technical Communication               | 10           | Ideas communicated clearly and professionally | Mostly clear communication  | Communication needs improvement |
| 2.             | Organization of Report / Presentation | 10           | Well-structured and systematic                | Minor organizational issues | Poor organization               |
| 3.             | Use of Technical Content              | 10           | Appropriate and accurate technical content    | Minor inaccuracies          | Limited technical content       |
| 4.             | Presentation Skills                   | 10           | Highly effective presentation and explanation | Good presentation           | Basic presentation              |
| 5.             | Overall Academic Quality              | 10           | Professional and high-quality work            | Good quality work           | Satisfactory quality            |
|                | <b>Total</b>                          | <b>50</b>    |                                               |                             |                                 |

| 26NCC01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | NCC Course –I<br>(Only for NCC Students)                                                                          |                                                     | SEMESTER           |  |    |         | II |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------|--|----|---------|----|----|----|
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                   |                                                     | Category           |  | -  | Credits |    | 2  |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                   |                                                     | Hours/<br>Semester |  | L  | T       | P  | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                   |                                                     |                    |  | 30 | 0       | 0  | 30 | 60 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | To Maintain the unity and disciplines to the students.                                                            |                                                     |                    |  |    |         |    |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   | NCC GENERAL & NATIONAL INTEGRATION AND AWARENESS    |                    |  |    |         |    |    | 6  |
| Aims, Objectives and Organization of NCC – Incentives to NCC Cadets – Duties of NCC Cadets – NCC Camps: Types and Conduct – National Integration: Importance and Necessity – Factors Affecting National Integration – Unity in Diversity – Threats to National Security.                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                   | PERSONALITY DEVELOPMENT & LEADERSHIP DEVELOPMENT    |                    |  |    |         |    |    | 6  |
| Personality Development Capsule – Self Awareness – Empathy – Creative and Critical Thinking – Decision Making – Communication Skills – Group Discussion – Stress Emotions – Change Your Mindset – Interpersonal Relations and Teamwork – Time Management – Civil Sense – Career Counselling – SSB Procedures and Interview Skills; Leadership Capsule – Traits, Indicators, Motivation, Ethics and Honour Code – Case Studies: Shivaji, APJ Abdul Kalam, Deepa Malik, Maharana Pratap, Ratan Tata, Kiran Majumdar Shaw, Jhansi Ki Rani, Narayan Murthy, Prakash Padukone, Tipu Sultan, Rabindranath Tagore. |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                   | DISASTER MANAGEMENT AND HEALTH & HYGIENE            |                    |  |    |         |    |    | 6  |
| Disaster Management Capsule – Social Service and Community Development – Types of Disasters – Organization, Capability and Role of NCC Cadets – Fire Service and Fire Fighting – Initiative Training – Organization Skills – Do’s and Don’ts – Natural Disasters – Man-Made Disasters – Health and Sanitation – First Aid in Common Medical Emergencies – Treatment and Care of Wounds – Introduction to Yoga and Exercises.                                                                                                                                                                                |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                   | PRINCIPLES OF FLIGHT & GENERAL SERVICE KNOWLEDGE    |                    |  |    |         |    |    | 6  |
| Laws of Motion – Glossary Terms – Bernoulli’s Principle – Aerofoil – Forces Acting on Aircraft – Lift and Drag – Flaps and Slats – Stall – Thrust – Armed Forces and IAF Capsule – Modes of Entry in IAF – Civil Aviation – Aircraft Recognition – Latest Trends and Acquisitions.                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                   | NAVIGATION, AERO ENGINES, AIR CAMPAIGNS & AIRMANSHP |                    |  |    |         |    |    | 6  |
| Requirements of Navigation – Glossary Terms – Maps – Map Reading – Basic Theory – Types of Engines – Piston Engines – Jet Engines – Turbo Prop Engines – Indo-Pak War 1971 – Operation Safed Sagar – Famous Air Heroes – Airmanship – Airfield Layout – Rules of the Air – Circuit Procedures – ATC RT Procedures – Aviation Medicine – Survival.                                                                                                                                                                                                                                                           |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| L:30, P:0, SL :30, Total:60 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                   |                                                     |                    |  |    |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | William H. McRaven, <i>The Hero Code: Lessons Learned from Lives Well Lived</i> , Grand Central Publishing, 2019. |                                                     |                    |  |    |         |    |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | S. K. Mangal, <i>Leadership and Personality Development</i> , PHI Learning Pvt. Ltd., 2018.                       |                                                     |                    |  |    |         |    |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | N. V. K. Raju, <i>Disaster Management and Preparedness</i> , CBS Publishers, 2019.                                |                                                     |                    |  |    |         |    |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | A. K. Gandhi, <i>National Security and National Integration in India</i> , New Century Publications, 2017.        |                                                     |                    |  |    |         |    |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | V. K. Sharma, <i>Fundamentals of Aviation and Air Navigation</i> , Himalaya Publishing House, 2018.               |                                                     |                    |  |    |         |    |    |    |

**E-RESOURCES:**

|    |                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------|
| 1. | National Cadet Corps (NCC)<br><a href="https://indiancc.nic.in/">https://indiancc.nic.in/</a>            |
| 2. | Ministry of Defence, Government of India<br><a href="https://mod.gov.in/">https://mod.gov.in/</a>        |
| 3. | National Disaster Management Authority (NDMA)<br><a href="https://ndma.gov.in/">https://ndma.gov.in/</a> |
| 4. | Indian Air Force<br><a href="https://indianairforce.nic.in/">https://indianairforce.nic.in/</a>          |

| COURSE OUTCOMES (COs) / | Mapping | Mapping |
|-------------------------|---------|---------|
|-------------------------|---------|---------|

| At the end of the course, the students will have the ability to | POs | PSOs |
|-----------------------------------------------------------------|-----|------|
|-----------------------------------------------------------------|-----|------|

|            |                                                                                                                                                               |                            |      |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
| <b>C01</b> | Acquire knowledge about the history, organization, objectives, incentives, duties, and camps of NCC.                                                          | PO8,<br>PO11               | -    |
| <b>C02</b> | Understand the concept of national integration, national security, unity in diversity, and their significance in nation building.                             | PO6, PO8,<br>PO11          | PSO1 |
| <b>C03</b> | Apply principles of personality development, leadership, communication, teamwork, ethics, and decision-making in personal and professional life.              | PO8, PO9,<br>PO10,         | PSO1 |
| <b>C04</b> | Understand the fundamentals of disaster management, health, hygiene, first aid, and the role of NCC cadets during emergencies and disaster situations.        | PO6, PO7,<br>PO8           | PSO2 |
| <b>C05</b> | Understand the principles of flight, aviation systems, navigation, aero engines, armed forces, and airmanship practices.                                      | PO1, PO2,<br>PO8           | PSO2 |
| <b>C06</b> | Demonstrate discipline, leadership, social responsibility, patriotism, and service-oriented attitudes through NCC training and community-oriented activities. | PO8, PO9,<br>PO10,<br>PO11 | PSO3 |

### The Course Articulation Matrix (CAM) for defined Cos

|     | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO1 1 | PS O 01 | PS O 02 | PS O 03 |
|-----|-----|------|------|------|------|------|------|------|------|-------|-------|---------|---------|---------|
| C01 | -   | -    | -    | -    | -    | -    | -    | 3    | -    | -     | 2     | -       | -       | -       |
| C02 | -   | -    | -    | -    | -    | 2    | -    | 3    | -    | -     | 2     | 2       | -       | -       |
| C03 | -   | -    | -    | -    | -    | -    | -    | 3    | 3    | 2     | -     | 2       | -       | -       |
| C04 | -   | -    | -    | -    | -    | 2    | 2    | 3    | -    | -     | -     | -       | 2       | -       |
| C05 | 2   | 2    | -    | -    | -    | -    | -    | 3    | -    | -     | -     | -       | 2       | -       |
| C06 | -   | -    | -    | -    | -    | -    | -    | 3    | 3    | 3     | 2     | -       | -       | 3       |

### Activities:

|    |                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Activity 1:</b> Participate in NCC orientation programmes and awareness sessions to understand the organization, objectives, and role of NCC in nation building.                |
| 2. | <b>Activity 2:</b> Participate in leadership, personality development, and communication skill workshops to enhance teamwork, decision-making, and interpersonal skills.           |
| 3. | <b>Activity 3:</b> Participate in disaster management drills, first aid training, and community service activities to develop social responsibility and emergency response skills. |

**Rubrics for evaluation: CO5**

| Sl. No. | Criterion                      | Marks      | Excellent (3)                                                              | Good (2)                                        | Satisfactory (1)                 |
|---------|--------------------------------|------------|----------------------------------------------------------------------------|-------------------------------------------------|----------------------------------|
| 1.      | Knowledge of Aviation Concepts | 25         | Demonstrates comprehensive understanding of aviation and flight principles | Demonstrates good understanding with minor gaps | Demonstrates basic understanding |
| 2.      | Technical Interpretation       | 25         | Accurately explains aviation systems and navigation concepts               | Explains concepts with minor errors             | Limited explanation of concepts  |
| 3.      | Application and Analysis       | 25         | Effectively relates theory to practical aviation scenarios                 | Adequately relates concepts to applications     | Limited application of concepts  |
| 4.      | Presentation and Communication | 25         | Presents ideas clearly and confidently                                     | Communicates adequately with minor hesitation   | Communication lacks clarity      |
|         | <b>Total</b>                   | <b>100</b> |                                                                            |                                                 |                                  |

**Rubrics for evaluation: CO6**

| Sl. No. | Criterion                         | Marks      | Excellent (3)                                                     | Good (2)                                          | Satisfactory (1)                                  |
|---------|-----------------------------------|------------|-------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| 1.      | Discipline and Commitment         | 25         | Consistently demonstrates discipline, punctuality, and commitment | Demonstrates good discipline with minor lapses    | Demonstrates basic discipline                     |
| 2.      | Leadership and Teamwork           | 25         | Effectively leads and collaborates with peers                     | Participates actively with minor limitations      | Limited leadership and teamwork                   |
| 3.      | Social Responsibility and Service | 25         | Actively contributes to community service and social initiatives  | Participates satisfactorily in service activities | Limited participation in service activities       |
| 4.      | Patriotism and Ethical Conduct    | 25         | Demonstrates strong patriotic values and ethical behavior         | Demonstrates good values and conduct              | Demonstrates basic awareness of values and ethics |
|         | <b>Total</b>                      | <b>100</b> |                                                                   |                                                   |                                                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------|----|---------|---|-----|-----|
| 26MA302                                                                                                                                                                                                                                                                                                                                                                                                                              | STATISTICS AND NUMERICAL METHODS<br>(B.E. EEE Programme)                                                                                                                                                                               |                                                          | SEMESTER           |    |         |   | III |     |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                        |                                                          | Category           | BS | Credits |   |     | 3   |
| Basic knowledge of calculus, differential equations, infinite series and elementary transform techniques.                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                        |                                                          | Hours/<br>Semester | L  | T       | P | SL  | TH  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                        |                                                          |                    | 45 | 15      | - | 30  | 90  |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To understand the fundamental concepts of basic statistics, measures of central tendency, moments skewness, kurtosis and curve fitting by the method of least squares.                                                                 |                                                          |                    |    |         |   |     |     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To develop knowledge of hypothesis testing techniques for large samples, small samples, correlation coefficient, ratio of variances and chi-square tests for goodness of fit and independence of attributes.                           |                                                          |                    |    |         |   |     |     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To study numerical methods for solving algebraic and transcendental equations, system of linear equations, interpolation, numerical differentiation and numerical integration.                                                         |                                                          |                    |    |         |   |     |     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To acquire problem-solving skills in numerical solutions of ordinary differential equations using Taylor series method, Euler method, modified Euler method, Runge-Kutta method, Milne's method and Adam's predictor-corrector method. |                                                          |                    |    |         |   |     |     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                   | To understand finite difference methods for solving partial differential equations such as Laplace equation, Poisson equation, heat equation and wave equation arising in engineering and scientific applications.                     |                                                          |                    |    |         |   |     |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                        | BASIC STATISTICS                                         |                    |    |         |   |     | 9+3 |
| Measures of Central tendency: Moments, Skewness and Kurtosis, Curve fitting by the Method of Least Squares –Fitting of straight lines, second degree parabolas and curves reducible to linear forms.                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                        | TEST OF HYPOTHESIS                                       |                    |    |         |   |     | 9+3 |
| Test of significance: Large Sample tests for Single proportion, difference of proportions, single mean and difference of means- Small Sample test for single mean, difference of means and correlation co-efficient, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.                                                                                                               |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                        | INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION |                    |    |         |   |     | 9+3 |
| Solution of Algebraic and Transcendental equations by Newton-Raphson method- Solution of system of equations by Gauss Elimination and Gauss Seidel iterative methods - Interpolation using Newton's Forward and Backward formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae Numerical Differentiation and Integration: Trapezoidal rule and Simpson's 1/3 rule, Simpson's 3/8 rule. |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                        | NUMERICAL SOLUTION FOR ORDINARY DIFFERENTIAL EQUATIONS   |                    |    |         |   |     | 9+3 |
| Ordinary differential equations: Taylor series method- Euler and modified Euler's method- Runge-Kutta method of fourth order for solving first and second order differential equations- Milne's and Adam's predictor - corrector methods.                                                                                                                                                                                            |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                        | NUMERICAL SOLUTION FOR PARTIAL DIFFERENTIAL EQUATIONS    |                    |    |         |   |     | 9+3 |
| Partial differential equations: Finite difference solution of two-dimensional Laplace and Poisson equations- Implicit and Explicit methods for one dimensional heat equation (Bender Schmidt and Crank-Nicholson methods) - Finite difference explicit method for wave equation.                                                                                                                                                     |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| L:45, T:15, SL :30, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| Continuous Assessment: 40%                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |
| End Semester Examinations: 60%                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                        |                                                          |                    |    |         |   |     |     |

**TEXT BOOKS:**

|    |                                                                                                                                                     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Veerarajan T, "Probability and Random Process With Queuing theory", 4 <sup>th</sup> Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2016. |
| 2. | Kandasamy.P, Thilagavathy.K, Gunavathi.K, "Numerical Methods", S. Chand & Co., New Delhi, 2005.                                                     |

**REFERENCE BOOKS:**

|    |                                                                                                                                           |
|----|-------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Gupta, S.C. and Kapoor, V.K., "Fundamentals of Mathematical Statistics", 11 <sup>th</sup> Edition, S. Chand and Sons, New Delhi, 2014.    |
| 2. | Freund John, E. and Miller Irwin, "Probability and Statistics for Engineers", 8 <sup>th</sup> Edition, Prentice Hall India (P) Ltd, 2010. |
| 3. | Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 6 <sup>th</sup> Edition, Pearson Education Asia, New Delhi, 2002.         |

**E-RESOURCES:**

|    |                                                                                                                                                                                                                                                                                                         |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | NPTEL, "Numerical Methods", National Programme on Technology Enhanced Learning, <a href="https://nptel.ac.in/courses/111107105">https://nptel.ac.in/courses/111107105</a>                                                                                                                               |
| 2. | NPTEL, "Probability and Statistics", National Programme on Technology Enhanced Learning, <a href="https://nptel.ac.in/courses/111105041">https://nptel.ac.in/courses/111105041</a>                                                                                                                      |
| 3. | MIT OpenCourseWare, "Numerical Methods for Engineers", Massachusetts Institute of Technology, <a href="https://ocw.mit.edu/courses/2-086-numerical-computation-for-mechanical-engineers-spring-2013/">https://ocw.mit.edu/courses/2-086-numerical-computation-for-mechanical-engineers-spring-2013/</a> |
| 4. | Khan Academy, "Statistics and Probability", <a href="https://www.khanacademy.org/math/statistics-probability">https://www.khanacademy.org/math/statistics-probability</a>                                                                                                                               |
| 5. | Wolfram MathWorld, "Numerical Analysis, Interpolation, Differential Equations and Statistics", Wolfram Research, <a href="https://mathworld.wolfram.com/Interpolation.html">https://mathworld.wolfram.com/Interpolation.html</a>                                                                        |

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                                                                                                                                                                                                                             |     |      |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| <b>CO1</b> | Remember and understand the fundamental concepts and methods of statistics, hypothesis testing, interpolation, numerical differentiation and integration, numerical solutions of ordinary and partial differential equations including statistical measures, significance tests, iterative methods, interpolation techniques and finite difference methods. | --  | --   |
| <b>CO2</b> | Apply statistical techniques, numerical methods, interpolation formulas, integration methods and numerical solution procedures for ordinary and partial differential equations to solve scientific, engineering and data analysis problems.                                                                                                                 | PO1 | PSO1 |
| <b>CO3</b> | Analyze statistical data and numerical problems using hypothesis testing, interpolation techniques, iterative methods, and numerical solution methods for ordinary and partial differential equations by selecting suitable computational approaches and interpreting the accuracy of results.                                                              | PO2 | PSO1 |
| <b>CO4</b> | Develop computational models and numerical algorithms for solving statistical, algebraic, ordinary differential equation and partial differential equation problems arising in engineering applications.                                                                                                                                                    | PO3 | PSO2 |
| <b>CO5</b> | Utilize numerical and statistical techniques through computational tools and assignment-based problem solving to improve analytical and programming-oriented skills.                                                                                                                                                                                        | PO5 | PSO2 |

|            |                                                                                                                                                                                                              |      |    |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|
| <b>CO6</b> | Investigate real-world engineering and scientific problems using statistical analysis, numerical approximation methods, and finite difference techniques to support effective decision-making and modelling. | PO10 | -- |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|

**The Course Articulation Matrix (CAM) for defined COs:**

|            | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO1</b> |            |            |            |            |            |            |            |            |            |             |             |             |             |             |
| <b>CO2</b> | 3          |            |            |            |            |            |            |            |            |             |             | 3           |             |             |
| <b>CO3</b> |            | 2          |            |            |            |            |            |            |            |             |             | 2           |             |             |
| <b>CO4</b> |            |            | 1          |            |            |            |            |            |            |             |             |             | 1           |             |
| <b>CO5</b> |            |            |            |            | 3          |            |            |            |            |             |             |             | 1           |             |
| <b>CO6</b> |            |            |            |            |            |            |            |            |            | 3           |             |             |             |             |
| <b>Avg</b> | <b>3</b>   | <b>2</b>   | <b>1</b>   |            | <b>3</b>   |            |            |            |            | <b>3</b>    |             | <b>2.5</b>  | <b>1</b>    |             |

**Activities:**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Students shall solve selected problems from statistics, hypothesis testing, interpolation, numerical differentiation, numerical integration, ordinary differential equations, and partial differential equations using computational tools such as Excel, Python, MATLAB, Scilab, R, or any open-source software. This activity develops analytical, computational and programming-oriented problem-solving skills. |
| 2. | Students shall prepare a short report or presentation on selected real-world engineering or scientific problems involving statistical analysis, numerical approximation methods, iterative methods or finite difference techniques. This activity develops the ability to communicate numerical procedures, computational results, graphical representations, interpretations and conclusions effectively.          |

**Rubrics for evaluation: CO5**

| <b>Sl. No.</b> | <b>Criterion</b>               | <b>Marks</b> | <b>Excellent (7-8)</b>                                                       | <b>Good (4-6)</b>                                     | <b>Satisfactory (1-3)</b>                          |
|----------------|--------------------------------|--------------|------------------------------------------------------------------------------|-------------------------------------------------------|----------------------------------------------------|
| 1.             | Selection of problem           | 8            | Suitable statistical/numerical problem is selected and clearly understood    | Problem is relevant, but needs minor clarity          | Problem selection is basic or unclear              |
| 2.             | Use of computational tool      | 8            | Tool is used effectively with correct procedure                              | Tool is used properly with minor errors               | Tool usage is limited or unclear                   |
| 3.             | Accuracy of solution           | 8            | Computation and numerical/statistical analysis are accurate                  | Minor computational errors are present                | Major errors in computation or analysis            |
| 4.             | Interpretation of results      | 8            | Results are clearly interpreted with practical relevance                     | Interpretation is limited                             | Interpretation is weak or missing                  |
| 5.             | Presentation and documentation | 8            | Work is neatly organized with clear numerical presentation and documentation | Presentation is good with minor organizational issues | Presentation is satisfactory but lacks consistency |
|                | <b>Total</b>                   | <b>40</b>    |                                                                              |                                                       |                                                    |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                                    | Marks     | Excellent (7-8)                                                    | Good (4-6)                                         | Satisfactory (1-3)                        |
|---------|----------------------------------------------|-----------|--------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------|
| 1.      | Identification of real-world problem         | 8         | Problem is clearly identified with proper objective                | Problem is identified, but needs minor improvement | Problem statement is unclear              |
| 2.      | Application of statistical/ numerical method | 8         | Appropriate method is applied correctly with proper steps          | Method is mostly correct with minor errors         | Method is incomplete or incorrect         |
| 3.      | Graphical/ computational representation      | 8         | Tables, graphs, outputs or numerical results are clearly presented | Representation is acceptable with minor errors     | Representation is poor or missing         |
| 4.      | Report writing and conclusion                | 8         | Report is well-structured with clear interpretation and conclusion | Report is organized, but needs improvement         | Report is incomplete or poorly structured |
| 5.      | Overall presentation and academic quality    | 8         | Work demonstrates excellent academic quality and professionalism   | Academic quality is good with minor issues         | Academic presentation is satisfactory     |
|         | <b>Total</b>                                 | <b>40</b> |                                                                    |                                                    |                                           |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        | -          | -           | 24                    | 3                |
| <b>CO3</b>   | 16        | 16        | -          | -           | 16                    | 2                |
| <b>CO4</b>   | 8         | 8         | -          | -           | 8                     | 1                |
| <b>CO5</b>   | -         | -         | 40         | -           | 25                    | 3                |
| <b>CO6</b>   | -         | -         | -          | 40          | 25                    | 3                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------|--|--------------------|--------|--------|-----|----|----|
| 26EE301                                                                                                                                                                                                                                                                                        |                                                                                                                                      | ELECTROMAGNETIC THEORY |  | SEMESTER           |        |        | III |    |    |
| Prerequisites                                                                                                                                                                                                                                                                                  |                                                                                                                                      |                        |  | Category           | ES(PC) | Credit |     |    | 3  |
|                                                                                                                                                                                                                                                                                                |                                                                                                                                      |                        |  | Hours/<br>Semester | L      | T      | P   | SL | TH |
|                                                                                                                                                                                                                                                                                                |                                                                                                                                      |                        |  |                    | 30     | 15     | -   | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                              |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| 1.                                                                                                                                                                                                                                                                                             | To introduce different coordinate systems, concepts of electrostatic, magneto static and time varying electromagnetic fields.        |                        |  |                    |        |        |     |    |    |
| 2.                                                                                                                                                                                                                                                                                             | To apply Maxwell's equations for various engineering applications involving electromagnetic waves.                                   |                        |  |                    |        |        |     |    |    |
|                                                                                                                                                                                                                                                                                                |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| UNIT – I                                                                                                                                                                                                                                                                                       |                                                                                                                                      | ELECTROSTATICS – I     |  |                    |        |        |     |    | 9  |
| Components of a vector and Classification of vector fields - Coordinate Systems and transformation – Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.          |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| UNIT – II                                                                                                                                                                                                                                                                                      |                                                                                                                                      | ELECTROSTATICS – II    |  |                    |        |        |     |    | 9  |
| Electric flux density – Electric potential – Electric dipole – Electric field in free space, conductors, dielectrics, - Dielectric polarization- Dielectric strength- Poisson's and Laplace's equations, Capacitance, Energy density.                                                          |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| UNIT – III                                                                                                                                                                                                                                                                                     |                                                                                                                                      | MAGNETOSTATICS         |  |                    |        |        |     |    | 9  |
| Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) –Magnetic scalar and vector potential - Magnetic force, and Torque - Magnetization, Magnetic field in multiple media, Inductance, Energy density. |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| UNIT – IV                                                                                                                                                                                                                                                                                      |                                                                                                                                      | ELECTRODYNAMIC FIELDS  |  |                    |        |        |     |    | 9  |
| Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations– Time-Varying Potentials - Time-Harmonic Fields - Relation between field theory and circuit theory                                                                               |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| UNIT – V                                                                                                                                                                                                                                                                                       |                                                                                                                                      | ELECTROMAGNETIC WAVES  |  |                    |        |        |     |    | 9  |
| Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector and theorem.                                                              |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| L:30, T:15, SL :45, Total:90 Hours                                                                                                                                                                                                                                                             |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| Weightage:<br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                       |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                               |                                                                                                                                      |                        |  |                    |        |        |     |    |    |
| 1.                                                                                                                                                                                                                                                                                             | D. J. Griffiths, "Introduction to Electrodynamics", PHI Learning, 4 <sup>th</sup> Edition, New Delhi, 2015.                          |                        |  |                    |        |        |     |    |    |
| 2.                                                                                                                                                                                                                                                                                             | E. Purcell and D. Morin, "Electricity and Magnetism", Cambridge University Press, 3 <sup>rd</sup> Edition, 2013.                     |                        |  |                    |        |        |     |    |    |
| 3.                                                                                                                                                                                                                                                                                             | M. O. Sadiku and S. V. Kulkarni, "Principles of Electromagnetics", Oxford University Press, 6 <sup>th</sup> Edition, 2015.           |                        |  |                    |        |        |     |    |    |
| 4.                                                                                                                                                                                                                                                                                             | D. K. Cheng, "Field and Wave Electromagnetics", Pearson Education, 2 <sup>nd</sup> Edition, 2014.                                    |                        |  |                    |        |        |     |    |    |
| 5.                                                                                                                                                                                                                                                                                             | R. P. Feynman, R. Leighton and M. Sands, Feynman Lectures on Physics Vol.-II (Millennium Edition), Pearson Education, 2012.          |                        |  |                    |        |        |     |    |    |
| 6.                                                                                                                                                                                                                                                                                             | J. Edminister, Schaum's Outline, 'Theory and Problems in Electromagnetics', 2 <sup>nd</sup> Revised Edition, Tata McGraw-Hill, 2010. |                        |  |                    |        |        |     |    |    |

**E-RESOURCES:**

1. <https://nptel.ac.in/courses/108104087>
2. MathWorks (MATLAB/Simulink): Simscape Electrical and Power Systems Modelling.

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                               |                |      |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------|
| <b>CO1</b> | Define the theorems associated with electro statics, electromagnetic system and explain electromagnetic wave generation and propagation in different mediums. | --             | ---  |
| <b>CO2</b> | <b>Apply</b> the knowledge of electrostatic and magneto static fields, to obtain electric and magnetic field intensity parameters of the given system         | PO1            | PSO1 |
| <b>CO3</b> | <b>Analyse</b> the electrostatic or electromagnetic system and compute its wave parameters                                                                    | PO2            | PSO1 |
| <b>CO4</b> | <b>Design</b> the specific electrostatic or electromagnetic system to meet the specifications of a given                                                      | PO3            | PSO2 |
| <b>CO5</b> | <b>Use simulation tool</b> , analyze the field distribution in a given electromagnetic system and electromagnetic wave propagation in different mediums       | PO5, PO8       | PSO2 |
| <b>CO6</b> | Engage in critical analysis of electromagnetic waves in power transmission lines and <b>present</b> the report for its impact on environment                  | PO6, PO9, PO11 | PSO3 |

**The Course Articulation Matrix(CAM) for defined COs**

|            | <b>PO<br/>1</b> | <b>PO<br/>2</b> | <b>PO<br/>3</b> | <b>PO<br/>4</b> | <b>PO<br/>5</b> | <b>PO<br/>6</b> | <b>PO<br/>7</b> | <b>PO<br/>8</b> | <b>PO<br/>9</b> | <b>PO<br/>10</b> | <b>PO<br/>11</b> | <b>PS<br/>O<br/>1</b> | <b>PSO<br/>2</b> | <b>PSO<br/>3</b> |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|-----------------------|------------------|------------------|
| <b>CO1</b> |                 |                 |                 |                 |                 |                 |                 |                 |                 |                  |                  |                       |                  |                  |
| <b>CO2</b> | 3               |                 |                 |                 |                 |                 |                 |                 |                 |                  |                  | 3                     |                  |                  |
| <b>CO3</b> |                 | 2               |                 |                 |                 |                 |                 |                 |                 |                  |                  | 2                     |                  |                  |
| <b>CO4</b> |                 |                 | 2               |                 |                 |                 |                 |                 |                 |                  |                  |                       | 2                |                  |
| <b>CO5</b> |                 |                 |                 |                 | 1               |                 |                 |                 | 1               |                  |                  |                       | 2                |                  |
| <b>CO6</b> |                 |                 |                 |                 |                 | 1               |                 | 1               | 1               |                  |                  |                       |                  | 2                |

**Activities:**

1. Simulation studies of electromagnetic system (CO5) (Self-learning activity)
2. Technical report presentation (CO6) (Self-learning activity)

**Rubrics for evaluation:CO5**

| Sl. No. | Criterion                                    | Marks      | Excellent (3)                                       | Good(2)                                           | Satisfactory (1)                              |
|---------|----------------------------------------------|------------|-----------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| 1.      | Modelling of electromagnetic system          | 30         | Well knowledge of the mathematical model            | Fair knowledge of the mathematical model          | Poor knowledge of the mathematical model      |
| 2.      | Simulation studies of electromagnetic system | 30         | High level knowledge of simulation tools and models | Moderate knowledge of simulation tools and models | Poor knowledge of simulation tools and models |
| 3.      | Technical analysis and Presentation          | 40         | Detailed analysis, and well presentation            | Presentation needs improvement                    | Poor presentation                             |
|         | <b>Total</b>                                 | <b>100</b> |                                                     |                                                   |                                               |

**Rubrics for evaluation:CO6**

| Sl. No. | Criterion                                                     | Marks      | Excellent (3)                                                      | Good(2)                                                                   | Satisfactory (1)                                                      |
|---------|---------------------------------------------------------------|------------|--------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1.      | Analysis of electromagnetic waves in power transmission lines | 30         | Full analysis of HT/EHT electromagnetic waves -theoretical studies | Partial studies of HT/EHT electromagnetic waves                           | Simple analysis of HT/EHT system                                      |
| 2.      | Studies on impact of electromagnetic waves in the environment | 30         | Theoretical studies on electromagnetic waves in the environment    | Moderate knowledge in studies on electromagnetic waves in the environment | Less knowledge in studies on electromagnetic waves in the environment |
| 3.      | Technical report preparation                                  | 40         | Presentation / Report is clear and well structured                 | Presentation / Report is structured, but needs improvement                | Poorly structured presentation / report                               |
|         | <b>Total</b>                                                  | <b>100</b> |                                                                    |                                                                           |                                                                       |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24               | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Strength = 3 (if percentage >20%); Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |                                          |                    |          |        |   |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------|--------------------|----------|--------|---|-----|----|
| 26EE302                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                         | SIGNALS AND SYSTEMS                      |                    | SEMESTER |        |   | III |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |                                          | Category           | ES(PC)   | Credit |   |     | 3  |
| Fourier Series and Transforms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |                                          | Hours/<br>Semester | L        | T      | P | SL  | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |                                          |                    | 30       | 15     | 0 | 45  | 90 |
| Course Objectives:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |                                          |                    |          |        |   |     |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | To understand the concepts of continuous time and discrete time systems |                                          |                    |          |        |   |     |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | To analyze systems in complex frequency domain                          |                                          |                    |          |        |   |     |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | To understand sampling theorem and its implications.                    |                                          |                    |          |        |   |     |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |                                          |                    |          |        |   |     |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                         | INTRODUCTION TO SIGNALS AND SYSTEMS      |                    |          |        |   |     | 9  |
| Signals and systems- Signal properties: periodicity, absolute integrability, deterministic and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & amp; Aperiodic signals, Deterministic & amp; Random signals, Energy & amp; Power signals. System properties: linearity, additivity and homogeneity, shift-invariance, causality, stability, realizability, Examples.                            |                                                                         |                                          |                    |          |        |   |     |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         | CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS |                    |          |        |   |     | 9  |
| Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.                                    |                                                                         |                                          |                    |          |        |   |     |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                         | FOURIER AND LAPLACE TRANSFORMS           |                    |          |        |   |     | 9  |
| Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. |                                                                         |                                          |                    |          |        |   |     |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         | Z- TRANSFORMS                            |                    |          |        |   |     | 9  |
| Z-transform and its properties, inverse z-transforms; difference equation – Solution by z transform, application to discrete systems - Stability analysis, frequency response – Convolution.                                                                                                                                                                                                                                                                                                                                                                                 |                                                                         |                                          |                    |          |        |   |     |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                         | SAMPLING AND RECONSTRUCTION              |                    |          |        |   |     | 9  |
| The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.                                                                                                                                                                                                              |                                                                         |                                          |                    |          |        |   |     |    |
| L:30, T:15, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                         |                                          |                    |          |        |   |     |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                         |                                          |                    |          |        |   |     |    |
| Continuous Assessment 40%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                         |                                          |                    |          |        |   |     |    |
| End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |                                          |                    |          |        |   |     |    |

|                                                                                                    |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|--------------|--------------|-------------------------------------|-------------------------|--------------|
| <b>Text Books:</b>                                                                                 |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 1.                                                                                                 | Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015.                                                                                                                                 |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 2.                                                                                                 | J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006                                                                                          |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 3.                                                                                                 | B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.                                                                                                                                        |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 4.                                                                                                 | A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall,2009.                                                                                                                        |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>References:</b>                                                                                 |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 1.                                                                                                 | H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 2.                                                                                                 | S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.                                                                                                                                      |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 3.                                                                                                 | M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.                                                                                                                                 |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| 1.                                                                                                 | <a href="https://nptel.ac.in/courses/117104074/">https://nptel.ac.in/courses/117104074/</a>                                                                                                                      |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
|                                                                                                    |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              | <b>Mapping<br/>POs</b>              | <b>Mapping<br/>PSOs</b> |              |
| <b>CO1</b>                                                                                         | Explain the properties and classifications of continuous-time and discrete-time signals and systems.                                                                                                             |             |             |             |             |            |             |             |             |              |              | --                                  | --                      |              |
| <b>CO2</b>                                                                                         | Analyze continuous-time and discrete-time LTI systems using convolution, differential equations, and state-space techniques.                                                                                     |             |             |             |             |            |             |             |             |              |              | PO2                                 | PSO1                    |              |
| <b>CO3</b>                                                                                         | Apply Fourier series, Fourier transform, Laplace transform, and DFT concepts for signal and system analysis.                                                                                                     |             |             |             |             |            |             |             |             |              |              | PO1, PO3,<br>PO4                    | PSO1,<br>PSO2           |              |
| <b>CO4</b>                                                                                         | Analyze discrete-time systems using Z-transform techniques and evaluate sampling and reconstruction processes.                                                                                                   |             |             |             |             |            |             |             |             |              |              | PO2, PO3,<br>PO4                    | PSO1,<br>PSO2           |              |
| <b>CO5</b>                                                                                         | Study and simulate signal and system operations using MATLAB or open-source simulation software through self-learning activities and interpret the results while considering practical engineering applications. |             |             |             |             |            |             |             |             |              |              | PO5, PO6,<br>PO7, PO8,<br>PO9, PO11 | PSO2,<br>PSO3           |              |
| <b>CO6</b>                                                                                         | Study applications of signals and systems through case studies, self-learning activities, and technical presentations while considering societal and economic impacts.                                           |             |             |             |             |            |             |             |             |              |              | PO5, PO6<br>PO7, PO8,<br>PO9, PO11  | PSO3                    |              |
|                                                                                                    |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>The Course Articulation Matrix (CAM) for defined COs</b>                                        |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>CO</b>                                                                                          | <b>PO 1</b>                                                                                                                                                                                                      | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b>                        | <b>PSO 2</b>            | <b>PSO 3</b> |
| <b>CO1</b>                                                                                         |                                                                                                                                                                                                                  |             |             |             |             |            |             |             |             |              |              |                                     |                         |              |
| <b>CO2</b>                                                                                         |                                                                                                                                                                                                                  | 3           |             |             |             |            |             |             |             |              |              | 3                                   |                         |              |
| <b>CO3</b>                                                                                         | 3                                                                                                                                                                                                                |             | 3           | 2           |             |            |             |             |             |              |              | 3                                   | 2                       |              |
| <b>CO4</b>                                                                                         |                                                                                                                                                                                                                  | 3           | 3           | 2           |             |            |             |             |             |              |              | 3                                   | 2                       |              |
| <b>CO5</b>                                                                                         |                                                                                                                                                                                                                  |             |             |             | 3           | 3          | 2           | 2           | 2           |              | 3            |                                     | 3                       | 2            |
| <b>CO6</b>                                                                                         |                                                                                                                                                                                                                  |             |             |             | 3           | 3          | 2           | 2           | 2           |              | 3            |                                     |                         | 3            |

| Activities:                 |                                                                                                                                                                                           |           |                                                                                    |                                                                     |                                                                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------|
| 1.                          | Perform simulation and analysis of continuous-time and discrete-time signals and systems using MATLAB or open-source software tools (CO5).                                                |           |                                                                                    |                                                                     |                                                                   |
| 2.                          | Analyze real-time applications of signals and systems in communication, control, and signal processing through case studies, self-learning activities, and technical presentations (CO6). |           |                                                                                    |                                                                     |                                                                   |
|                             |                                                                                                                                                                                           |           |                                                                                    |                                                                     |                                                                   |
| Rubrics for evaluation:CO5  |                                                                                                                                                                                           |           |                                                                                    |                                                                     |                                                                   |
| Sl. No.                     | Criterion                                                                                                                                                                                 | Marks     | Excellent (3)                                                                      | Good(2)                                                             | Satisfactory(1)                                                   |
| 1.                          | Problem formulation and selection of signal/system model                                                                                                                                  | 10        | Correctly formulates the problem with appropriate circuit design and parameters    | Formulates the problem with minor errors in circuit/model selection | Basic problem formulation with incomplete or incorrect parameters |
| 2.                          | Development of simulation circuit and generation of accurate results/plots                                                                                                                | 15        | Simulation executed correctly with accurate plots/results                          | Simulation completed with minor errors in results/plots             | Simulation partially completed with inadequate results            |
| 3.                          | Analysis and interpretation of simulation results with engineering relevance                                                                                                              | 10        | Clearly interprets results with proper engineering justification                   | Provides acceptable interpretation with limited explanation         | Gives basic interpretation with insufficient analysis             |
| 4.                          | Report preparation, presentation, and documentation of findings                                                                                                                           | 5         | Well-organized report with clear presentation and proper formatting                | Report is adequate with minor presentation issues                   | Report lacks clarity and proper organization                      |
|                             | <b>Total</b>                                                                                                                                                                              | <b>40</b> |                                                                                    |                                                                     |                                                                   |
|                             |                                                                                                                                                                                           |           |                                                                                    |                                                                     |                                                                   |
| Rubrics for evaluation: CO6 |                                                                                                                                                                                           |           |                                                                                    |                                                                     |                                                                   |
| Sl. No.                     | Criterion                                                                                                                                                                                 | Marks     | Excellent (3)                                                                      | Good(2)                                                             | Satisfactory(1)                                                   |
| 1.                          | Understanding of signal and system concepts with practical applications                                                                                                                   | 10        | Demonstrates strong understanding with relevant practical applications             | Demonstrates moderate understanding with limited application        | Demonstrates basic understanding with minimal applications        |
| 2.                          | Case study analysis considering technical, societal, and economic aspects                                                                                                                 | 15        | Provides detailed technical analysis with clear societal / economic considerations | Provides acceptable analysis with partial consideration of impacts  | Provides basic analysis with minimal consideration of impacts     |
| 3.                          | Evidence of self-learning, problem-solving, and independent study                                                                                                                         | 10        | Shows extensive self-learning with additional references and insights              | Shows moderate self-learning with adequate references               | Shows limited self-learning with minimal references               |

|    |                                                       |           |                                                                       |                                                                |                                                        |
|----|-------------------------------------------------------|-----------|-----------------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------|
| 4. | Presentation, communication, and report documentation | 5         | Presents ideas clearly with effective communication and documentation | Presentation is understandable with minor communication issues | Presentation lacks clarity and effective communication |
|    | <b>Total</b>                                          | <b>40</b> |                                                                       |                                                                |                                                        |

The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| C01          | 24        |           |            |             | 12                    | 2                |
| C02          | 24        |           |            |             | 12                    | 2                |
| C03          | 12        | 12        |            |             | 12                    | 2                |
| C04          |           | 48        |            |             | 24                    | 3                |
| C05          |           |           | 40         |             | 20                    | 2                |
| C06          |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--|--------------------|--------|---------|-----|----|----|
| 26EE303                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                              | DC MACHINES AND TRANSFORMERS            |  | SEMESTER           |        |         | III |    |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                              |                                         |  | Category           | ES(PC) | Credits |     |    | 3  |
| NIL                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                              |                                         |  | Hours/<br>Semester | L      | T       | P   | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                              |                                         |  |                    | 45     | -       | -   | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                     | To understand the concepts of electromechanical energy conversion and to gain the knowledge on single and multiple-excited magnetic systems. |                                         |  |                    |        |         |     |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                     | To gain the knowledge on construction and principles of operation of DC machines and transformers.                                           |                                         |  |                    |        |         |     |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                     | To analyse the performance characteristics of different types of DC machines and transformers.                                               |                                         |  |                    |        |         |     |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                     | To appreciate the applications of DC machines and transformers.                                                                              |                                         |  |                    |        |         |     |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                     | To compute the performance parameters of DC machines and transformers by conducting various tests.                                           |                                         |  |                    |        |         |     |    |    |
|                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                              | ELECTROMECHANICAL ENERGY CONVERSION     |  |                    |        |         |     |    | 9  |
| Magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits – Energy in magnetic systems – Field energy & mechanical force – Single and Multiple-excited magnetic field systems.                                                                                                                                        |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                              | DC GENERATORS                           |  |                    |        |         |     |    | 9  |
| Constructional features of DC machine – Principle of operation of DC generator – EMF equation – Types of excitation – No load and load characteristics of DC generators – Commutation - Armature reaction – Parallel operation of DC shunt generators – Applications.                                                                                  |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                              | DC MOTORS                               |  |                    |        |         |     |    | 9  |
| Principle of operation of DC motors - Back EMF – Torque equation – Types of DC motors – Speed and Torque characteristics of DC motors – Starting of DC motors: 3- point starter, 4- point starter– Speed control of shunt and series motor : Field current control and Armature voltage control – Applications.                                        |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                              | TRANSFORMERS                            |  |                    |        |         |     |    | 9  |
| Constructional features of single phase transformers (Core and shell type) –Principle of operation - EMF equation –ideal transformer characteristics - Practical Transformer working on No- load and Load with phasor diagram – Equivalent circuit – Voltage Regulation – Parallel operation - Autotransformers - Three phase transformer connections. |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                              | TESTING OF DC MACHINES AND TRANSFORMERS |  |                    |        |         |     |    | 9  |
| Losses and efficiency – Condition for maximum efficiency – Testing of DC machines: Swinburne's test and Hopkinson's test - Testing of transformers: open circuit and short circuit tests, Sumpner's test – All day efficiency.                                                                                                                         |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| L:45, SL:45, Total: 90 Hours                                                                                                                                                                                                                                                                                                                           |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| Weightage:<br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                               |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| TEXT BOOKS:                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                              |                                         |  |                    |        |         |     |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                     | D.P. Kothari, I.J. Nagrath, "Electric Machines", Fifth Edition, McGraw-Hill Education, New York, 2017.                                       |                                         |  |                    |        |         |     |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                     | Dr. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, New Delhi, 2 <sup>nd</sup> Edition, 2021.                                       |                                         |  |                    |        |         |     |    |    |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                                                                                                                |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|-------|-------|--------------------|-----------------|-------|
| 1.                                                                                         | B.L. Theraja& A.K. Theraja, "Electrical Technology", Vol.II, S.Chand & Company Ltd., New Delhi, 2015.                                                                                                                                                                                          |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| 2.                                                                                         | A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, "Electric Machinery", McGraw Hill Education Ltd, 6 <sup>th</sup> Edition, 2017.                                                                                                                                                           |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| 3.                                                                                         | K. Murugesh Kumar, "DC Machines and Transformers", Vikas Publishing House Pvt. Ltd., Second Edition, 2004.                                                                                                                                                                                     |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                                                                                                                |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| 1.                                                                                         | <a href="http://www.onlinecourses.nptel.ac.in">www.onlinecourses.nptel.ac.in</a>                                                                                                                                                                                                               |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| 2.                                                                                         | <a href="http://www.class-central.com">www.class-central.com</a>                                                                                                                                                                                                                               |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| 3.                                                                                         | <a href="http://www.mooc-list.com">www.mooc-list.com</a>                                                                                                                                                                                                                                       |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                                                                                                                |      |      |      |      |      |      |      |      |       |       | Mapping<br>POs     | Mapping<br>PSOs |       |
| CO1                                                                                        | Apply the concepts of electromechanical energy conversion in single and multiple excited magnetic field system.                                                                                                                                                                                |      |      |      |      |      |      |      |      |       |       | PO1                | PSO1            |       |
| CO2                                                                                        | Apply the electromagnetic principles to understand the construction and operation of DC machines and transformers & Apply appropriate starting and speed control methods to DC motor.                                                                                                          |      |      |      |      |      |      |      |      |       |       | PO1                | PSO1            |       |
| CO3                                                                                        | Analyse the performance characteristics of DC machines, and transformers and arrive at a suitable application. Analyse the parallel operation of DC generators / transformers and arrive at a suitable conclusion.                                                                             |      |      |      |      |      |      |      |      |       |       | PO2                | PSO1            |       |
| CO4                                                                                        | Evaluate the specified parameters/characteristics of DC machines and transformers by applying suitable testing methods.                                                                                                                                                                        |      |      |      |      |      |      |      |      |       |       | PO4                | PSO2            |       |
| CO5                                                                                        | Prepare an assignment on solving numerical problems in electromechanical energy conversion / Parallel operation of DC generators/transformers, & apply the knowledge of DC Machines and transformers to answer in MCQ type questions.                                                          |      |      |      |      |      |      |      |      |       |       | PO3 , PO9<br>PO11  | PSO1,<br>PSO3   |       |
| CO6                                                                                        | Perform as a team member, to present technical seminar on parallel operation of DC generators or transformers / constructional features and operation of DC machines or transformers / three-phase transformer connections and its application / Applications of DC machines and transformers. |      |      |      |      |      |      |      |      |       |       | PO8<br>PO9<br>PO11 | PSO3            |       |
| The Course Articulation Matrix (CAM) for defined COs                                       |                                                                                                                                                                                                                                                                                                |      |      |      |      |      |      |      |      |       |       |                    |                 |       |
| CO                                                                                         | PO 1                                                                                                                                                                                                                                                                                           | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1              | PSO 2           | PSO 3 |
| CO1                                                                                        | 3                                                                                                                                                                                                                                                                                              |      |      |      |      |      |      |      |      |       |       | 3                  |                 |       |
| CO2                                                                                        | 3                                                                                                                                                                                                                                                                                              |      |      |      |      |      |      |      |      |       |       | 3                  |                 |       |
| CO3                                                                                        |                                                                                                                                                                                                                                                                                                | 3    |      |      |      |      |      |      |      |       |       | 3                  |                 |       |
| CO4                                                                                        |                                                                                                                                                                                                                                                                                                |      |      | 3    |      |      |      |      |      |       |       |                    | 3               |       |
| CO5                                                                                        |                                                                                                                                                                                                                                                                                                |      | 1    |      |      |      |      |      | 1    |       | 1     | 1                  |                 | 1     |
| CO6                                                                                        |                                                                                                                                                                                                                                                                                                |      |      |      |      |      |      | 1    | 1    |       | 1     |                    |                 | 1     |

| Activities:                                                           |                                                                                                                          |            |                                                                                                           |                                                                                                                    |                                                                                            |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 1.                                                                    | a) Assignment in Solving Numerical Problems - 60% (CO5)<br>b) Multiple Choice Question type based Assessment - 40% (CO5) |            |                                                                                                           |                                                                                                                    |                                                                                            |
| 2.                                                                    | Technical Seminar Presentation(CO6)                                                                                      |            |                                                                                                           |                                                                                                                    |                                                                                            |
|                                                                       |                                                                                                                          |            |                                                                                                           |                                                                                                                    |                                                                                            |
| Rubrics for evaluation: CO5 - Assignment in solving numerical problem |                                                                                                                          |            |                                                                                                           |                                                                                                                    |                                                                                            |
| Sl. No.                                                               | Criterion                                                                                                                | Marks      | Excellent (3)                                                                                             | Good(2)                                                                                                            | Satisfactory (1)                                                                           |
| 1.                                                                    | Problem formulation and set up                                                                                           | 20         | Problem statement and circuit diagram are clearly defined                                                 | Problem statement defined, but missing minor parameters or parts of the circuit diagram                            | Wrong setup or no circuit diagram provided.                                                |
| 2.                                                                    | Physical Principles & Analysis                                                                                           | 30         | Correctly selects and applies fundamental electromechanical equations                                     | Correctly selects fundamental principles but makes minor errors in application                                     | Applies completely incorrect physical principles, and theories,                            |
| 3.                                                                    | Mathematical Execution & Units                                                                                           | 30         | Performs mathematical manipulations clearly and proper SI units are stated in answer                      | mathematical procedures, but results contain minor calculation errors                                              | Mathematical steps are incomplete and incorrect answers.                                   |
| 4.                                                                    | Report presentation                                                                                                      | 20         | Report is clear and well structured                                                                       | Report is structured, but needs improvement                                                                        | Poorly structured report                                                                   |
|                                                                       | <b>Total</b>                                                                                                             | <b>100</b> |                                                                                                           |                                                                                                                    |                                                                                            |
|                                                                       |                                                                                                                          |            |                                                                                                           |                                                                                                                    |                                                                                            |
| Rubrics for evaluation: CO6 - Technical Seminar Presentation          |                                                                                                                          |            |                                                                                                           |                                                                                                                    |                                                                                            |
| Sl. No.                                                               | Criterion                                                                                                                | Marks      | Excellent (3)                                                                                             | Good(2)                                                                                                            | Satisfactory (1)                                                                           |
| 1.                                                                    | Technical Content and Understanding                                                                                      | 30         | Clearly explains condition of parallel operation and circulating currents issue and its remedial measures | Correctly lists prerequisites like parallel configurations and load-sharing behaviors, but explanations lack depth | Fundamental conditions are missing. Mathematical equations or vector groups are incorrect. |

|    |                                       |            |                                                                            |                                                                                    |                                                       |
|----|---------------------------------------|------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|
| 2. | Performance analysis and applications | 30         | Clearly presents performance analysis and applications to real time system | Performance analysis is present and but application to real time system is unclear | Lacks in analysis and application to real time system |
| 3. | Team Participation and Collaboration  | 20         | Actively contributes and collaborates effectively with team members        | Participates with moderate contribution                                            | Limited participation in team activities              |
| 4. | Presentation and Demonstration        | 20         | Clearly explains and demonstrates the operation confidently                | Provides moderate explanation and demonstration                                    | Unable to explain or demonstrate effectively          |
|    | <b>Total</b>                          | <b>100</b> |                                                                            |                                                                                    |                                                       |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |               | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|---------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activities II |                       |                  |
| <b>CO1</b>   | 22               |           |            |               | 11                    | 2                |
| <b>CO2</b>   | 16               | 16        |            |               | 11                    | 2                |
| <b>CO3</b>   | 22               | 22        |            |               | 22                    | 3                |
| <b>CO4</b>   |                  | 22        |            |               | 11                    | 2                |
| <b>CO5</b>   |                  |           | 40         |               | 20                    | 2                |
| <b>CO6</b>   |                  |           |            | 40            | 20                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>     | <b>100</b>            |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                                                     |                    |        |         |   |     |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------|--------|---------|---|-----|----|
| 26EE304                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ANALOG AND DIGITAL INTEGRATED CIRCUITS                                                           |                                                     | SEMESTER           |        |         |   | III |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |                                                     | Category           | ES(PC) | Credits |   |     | 3  |
| Electronic Devices and Circuits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                                                     | Hours/<br>Semester | L      | T       | P | SL  | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                                                     |                    | 45     | -       | - | 45  | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                  |                                                     |                    |        |         |   |     |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To impart knowledge on the operation, characteristics and applications of Operational Amplifier. |                                                     |                    |        |         |   |     |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To understand the operation and application of Special linear ICs.                               |                                                     |                    |        |         |   |     |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To simplify the switching functions using K-map and Tabulation methods.                          |                                                     |                    |        |         |   |     |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To design and analyze the combination allogic circuits.                                          |                                                     |                    |        |         |   |     |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | To design and analyze the synchronous and asynchronous sequential logic circuits.                |                                                     |                    |        |         |   |     |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  | OPERATIONAL AMPLIFIERS                              |                    |        |         |   |     | 9  |
| Operational amplifiers - Equivalent circuit, voltage transfer curve-Open loop Op-amp configurations –Voltage series, Voltage shunt feedback amplifiers configurations, closed loop differential amplifiers for single and differential outputs.<br>Output offset voltage, minimizing output offset voltage due to input bias current and input offset current, factors affecting off set parameters, CMRR - Open loop and closed loop frequency response of op-amps, circuit stability, slew rate and its effects in applications                                                                                                                                                                                  |                                                                                                  |                                                     |                    |        |         |   |     |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  | APPLICATION OF OPERATIONAL AMPLIFIER AND LINEAR ICS |                    |        |         |   |     | 9  |
| DC & AC amplifiers- Summing, Scaling and Averaging amplifiers - Instrumentation amplifier - Voltage to Current converter for floating and grounded loads - Current to voltage converter-Integrator, Differentiator. Voltage comparators - Zero Crossing Detector - Schmitt trigger with voltage limiter - Precision Rectifier Circuits - Peak Detector - Sample and Hold circuit, Active Filters - Frequency response characteristics of major active filters, first and higher order low pass and high pass filters, all pass filters.<br>Functional block diagram and Applications of Linear ICs: IC 555 Timer - IC 566 Voltage controlled oscillator - IC 565 Phase-locked loops - IC LM317 voltage regulators. |                                                                                                  |                                                     |                    |        |         |   |     |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                  | COMBINATIONAL LOGIC CIRCUITS                        |                    |        |         |   |     | 9  |
| Representation of logic functions: SOP and POS forms - Simplification of switching functions: K-maps method and Quine McCluskey (Tabulation) method.<br>Design of combinational logic circuits: Adders – Subtractors – 2 bit Magnitude Comparator-Multiplexer - Demultiplexer - Encoder - Priority Encoder - Decoder – Code Converters. Implementation of combinational logic circuits using multiplexers and Decoder                                                                                                                                                                                                                                                                                              |                                                                                                  |                                                     |                    |        |         |   |     |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                  | SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS               |                    |        |         |   |     | 9  |
| Flip-flops: SR, D, JK and T - Conversion of flip-flops; Classification of sequential circuits: Moore and Mealy models - Analysis and design of synchronous sequential circuits - Design of synchronous counters - Universal shift register.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                  |                                                     |                    |        |         |   |     |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                  | ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS              |                    |        |         |   |     | 9  |
| Fundamental mode and pulse mode circuits, Analysis procedure of asynchronous circuits with /without using of SR latches- primitive state / flow table – Reduction of state and flow table - state assignment –Design Procedure of asynchronous circuits with /without using of SR latches-Problems in asynchronous sequential circuits: cycles -Races –Hazards.                                                                                                                                                                                                                                                                                                                                                    |                                                                                                  |                                                     |                    |        |         |   |     |    |
| L:45, SL:45, Total: 90 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                  |                                                     |                    |        |         |   |     |    |

**Weightage:**

Continuous Assessment 40%

End Semester Examinations 60%

**TEXT BOOKS:**

|    |                                                                                                                                                                 |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Ramakant A Gayakward, "Op-Amps and Linear Integrated Circuits", Fourth Edition, Pearson Education, 2003.                                                        |
| 2. | D.Roy Chowdhury and Shail B. Jain, "Linear Integrated Circuits", Fourth Edition, New Age International (P) Ltd Publishers, 2014.                                |
| 3. | M. Morris Mano, "Digital Design", Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2010 . |
| 4. | S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", Third Edition, Vikas Publishing House Pvt. Ltd, New Delhi, 2011                               |

**REFERENCE BOOKS:**

|    |                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Jacob Millman, Christos C.Halkias, "Integrated Electronics- Analog and Digital circuits system", Tata McGraw Hill 2003.                                     |
| 2. | R.P.Jain, "Modern Digital Electronics", Third Edition, Tata McGraw-Hill Publishing company limited, New Delhi, 2011.                                        |
| 3. | Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2015                                                                            |
| 4. | Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", Fifth Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2012. |
| 5. | William I. Fletcher, "An Engineering Approach to Digital Design", Pearson India, 2015.                                                                      |

**E-RESOURCES:**

|    |                                                                                                                        |
|----|------------------------------------------------------------------------------------------------------------------------|
| 1. | <a href="https://nptel.ac.in/courses/108108111">https://nptel.ac.in/courses/108108111</a> (linear integrated circuits) |
| 2. | <a href="https://onlinecourses.nptel.ac.in/digital">Onlinecourses.nptel.ac.in/digital</a> electronic circuits          |

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to**

|            |                                                                                                                                                                                                                                                                                                                                     | <b>Mapping POs</b> | <b>Mapping PSOs</b> |
|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|
| <b>CO1</b> | <b>Analyze</b> the AC and DC characteristics of Op-Amp and arrive at a suitable conclusion.                                                                                                                                                                                                                                         | PO2, PO3           | PSO1                |
| <b>CO2</b> | <b>Design</b> of analog electronic circuits using Op-Amp to meet the given specifications                                                                                                                                                                                                                                           | PO3, PO5           | PSO1, PSO2          |
| <b>CO3</b> | <b>Design and implement</b> of combinational logic circuits for a specific application / minimize the switching functions using K-map and Tabulation method.                                                                                                                                                                        | PO3, PO5,          | PSO1<br>PSO2        |
| <b>CO4</b> | <b>Analyse and Design</b> of synchronous / asynchronous sequential logic circuits.                                                                                                                                                                                                                                                  | PO2, PO3           | PSO1                |
| <b>CO5</b> | Present an <b>assignment</b> on solving numerical problems in analyse and design of digital electronics circuits / Apply knowledge of analog and digital electronics circuits to answer in <b>MCQ type</b> questions                                                                                                                | PO1, PO3,          | PSO1, PSO2          |
| <b>CO6</b> | Perform as a team member, to present technical <b>seminar</b> on Special Linear ICs for identified application / Operation of Zero Crossing Detector - Schmitt trigger - Peak Detector - Sample and Hold circuit/ Active filters / Problems in asynchronous sequential circuits: Cycles, Races, Hazards and its elimination method. | PO9, PO11          | PSO3                |

### The Course Articulation Matrix (CAM) for defined COs

| CO  | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| CO1 |      | 2    |      |      |      |      |      |      |      |       |       | 2     |       |       |
| CO2 |      |      | 2    |      | 2    |      |      |      |      |       |       | 2     | 1     |       |
| CO3 |      |      | 2    |      | 2    |      |      |      |      |       |       | 2     | 2     |       |
| CO4 |      | 2    | 2    |      |      |      |      |      |      |       |       | 2     | 2     |       |
| CO5 |      |      | 1    |      |      |      |      |      | 1    |       | 1     | 1     |       | 1     |
| CO6 |      |      |      |      |      |      |      | 1    | 1    |       | 1     |       |       | 1     |

#### Activities:

|    |                                                                                                                                                |
|----|------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | a) Assignment – Solving problems in digital electronic circuits - 60% (CO5) &<br>b) Multiple Choice Question type based Assessment - 40% (CO5) |
| 2. | Technical Seminar Presentation in analog and digital integrated circuits (CO6)                                                                 |

#### Rubrics for evaluation: CO5 - Assignment in solving numerical problem in analog and digital electronics circuits.

| Sl. No. | Criterion                                 | Marks      | Excellent (3)                                         | Good (2)                                                         | Satisfactory (1)                                          |
|---------|-------------------------------------------|------------|-------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------|
| 1.      | Problem formulation & boundary conditions | 20         | Problem and boundary conditions are clearly defined   | Problem defined, but some of the boundary conditions are unclear | Problem statement defined but unclear boundary conditions |
| 2.      | Mathematical calculation / Analysis       | 30         | Mathematical analysis / calculation is well-presented | Mathematical calculation is done, but with minor errors.         | Mathematical analysis / calculation is incomplete         |
| 3.      | Interpretation of results                 | 20         | Results are clearly Interpreted & justified           | Results are interpreted but limited justification                | Unclear interpretation                                    |
| 4.      | Report presentation                       | 10         | Report is clear and well structured                   | Report is structured, but needs improvement                      | Poorly structured report                                  |
|         | <b>Total</b>                              | <b>100</b> |                                                       |                                                                  |                                                           |

#### Rubrics for evaluation: CO6 - Technical Seminar Presentation

| Sl. No. | Criterion                             | Marks | Excellent (3)                                                              | Good (2)                                                                           | Satisfactory (1)                                      |
|---------|---------------------------------------|-------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1.      | Technical content and Understanding   | 30    | Clearly explains operation of analog / digital electronics circuits        | Explanation needs improvement                                                      | Limited understanding                                 |
| 2.      | Performance analysis and applications | 30    | Clearly presents performance analysis and applications to real time system | Performance analysis is present and but application to real time system is unclear | Lacks in analysis and application to real time system |

|    |                                      |            |                                                                     |                                         |                                          |
|----|--------------------------------------|------------|---------------------------------------------------------------------|-----------------------------------------|------------------------------------------|
| 3. | Team Participation and Collaboration | 20         | Actively contributes and collaborates effectively with team members | Participates with moderate contribution | Limited participation in team activities |
| 4. | Presentation & Communication         | 20         | Presentation is clear and well-structured                           | Presentation needs improvement          | Poorly structured                        |
|    | <b>Total</b>                         | <b>100</b> |                                                                     |                                         |                                          |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>C01</b>   | 22        |           |            |             | 11                    | 2                |
| <b>C02</b>   | 22        |           |            |             | 11                    | 2                |
| <b>C03</b>   | 16        | 16        |            |             | 16                    | 2                |
| <b>C04</b>   |           | 44        |            |             | 22                    | 3                |
| <b>C05</b>   |           |           | 40         |             | 20                    | 2                |
| <b>C06</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--------------------|--------|---------|---|-----|----|
| 26EE305                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MEASUREMENTS AND INSTRUMENTATION                                                                                                                                                                               |                                                       | SEMESTER           |        |         |   | III |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                |                                                       | Category           | ES(PC) | Credits |   |     | 3  |
| Electric Circuit Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                |                                                       | Hours/<br>Semester | L      | T       | P | SL  | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                |                                                       |                    | 45     | -       | - | 45  | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | To provide knowledge on the fundamental elements of a generalized measurement system, including static/dynamic characteristics, error analysis, and the operational principles of PMMC and moving iron meters. |                                                       |                    |        |         |   |     |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | To introduce techniques and instruments for measuring power, energy, and frequency, including the application of instrument transformers and smart meters.                                                     |                                                       |                    |        |         |   |     |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | To provide expertise in circuit analysis using DC and AC bridges for the precise determination of unknown resistance, inductance, and capacitance.                                                             |                                                       |                    |        |         |   |     |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | To introduce signal visualization and analysis using Cathode Ray and Digital Storage Oscilloscopes, alongside the operation of digital multi-meters and voltmeters.                                            |                                                       |                    |        |         |   |     |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                               | To provide knowledge on the classification and application of transducers for non-electrical quantities and the integration of smart sensors in modern instrumentation systems.                                |                                                       |                    |        |         |   |     |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| UNIT – I                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                | MEASUREMENT SYSTEM                                    |                    |        |         |   |     | 9  |
| Elements of a generalized measurement system – Static and dynamic characteristics – Errors in measurement. Measurement of voltage and current: Permanent magnet moving coil and moving iron type meters.                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| UNIT – II                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                | MEASUREMENT OF POWER, ENERGY AND FREQUENCY            |                    |        |         |   |     | 9  |
| Measurement of power: Single and three phase electrodynamicometer type watt meters – Construction, operation – torque equation for deflection – errors. Measurement of energy: Single phase induction type energy meters. Instrument transformers: Current and Potential transformers. Power factor meters: Single phase electrodynamicometer type power factor meter. Frequency meter: Electrical resonance type frequency meter. Introduction to smart meters. |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| UNIT – III                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                | DC AND AC BRIDGES                                     |                    |        |         |   |     | 9  |
| Balance equations – Wheatstone bridge – Kelvin double Bridge –Maxwell’s inductance capacitance bridge – Hay’s bridge – Anderson’s bridge – Schering bridge and De Sauty’s bridge.                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| UNIT – IV                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                | POTENTIOMETERS, OSCILLOSCOPES AND DIGITAL INSTRUMENTS |                    |        |         |   |     | 9  |
| DC potentiometer – Crompton’s Potentiometer, AC potentiometer– Drysdale polar potentiometer– Gall Tinsley co-ordinate type potentiometer. Cathode Ray Oscilloscope and Digital storage Oscilloscope: Construction, operation and Applications. Digital multi-meters, Digital voltmeters.                                                                                                                                                                         |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| UNIT – V                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                | MEASUREMENT OF NON-ELECTRICAL QUANTITIES              |                    |        |         |   |     | 9  |
| Classification of transducers –Position transducers, Piezo-electric transducers and Hall effect transducers. Measurement of pressure, temperature and displacement– Introduction to Smart Sensors                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| L:45, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| Continuous Assessment 40%                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |
| End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                |                                                       |                    |        |         |   |     |    |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                                 |                             |                 |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------|
| 1.                                                                                         | A. K. Sawhney, "A Course in Electrical & Electronics Measurement & Instrumentation", Dhanpat Rai and Co, 2015.                                                                                                  |                             |                 |
| 2.                                                                                         | J. B. Gupta, "Electrical Measurements & Measuring Instruments", S.K. Kataria & Sons, 2020.                                                                                                                      |                             |                 |
| 3.                                                                                         | E. O. Doebelin, "Measurements Systems- Application and Design", Tata McGraw Hill Publishing Company, 2015.                                                                                                      |                             |                 |
| 4.                                                                                         | D. V. S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd, 2010.                                                                                                                     |                             |                 |
| 5.                                                                                         | H. S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill, 2015.                                                                                                                                              |                             |                 |
| 6.                                                                                         | Martin Reissland, "Electrical Measurements", New Age International (P) Ltd., Delhi, 2011.                                                                                                                       |                             |                 |
|                                                                                            |                                                                                                                                                                                                                 |                             |                 |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                                 |                             |                 |
| 1.                                                                                         | NPTEL: Electrical Measurements and Instrumentation, IIT Kharagpur (Online Course).                                                                                                                              |                             |                 |
| 2.                                                                                         | Coursera: Introduction to Sensors, University of Colorado Boulder.                                                                                                                                              |                             |                 |
| 3.                                                                                         | National Instruments (NI): Measurement Fundamentals and LabVIEW Documentation.                                                                                                                                  |                             |                 |
| 4.                                                                                         | IEEE Xplore: Transactions on Instrumentation and Measurement (Research Journal).                                                                                                                                |                             |                 |
| 5.                                                                                         | MIT Open Courseware: Feedback System Packaging and Sensor Integration.                                                                                                                                          |                             |                 |
|                                                                                            |                                                                                                                                                                                                                 |                             |                 |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                                 | Mapping<br>POs              | Mapping<br>PSOs |
| CO1                                                                                        | <b>Explain</b> the fundamental principles of measurement systems and the structure of instrumentation systems for electrical and non-electrical parameters measurements.                                        | --                          | --              |
| CO2                                                                                        | <b>Apply</b> the principles of electromagnetism to measure power, energy, and frequency using induction and electrodynamicometer instruments, DC and AC bridges, digital instruments, CRO, DSO and transducers. | PO1                         | PSO1            |
| CO3                                                                                        | <b>Analyse</b> the performance of measuring instruments and balance equations for various DC and AC bridges to determine unknown resistance, inductance, and capacitance.                                       | PO2                         | PSO1            |
| CO4                                                                                        | <b>Analyse</b> electrical signals using CRO and DSO and the implications of transducers for non-electrical parameters measurements.                                                                             | PO2                         | PSO1            |
| CO5                                                                                        | Perform <b>research</b> on the advancements in smart meters and sensors through <b>self-learning activities</b> and evaluate their <b>societal and economic impacts</b> .                                       | PO4,<br>PO6,<br>PO9, PO11   | PSO2            |
| CO6                                                                                        | Perform as a <b>member of team</b> for the selection and application of suitable transducers for non-electrical quantities and <b>present technical findings</b> through <b>self-learning activities</b> .      | PO5,<br>PO6,<br>PO8,<br>PO9 | PSO2            |
|                                                                                            |                                                                                                                                                                                                                 |                             |                 |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| <b>CO1</b> |      |      |      |      |      |      |      |      |      |       |       |       |       |       |
| <b>CO2</b> | 3    |      |      |      |      |      |      |      |      |       |       | 3     |       |       |
| <b>CO3</b> |      | 3    |      |      |      |      |      |      |      |       |       | 3     |       |       |
| <b>CO4</b> |      | 3    |      |      |      |      |      |      |      |       |       | 3     |       |       |
| <b>CO5</b> |      |      |      | 2    |      | 1    |      |      | 1    |       | 1     |       | 3     |       |
| <b>CO6</b> |      |      |      |      | 2    | 1    |      | 1    | 1    |       |       |       | 3     |       |

#### Activities:

|    |                                                               |
|----|---------------------------------------------------------------|
| 1. | Technical Seminar Presentation (CO5) (Self-learning activity) |
| 2. | Technical Report Presentation (CO6) (Self-learning activity)  |

#### Rubrics for evaluation: CO5

| Sl. No. | Criterion                                     | Marks      | Excellent (3)                                | Good (2)                                         | Satisfactory (1)                                 |
|---------|-----------------------------------------------|------------|----------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| 1.      | Identification of smart meters / sensors      | 30         | High knowledge on smart meters / sensors     | Fair knowledge on smart meters / sensors         | Satisfactory knowledge on smart meters / sensors |
| 2.      | Understanding the principle                   | 30         | High knowledge of the principle of operation | Moderate knowledge of the principle of operation | Low knowledge of the principle of operation      |
| 3.      | Measuring system using smart meters / sensors | 30         | Explain the sub systems                      | Partially familiar on sub system                 | Not familiar on sub systems                      |
| 4.      | Report presentation                           | 10         | Report is clear and well structured          | Report is structured, but needs improvement      | Poorly structured report                         |
|         | <b>Total</b>                                  | <b>100</b> |                                              |                                                  |                                                  |

#### Rubrics for evaluation: CO6

| Sl. No. | Criterion                                 | Marks | Excellent (3)                                | Good (2)                                               | Satisfactory (1)                                         |
|---------|-------------------------------------------|-------|----------------------------------------------|--------------------------------------------------------|----------------------------------------------------------|
| 1.      | Identification of structure of the system | 30    | Able to explain the structure of the system  | Fair knowledge on structure of the system              | Poor knowledge on structure of the system                |
| 2.      | Develop measurement system                | 30    | Familiar with designing a measurement system | Partially familiar with designing a measurement system | Satisfactory knowledge in designing a measurement system |

|    |                              |            |                                           |                                |                      |
|----|------------------------------|------------|-------------------------------------------|--------------------------------|----------------------|
| 3. | Evidence of self-learning    | 30         | Use of relevant journals/sources          | Limited sources                | Very limited sources |
| 4. | Presentation & Communication | 10         | Presentation is clear and well-structured | Presentation needs improvement | Poorly structured    |
|    | <b>Total</b>                 | <b>100</b> |                                           |                                |                      |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 24        |           |            |             | 12                    | 2                |
| <b>CO4</b>   |           | 24        |            |             | 12                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                          |                                                                                                                        |  |                    |        |         |    |     |     |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--|--------------------|--------|---------|----|-----|-----|
| 26EE306                                                                  | DC MACHINES AND TRANSFORMERS LABORATORY                                                                                |  | SEMESTER           |        |         |    | III |     |
| Prerequisites                                                            |                                                                                                                        |  | Category           | ES(PC) | Credits |    |     | 2   |
| NIL                                                                      |                                                                                                                        |  | Hours/<br>Semester | L      | T       | P  | SL  | TH  |
|                                                                          |                                                                                                                        |  |                    | -      | -       | 45 | 15  | 60  |
| COURSE OBJECTIVES                                                        |                                                                                                                        |  |                    |        |         |    |     |     |
| 1.                                                                       | Conduct experiments to obtain the performance characteristics of DC machines and transformers.                         |  |                    |        |         |    |     |     |
| 2.                                                                       | To gain knowledge on experimental skill of testing different types of DC machines and transformers.                    |  |                    |        |         |    |     |     |
|                                                                          |                                                                                                                        |  |                    |        |         |    |     |     |
| LIST OF EXPERIMENTS                                                      |                                                                                                                        |  |                    |        |         |    |     |     |
| 1.                                                                       | Open circuit and load characteristics of separately excited DC generator.                                              |  |                    |        |         |    |     | CO1 |
| 2.                                                                       | Open circuit and load characteristics of self-excited DC shunt generator.                                              |  |                    |        |         |    |     | CO1 |
| 3.                                                                       | Load characteristics of DC long shunt and short shunt compound generator with cumulative and differential connections. |  |                    |        |         |    |     | CO1 |
| 4.                                                                       | Load test on DC shunt motor.                                                                                           |  |                    |        |         |    |     | CO1 |
| 5.                                                                       | Load test on DC series motor.                                                                                          |  |                    |        |         |    |     | CO1 |
| 6.                                                                       | Speed control of DC shunt motor                                                                                        |  |                    |        |         |    |     | CO2 |
| 7.                                                                       | Swinburne’s test on DC machine                                                                                         |  |                    |        |         |    |     | CO3 |
| 8.                                                                       | Hopkinson’s test on two identical DC machines.                                                                         |  |                    |        |         |    |     | CO3 |
| 9.                                                                       | Load test on single-phase transformer / three phase Transformer                                                        |  |                    |        |         |    |     | CO4 |
| 10.                                                                      | Open circuit and Short circuit tests on single phase Transformer                                                       |  |                    |        |         |    |     | CO4 |
| 11.                                                                      | Sumpner’s test on Single-phase transformers.                                                                           |  |                    |        |         |    |     | CO4 |
| 12.                                                                      | Study of DC motor starters / and 3-phase transformer connections                                                       |  |                    |        |         |    |     | CO5 |
| P:45, SL:15, Total: 60 Hours                                             |                                                                                                                        |  |                    |        |         |    |     |     |
| Weightage:<br>Continuous Assessment 60%<br>End Semester Examinations 40% |                                                                                                                        |  |                    |        |         |    |     |     |
| REFERENCE BOOKS:                                                         |                                                                                                                        |  |                    |        |         |    |     |     |
| 1.                                                                       | Department Lab Manual, “DC machines and Transformers Laboratory”.                                                      |  |                    |        |         |    |     |     |
| 2.                                                                       | G.P. Chhalotra, ‘Experiments in Electrical Engineering’, 3 <sup>rd</sup> Edition. Khanna Publishers, Delhi, 2004.      |  |                    |        |         |    |     |     |
| 3.                                                                       | C.S. Indulkar, ‘Laboratory Experiments in Electrical Power’, 3 <sup>rd</sup> Edition. Khanna Publishers, Delhi, 2010.  |  |                    |        |         |    |     |     |

| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                     | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| <b>CO1</b>                                                                                         | Analyze the performance characteristics of DC machines through experimental testing and evaluate their suitability for industrial applications                                                                                                                      | PO2, PO4<br>PO8        | PSO1, PSO2              |
| <b>CO2</b>                                                                                         | Implement and verify various speed-control methods of a DC shunt motor through experimental testing.                                                                                                                                                                | PO1, PO4<br>PO8        | PSO1, PSO2              |
| <b>CO3</b>                                                                                         | Predetermine the performance parameters and efficiency of DC machines under varying load conditions using indirect testing methods.                                                                                                                                 | PO2, PO4,<br>PO8       | PSO1, PSO2              |
| <b>CO4</b>                                                                                         | Evaluate and compare the voltage regulation and efficiency of a transformer under varying load profiles using direct and indirect testing methods.                                                                                                                  | PO2, PO4<br>PO8        | PSO1, PSO2              |
| <b>CO5</b>                                                                                         | Perform as a team member to demonstrate the working of DC motor starters, three-phase transformer connections, constructional features of DC Machines or transformers/ Develop and analyze simulation model of DC machines and transformers using engineering tool. | PO8, PO9,<br>PO11      | PSO1, PSO2              |
| <b>CO6</b>                                                                                         | Prepare a <b>technical report</b> on the experiments conducted.                                                                                                                                                                                                     | PO8, PO9,<br>PO11      | PSO2, PSO3              |

#### The Course Articulation Matrix (CAM) for defined COs

| CO         | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| <b>CO1</b> |     | 2   |     | 2   |     |     |     | 1   |     |      |      | 2    | 1    |      |
| <b>CO2</b> | 2   |     |     | 2   |     |     |     | 1   |     |      |      | 2    | 1    |      |
| <b>CO3</b> |     | 2   |     | 2   |     | 1   |     | 1   |     |      |      | 1    | 2    |      |
| <b>CO4</b> |     | 2   |     | 2   |     | 1   |     | 1   |     |      |      | 1    | 2    |      |
| <b>CO5</b> |     |     |     |     |     |     |     | 1   | 1   |      | 1    |      | 1    | 1    |
| <b>CO6</b> |     |     |     |     |     |     |     | 1   | 1   |      | 1    |      |      | 1    |

#### Activities:

|    |                                                                                                                                                     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Demonstration of operation of DC motor starter / Three-phase transformer connections / constructional features of DC Machines or transformers (CO5) |
| 2. | Technical Report Preparation and Documentation (CO6)                                                                                                |

#### Rubrics for evaluation: CO5 – Demonstration of operation of DC Motor starter and three-phase transformer connections / constructional features of DC Machines or transformers

| Sl. No. | Criterion                                                                        | Marks | Excellent (3)                                                                        | Good(2)                                     | Satisfactory (1)          |
|---------|----------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------|---------------------------------------------|---------------------------|
| 1.      | Component / Terminal Identification (DC motor starter / three-phase transformer) | 30    | Confidently traces the component/ terminal and accurately describes the role of each | Identifies terminals but makes minor errors | Cannot identify terminals |

|    |                                                                                                      |            |                                                                         |                                                          |                                                        |
|----|------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 2. | Demonstration of operation (Start-up Procedure of starter / Phase Grouping (Y and Δ) of transformer) | 40         | Accurately explain the operation and procedure                          | Completes the demonstration but requires guidance.       | Fails to verify the operation                          |
| 3. | Reflective learning & Communication                                                                  | 30         | Demonstrates deep learning insights and effective communication skills. | Shows reasonable understanding and communication ability | Limited reflective learning and communication ability. |
|    | <b>Total</b>                                                                                         | <b>100</b> |                                                                         |                                                          |                                                        |

#### Rubrics for evaluation: CO6 - Technical Report Preparation

| Sl. No. | Criterion                           | Marks      | Excellent (3)                                                                                | Good(2)                                                  | Satisfactory (1)                                       |
|---------|-------------------------------------|------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 1.      | Team work and Participation         | 40         | Actively contributes, collaborates effectively and demonstrate leadership in team activities | Participates regularly and contributes to team tasks.    | Limited Participation and contribution                 |
| 2.      | Documentation Preparation           | 30         | Well-organized, accurate, and comprehensive Documentation                                    | Documentation is complete with minor errors              | Documentation is incomplete or lacks of clarity        |
| 3.      | Reflective learning & Communication | 30         | Demonstrates deep learning insights and effective communication skills.                      | Shows reasonable understanding and communication ability | Limited reflective learning and communication ability. |
|         | <b>Total</b>                        | <b>100</b> |                                                                                              |                                                          |                                                        |

#### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>CO1</b>   | 40                                                               |            | 20                    | 2                |
| <b>CO2</b>   | 10                                                               |            | 5                     | 1                |
| <b>CO3</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO4</b>   | 30                                                               |            | 15                    | 2                |
| <b>CO5</b>   |                                                                  | 50         | 25                    | 3                |
| <b>CO6</b>   |                                                                  | 50         | 25                    | 3                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

|                                                 |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------|----------------|----------|-----------|------------|
| <b>26EE307</b>                                  | <b>ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY</b>                                                                                                                                                     |                            | <b>SEMESTER</b> |                |          |           | <b>III</b> |
| <b>Prerequisites</b>                            |                                                                                                                                                                                                              | <b>Category</b>            | <b>ES(PC)</b>   | <b>Credits</b> |          |           | <b>2</b>   |
| Electronic Devices Laboratory                   |                                                                                                                                                                                                              | <b>Hours/<br/>Semester</b> | <b>L</b>        | <b>T</b>       | <b>P</b> | <b>SL</b> | <b>TH</b>  |
|                                                 |                                                                                                                                                                                                              |                            | -               | -              | 45       | 15        | 60         |
| <b>COURSE OBJECTIVES</b>                        |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
| 1.                                              | To conduct experiments for analyse the performance of analog integrated circuits.                                                                                                                            |                            |                 |                |          |           |            |
| 2.                                              | To implement and verify the operation of various digital electronics circuits.                                                                                                                               |                            |                 |                |          |           |            |
| <b>LIST OF EXPERIMENTS (Any 10 Experiments)</b> |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
| 1.                                              | Verification of IC 741 characteristics: inverting and non-inverting amplifier - voltage follower.                                                                                                            |                            |                 |                |          |           | CO1        |
| 2.                                              | Verification of IC 741 Applications circuits: Summer, differentiator and integrator.                                                                                                                         |                            |                 |                |          |           | CO2        |
| 3.                                              | Design of zero crossing detector and Schmitt trigger circuit using OP-AMP.                                                                                                                                   |                            |                 |                |          |           | CO2        |
| 4.                                              | Design and testing of first order Low Pass and High Pass Active filters.                                                                                                                                     |                            |                 |                |          |           | CO2        |
| 5.                                              | Design of Wien bridge oscillator and RC phase shift oscillator using OP-AMP.                                                                                                                                 |                            |                 |                |          |           | CO2        |
| 6.                                              | Design of Astable and Monostable Multivibrator circuits using NE/SE 555 timer.                                                                                                                               |                            |                 |                |          |           | CO2        |
| 7.                                              | Design of Voltage controlled oscillator using NE/SE 566.                                                                                                                                                     |                            |                 |                |          |           | CO2        |
| 8.                                              | Design of Voltage regulator using IC723 /<br>Design of +5V, 1A regulated Power supply using IC 7805/<br>Design of variable power supply using IC LM317/<br>Design of dual power supply using LM 320 / LM340. |                            |                 |                |          |           | CO1        |
| 9.                                              | Realize the half Adder/ half subtractor using minimum number of NAND/NOR gates.                                                                                                                              |                            |                 |                |          |           | CO3        |
| 10.                                             | Design of code converter circuits.                                                                                                                                                                           |                            |                 |                |          |           | CO3        |
| 11.                                             | Implementation of Multiplixers, Demultiplexers, Encoders and Decoders                                                                                                                                        |                            |                 |                |          |           | CO3        |
| 12.                                             | Study of different types of Flip-Flops.                                                                                                                                                                      |                            |                 |                |          |           | CO4        |
| 13.                                             | Design of 3-bit synchronous counters.                                                                                                                                                                        |                            |                 |                |          |           | CO4        |
| 14.                                             | Design of 4-Bit shift registers using flip-flop.                                                                                                                                                             |                            |                 |                |          |           | CO4        |
| 15.                                             | Testing of asynchronous counters using flip-flops.                                                                                                                                                           |                            |                 |                |          |           | CO4        |
| <b>P:45, SL:15, Total: 60 Hours</b>             |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
| <b>Weightage:</b>                               |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
| Continuous Assessment 60%                       |                                                                                                                                                                                                              |                            |                 |                |          |           |            |
| End Semester Examinations 40%                   |                                                                                                                                                                                                              |                            |                 |                |          |           |            |

**REFERENCE BOOKS:**

|    |                                                                                                                                                                |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | D.Roy Chowdhury and Shail B. Jain, "Linear Integrated Circuits", Fourth Edition, New Age International (P) Ltd Publishers, 2014.                               |
| 2. | M. Morris Mano, "Digital Design", Third Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2010. |
| 3. | Department Lab Manual, "Analog and Digital Integrated Circuits Laboratory".                                                                                    |

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                                                                                                                  |                    |            |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------|
| <b>CO1</b> | <b>Design and verify</b> the performance of operational amplifier / voltage regulator based on specified performance criteria.                                                                                                                   | PO3, PO4, PO8      | PSO1, PSO2 |
| <b>CO2</b> | <b>Design</b> analog electronic circuits using operational amplifiers to meet given specifications and <b>verify</b> them experimentally. (integrator & differentiator, Wien bridge & RC phase shift oscillator, Schmitt trigger, Active filter) | PO3, PO4, PO5, PO8 | PSO1, PSO2 |
| <b>CO3</b> | <b>Design and verify</b> the performance of combinational logic circuits for specific applications.                                                                                                                                              | PO3, PO4, PO8      | PSO1, PSO2 |
| <b>CO4</b> | <b>Design and verify</b> the performance of synchronous and asynchronous sequential logic circuits for specific applications.                                                                                                                    | PO3, PO4, PO8      | PSO1, PSO2 |
| <b>CO5</b> | <b>Develop simulation model</b> of analog / digital electronics circuits for specific applications using engineering tool and present the report.                                                                                                | PO5, PO9           | PSO2, PSO3 |
| <b>CO6</b> | <b>Prepare a technical report</b> on the experiments conducted.                                                                                                                                                                                  | PO8, PO9, PO11     | PSO3       |

**The Course Articulation Matrix (CAM) for defined COs**

| CO         | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| <b>CO1</b> |     |     | 2   | 2   |     |     |     | 1   |     |      |      | 2    | 1    |      |
| <b>CO2</b> |     |     | 2   | 2   | 1   |     |     | 1   |     |      |      | 2    | 1    |      |
| <b>CO3</b> |     |     | 2   | 2   |     |     |     | 1   |     |      |      | 2    | 1    |      |
| <b>CO4</b> |     |     | 2   | 2   |     |     |     | 1   |     |      |      | 2    | 2    |      |
| <b>CO5</b> |     |     |     |     | 2   |     |     |     | 2   |      |      |      | 2    | 1    |
| <b>CO6</b> |     |     |     |     |     |     |     | 1   | 1   |      | 1    |      |      | 1    |

**Activities:**

|    |                                                                   |
|----|-------------------------------------------------------------------|
| 1. | Simulation Model of analog and digital electronics circuits (CO5) |
| 2. | Technical Report Presentation and Documentation (CO6)             |

### Rubrics for evaluation: C05 – Simulation Model of analog and digital electronics circuits.

| Sl. No. | Criterion                                               | Marks      | Excellent (3)                                                         | Good(2)                                                        | Satisfactory (1)                                           |
|---------|---------------------------------------------------------|------------|-----------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------|
| 1.      | Design Specifications and Design calculation            | 20         | Design specification and design calculation are clearly done          | Design specification is done but design calculation is unclear | Design specification and design calculation are inadequate |
| 2.      | Simulation Model (analog / digital electronic circuits) | 30         | Simulation model is aligned with application                          | Simulation is correct and not aligned with application         | Requires guidance to complete the simulation               |
| 3.      | Performance Analysis & Interpretation of results        | 30         | Accurately analyzes / results and provides meaningful interpretations | Analyses / results are interpreted but limited justification   | Limited analysis and interpretation                        |
| 4.      | Report presentation                                     | 20         | Report is clear and well structured                                   | Report is structured, but needs improvement                    | Poorly structured report                                   |
|         | <b>Total</b>                                            | <b>100</b> |                                                                       |                                                                |                                                            |

### Rubrics for evaluation: C06 - Technical Report Presentation

| Sl. No. | Criterion                           | Marks      | Excellent (3)                                                                                | Good(2)                                                  | Satisfactory (1)                                       |
|---------|-------------------------------------|------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 1.      | Team work and Participation         | 40         | Actively contributes, collaborates effectively and demonstrate leadership in team activities | Participates regularly and contributes to team tasks.    | Limited Participation and contribution                 |
| 2.      | Documentation Presentation          | 30         | Well-organized, accurate, and comprehensive Documentation                                    | Documentation is complete with minor errors              | Documentation is incomplete or lacks of clarity        |
| 3.      | Reflective learning & Communication | 30         | Demonstrates deep learning insights and effective communication skills.                      | Shows reasonable understanding and communication ability | Limited reflective learning and communication ability. |
|         | <b>Total</b>                        | <b>100</b> |                                                                                              |                                                          |                                                        |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Laboratory Component                                             |            | Percentage allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>C01</b>   | 20                                                               |            | 10                    | 2                |
| <b>C02</b>   | 40                                                               |            | 20                    | 2                |
| <b>C03</b>   | 20                                                               |            | 10                    | 2                |
| <b>C04</b>   | 20                                                               |            | 10                    | 2                |
| <b>C05</b>   |                                                                  | 50         | 25                    | 3                |
| <b>C06</b>   |                                                                  | 50         | 25                    | 3                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

|                                                                                                                                                                                                                                                             |                                                                                                                              |                     |                    |    |         |    |     |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|----|---------|----|-----|----|
| 26ENC03                                                                                                                                                                                                                                                     | PLACEMENT AND SOFT SKILLS LABORATORY<br>B.E. (Common to All Branches)                                                        |                     | SEMESTER           |    |         |    | III |    |
| Prerequisites                                                                                                                                                                                                                                               |                                                                                                                              |                     | Category           | HM | Credits |    | 2   |    |
| 1. Basic knowledge in reading skill and writing skill<br>2. Basic ability in listening skill and speaking skill                                                                                                                                             |                                                                                                                              |                     | Hours/<br>Semester | L  | T       | P  | SL  | TH |
|                                                                                                                                                                                                                                                             |                                                                                                                              |                     | -                  | -  | 45      | 15 | 60  |    |
| COURSE OBJECTIVES                                                                                                                                                                                                                                           |                                                                                                                              |                     |                    |    |         |    |     |    |
| 1.                                                                                                                                                                                                                                                          | To develop learners' overall employability communication skills in writing, speaking, verbal ability, and reasoning.         |                     |                    |    |         |    |     |    |
| 2.                                                                                                                                                                                                                                                          | To strengthen learners' professional writing competence for letters, emails, resumes, and reports.                           |                     |                    |    |         |    |     |    |
| 3.                                                                                                                                                                                                                                                          | To enhance learners' oral communication and group interaction skills for presentations, discussions, and workplace contexts. |                     |                    |    |         |    |     |    |
| 4.                                                                                                                                                                                                                                                          | To build learners' soft skills, confidence, and interview readiness for successful career entry.                             |                     |                    |    |         |    |     |    |
| 5.                                                                                                                                                                                                                                                          | To improve learners' verbal and logical abilities to support effective communication and problem-solving                     |                     |                    |    |         |    |     |    |
| UNIT - I                                                                                                                                                                                                                                                    |                                                                                                                              | WRITING SKILLS      |                    |    |         |    |     | 9  |
| Letter seeking permission to go on industrial visit, Letter of invitation, Resume and cover letter, Job application, E-mail writing, Report writing - progress in project work                                                                              |                                                                                                                              |                     |                    |    |         |    |     |    |
| UNIT - II                                                                                                                                                                                                                                                   |                                                                                                                              | SPEAKING SKILLS     |                    |    |         |    |     | 9  |
| Welcome address and vote of thanks, Analysing and presenting business articles, Power point presentation, Presenting the visuals effectively, Group discussion, Participating in group discussions, Understanding group dynamics, Brain-storming the topics |                                                                                                                              |                     |                    |    |         |    |     |    |
| UNIT - III                                                                                                                                                                                                                                                  |                                                                                                                              | SOFT SKILLS         |                    |    |         |    |     | 9  |
| Employability and career skills, Self-introduction, Introducing oneself to the audience, introducing the topic, Interview skills, Interview etiquette, Dress code, Body language, Attending job interviews                                                  |                                                                                                                              |                     |                    |    |         |    |     |    |
| UNIT - IV                                                                                                                                                                                                                                                   |                                                                                                                              | VERBAL ABILITIES    |                    |    |         |    |     | 9  |
| Error Spotting, Listening Comprehension, Reading comprehension, Rearranging Jumbled sentences, Vocabulary                                                                                                                                                   |                                                                                                                              |                     |                    |    |         |    |     |    |
| UNIT - V                                                                                                                                                                                                                                                    |                                                                                                                              | REASONING ABILITIES |                    |    |         |    |     | 9  |
| Series completion, Analogy, Classification, Coding-Decoding, Blood relations, Seating Arrangements, Directional Sense, Venn Diagram, Logical reasoning, Statements and Conclusions                                                                          |                                                                                                                              |                     |                    |    |         |    |     |    |
| P:45, SL:15, Total:60 Hours                                                                                                                                                                                                                                 |                                                                                                                              |                     |                    |    |         |    |     |    |
| Weightage:<br>Continuous Assessment - 60%<br>End Semester Examinations - 40%                                                                                                                                                                                |                                                                                                                              |                     |                    |    |         |    |     |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                            |                                                                                                                              |                     |                    |    |         |    |     |    |
| 1.                                                                                                                                                                                                                                                          | Pease, Allan, and Barbara Pease. <i>The Definitive Book of Body Language</i> . Bantam Books,2017.                            |                     |                    |    |         |    |     |    |
| 2.                                                                                                                                                                                                                                                          | Pillai, Sabeena, and Agna Fernandez. <i>Soft Skills and Employability Skills</i> . Cambridge University Press, 2018.         |                     |                    |    |         |    |     |    |
| 3.                                                                                                                                                                                                                                                          | Aggarwal, R. S. <i>A Modern Approach to Verbal and Non-Verbal Reasoning</i> . S. Chand Publishing, 2018.                     |                     |                    |    |         |    |     |    |
| 4.                                                                                                                                                                                                                                                          | Mitra, Barun K. <i>Personality Development and Soft Skills</i> . Oxford University Press, 2016.                              |                     |                    |    |         |    |     |    |
| 5.                                                                                                                                                                                                                                                          | Thorpe, Edgar, and Showick Thorpe. <i>Winning at Interviews</i> . Pearson Education, 2015.                                   |                     |                    |    |         |    |     |    |

**E-RESOURCES:**

|    |                                                                                         |
|----|-----------------------------------------------------------------------------------------|
| 1. | <a href="https://www.indiabix.com/">https://www.indiabix.com/</a>                       |
| 2. | <a href="https://www.placementpreparation.io/">https://www.placementpreparation.io/</a> |
| 3. | <a href="https://www.edx.org/">https://www.edx.org/</a>                                 |
| 4. | <a href="https://www.cambridgeenglish.org/">https://www.cambridgeenglish.org/</a>       |
| 5. | <a href="https://www.coursera.org/">https://www.coursera.org/</a>                       |

**COURSE OUTCOMES (COs) /****At the end of the course, the students will have the ability to****Mapping  
POs****Mapping  
PSOs**

|            |                                                                                                                                                                                                                      |                 |      |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|
| <b>CO1</b> | Apply effective writing skills to produce professional documents such as letters, resumes, cover letters, emails, and project reports.                                                                               | PO9, PO11       |      |
| <b>CO2</b> | Demonstrate oral communication skills by participating in presentations, group discussions, brainstorming sessions, and delivering structured talks using appropriate language and presentation techniques.          | PO8, PO9, PO11  | PSO3 |
| <b>CO3</b> | Apply verbal ability skills to enhance language accuracy and comprehension through error spotting, vocabulary usage, reading comprehension, listening comprehension, and sentence rearrangement.                     | PO9, PO11       |      |
| <b>CO4</b> | Solve logical and analytical problems using reasoning abilities such as series completion, analogy, classification, coding-decoding, seating arrangements, blood relations, and data interpretation.                 | PO9, PO11       |      |
| <b>CO5</b> | Develop employability and workplace readiness skills by practicing self-introduction, interview techniques, interview etiquette, professional dress code, and body language.                                         | PO9, PO11       |      |
| <b>CO6</b> | Integrate communication, analytical, and interpersonal skills to function effectively in academic and professional environments by demonstrating overall competence in written, spoken, verbal, and reasoning tasks. | PO9, PO10, PO11 | PSO3 |

**The Course Articulation Matrix (CAM) for defined COs**

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|-------------|-------------|-------------|-------------|------------|------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> |             |             |             |             |            |            |             |             | 3           |              | 2            |              |              |              |
| <b>CO2</b> |             |             |             |             |            |            |             | 2           | 3           |              | 2            |              |              | 2            |
| <b>CO3</b> |             |             |             |             |            |            |             |             | 3           |              | 2            |              |              |              |
| <b>CO4</b> |             |             |             |             |            |            |             |             | 3           |              | 2            |              |              |              |
| <b>CO5</b> |             |             |             |             |            |            |             |             | 3           |              | 2            |              |              |              |
| <b>CO6</b> |             |             |             |             |            |            |             |             | 3           | 2            | 2            |              |              | 2            |

| <b>Activities:</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                 | <p><b>CO1: Apply effective writing skills to produce professional documents such as letters, resumes, cover letters, emails, and project reports.</b></p> <p>(i) <b>Cover Letter and Resume:</b><br/>Draft a resume and cover letter for a job advertisement</p> <p>(ii) <b>Letter Writing:</b><br/>Write formal letter for an internship, industrial visit, workshop, or training programme;<br/>Write a letter to invite a chief guest, industry expert, or alumni for a college event.</p> <p>(iii) <b>Email Writing:</b><br/>Write an email applying for an internship in a company; Send an email requesting registration for a workshop, seminar, or conference.</p>                                                                                                                                                                  |
| 2.                 | <p><b>CO2: Demonstrate oral communication skills by participating in presentations, group discussions, brainstorming sessions, and delivering structured talks using appropriate language and presentation techniques.</b></p> <p>(i) <b>Self-Introduction:</b><br/>Professional self-introduction activity for placement preparation.</p> <p>(ii) <b>Group Discussion:</b><br/>Group discussion on current social, technical, or business issues.</p> <p>(iii) <b>Welcome Address, Vote of Thanks:</b><br/>Conduct a mock seminar where students deliver welcome addresses and vote of thanks.</p> <p>(iv) <b>Power Point Presentation:</b><br/>Prepare and deliver a PowerPoint presentation on a technical, business, or general-interest topic using appropriate visual aids, effective slide design, and clear oral communication.</p> |
| 3.                 | <p><b>CO3: Apply verbal ability skills to enhance language accuracy and comprehension through error spotting, vocabulary usage, reading comprehension, listening comprehension, and sentence rearrangement.</b></p> <p>(i) <b>Jumbled Sentences:</b><br/>Sentence reconstruction activity to improve coherence and logical sequencing.</p> <p>(ii) <b>Reading Comprehension:</b><br/>Analyze newspaper articles, business reports, or technical passages and answer comprehension questions.</p> <p>(iii) <b>Error Spotting:</b><br/>Identify and correct errors related to tenses, articles, prepositions, and subject-verb agreement.</p>                                                                                                                                                                                                 |
| 4.                 | <p><b>CO4: Solve logical and analytical problems using reasoning abilities such as series completion, analogy, classification, coding-decoding, seating arrangements, blood relations, and data interpretation.</b></p> <p>(i) <b>Series Completion:</b><br/>Pattern recognition and numerical reasoning exercises.</p> <p>(ii) <b>Analogy:</b><br/>Verbal and logical analogy exercises.</p> <p>(iii) <b>Coding-Decoding:</b><br/>Coding-decoding problem-solving exercises in teams</p> <p>(iv) <b>Blood Relations:</b><br/>Family tree analysis and relationship mapping tasks.</p> <p>(v) <b>Seating Arrangements:</b><br/>Puzzle-solving activities involving linear and circular arrangements.</p> <p>(vi) <b>Logical Reasoning:</b><br/>Aptitude test simulations for placement preparation.</p>                                     |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. | <b>CO5: Develop employability and workplace readiness skills by practicing self-introduction, interview techniques, interview etiquette, professional dress code, and body language.</b><br><b>(i) Self-Introduction, Job Interview:</b><br>Resume-based interview practice and feedback sessions;<br>Mock interview sessions with HR and technical rounds;<br>Professional etiquette workshop focusing on dress code, body language, and workplace behaviour.                                                                                                                                                                                                                                                                                                                                   |
| 6. | <b>CO6: Integrate communication, analytical, and interpersonal skills to function effectively in academic and professional environments by demonstrating overall competence in written, spoken, verbal, and reasoning tasks.</b><br><b>(i) Placement:</b><br>Campus recruitment simulation involving aptitude test, group discussion, and personal interview.<br><b>(ii) Presentation of Business Article:</b><br>Team-based analysis and presentation of a business or technical article.<br><b>(iii) Welcome Address, Vote of Thanks:</b><br>Organize and manage a mock conference or seminar, assigning roles to students.<br><b>(iv) Welcome Address, Vote of Thanks:</b><br>Portfolio preparation documenting written tasks, presentations, interview performance, and reasoning exercises. |

#### Rubrics for evaluation:CO1

| Sl. No. | Criterion               | Marks     | Excellent (3)                          | Good(2)                     | Satisfactory (1)             |
|---------|-------------------------|-----------|----------------------------------------|-----------------------------|------------------------------|
| 1.      | Content Relevance       | 5         | Fully relevant content                 | Mostly relevant content     | Limited relevance            |
| 2.      | Organization and Format | 5         | Well-organized and correctly formatted | Minor organizational errors | Poor organization and format |
| 3.      | Professional Tone       | 5         | Appropriate professional tone          | Generally appropriate tone  | Inappropriate tone           |
| 4.      | Language Accuracy       | 5         | Error-free language                    | Minor language errors       | Frequent language errors     |
|         | <b>Total</b>            | <b>20</b> |                                        |                             |                              |

#### Rubrics for evaluation:CO2

| Sl. No. | Criterion            | Marks     | Excellent (3)                                | Good(2)                           | Satisfactory (1)                     |
|---------|----------------------|-----------|----------------------------------------------|-----------------------------------|--------------------------------------|
| 1.      | Clarity and Fluency  | 5         | Clear and fluent speech                      | Minor hesitation                  | Frequent hesitation                  |
| 2.      | Content Organization | 5         | Well-structured presentation                 | Adequately organized              | Poorly organized                     |
| 3.      | Presentation Skills  | 5         | Excellent delivery and engagement            | Adequate delivery                 | Limited engagement                   |
| 4.      | Body Language        | 5         | Excellent posture, eye contact, and gestures | Adequate non-verbal communication | Poor posture and limited eye contact |
|         | <b>Total</b>         | <b>20</b> |                                              |                                   |                                      |

**Rubrics for evaluation:CO3**

| Sl. No. | Criterion          | Marks     | Excellent (3)                 | Good(2)                   | Satisfactory (1)         |
|---------|--------------------|-----------|-------------------------------|---------------------------|--------------------------|
| 1.      | Comprehension      | 5         | Excellent understanding       | Good understanding        | Limited understanding    |
| 2.      | Language Accuracy  | 5         | Accurate error identification | Minor inaccuracies        | Frequent inaccuracies    |
| 3.      | Vocabulary Usage   | 5         | Appropriate vocabulary usage  | Adequate vocabulary usage | Limited vocabulary usage |
| 4.      | Logical Sequencing | 5         | Highly logical sequencing     | Generally logical         | Poor sequencing          |
|         | <b>Total</b>       | <b>20</b> |                               |                           |                          |

**Rubrics for evaluation:CO4**

| Sl. No. | Criterion         | Marks     | Excellent (3)             | Good(2)                    | Satisfactory (1)         |
|---------|-------------------|-----------|---------------------------|----------------------------|--------------------------|
| 1.      | Problem Analysis  | 5         | Accurate problem analysis | Good analysis              | Limited analysis         |
| 2.      | Logical Reasoning | 5         | Strong reasoning ability  | Adequate reasoning ability | Weak reasoning ability   |
| 3.      | Accuracy          | 5         | Highly accurate solutions | Adequate vocabulary usage  | Limited vocabulary usage |
| 4.      | Time Management   | 5         | Completes within time     | Minor delay                | Significant delay        |
|         | <b>Total</b>      | <b>20</b> |                           |                            |                          |

**Rubrics for evaluation: CO5**

| Sl. No. | Criterion              | Marks     | Excellent (3)                     | Good(2)                | Satisfactory (1)        |
|---------|------------------------|-----------|-----------------------------------|------------------------|-------------------------|
| 1.      | Professional Etiquette | 2.5       | Highly professional behaviour     | Generally professional | Limited professionalism |
| 2.      | Interview Skills       | 2.5       | Confident and effective responses | Adequate responses     | Weak responses          |
| 3.      | Body Language          | 2.5       | Excellent body language           | Adequate body language | Poor body language      |
| 4.      | Workplace Readiness    | 2.5       | Highly workplace-ready            | Reasonably prepared    | Needs improvement       |
|         | <b>Total</b>           | <b>10</b> |                                   |                        |                         |

**Rubrics for evaluation: CO6**

| Sl. No. | Criterion            | Marks | Excellent (3)                     | Good(2)                     | Satisfactory (1)       |
|---------|----------------------|-------|-----------------------------------|-----------------------------|------------------------|
| 1.      | Communication Skills | 2.5   | Highly effective communication    | Effective communication     | Limited effectiveness  |
| 2.      | Analytical Skills    | 2.5   | Strong analytical ability         | Adequate analytical ability | Weak reasoning ability |
| 3.      | Teamwork Skills      | 2.5   | Excellent teamwork and leadership | Good teamwork               | Limited teamwork       |

|    |                         |           |                                 |                                  |                      |
|----|-------------------------|-----------|---------------------------------|----------------------------------|----------------------|
| 4. | Professional Competence | 2.5       | Demonstrates overall competence | Demonstrates adequate competence | Requires improvement |
|    | <b>Total</b>            | <b>10</b> |                                 |                                  |                      |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>C01</b>   | 20                                                               | 20         | 20                    | 2                |
| <b>C02</b>   | 20                                                               | 20         | 20                    | 2                |
| <b>C03</b>   | 20                                                               | 20         | 20                    | 2                |
| <b>C04</b>   | 20                                                               | 20         | 20                    | 2                |
| <b>C05</b>   | 10                                                               | 10         | 10                    | 2                |
| <b>C06</b>   | 10                                                               | 10         | 10                    | 2                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

Note:Purely as anExample: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                         |                                                                                                                                                      |                             |                    |          |         |    |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------|----------|---------|----|-----|
| 26MCS02                                                                                                                                                                                                                 |                                                                                                                                                      | INNOVATION SPRINTS          |                    | SEMESTER |         |    | III |
| Prerequisites                                                                                                                                                                                                           |                                                                                                                                                      |                             | Category           | SD       | Credits |    | 0   |
|                                                                                                                                                                                                                         |                                                                                                                                                      |                             | Hours/<br>Semester | L        | T       | P  | SL  |
|                                                                                                                                                                                                                         |                                                                                                                                                      |                             |                    | 0        | 0       | 15 | 15  |
| COURSE OBJECTIVES                                                                                                                                                                                                       |                                                                                                                                                      |                             |                    |          |         |    |     |
| 1.                                                                                                                                                                                                                      | To understand the fundamentals of Design thinking and apply in ideating solutions for real world problems.                                           |                             |                    |          |         |    |     |
| 2.                                                                                                                                                                                                                      | To solve challenges through problem curation, problem validation and customer discovery problems.                                                    |                             |                    |          |         |    |     |
|                                                                                                                                                                                                                         |                                                                                                                                                      |                             |                    |          |         |    |     |
| UNIT - I                                                                                                                                                                                                                |                                                                                                                                                      | CHALLENGE CURATION          |                    |          |         |    | 3   |
| Introduction: Design Thinking Principles - Design Thinking Values - Design Thinking Methods - Challenge impact setting - Framing the design challenge.                                                                  |                                                                                                                                                      |                             |                    |          |         |    |     |
| UNIT - II                                                                                                                                                                                                               |                                                                                                                                                      | CUSTOMER-CENTRIC INNOVATION |                    |          |         |    | 3   |
| Understanding Customer needs - Empathy building techniques - gap analysis - adoption barriers - observations and insights - Translating Insights into Innovation Opportunities                                          |                                                                                                                                                      |                             |                    |          |         |    |     |
| UNIT - III                                                                                                                                                                                                              |                                                                                                                                                      | IDEA GENERATION             |                    |          |         |    | 3   |
| Identifying pains & gains - crafting value proposition - Ideation - Divergent Thinking - Ideation methods- Rules of brainstorming-Managing risks - Concept of minimum usable prototypes - Generating solution concepts. |                                                                                                                                                      |                             |                    |          |         |    |     |
| UNIT - IV                                                                                                                                                                                                               |                                                                                                                                                      | PROTOTYPING                 |                    |          |         |    | 3   |
| Prototyping concepts - Palm Pilot Experiment - Fake it before make it - Prototyping - The Law of Failure - Building a Prototype-Testing the Prototypes                                                                  |                                                                                                                                                      |                             |                    |          |         |    |     |
| UNIT - V                                                                                                                                                                                                                |                                                                                                                                                      | PITCH & PRESENTATION        |                    |          |         |    | 3   |
| Science of Story telling - the blueprint for story telling - Pitch Script - Pitch Presentations - Best practices to creating a compelling pitch - communication fundamentals                                            |                                                                                                                                                      |                             |                    |          |         |    |     |
| P:15, SL:15 Total:30 Hours                                                                                                                                                                                              |                                                                                                                                                      |                             |                    |          |         |    |     |
| Weightage:                                                                                                                                                                                                              |                                                                                                                                                      |                             |                    |          |         |    |     |
| Continuous Assessment 100%                                                                                                                                                                                              |                                                                                                                                                      |                             |                    |          |         |    |     |
| REFERENCE BOOKS:                                                                                                                                                                                                        |                                                                                                                                                      |                             |                    |          |         |    |     |
| 1.                                                                                                                                                                                                                      | Tim Brown (2019), "Change by Design: How design thinking transforms organizations and inspires innovation"                                           |                             |                    |          |         |    |     |
| 2.                                                                                                                                                                                                                      | Jan Chipchase& Simon Steinhardt (2013), "Hidden in Plain Sight: How to Create extraordinary Products for Tomorrow's Customers", Harper Business 2013 |                             |                    |          |         |    |     |
| 3.                                                                                                                                                                                                                      | Christian Madsbjerg & Mikkel B. Rasmussen (2014), "The Moment of Clarity", Harvard Business Review Press                                             |                             |                    |          |         |    |     |
| 4.                                                                                                                                                                                                                      | IdrisMootee (2013), Design Thinking for Strategic Innovation, Willey                                                                                 |                             |                    |          |         |    |     |
| 5.                                                                                                                                                                                                                      | Alexander Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want (Strategyzer) John Wiley & Sons, 2014            |                             |                    |          |         |    |     |

**E-RESOURCES:**

|    |                                                                                                                                                                 |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Alberto Savoia, *The Pretotyping Manifesto*, 2009                                                                                                               |
| 2. | <a href="https://sites.google.com/a/pretotyping.org/www/the-pretotyping-manifesto">https://sites.google.com/a/pretotyping.org/www/the-pretotyping-manifesto</a> |
| 3. | Jazz Factory, *All About Presentations*, <a href="http://blog.jazzfactory.in/">http://blog.jazzfactory.in/</a>                                                  |
| 4. | Pretotyping Methodology, <a href="https://www.pretotyping.org/methodology.html">https://www.pretotyping.org/methodology.html</a> )                              |

| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                          | Mapping<br>POs     | Mapping<br>PSOs |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|
| <b>CO1</b>                                                                                 | Identify real-world problems                                                                                             | PO9, PO11          | -               |
| <b>CO2</b>                                                                                 | Apply the challenge curation techniques to real-world problems.                                                          | PO9, PO11          | PSO1            |
| <b>CO3</b>                                                                                 | Analyze the problems and generate solutions to address the challenges                                                    | PO9, PO10,<br>PO11 | PSO1            |
| <b>CO4</b>                                                                                 | Build solutions using prototyping tools & techniques                                                                     | PO9, PO11          | PSO2            |
| <b>CO5</b>                                                                                 | Develop an innovation pitch to effectively communicate the idea to solve the identified problem                          | PO8, PO9,<br>PO11  | PSO2            |
| <b>CO6</b>                                                                                 | Demonstrate teamwork, leadership, and entrepreneurial skills in developing innovative solutions for real-world problems. | PO9, PO10,<br>PO11 | PSO3            |

### The Course Articulation Matrix (CAM) for defined Cos

|     | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | PSO01 | PSO02 | PSO03 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|-------|-------|-------|
| C01 | -   | -   | -   | -   | -   | -   | -   | -   | 3   | -    | 2    | -     | -     | -     |
| C02 | -   | -   | -   | -   | -   | -   | -   | -   | 3   | -    | 3    | 3     | -     | -     |
| C03 | -   | -   | -   | -   | -   | -   | -   | -   | 3   | 2    | 3    | 2     | -     | -     |
| C04 | -   | -   | -   | -   | -   | -   | -   | -   | 2   | -    | 2    | -     | 3     | -     |
| C05 | -   | -   | -   | -   | -   | -   | -   | 2   | 2   | -    | 2    | -     | 2     | -     |
| C06 | -   | -   | -   | -   | -   | -   | -   | -   | 3   | 3    | 3    | -     | -     | 3     |

**Activities:**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Activity 1: Problem Identification and Solution Ideation Sprint</b><br>Identify real-world problems through observations, surveys, and stakeholder interactions, understand user needs and challenges, analyze problems using simple design thinking tools, prepare a clear problem statement, generate multiple solution ideas through brainstorming, evaluate alternative solutions, select the most suitable solution, and document the problem analysis and proposed solution. |
| 2. | <b>Activity 2: Prototype Development and Innovation Pitch Sprint</b><br>Prepare sketches or CAD models, develop a prototype or proof-of-concept model, test and validate the prototype, collect user feedback and improve the design, document the development process, prepare an innovation pitch and implementation plan, present the prototype before evaluators, and showcase teamwork, leadership, innovation, and entrepreneurial skills.                                      |

**Rubrics for evaluation: CO5**

| <b>Sl. No.</b> | <b>Criterion</b>                           | <b>Marks</b> | <b>Excellent (3)</b>                                                                | <b>Good (2)</b>                                                     | <b>Satisfactory (1)</b>                                       |
|----------------|--------------------------------------------|--------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------|
| 1.             | Problem Presentation and Value Proposition | 25           | Clearly presents the problem, need, and value proposition with strong justification | Presents the problem and value proposition with minor gaps          | Presents the problem with limited clarity and justification   |
| 2.             | Content Organization and Pitch Structure   | 25           | Pitch is well-structured, logical, and professionally organized                     | Organization is adequate with minor lapses                          | Organization lacks clarity and logical flow                   |
| 3.             | Communication and Presentation Skills      | 25           | Delivers the pitch confidently with excellent verbal and non-verbal communication   | Communicates effectively with minor hesitation                      | Communication lacks confidence and clarity                    |
| 4.             | Visual Aids and Response to Questions      | 25           | Uses highly effective visual aids and responds accurately to questions              | Uses adequate visual aids and answers most questions satisfactorily | Limited visual support and difficulty responding to questions |
|                | <b>Total</b>                               | <b>100</b>   |                                                                                     |                                                                     |                                                               |

**Rubrics for evaluation: CO6**

| <b>Sl. No.</b> | <b>Criterion</b>                                   | <b>Marks</b> | <b>Excellent (3)</b>                                                                       | <b>Good (2)</b>                                            | <b>Satisfactory (1)</b>                                             |
|----------------|----------------------------------------------------|--------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------|
| 1.             | Teamwork and Collaboration                         | 25           | Actively contributes, collaborates effectively, and supports team goals                    | Participates well with minor collaboration issues          | Participates minimally with limited teamwork                        |
| 2.             | Leadership and Decision Making                     | 25           | Demonstrates strong leadership, initiative, and effective decision-making                  | Demonstrates leadership with occasional guidance required  | Shows limited leadership and decision-making ability                |
| 3.             | Entrepreneurial Thinking and Innovation            | 25           | Demonstrates excellent entrepreneurial mindset and identifies implementation opportunities | Demonstrates good entrepreneurial awareness and innovation | Demonstrates basic understanding of innovation and entrepreneurship |
| 4.             | Project Management and Professional Responsibility | 25           | Effectively plans, organizes, and completes assigned tasks within deadlines                | Manages tasks adequately with minor delays                 | Shows limited planning and project management skills                |
|                | <b>Total</b>                                       | <b>100</b>   |                                                                                            |                                                            |                                                                     |

|                                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |  |                    |    |         |   |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--|--------------------|----|---------|---|-----|----|
| 26NCC02                                                                                                                                                                                                                                                                                                                                  | NCC Course –II<br>(Only for NCC Students)                                                                         |  | SEMESTER           |    |         |   | III |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                            |                                                                                                                   |  | Category           | -  | Credits |   |     | 2  |
|                                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |  | Hours/<br>Semester | L  | T       | P | SL  | TH |
|                                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |  |                    | 30 | 0       | 0 | 30  | 60 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                        |                                                                                                                   |  |                    |    |         |   |     |    |
| 1.                                                                                                                                                                                                                                                                                                                                       | To Maintain the unity and disciplines to the students.                                                            |  |                    |    |         |   |     |    |
|                                                                                                                                                                                                                                                                                                                                          |                                                                                                                   |  |                    |    |         |   |     |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                 | SOCIAL SERVICE & COMMUNITY DEVELOPMENT                                                                            |  |                    |    |         |   |     | 6  |
| Basic of social service and its need – Rural Development Program – NGOs Roles and Contribution – Drug abuse and Trafficking – Civic Responsibilities – Causes & Prevention of AIDS/HIV – Counter Terrorism – Corruption – Social Evil – RTI & RTE – Traffic Control Organization – Anti-Drunken Driving.                                 |                                                                                                                   |  |                    |    |         |   |     |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                | GENERAL AWARENESS & ADVENTURE                                                                                     |  |                    |    |         |   |     | 6  |
| General Knowledge – Logical & Analytical Reasoning – Modes of Entry to Army, CAPF, Police – SSB Procedure – Para Sailing – Slithering – Rock Climbing – Cycling and Trekking.                                                                                                                                                            |                                                                                                                   |  |                    |    |         |   |     |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                               | AERO ENGINES & NAVIGATION                                                                                         |  |                    |    |         |   |     | 6  |
| Introduction to Aero Engines and its Types – Components of Aero Engines – Principles of Propulsion – Basic Terminology – Jet Engines – Brayton Cycle – Turbo Prop Engines and its Types – Requirements of Navigation – Lines on Earth – Maps and its Types – Symbols used in Maps – Scales of Maps – Map Reading Procedure and its Aids. |                                                                                                                   |  |                    |    |         |   |     |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                | AIRFRAME & METEOROLOGY                                                                                            |  |                    |    |         |   |     | 6  |
| Aircraft Control – Primary and Secondary – Fuselage – Main Plane and Tail Plane – Ailerons, Elevators & Rudders – Landing Gear – Importance of METT in Aviation – Atmosphere – Clouds and Precipitation – Flying Hazards.                                                                                                                |                                                                                                                   |  |                    |    |         |   |     |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                 | FLIGHT INSTRUMENTS & AEROMODELLING                                                                                |  |                    |    |         |   |     | 6  |
| Airspeed Indicator – Altimeter – Artificial Horizon – Radar and its Type – Instruments Battery Test – Compass – History of Aero Modelling – Basic Materials & Tools – Types of Aero Modelling – Flying/Building of Aero Models – General Safety Procedure.                                                                               |                                                                                                                   |  |                    |    |         |   |     |    |
| L:30, P:0, SL :30, Total:60 Hours                                                                                                                                                                                                                                                                                                        |                                                                                                                   |  |                    |    |         |   |     |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                         |                                                                                                                   |  |                    |    |         |   |     |    |
| 1.                                                                                                                                                                                                                                                                                                                                       | William H. McRaven, <i>The Hero Code: Lessons Learned from Lives Well Lived</i> , Grand Central Publishing, 2019. |  |                    |    |         |   |     |    |
| 2.                                                                                                                                                                                                                                                                                                                                       | S. K. Mangal, <i>Leadership and Personality Development</i> , PHI Learning Pvt. Ltd., 2018.                       |  |                    |    |         |   |     |    |
| 3.                                                                                                                                                                                                                                                                                                                                       | N. V. K. Raju, <i>Disaster Management and Preparedness</i> , CBS Publishers, 2019.                                |  |                    |    |         |   |     |    |
| 4.                                                                                                                                                                                                                                                                                                                                       | R. P. Saini, <i>Air Navigation and Aviation Meteorology</i> , CBS Publishers, 2017.                               |  |                    |    |         |   |     |    |
| 5.                                                                                                                                                                                                                                                                                                                                       | V. K. Sharma, <i>Fundamentals of Aviation and Air Navigation</i> , Himalaya Publishing House, 2018.               |  |                    |    |         |   |     |    |

**E-RESOURCES:**

|    |                                                                                                       |
|----|-------------------------------------------------------------------------------------------------------|
| 1. | National Cadet Corps (NCC) <a href="https://indiancc.nic.in/">https://indiancc.nic.in/</a>            |
| 2. | Ministry of Defence, Government of India <a href="https://mod.gov.in/">https://mod.gov.in/</a>        |
| 3. | National Disaster Management Authority (NDMA) <a href="https://ndma.gov.in/">https://ndma.gov.in/</a> |
| 4. | Indian Air Force <a href="https://indianairforce.nic.in/">https://indianairforce.nic.in/</a>          |

| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                     | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| <b>CO1</b>                                                                                         | Understand the importance of social service, community development, civic responsibilities, and national values.                                    | PO6, PO8, PO11         | PSO1                    |
| <b>CO2</b>                                                                                         | Apply general awareness, logical reasoning, and leadership skills in defence-oriented and adventure activities.                                     | PO8, PO9, PO10         | PSO1                    |
| <b>CO3</b>                                                                                         | Understand the principles of aero engines, propulsion systems, navigation, map reading, and related aviation concepts.                              | PO1, PO2, PO8          | PSO2                    |
| <b>CO4</b>                                                                                         | Understand the structure, control systems, meteorological factors, and operational aspects of aircraft.                                             | PO1, PO2, PO8          | PSO2                    |
| <b>CO5</b>                                                                                         | Understand the working principles and applications of flight instruments, avionics systems, and aeromodelling techniques.                           | PO1, PO2, PO5, PO8     | PSO2                    |
| <b>CO6</b>                                                                                         | Demonstrate discipline, leadership, teamwork, adventure spirit, and social responsibility through NCC training and community engagement activities. | PO8, PO9, PO10, PO11   | PSO3                    |

**The Course Articulation Matrix (CAM) for defined Cos**

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 01</b> | <b>PSO 02</b> | <b>PSO 03</b> |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|---------------|---------------|---------------|
| <b>CO1</b> | -           | -           | -           | -           | -           | 2           | -           | 3           | -           | -            | 2            | 2             | -             | -             |
| <b>CO2</b> | -           | -           | -           | -           | -           | -           | -           | 3           | 3           | 2            | -            | 2             | -             | -             |
| <b>CO3</b> | 2           | 2           | -           | -           | -           | -           | -           | 3           | -           | -            | -            | -             | 2             | -             |
| <b>CO4</b> | 2           | 2           | -           | -           | -           | -           | -           | 3           | -           | -            | -            | -             | 2             | -             |
| <b>CO5</b> | 2           | 2           | -           | -           | 2           | -           | -           | 3           | -           | -            | -            | -             | 3             | -             |
| <b>CO6</b> | -           | -           | -           | -           | -           | -           | -           | 3           | 3           | 3            | 2            | -             | -             | 3             |

**Activities:**

|    |                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Activity 1:</b> Participate in community service and social awareness programmes to develop civic responsibility and social commitment.                                         |
| 2. | <b>Activity 2:</b> Participate in adventure activities such as trekking, cycling, rock climbing, and leadership camps to enhance teamwork, confidence, and decision-making skills. |
| 3. | <b>Activity 3:</b> Participate in navigation, map-reading, aeromodelling, and aviation awareness programmes to gain practical knowledge of aerospace and defence-related concepts. |

**Rubrics for evaluation: C05**

| <b>Sl. No.</b> | <b>Criterion</b>                | <b>Marks</b> | <b>Excellent (3)</b>                                                                | <b>Good (2)</b>                                 | <b>Satisfactory (1)</b>          |
|----------------|---------------------------------|--------------|-------------------------------------------------------------------------------------|-------------------------------------------------|----------------------------------|
| 1.             | Knowledge of Flight Instruments | 25           | Demonstrates comprehensive understanding of flight instruments and avionics systems | Demonstrates good understanding with minor gaps | Demonstrates basic understanding |
| 2.             | Technical Interpretation        | 25           | Accurately explains instrument functions and aircraft applications                  | Explains concepts with minor errors             | Limited explanation of concepts  |
| 3.             | Aeromodelling Application       | 25           | Effectively applies concepts in aeromodelling activities and projects               | Adequately relates concepts to applications     | Limited application of concepts  |
| 4.             | Presentation and Communication  | 25           | Presents ideas clearly and confidently                                              | Communicates adequately with minor hesitation   | Communication lacks clarity      |
|                | <b>Total</b>                    | <b>100</b>   |                                                                                     |                                                 |                                  |

**Rubrics for evaluation: C06**

| <b>Sl. No.</b> | <b>Criterion</b>                                  | <b>Marks</b> | <b>Excellent (3)</b>                                              | <b>Good (2)</b>                                   | <b>Satisfactory (1)</b>                           |
|----------------|---------------------------------------------------|--------------|-------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| 1              | Discipline and Commitment                         | 25           | Consistently demonstrates discipline, punctuality, and commitment | Demonstrates good discipline with minor lapses    | Demonstrates basic discipline                     |
| 2              | Leadership and Teamwork                           | 25           | Effectively leads and collaborates with peers                     | Participates actively with minor limitations      | Limited leadership and teamwork                   |
| 3              | Adventure Participation and Social Responsibility | 25           | Actively contributes to community service and social initiatives  | Participates satisfactorily in service activities | Limited participation in service activities       |
| 4              | Ethical Conduct and Communication                 | 25           | Demonstrates strong patriotic values and ethical behavior         | Demonstrates good values and conduct              | Demonstrates basic awareness of values and ethics |
|                | <b>Total</b>                                      | <b>100</b>   |                                                                   |                                                   |                                                   |

|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------|-----------------|----------------|----------|-----------|-----------|
| <b>26EE401</b>                                                                                                                                                                                                                                                                                                                                                                                   | <b>SYNCHRONOUS AND INDUCTION MACHINES</b>                                                                                                        |                                                             |                            | <b>SEMESTER</b> |                |          |           | <b>IV</b> |
| <b>Prerequisites</b>                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                  |                                                             | <b>Category</b>            | <b>ES(PC)</b>   | <b>Credits</b> |          |           | <b>3</b>  |
|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  |                                                             | <b>Hours/<br/>Semester</b> | <b>L</b>        | <b>T</b>       | <b>P</b> | <b>SL</b> | <b>TH</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  |                                                             |                            | 30              | 15             | -        | 45        | 90        |
| <b>COURSE OBJECTIVES</b>                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| 1.                                                                                                                                                                                                                                                                                                                                                                                               | To understand the construction, operating principles, and performance characteristics of alternators and synchronous motors.                     |                                                             |                            |                 |                |          |           |           |
| 2.                                                                                                                                                                                                                                                                                                                                                                                               | To analyze the voltage regulation, synchronization, and parallel operation of synchronous machines using various testing and analytical methods. |                                                             |                            |                 |                |          |           |           |
| 3.                                                                                                                                                                                                                                                                                                                                                                                               | To study the construction, operation, and starting methods of three phase induction motors and induction generators.                             |                                                             |                            |                 |                |          |           |           |
| 4.                                                                                                                                                                                                                                                                                                                                                                                               | To evaluate the performance of three phase induction motors through equivalent circuits, torque-slip characteristics, and testing methods.       |                                                             |                            |                 |                |          |           |           |
| 5.                                                                                                                                                                                                                                                                                                                                                                                               | To gain knowledge of the construction, operating principles, and applications of single- phase induction motors and special motors.              |                                                             |                            |                 |                |          |           |           |
| <b>UNIT - I</b>                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  | <b>ALTERNATOR</b>                                           |                            |                 |                |          |           | <b>9</b>  |
| Construction, types, practical rating of synchronous generators, winding factors, production of EMF, armature reaction, Synchronous reactance, phasor diagram, Methods of pre-determination of voltage regulation- Synchronous impedance, ampere turn, Potier triangle methods. Two reaction theory–Slip test, and parallel operation synchronization -Change of excitation and mechanical input |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>UNIT - II</b>                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                  | <b>SYNCHRONOUS MOTOR</b>                                    |                            |                 |                |          |           | <b>9</b>  |
| Theory of operation–phasor diagrams, Torque equation – Operation on infinite bus bars, variation of current and power factor with excitation. Hunting and its suppression, V and inverted V curves, Synchronous condenser, method of starting.                                                                                                                                                   |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>UNIT-III</b>                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  | <b>THREE PHASE INDUCTION MACHINES</b>                       |                            |                 |                |          |           | <b>9</b>  |
| Constructional details, types, production of rotating magnetic field-principle of operation and practical rating of induction motors. Need for starting – Types of starters – DOL, Rotor resistance and Auto transformer and star-delta starters. Generator action: self-excitation, operation, and applications.                                                                                |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>UNIT- IV</b>                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  | <b>ANALYSIS AND TESTING OF THREE PHASE INDUCTION MOTORS</b> |                            |                 |                |          |           | <b>9</b>  |
| Phasor diagram, equivalent circuit, Torque equation-starting and maximum-torque, maximum-output, slip for maximum output, Torque-slip characteristics, losses and efficiency. Testing-no load and blocked rotor tests- equivalent circuit parameters, circle diagram.                                                                                                                            |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>UNIT - V</b>                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  | <b>SINGLE PHASE INDUCTION MOTOR</b>                         |                            |                 |                |          |           | <b>9</b>  |
| Constructional details of single-phase induction motor – Double field revolving theory and operation – Equivalent circuit – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Shaded pole induction motor – repulsion motor - Hysteresis motor.                                                                                                 |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>L:30, T:15, SL:45, Total: 90 Hours</b>                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>Weightage:</b><br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| <b>TEXT BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                  |                                                             |                            |                 |                |          |           |           |
| 1.                                                                                                                                                                                                                                                                                                                                                                                               | D.P. Kothari, I.J. Nagrath, "Electric Machines", 5th Edition, McGraw-Hill Education, New York, 2017.                                             |                                                             |                            |                 |                |          |           |           |
| 2.                                                                                                                                                                                                                                                                                                                                                                                               | Dr. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, Delhi, 2nd Edition, 2021.                                                          |                                                             |                            |                 |                |          |           |           |
| 3.                                                                                                                                                                                                                                                                                                                                                                                               | A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans, "Electric Machinery", McGraw Hill Education, 6th Edition                                    |                                                             |                            |                 |                |          |           |           |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------|-----|-----|-----|-----|---------------------------------------------------------------------|-----|-------|-----------------------------------------------------|-------|-----------------|-------|
| 1.                                                                                         | B.L.Theraja & A.K. Theraja, "Electrical Technology", Vol.II, S.Chand & Company Ltd., New Delhi, 2015.                                                                                   |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| 2.                                                                                         | Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", Tata McGraw Hill Publications, 2001.                                                                                 |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       | Mapping<br>POs                                      |       | Mapping<br>PSOs |       |
| CO1                                                                                        | Recall and understand the construction, operating principles and characteristics of synchronous and induction machines.                                                                 |       |                                                                                 |     |     |     |     |                                                                     |     |       | --                                                  |       | --              |       |
| CO2                                                                                        | Apply the principles of synchronous and induction machines to determine their operating conditions and performance parameters.                                                          |       |                                                                                 |     |     |     |     |                                                                     |     |       | PO1, PO2                                            |       | PSO1            |       |
| CO3                                                                                        | Analyse the construction, operation and performance of synchronous machines and three-phase induction machines using appropriate analytical methods.                                    |       |                                                                                 |     |     |     |     |                                                                     |     |       | PO1, PO2, PO5                                       |       | PSO1, PSO2      |       |
| CO4                                                                                        | Analyse the performance, testing and operating characteristics of three-phase and single-phase induction machines for different operating conditions and applications.                  |       |                                                                                 |     |     |     |     |                                                                     |     |       | PO1, PO2, PO4, PO5                                  |       | PSO1, PSO2      |       |
| CO5                                                                                        | Develop solutions to electrical-machine-related problems through simulation, mini projects, case studies, model demonstrations or other activity-based learning.                        |       |                                                                                 |     |     |     |     |                                                                     |     |       | PO3, PO4, PO5, PO8, PO10                            |       | PSO2, PSO3      |       |
| CO6                                                                                        | Demonstrate professional learning and communication through technical reports, seminars, presentations, market surveys or other experiential activities related to electrical machines. |       |                                                                                 |     |     |     |     |                                                                     |     |       | PO8, PO9, PO11                                      |       | PSO3            |       |
| The Course Articulation Matrix (CAM) for defined COs                                       |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
|                                                                                            | PO1                                                                                                                                                                                     | PO2   | PO3                                                                             | PO4 | PO5 | PO6 | PO7 | PO8                                                                 | PO9 | PO 10 | PO1 1                                               | PSO 1 | PSO 2           | PSO 3 |
| CO1                                                                                        |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| CO2                                                                                        | 3                                                                                                                                                                                       | 2     |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     | 3     |                 |       |
| CO3                                                                                        | 3                                                                                                                                                                                       | 3     |                                                                                 |     | 2   |     |     |                                                                     |     |       |                                                     | 3     | 2               |       |
| CO4                                                                                        | 3                                                                                                                                                                                       | 3     |                                                                                 | 2   | 3   |     |     |                                                                     |     |       |                                                     | 3     | 3               |       |
| CO5                                                                                        |                                                                                                                                                                                         |       | 3                                                                               | 2   | 3   |     |     | 2                                                                   |     | 2     |                                                     |       | 3               | 2     |
| CO6                                                                                        |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     | 3                                                                   | 3   |       | 3                                                   |       |                 | 3     |
| Activities:                                                                                |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| 1.                                                                                         | Simulation and analysis the machine performance using appropriate software tools. (CO5)                                                                                                 |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| 2.                                                                                         | Technical seminar / case study / mini project on applications and performance of synchronous and induction machines. (CO6)                                                              |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| Rubrics for evaluation: CO5 – Simulation and Analysis                                      |                                                                                                                                                                                         |       |                                                                                 |     |     |     |     |                                                                     |     |       |                                                     |       |                 |       |
| Sl. No.                                                                                    | Criterion                                                                                                                                                                               | Marks | Excellent (3)                                                                   |     |     |     |     | Good(2)                                                             |     |       | Satisfactory (1)                                    |       |                 |       |
| 1.                                                                                         | Problem identification and simulation model                                                                                                                                             | 20    | Problem is clearly identified and an appropriate simulation model is developed. |     |     |     |     | Problem is identified and the model is developed with minor errors. |     |       | Problem/model is partially identified or developed. |       |                 |       |
| 2.                                                                                         | Selection and use of software tools                                                                                                                                                     | 20    | Appropriate software tools and parameters are selected and used effectively.    |     |     |     |     | Appropriate tools are used with minor errors.                       |     |       | Limited or inappropriate use of software tools.     |       |                 |       |

|    |                                    |            |                                                                             |                                                                      |                                                         |
|----|------------------------------------|------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------|
| 3. | Simulation and analysis of results | 40         | Simulation is accurate and results are thoroughly analysed and interpreted. | Simulation is completed with reasonable analysis and interpretation. | Limited simulation and basic interpretation of results. |
| 4. | Technical report and presentation  | 20         | Report/presentation is clear, technically sound and well structured.        | Report/presentation is satisfactory with minor gaps.                 | Report/presentation is incomplete or poorly structured. |
|    | <b>Total</b>                       | <b>100</b> |                                                                             |                                                                      |                                                         |

**Rubrics for evaluation: CO6 - Technical seminar / case study / mini project**

| Sl. No. | Criterion                      | Marks      | Excellent (3)                                                                                  | Good (2)                                                              | Satisfactory (1)                                               |
|---------|--------------------------------|------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------|
| 1.      | Technical content and analysis | 30         | Content is technically accurate with clear analysis and relevant applications.                 | Content is accurate with reasonable analysis.                         | Limited technical content and analysis.                        |
| 2.      | Communication and presentation | 30         | Presentation is clear, confident, well organized and effectively communicated.                 | Presentation is clear with minor communication gaps.                  | Presentation is basic and lacks clarity or organization.       |
| 3.      | Report / response to questions | 20         | Report is well structured and questions are answered accurately with good technical reasoning. | Report is satisfactory and most questions are answered appropriately. | Report is incomplete and responses show limited understanding. |
| 4.      | Technical content and analysis | 20         | Content is technically accurate with clear analysis and relevant applications.                 | Content is accurate with reasonable analysis.                         | Limited technical content and analysis.                        |
|         | <b>Total</b>                   | <b>100</b> |                                                                                                |                                                                       |                                                                |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24               | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------|--------|---------|---|----|----|
| 26EE402                                                                                                                                                                                                                                                                                                                                                               | POWER GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEM                                                                                                                                                  |                                                      | SEMESTER           |        |         |   | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                         |                                                      | Category           | ES(PC) | Credits |   |    | 3  |
| Electric Circuit Analysis, Electromagnetic theory                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                         |                                                      | Hours/<br>Semester | L      | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |                                                      |                    | 30     | 15      | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                    | To understand the structure of power systems, the economics of energy generation, and the operational layouts of thermal, hydro, and nuclear power plants.                                              |                                                      |                    |        |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                    | To calculate electrical parameters (resistance, inductance, and capacitance) for various line configurations and understand the physical effects like skin and proximity effects on transmission lines. |                                                      |                    |        |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                    | To evaluate the transmission line performance through equivalent circuits and phasor diagrams, focusing on efficiency, voltage regulation, and phenomena like the Ferranti and corona effects.          |                                                      |                    |        |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                    | To impart knowledge on the selection and efficiency of insulators and the constructional and thermal characteristics of underground cables.                                                             |                                                      |                    |        |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                    | To study substation layouts, various grounding methodologies, and the classification of AC and DC distribution schemes.                                                                                 |                                                      |                    |        |         |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| UNIT – I                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                         | POWER GENERATION SYSTEMS                             |                    |        |         |   |    | 9  |
| Structure of electric power system–Terms, factors and significance of load curve –Economics of power generation–Cost of electrical energy – Power generating station: Layout and operation of thermal, hydroelectric and nuclear power plants –Comparison of power plants. Introduction to cogeneration, combined heat and power, and distributed generation systems. |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| UNIT – II                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                         | TRANSMISSION LINE PARAMETERS                         |                    |        |         |   |    | 9  |
| Line resistance- Inductance and capacitance calculations of single phase and three phase transmission lines with single and double circuits–Effect of earth on the capacitance of the transmission line–Skin and proximity effects–Inductive interference between power and communication lines.                                                                      |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| UNIT – III                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                         | PERFORMANCE OF TRANSMISSION LINES                    |                    |        |         |   |    | 9  |
| Representation of lines–Performance of short line, medium line and long transmission line: equivalent circuits, phasor diagrams, transmission efficiency and voltage regulation, ABCD constants–Surge impedance loading–Ferranti effect and corona effect.                                                                                                            |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| UNIT – IV                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                         | OVERHEAD LINE INSULATORS AND CABLES                  |                    |        |         |   |    | 9  |
| Insulators: Types, potential distribution over a string of suspension insulators–Improvement of string efficiency. Underground cables: Constructional features of LT and HT cables, capacitance of single core and 3- core cables, dielectric stress in a single core cable- grading of cables, thermal resistance of dielectric of a single core cable.              |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| UNIT – V                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                         | SUBSTATION, GROUNDING SYSTEM AND DISTRIBUTION SYSTEM |                    |        |         |   |    | 9  |
| Substation: Lay out and operation–bus-bar arrangements in sub stations. Grounding: Need and types, Neutral grounding and Resonant grounding–Transformer Earthing. Distribution system: Classification, Layout of AC and DC distribution, Connection schemes of distribution system.                                                                                   |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |
| L:30, T:15, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                         |                                                      |                    |        |         |   |    |    |

|                                                                                                    |                                                                                                                                                                                                                                                                                                                      |  |                             |                         |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------|-------------------------|
| <b>Weightage:</b><br>Continuous Assessment 40%<br>End Semester Examinations 60%                    |                                                                                                                                                                                                                                                                                                                      |  |                             |                         |
| <b>REFERENCE BOOKS:</b>                                                                            |                                                                                                                                                                                                                                                                                                                      |  |                             |                         |
| 1.                                                                                                 | C. L. Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., 2018.                                                                                                                                                                                                                                      |  |                             |                         |
| 2.                                                                                                 | S. N. Singh, "Electric Power Generation, Transmission and Distribution", Second Edition, PHI Pvt. Ltd., 2012.                                                                                                                                                                                                        |  |                             |                         |
| 3.                                                                                                 | Turan Gönen, Chee-Wooi Ten, and Ali Mehrizi-Sani, "Electric Power Distribution Engineering", Fourth Edition, CRC Press, 2024.                                                                                                                                                                                        |  |                             |                         |
| 4.                                                                                                 | Ray, "Electrical Power Systems: Concepts, Theory and Practice", PHI Pvt. Ltd., 2012.                                                                                                                                                                                                                                 |  |                             |                         |
| 5.                                                                                                 | V. K. Mehta, and Rohit Mehta, "Principles of Power System", S. Chand & Company Ltd., 2012.                                                                                                                                                                                                                           |  |                             |                         |
| <b>E-RESOURCES:</b>                                                                                |                                                                                                                                                                                                                                                                                                                      |  |                             |                         |
| 1.                                                                                                 | NPTEL: Power System Engineering.                                                                                                                                                                                                                                                                                     |  |                             |                         |
| 2.                                                                                                 | IEEE Power & Energy Society (PES): Resource Centre for Power Transmission and Substation Design.                                                                                                                                                                                                                     |  |                             |                         |
| 3.                                                                                                 | Bureau of Indian Standards (BIS): Technical Standards for Electrical Installations and Underground Cables.                                                                                                                                                                                                           |  |                             |                         |
| 4.                                                                                                 | Central Electricity Authority (CEA): Manual on Transmission Planning Criteria and Indian Grid Standards.                                                                                                                                                                                                             |  |                             |                         |
| 5.                                                                                                 | MathWorks (MATLAB/Simulink): Simscape Electrical and Power Systems Modelling.                                                                                                                                                                                                                                        |  |                             |                         |
|                                                                                                    |                                                                                                                                                                                                                                                                                                                      |  |                             |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                                                                                                                                                                      |  | <b>Mapping<br/>POs</b>      | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                         | <b>Describe</b> the fundamental operations and structural components of power generation, transmission, and distribution systems, including various power plant types and distribution layouts.                                                                                                                      |  | --                          | ---                     |
| <b>CO2</b>                                                                                         | <b>Apply</b> mathematical and electromagnetic principles to estimate transmission line parameters and develop mathematical models for different circuit configurations, and to determine the performance characteristics and configurations of insulators, underground cables, substation, and distribution systems. |  | PO1                         | PSO1                    |
| <b>CO3</b>                                                                                         | <b>Analyse</b> the performance of short, medium, and long transmission lines by evaluating transmission efficiency, voltage regulation, the distribution of potential in insulator strings and the dielectric stress in cables to determine the suitability of components for high-tension and low-tension systems.  |  | PO2                         | PSO1                    |
| <b>CO4</b>                                                                                         | <b>Analyse</b> the operation of short, medium, and long transmission lines, applicability of insulators and underground cables, and operation of substation and distribution systems.                                                                                                                                |  | PO2                         | PSO2                    |
| <b>CO5</b>                                                                                         | <b>As a member of team, research</b> the advancements in emerging technologies, such as generation systems/ transmission systems / distribution systems through <b>self-learning activities</b> and <b>present the findings</b> while considering <b>societal</b> and <b>economic</b> impacts.                       |  | PO4,<br>PO6,<br>PO8,<br>PO9 | PSO2                    |

|            |                                                                                                                                                                                                                                                    |                              |               |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------|
| <b>CO6</b> | <b>Design and develop simulation</b> models for power transmission /distribution systems through <b>self-directed learning activities</b> and <b>present the findings</b> ensuring compliance with <b>Indian Standards for system performance.</b> | PO5,<br>PO7,<br>PO9,<br>PO11 | PSO2,<br>PSO3 |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------|

### The Course Articulation Matrix (CAM) for defined COs

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> |             |             |             |             |             |             |             |             |             |              |              |              |              |              |
| <b>CO2</b> | 3           |             |             |             |             |             |             |             |             |              |              | 3            |              |              |
| <b>CO3</b> |             | 3           |             |             |             |             |             |             |             |              |              | 3            |              |              |
| <b>CO4</b> |             |             |             | 2           |             | 1           |             | 1           | 1           |              |              |              | 3            |              |
| <b>CO5</b> |             |             |             | 2           |             | 1           |             | 1           | 1           |              |              |              | 3            |              |
| <b>CO6</b> |             |             |             |             | 2           |             | 1           |             | 1           |              | 2            |              | 2            | 1            |

### Activities:

|    |                                                                                                                      |
|----|----------------------------------------------------------------------------------------------------------------------|
| 1. | Technical seminar / report presentation (CO5) (Self-learning activity)                                               |
| 2. | Simulation of transmission / distribution systems in compliance with Indian Standards (CO6) (Self-learning activity) |

### Rubrics for evaluation: CO5

| <b>Sl. No.</b> | <b>Criterion</b>                                                    | <b>Marks</b> | <b>Excellent (3)</b>                                                                        | <b>Good(2)</b>                                              | <b>Satisfactory (1)</b>                                 |
|----------------|---------------------------------------------------------------------|--------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------|
| 1.             | Identifying the emerging technology                                 | 30           | Identification of the latest technology in generation / transmission / distribution systems | The technology is identified, but it is not recent.         | The technology is identified but it is conventional.    |
| 2.             | Understanding the advancements in the network topology / operations | 30           | Familiar on changes in the network topology / operations                                    | Moderate knowledge in network topology changes / operations | Less knowledge in network topology changes / operations |
| 3.             | Visualising the impacts in network operation                        | 30           | Good knowledge on the impact in network operations                                          | Fair knowledge on the impact in network operations          | Poor knowledge on the impact in network operations      |
| 4.             | Seminar / Report presentation                                       | 10           | Presentation / Report is clear and well structured                                          | Presentation / Report is structured, but needs improvement  | Poorly structured presentation / report                 |
|                | <b>Total</b>                                                        | <b>100</b>   |                                                                                             |                                                             |                                                         |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                           | Marks      | Excellent (3)                                       | Good (2)                                          | Satisfactory (1)                              |
|---------|-------------------------------------|------------|-----------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| 1.      | Modelling of the network components | 30         | Well knowledge of the mathematical model            | Fair knowledge of the mathematical model          | Poor knowledge of the mathematical model      |
| 2.      | Knowledge about Indian Standards    | 30         | Well knowledge of Indian Standard                   | Fair knowledge of Indian Standard                 | Poor knowledge of Indian Standard             |
| 3.      | Simulation models                   | 30         | High level knowledge of simulation tools and models | Moderate knowledge of simulation tools and models | Poor knowledge of simulation tools and models |
| 4.      | Presentation & Communication        | 10         | Presentation is clear and well-structured           | Presentation needs improvement                    | Poorly structured                             |
|         | <b>Total</b>                        | <b>100</b> |                                                     |                                                   |                                               |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        | -          | -           | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 24        |           |            |             | 12                    | 3                |
| <b>CO4</b>   |           | 24        |            |             | 12                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);

Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                              |  |                    |        |        |   |    |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--|--------------------|--------|--------|---|----|----|
| 26EE403                                                                                                                                                                                                                                                                                                                                                                                          | POWER ELECTRONICS                                                                                                            |  | SEMESTER           |        |        |   | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                              |  | Category           | ES(PC) | Credit |   |    | 3  |
| Electric circuit analysis                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                              |  | Hours/<br>Semester | L      | T      | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                              |  |                    | 45     | -      | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                              |  |                    |        |        |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                               | To impart knowledge on the characteristics of various power semiconductor devices, converters and their operation.           |  |                    |        |        |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                               | Design and synthesis of the different nature of power conversion circuits.                                                   |  |                    |        |        |   |    |    |
|                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                              |  |                    |        |        |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                         | POWER SEMICONDUCTOR DEVICES                                                                                                  |  |                    |        |        |   |    | 9  |
| Requirements of an Ideal Switch - Power diodes - Basic structure and static & dynamic characteristics - types, Thyristors - basic structure and operation - static characteristics, Snubber Circuits - device specifications and ratings, MOSFETs and IGBTs - Basic structure, operation and Switching characteristics. Gate Driver Circuits for IGBTs and MOSFETs, Introduction to SiC Devices. |                                                                                                                              |  |                    |        |        |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                        | CONTROLLED RECTIFIERS                                                                                                        |  |                    |        |        |   |    | 9  |
| Single Phase – Semi converter with R and RL loads, fully controlled converters with continuous currents - Input side harmonics and power factor - Three Phase fully controlled converters with continuous and constant currents - Input side harmonics and power factor - Effect of source inductance.                                                                                           |                                                                                                                              |  |                    |        |        |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                       | DC – DC CONVERTERS                                                                                                           |  |                    |        |        |   |    | 9  |
| Switched Mode DC-DC Converters - Buck Converter - Boost Converter – Buck-Boost Converter, SEPIC Converter; Converter structure, and modes of operation, Design of Inductors and Capacitors for Power converters                                                                                                                                                                                  |                                                                                                                              |  |                    |        |        |   |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                        | INVERTERS                                                                                                                    |  |                    |        |        |   |    | 9  |
| Introduction to Inverters - Single Phase Inverters – Half Bridge Inverters and Full Bridge Inverters – Square wave operation – Introduction to PWM – Sinusoidal PWM - Unipolar PWM – Bipolar PWM – Three Phase Inverters – SPWM in three Phase Inverters.                                                                                                                                        |                                                                                                                              |  |                    |        |        |   |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                         | AC VOLTAGE CONTROLLERS                                                                                                       |  |                    |        |        |   |    | 9  |
| Introduction, principle of operation of single-phase and three-phase voltage AC voltage controllers for R, R-L & R-L-E loads and its applications, Single-phase to single-phase Cycloconverters, three-phase to single-phase Cycloconverters – Introduction to Matrix converters.                                                                                                                |                                                                                                                              |  |                    |        |        |   |    |    |
| L:30, T:15, SL :45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                              |  |                    |        |        |   |    |    |
| Weightage:                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                              |  |                    |        |        |   |    |    |
| Continuous Assessment 40%                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                              |  |                    |        |        |   |    |    |
| End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                              |  |                    |        |        |   |    |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                              |  |                    |        |        |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                               | Rashid, M.H, 'Power Electronics - Circuits, Devices and Applications', Prentice Hall Publications, 3rd Edition, 2003.        |  |                    |        |        |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                               | M.D.Singh and K.B.Kanchandhani, 'Power Electronics', Tata McGraw-Hill Publishing Company Limited, 2nd Edition, 2006.         |  |                    |        |        |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                               | Ned Mohan, Tore M. Undeland, William P. Robbins, 'Power Electronics', John Wiley & Sons Publications, 3rd Edition, 2006.     |  |                    |        |        |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                               | V.R.Moorthi, 'Power Electronics- Devices, Circuits and Industrial Applications', Oxford University Press, 1st Edition, 2005. |  |                    |        |        |   |    |    |

| E-RESOURCES: |                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1.           | <a href="https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee01">https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee01</a> |
| 2.           | Math Works (MATLAB/Simulink): Simscape Electrical and Power Systems Modelling.                                                                |

| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                         | Mapping<br>POs       | Mapping<br>PSOs |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------|
| CO1                                                                                        | <b>Describe</b> the operation of the different nature of power electronic converters with the help of its power circuit.                                                                                | --                   | ---             |
| CO2                                                                                        | <b>Apply</b> mathematical concepts and the principles of power semiconductor devices to derive the circuit models, and evaluate different power conversion topologies                                   | PO1                  | PSO1            |
| CO3                                                                                        | <b>Analyse</b> the performance of power electronic switch-based rectifiers, converters and inverters                                                                                                    | PO2                  | PSO1            |
| CO4                                                                                        | <b>Select</b> suitable power semiconductor devices and <b>design</b> power converter circuits to meet the requirements of specific power conversion applications                                        | PO3                  | PSO2            |
| CO5                                                                                        | Work effectively <b>as a team member</b> to identify the power converter employed in a power electronic product and prepare a technical report on its circuit design, devices used, and cost estimation | PO4,<br>PO8,<br>PO9  | PSO2            |
| CO6                                                                                        | Design <b>simulation models</b> for power electronic systems, conduct harmonic analysis, and interpret and present the resulting technical findings                                                     | PO5,<br>PO9,<br>PO11 | PSO3            |

### The Course Articulation Matrix (CAM) for defined COs

|     | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| C01 |      |      |      |      |      |      |      |      |      |       |       |       |       |       |
| C02 | 3    |      |      |      |      |      |      |      |      |       |       | 3     |       |       |
| C03 |      | 2    |      |      |      |      |      |      |      |       |       | 2     |       |       |
| C04 |      |      | 2    |      |      |      |      |      |      |       |       |       | 2     |       |
| C05 |      |      |      | 1    |      |      |      | 1    | 1    |       |       |       | 2     |       |
| C06 |      |      |      |      | 1    |      |      |      | 1    |       | 1     |       |       | 2     |

**Activities:**

|    |                                                                              |
|----|------------------------------------------------------------------------------|
| 1. | Technical report presentation (CO5) (Self-learning activity)                 |
| 2. | Simulation studies of power electronic system (CO6) (Self-learning activity) |

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### Rubrics for evaluation:CO5

| Sl. No. | Criterion                                                  | Marks      | Excellent (3)                                                           | Good(2)                                                    | Satisfactory (1)                          |
|---------|------------------------------------------------------------|------------|-------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------|
| 1.      | Identifying the product with power electronics application | 30         | Identification of the appropriate product with power converter topology | The product is identified with simple power converter.     | The identified product is just satisfied. |
| 2.      | Analyse the power circuit and devices used                 | 30         | Familiar on the power circuit and devices used                          | Moderate knowledge in devices identification               | Less knowledge in available power circuit |
| 3.      | Technical report preparation                               | 40         | Presentation / Report is clear and well structured                      | Presentation / Report is structured, but needs improvement | Poorly structured presentation / report   |
|         | <b>Total</b>                                               | <b>100</b> |                                                                         |                                                            |                                           |

### Rubrics for evaluation: CO6

| Sl. No. | Criterion                                        | Marks      | Excellent (3)                                       | Good (2)                                          | Satisfactory (1)                              |
|---------|--------------------------------------------------|------------|-----------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| 1.      | Modelling of power electronic converter          | 30         | Well knowledge of the mathematical model            | Fair knowledge of the mathematical model          | Poor knowledge of the mathematical model      |
| 2.      | Simulation studies of power electronic converter | 30         | High level knowledge of simulation tools and models | Moderate knowledge of simulation tools and models | Poor knowledge of simulation tools and models |
| 3.      | Technical analysis and Presentation              | 40         | Detailed analysis, and well presentation            | Presentation needs improvement                    | Poor presentation                             |
|         | <b>Total</b>                                     | <b>100</b> |                                                     |                                                   |                                               |

### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II |                       |                  |
| <b>CO1</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24               | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |                  |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |                  |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            | <b>2</b>         |

Note:Purely as anExample: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |                              |                    |        |         |   |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------|--------|---------|---|----|----|
| 26EE404                                                                                                                                                                                                                                                                                                                                         | INDUSTRIAL MANAGEMENT AND ECONOMICS                                                                                                |                              | SEMESTER           |        |         |   | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                    |                              | Category           | ES(PC) | Credits |   |    | 3  |
| Mathematics                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                    |                              | Hours/<br>Semester | L      | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                    |                              |                    | 45     | -       | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                               |                                                                                                                                    |                              |                    |        |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                              | To understand the fundamental principles and functions of management and organizational structures.                                |                              |                    |        |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                              | To gain knowledge of personnel management practices, labour welfare measures and forms of business organizations.                  |                              |                    |        |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                              | To understand the concepts of marketing and production management for effective business operations.                               |                              |                    |        |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                              | To develop an understanding of basic economic principles, taxation, national income and inflation.                                 |                              |                    |        |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                              | To acquire knowledge of the Indian financial system, banking institutions, capital markets and their role in economic development. |                              |                    |        |         |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    | MODERN CONCEPT OF MANAGEMENT |                    |        |         |   |    | 9  |
| Scientific management - Functions of management-Planning-Organising- Staffing-Directing- Motivating- Communicating- Coordinating- Controlling-Organizational structures- Line, Line and staff and Functional relationships - Span of control- Delegation- Management by Objectives.                                                             |                                                                                                                                    |                              |                    |        |         |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                    | PERSONNEL MANAGEMENT         |                    |        |         |   |    | 9  |
| Objectives and functions of personnel management- Recruitment-Selection and training of workers- Labour Welfare- Industrial Fatigue- Industrial disputes - Trade Unions- Quality circles. Formation of companies: Proprietary-Partnership-Joint stock companies- Public sector- Joint sector and Co-operative sector.                           |                                                                                                                                    |                              |                    |        |         |   |    |    |
| UNIT- III                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                    | MARKETING MANAGEMENT         |                    |        |         |   |    | 9  |
| Pricing- Promotion- Channels of distribution – Market research -Advertising. Production Management: Batch and mass production- Inventory control- EOQ-Project planning by PERT/CPM- Construction of Network (Basic ideas only).                                                                                                                 |                                                                                                                                    |                              |                    |        |         |   |    |    |
| UNIT- IV                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    | BASICS OF ECONOMICS          |                    |        |         |   |    | 9  |
| Theory of demand and supply- Price mechanism- Factors of production- Land, labour, capital and organization- National income- Difficulties in estimation- Taxation- Direct and indirect taxes- Progressive and regressive- Black money- Inflation-Causes and consequences.                                                                      |                                                                                                                                    |                              |                    |        |         |   |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    | INDIAN FINANCIAL SYSTEM      |                    |        |         |   |    | 9  |
| Reserve bank of India: Functions- Commercial banking system-Development financial institutions- IDBI- ICICI- SIDBI- IRBI- NABARD- Investment institutions-UTI- Insurance companies- Indian capital market- Stock market- Functions- Role of the public sector- Privatisation- Multinational corporations and their impact on the Indian economy |                                                                                                                                    |                              |                    |        |         |   |    |    |
| L:45, SL :45, Total:90 Hours                                                                                                                                                                                                                                                                                                                    |                                                                                                                                    |                              |                    |        |         |   |    |    |
| Weightage:<br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                        |                                                                                                                                    |                              |                    |        |         |   |    |    |
| REFERENCE BOOKS:                                                                                                                                                                                                                                                                                                                                |                                                                                                                                    |                              |                    |        |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                              | K. K. Ahuja, "Industrial management" Khanna Publishers, 1978.                                                                      |                              |                    |        |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                              | K.K Dewett, ShyamLal, "Modern economic theory" S Chand and Company Limited, 2008.                                                  |                              |                    |        |         |   |    |    |

### E-RESOURCES:

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**COURSE OUTCOMES (COs) :**

**At the end of the course, the students will have the ability to**

## Mapping POs

## Mapping PSOs

|            |                                                                                                                                                                                                         |                          |            |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|
| <b>C01</b> | <b>Recall and Understand</b> the fundamental concepts of management, personnel management, marketing, production, economics and the Indian financial system.                                            | --                       | --         |
| <b>C02</b> | <b>Apply</b> management, personnel, marketing, production, economic and financial principles to solve basic business-related problems.                                                                  | PO1, PO2                 | PSO1       |
| <b>C03</b> | <b>Analyse</b> organizational, personnel, marketing, production, economic and financial factors influencing business operations and decision-making.                                                    | PO1, PO2                 | PSO1, PSO2 |
| <b>C04</b> | <b>Analyse</b> economic conditions, taxation, inflation and financial systems to evaluate their impact on business and economic decision-making.                                                        | PO2, PO6                 | PSO1, PSO2 |
| <b>C05</b> | <b>Develop solutions</b> to management and economic problems through <b>case studies</b> , market surveys, mini projects and other activity-based learning.                                             | PO3, PO4, PO5, PO8, PO10 | PSO2, PSO3 |
| <b>C06</b> | Demonstrate professional communication, teamwork and lifelong learning through seminars, <b>technical reports, presentations</b> and other experiential activities related to management and economics. | PO8, PO9, PO11           | PSO3       |

### The Course Articulation Matrix (CAM) for defined COs

[illegible]

### Activities:

|    |                                                                                     |
|----|-------------------------------------------------------------------------------------|
| 1. | Case Study Analysis on Business Organizations and Management Practices <b>(C05)</b> |
| 2. | To prepare a Financial and Economic Survey Report <b>(C06)</b>                      |

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### Rubrics for evaluation: C05 - Case Study Analysis on Business Organizations and Management Practices

| Sl. No. | Criterion                | Marks      | Excellent (3)                                                          | Good(2)                                                           | Satisfactory (1)                                                  |
|---------|--------------------------|------------|------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
| 1.      | Problem Identification   | 20         | Identifies all core business problems accurately and insightfully.     | Identifies main business problems but misses minor ones.          | Fails to identify the core business problems accurately.          |
| 2.      | Management Analysis      | 30         | Correctly applies advanced management theories and framework concepts. | Applies basic management theories with minor analytical gaps.     | Shows incorrect or no use of management principles.               |
| 3.      | Strategic Solutions      | 30         | Proposes realistic, innovative, and highly actionable solutions.       | Proposes logical solutions that lack specific actionable details. | Offers unrealistic, vague, or unsupported recommendations.        |
| 4.      | Organization & Structure | 20         | Structure is highly logical with perfect formatting and scanability.   | Structure is mostly logical with minor formatting errors.         | Structure is disorganized and difficult for the reader to follow. |
|         | <b>Total</b>             | <b>100</b> |                                                                        |                                                                   |                                                                   |

### Rubrics for evaluation: C06- Technical Report Presentations

| Sl. No. | Criterion                                         | Marks      | Excellent (3)                                    | Good(2)                                           | Satisfactory (1)      |
|---------|---------------------------------------------------|------------|--------------------------------------------------|---------------------------------------------------|-----------------------|
| 1.      | Understanding the marketing and economic concepts | 20         | Clearly explains marketing and economic concepts | Explanation needs improvement                     | Limited understanding |
| 2.      | Economic considerations & financial management    | 30         | Clearly discusses Economic considerations        | Economic considerations are not clearly discussed | Poorly explained      |
| 3.      | Evidence of self-learning                         | 30         | Use of relevant journals/sources                 | Limited sources                                   | Very limited sources  |
| 4.      | Presentation & Communication                      | 20         | Presentation is clear and well-structured        | Presentation needs improvement                    | Poorly structured     |
|         | <b>Total</b>                                      | <b>100</b> |                                                  |                                                   |                       |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Theory Component |           |            |             | Percentage Allocation | Mapping Strength |
|--------------|------------------|-----------|------------|-------------|-----------------------|------------------|
|              | Test I           | Test II   | Activity I | Activity II |                       |                  |
| <b>C01</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>C02</b>   | 24               | 24        |            |             | 24                    | 3                |
| <b>C03</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>C04</b>   | 12               | 12        |            |             | 12                    | 2                |
| <b>C05</b>   |                  |           | 40         |             | 20                    | 2                |
| <b>C06</b>   |                  |           |            | 40          | 20                    |                  |
| <b>Total</b> | <b>60</b>        | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note:Purely as anExample: Strength = 3 (if percentage >20%);  
Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                               |                                                                                                          |  |                    |          |         |    |    |    |
|-------------------------------|----------------------------------------------------------------------------------------------------------|--|--------------------|----------|---------|----|----|----|
| 26EE405                       | SYNCHRONOUS AND INDUCTION MACHINES<br>LABORATORY                                                         |  |                    | SEMESTER |         |    | IV |    |
| Prerequisites                 |                                                                                                          |  | Category           | ES(PC)   | Credits |    | 2  |    |
|                               |                                                                                                          |  | Hours/<br>Semester | L        | T       | P  | SL | TH |
|                               |                                                                                                          |  |                    | -        | -       | 45 | 15 | 60 |
| COURSE OBJECTIVES             |                                                                                                          |  |                    |          |         |    |    |    |
| 1.                            | To understand the operation of synchronous machines.                                                     |  |                    |          |         |    |    |    |
| 2.                            | To understand the analysis of power angle curve of a synchronous machine                                 |  |                    |          |         |    |    |    |
| 3.                            | To understand the equivalent circuit of three phase and single-phase induction motor                     |  |                    |          |         |    |    |    |
| 4.                            | To understand the circle diagram of an induction motor by conducting a blocked rotor test.               |  |                    |          |         |    |    |    |
| 5.                            | To demonstrate the speed control methods of an induction motor.                                          |  |                    |          |         |    |    |    |
|                               |                                                                                                          |  |                    |          |         |    |    |    |
| LIST OF EXPERIMENTS           |                                                                                                          |  |                    |          |         |    |    |    |
| 1.                            | Predetermination of Voltage Regulation of three-phase alternator by EMF and MMF methods.                 |  |                    |          |         |    |    |    |
| 2.                            | Predetermination of Voltage Regulation of three-phase alternator by EMF and MMF methods.                 |  |                    |          |         |    |    |    |
| 3.                            | Slip test on three-phase salient pole alternator.                                                        |  |                    |          |         |    |    |    |
| 4.                            | V and inverted V curves of synchronous motors.                                                           |  |                    |          |         |    |    |    |
| 5.                            | Load test on three phase Induction motor.                                                                |  |                    |          |         |    |    |    |
| 6.                            | Circle diagram for three phase induction motor with No load and blocked rotor test data.                 |  |                    |          |         |    |    |    |
| 7.                            | Load test on three-phase Alternator.                                                                     |  |                    |          |         |    |    |    |
| 8.                            | Separation of losses in three phase induction motor.                                                     |  |                    |          |         |    |    |    |
| 9.                            | Load test on single-phase induction motor.                                                               |  |                    |          |         |    |    |    |
| 10.                           | Equivalent circuit and pre-determination of performance characteristics of single-phase induction motor. |  |                    |          |         |    |    |    |
| 11.                           | Separation of losses in single phase transformer using alternator.                                       |  |                    |          |         |    |    |    |
| 12.                           | Study of AC starters.                                                                                    |  |                    |          |         |    |    |    |
| P:45, SL:15, Total:60 Hours   |                                                                                                          |  |                    |          |         |    |    |    |
| Weightage:                    |                                                                                                          |  |                    |          |         |    |    |    |
| Continuous Assessment 60%     |                                                                                                          |  |                    |          |         |    |    |    |
| End Semester Examinations 40% |                                                                                                          |  |                    |          |         |    |    |    |

| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b> |                                                                                                                                                                  | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------|
| <b>CO1</b>                                                                                         | <b>Explain</b> the construction, operation and performance characteristics of synchronous machines through laboratory experiments.                               | PO1, PO2               | PSO1                    |
| <b>CO2</b>                                                                                         | <b>Analyze</b> the voltage regulation, power angle characteristics and synchronization of synchronous machines using experimental data.                          | PO2, PO4               | PSO1,<br>PSO2           |
| <b>CO3</b>                                                                                         | <b>Apply</b> equivalent circuit concepts and testing procedures to evaluate the performance of three-phase and single-phase induction motors.                    | PO1, PO2,<br>PO5       | PSO1,<br>PSO2           |
| <b>CO4</b>                                                                                         | <b>Analyze</b> the operating characteristics, losses and circle diagram of induction machines using test results.                                                | PO2, PO4               | PSO2                    |
| <b>CO5</b>                                                                                         | Perform laboratory experiments on synchronous and induction machines, interpret results and <b>solve practical engineering problems using appropriate tools.</b> | PO1, PO5,<br>PO9       | PSO2                    |
| <b>CO6</b>                                                                                         | Demonstrate teamwork, communication, documentation and lifelong learning skills through laboratory activities and <b>technical report preparation.</b>           | PO8, PO9,<br>PO11      | PSO1,<br>PSO3           |

#### The Course Articulation Matrix (CAM) for defined COs

|            | <b>PO1</b> | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PO7</b> | <b>PO8</b> | <b>PO9</b> | <b>PO10</b> | <b>PO11</b> | <b>PSO1</b> | <b>PSO2</b> | <b>PSO3</b> |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| <b>CO1</b> | 3          | 2          | -          | -          | -          | -          | -          | -          | -          | -           | -           | 3           | -           | -           |
| <b>CO2</b> | -          | 3          | -          | 3          | -          | -          | -          | -          | -          | -           | -           | 2           | 3           | -           |
| <b>CO3</b> | 3          | 2          | -          | -          | 3          | -          | -          | -          | -          | -           | -           | 3           | 2           | -           |
| <b>CO4</b> | -          | 3          | -          | 3          | -          | -          | -          | -          | -          | -           | -           | -           | 3           | -           |
| <b>CO5</b> | 3          | -          | -          | -          | 3          | -          | -          | -          | 2          | -           | -           | -           | 3           | -           |
| <b>CO6</b> | -          | -          | -          | -          | -          | -          | -          | 3          | 3          | -           | 3           | 2           | -           | 3           |

#### Activities:

|    |                                                                                                                                                                                                                                                                                                            |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Mini Case Study / Experimental Analysis</b><br>Student are conducting a laboratory experiment on synchronous or induction machines, analyze the obtained results using appropriate engineering tools, and prepare a technical report highlighting performance evaluation and practical problem-solving. |
| 2. | <b>Technical Presentation and Documentation</b><br>Students work in teams to prepare and deliver a technical presentation on an electrical machine's topic, accompanied by proper documentation and a reflective learning report.                                                                          |

#### Rubrics for evaluation: CO5 -Mini Case Study / Experimental Analysis

| <b>Sl. No.</b> | <b>Criterion</b>       | <b>Marks</b> | <b>Excellent (3)</b>                                                             | <b>Good(2)</b>                            | <b>Satisfactory (1)</b>                      |
|----------------|------------------------|--------------|----------------------------------------------------------------------------------|-------------------------------------------|----------------------------------------------|
| 1.             | Experimental Execution | 20           | Conducts the experiment accurately following all procedures and safety practices | Conducts the experiment with minor errors | Requires guidance to complete the experiment |

|              |                                |            |                                                                                         |                                                |                                       |
|--------------|--------------------------------|------------|-----------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------|
| 2.           | Data Analysis & Interpretation | 30         | Accurately analyzes results and provides meaningful interpretations                     | Analyzes results with minor errors             | Limited analysis and interpretation   |
| 3.           | Problem Solving & Application  | 30         | Effectively relates results to theory and solves practical engineering problems         | Shows reasonable application of concepts       | Limited ability to apply concepts     |
| 4.           | Report                         | 20         | Well-organized report with complete observations, calculations, graphs, and conclusions | Report is mostly complete with minor omissions | Incomplete or poorly organized report |
| <b>Total</b> |                                | <b>100</b> |                                                                                         |                                                |                                       |

**Rubrics for evaluation: CO6 - Technical Presentation and Documentation**

| Sl. No.      | Criterion                           | Marks      | Excellent (3)                                                                                  | Good(2)                                                  | Satisfactory (1)                                   |
|--------------|-------------------------------------|------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|
| 1.           | Teamwork & Participation            | 30         | Actively contributes, collaborates effectively, and demonstrates leadership in team activities | Participates regularly and contributes to team tasks     | Limited participation and contribution             |
| 2.           | Teamwork & Participation            | 25         | Presents concepts clearly with strong technical understanding and confidence                   | Presents concepts adequately with minor deficiencies     | Basic presentation with limited technical clarity  |
| 3.           | Documentation Quality               | 25         | Well-organized, accurate, and comprehensive documentation.                                     | Documentation is complete with minor errors              | Documentation is incomplete or lacks clarity       |
| 4.           | Reflective Learning & Communication | 20         | Demonstrates deep learning insights and effective communication skills                         | Shows reasonable understanding and communication ability | Limited reflection and communication effectiveness |
| <b>Total</b> |                                     | <b>100</b> |                                                                                                |                                                          |                                                    |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>CO1</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO2</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO3</b>   | 30                                                               |            | 15                    | 2                |
| <b>CO4</b>   | 30                                                               |            | 15                    | 2                |
| <b>CO5</b>   |                                                                  | 50         | 25                    | 3                |
| <b>CO6</b>   |                                                                  | 50         | 25                    | 3                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> |                       |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%); Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                            |                                                                                                                          |  |                    |                |         |                 |    |    |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--|--------------------|----------------|---------|-----------------|----|----|
| 26EE406                                                                                    | POWER ELECTRONICS LABORATORY                                                                                             |  | SEMESTER           |                |         |                 | IV |    |
| Prerequisites                                                                              |                                                                                                                          |  | Category           | ES(PC)         | Credits |                 |    | 2  |
| Electronic Devices and Circuits Laboratory                                                 |                                                                                                                          |  | Hours/<br>Semester | L              | T       | P               | SL | TH |
|                                                                                            |                                                                                                                          |  |                    | -              | -       | 45              | 15 | 60 |
| COURSE OBJECTIVES                                                                          |                                                                                                                          |  |                    |                |         |                 |    |    |
| 1.                                                                                         | To simulate and analyze the performance of different power electronic converter circuits.                                |  |                    |                |         |                 |    |    |
| 2.                                                                                         | To conduct experiments for power devices and basic power converter circuits.                                             |  |                    |                |         |                 |    |    |
|                                                                                            |                                                                                                                          |  |                    |                |         |                 |    |    |
| LIST OF EXPERIMENTS                                                                        |                                                                                                                          |  |                    |                |         |                 |    |    |
| 1.                                                                                         | V-I Characteristics of power diode and SCR                                                                               |  |                    |                |         |                 |    |    |
| 2.                                                                                         | Characteristics of Power MOSFET and IGBT                                                                                 |  |                    |                |         |                 |    |    |
| 3.                                                                                         | Single phase AC to DC fully controlled converter                                                                         |  |                    |                |         |                 |    |    |
| 4.                                                                                         | Buck and Boost Converters                                                                                                |  |                    |                |         |                 |    |    |
| 5.                                                                                         | MOSFET based single-phase PWM inverter                                                                                   |  |                    |                |         |                 |    |    |
| 6.                                                                                         | IGBT based three-phase PWM inverter                                                                                      |  |                    |                |         |                 |    |    |
| 7.                                                                                         | Single phase AC voltage controller                                                                                       |  |                    |                |         |                 |    |    |
| 8.                                                                                         | Simulation for Single phase and three phase dual converters                                                              |  |                    |                |         |                 |    |    |
| 9.                                                                                         | Simulation of Matrix Converter and SEPIC converter                                                                       |  |                    |                |         |                 |    |    |
| 10.                                                                                        | Simulation of Single phase PWM rectifiers                                                                                |  |                    |                |         |                 |    |    |
| 11.                                                                                        | Simulation study on Solar PV Energy System                                                                               |  |                    |                |         |                 |    |    |
| 12.                                                                                        | Simulation study on Wind Energy Conversion System                                                                        |  |                    |                |         |                 |    |    |
| P:45, SL:15 Total:60 Hours                                                                 |                                                                                                                          |  |                    |                |         |                 |    |    |
|                                                                                            |                                                                                                                          |  |                    |                |         |                 |    |    |
| Weightage:<br>Continuous Assessment 60%<br>End Semester Examinations 40%                   |                                                                                                                          |  |                    |                |         |                 |    |    |
|                                                                                            |                                                                                                                          |  |                    |                |         |                 |    |    |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                          |  |                    | Mapping<br>POs |         | Mapping<br>PSOs |    |    |
| CO1                                                                                        | Understand the characteristics of various switching devices and its applications in various power electronic converters. |  |                    | -              |         | -               |    |    |
| CO2                                                                                        | Demonstrate the operation of power switching converters and analyze its performance.                                     |  |                    | PO2, PO4       |         | PSO1, PSO2      |    |    |
| CO3                                                                                        | Design the power switching converters and demonstrate its operation.                                                     |  |                    | PO3, PO4       |         | PSO1, PSO2      |    |    |
| CO4                                                                                        | Develop the power converter for solar and wind energy conversion system.                                                 |  |                    | PO3            |         | PSO2            |    |    |

|            |                                                                                                                   |                |            |
|------------|-------------------------------------------------------------------------------------------------------------------|----------------|------------|
| <b>C05</b> | Develop the simulation model of the power electronic converter for a specific application and present the report. | PO5, PO9       | PSO2       |
| <b>C06</b> | Analyze and prepare the technical report on the experiments carried out.                                          | PO8, PO9, PO11 | PSO1, PSO3 |

### The Course Articulation Matrix (CAM) for defined COs

|            | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| <b>C01</b> |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
| <b>C02</b> |     | 1   |     | 1   |     |     |     |     |     |      |      | 1    | 1    |      |
| <b>C03</b> |     |     | 1   | 1   |     |     |     |     |     |      |      | 1    | 1    |      |
| <b>C04</b> |     |     | 2   |     |     |     |     |     |     |      |      |      | 2    |      |
| <b>C05</b> |     |     |     |     | 1   |     |     |     | 1   |      |      |      | 2    |      |
| <b>C06</b> |     |     |     |     |     |     |     | 1   | 1   |      | 1    | 1    |      | 1    |

### Activities:

|    |                                                     |
|----|-----------------------------------------------------|
| 1. | C05: Simulation Model of Power Electronic System    |
| 2. | C06: Technical Report preparation and Documentation |

### Rubrics for evaluation: C05

| Sl. No. | Criterion                           | Marks      | Excellent (3)                                                                   | Good(2)                                                      | Satisfactory (1)                             |
|---------|-------------------------------------|------------|---------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------|
| 1.      | Simulation Model of Power Converter | 40         | Simulation model is aligned with application                                    | Simulation model is correct and not aligned with application | Requires guidance to complete the simulation |
| 2.      | Analysis its performance            | 30         | Accurately analyzes results and provides meaningful interpretations             | Analyzes results with minor errors                           | Limited analysis and interpretation          |
| 3.      | Report presentation                 | 30         | Effectively relates results to theory and solves practical engineering problems | Shows reasonable application of concepts                     | Limited ability to apply concepts            |
|         | <b>Total</b>                        | <b>100</b> |                                                                                 |                                                              |                                              |

### Rubrics for evaluation:C06

| Sl. No. | Criterion                | Marks | Excellent (3)                                                                                  | Good(2)                                              | Satisfactory (1)                       |
|---------|--------------------------|-------|------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------|
| 1.      | Teamwork & Participation | 40    | Actively contributes, collaborates effectively, and demonstrates leadership in team activities | Participates regularly and contributes to team tasks | Limited participation and contribution |

|    |                                     |            |                                                                        |                                                          |                                                    |
|----|-------------------------------------|------------|------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------|
| 2. | Documentation Quality               | 30         | Well-organized, accurate, and comprehensive documentation.             | Documentation is complete with minor errors              | Documentation is incomplete or lacks clarity       |
| 3. | Reflective Learning & Communication | 30         | Demonstrates deep learning insights and effective communication skills | Shows reasonable understanding and communication ability | Limited reflection and communication effectiveness |
|    | <b>Total</b>                        | <b>100</b> |                                                                        |                                                          |                                                    |

**The Internal Assessment Matrix (IAM) for the defined COs:**

| CO           | Laboratory Component                                             |            | Percentage Allocation | Mapping Strength |
|--------------|------------------------------------------------------------------|------------|-----------------------|------------------|
|              | Evaluation of Student Work, Observation of Record and Model Test | Activities |                       |                  |
| <b>CO1</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO2</b>   | 40                                                               |            | 20                    | 2                |
| <b>CO3</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO4</b>   | 20                                                               |            | 10                    | 2                |
| <b>CO5</b>   |                                                                  | 50         | 25                    | 3                |
| <b>CO6</b>   |                                                                  | 50         | 25                    | 3                |
| <b>Total</b> | <b>100</b>                                                       | <b>100</b> | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%); Strength =2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------|----|---------|---|----|----|
| 26MCC02                                                                                                                                                                                                                                                                                                                                                                                                           | ENVIRONMENTAL SCIENCE AND ENGINEERING                                                                                                                                                                          |                                | SEMESTER           |    |         |   | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                |                                | Category           | MC | Credits |   |    | 3  |
| Nil                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                |                                | Hours/<br>Semester | L  | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                |                                |                    | 45 | -       | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                | To understand the fundamental concepts of ecology, biodiversity, environmental pollution, sustainable energy resources, climate change, and environmental sustainability relevant to engineering and society.  |                                |                    |    |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                | To acquire the ability to analyze environmental issues, pollution sources, biodiversity conservation strategies, and climate change mitigation measures using scientific principles.                           |                                |                    |    |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                | To examine the interrelationships between ecosystems, energy resources, environmental management practices, and sustainable development goals.                                                                 |                                |                    |    |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                | To assess the suitability of sustainable technologies, renewable energy resources, environmental policies, and management strategies for addressing environmental challenges.                                  |                                |                    |    |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                | To develop practical and self-learning skills through environmental observations, case studies, field-based activities, and sustainability assessments, and to interpret findings for real-world applications. |                                |                    |    |         |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                | ECOLOGY AND BIODIVERSITY:      |                    |    |         |   |    | 9  |
| Ecology – Definition, ecosystem – types – components (biotic and abiotic) – function – energy flow in ecosystem – components of forest, desert, river and ocean ecosystem – food chain and food web – ecological pyramid – ecological succession.<br>Biodiversity – levels – values – biodiversity hot spots and hope spots in India – endangered and endemic species – threats and conservation of biodiversity. |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| Activities                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| 1. Study of local ecosystem and identification of biotic and abiotic components.<br>2. Documentation of local biodiversity and endangered species.                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                | ENVIRONMENTAL POLLUTION:       |                    |    |         |   |    | 9  |
| Air pollution – sources, effects, control measures – Water pollution –sources, effects, control measures – Noise pollution – sources, effects, control measures –Soil pollution – causes, effects and control measures – solid and electronic waste management – Environmental protection acts.                                                                                                                   |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| Activities                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| 1. Survey of air, water, noise, and solid waste pollution sources in the locality.<br>2. Preparation of waste segregation and management plan.                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                | SUSTAINABLE ENERGY RESOURCES:  |                    |    |         |   |    | 9  |
| Energy management and conservation – Need of new sources – Different types new energy sources – Applications of solar energy, wind energy, hydrogen energy, ocean energy and tidal energy – Concept, origin and power plants of geothermal energy.                                                                                                                                                                |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| Activities                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| 1. Comparative study of renewable and non-renewable energy resources.<br>2. Energy audit of classroom/home.                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                | CLIMATE CHANGE AND MANAGEMENT: |                    |    |         |   |    | 9  |
| Causes for climate change – global warming – greenhouse effect – acid rain– ozone layer depletion – carbon sequestration, carbon foot print, carbon credit, Kyoto protocol – green climate fund (GCF), climate investment fund (CIF) – intergovernmental panel on climate change (IPCC) – clean development mechanism (CDM) – Paris agreement.                                                                    |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| Activity                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |
| Carbon footprint estimation of an individual or institution.                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                |                                |                    |    |         |   |    |    |

| UNIT - V                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           | ENVIRONMENTAL SUSTAINABILITY AND PRACTICES: |                        | 9                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------|-------------------------|
| Sustainability – concept, needs and challenges – economic, social, and environmental aspects of sustainability – transition from unsustainability to sustainability – sustainable development goals (SDGs) – targets, indicators, and intervention areas – zero waste and R concepts – environmental impact assessment (EIA) – sustainable habitat – green buildings, green materials, sustainable transport. |                                                                                                                                                                           |                                             |                        |                         |
| <b>Activity</b><br>Sustainability assessment of campus/community.                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |                                             |                        |                         |
| L:45, SL:45, Total:90 Hours                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |                                             |                        |                         |
| <b>Weightage:</b><br>Continuous Assessment 40%<br>End Semester Examinations 60%                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                           |                                             |                        |                         |
| <b>REFERENCE BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |                                             |                        |                         |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                            | Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.                                          |                                             |                        |                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                            | Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi 2016.                                                                                  |                                             |                        |                         |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                            | Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.                                                         |                                             |                        |                         |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                            | Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.                                                           |                                             |                        |                         |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                            | Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.                                                                |                                             |                        |                         |
| <b>E-RESOURCES:</b>                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |                                             |                        |                         |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                            | www.ePathshala.nic.in                                                                                                                                                     |                                             |                        |                         |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                            | www.onlinecourses.nptel.ac.in/                                                                                                                                            |                                             |                        |                         |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                            | eGyanKosh – IGNOU Repository (http://egyankosh.ac.in)                                                                                                                     |                                             |                        |                         |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                            | https://www.unep.org                                                                                                                                                      |                                             |                        |                         |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                            | MIT OpenCourseWare (https://ocw.mit.edu)                                                                                                                                  |                                             |                        |                         |
| <b>COURSE OUTCOMES (COs) /<br/>At the end of the course, the students will have the ability to</b>                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |                                             | <b>Mapping<br/>POs</b> | <b>Mapping<br/>PSOs</b> |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Explain the principles of ecology, biodiversity, environmental pollution, sustainable energy resources, climate change, and environmental sustainability.                 |                                             | ---                    | ---                     |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Apply environmental concepts and scientific principles to analyze ecosystem functions, pollution problems, biodiversity conservation, and sustainable energy utilization. |                                             | PO1                    | ---                     |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Analyze environmental challenges by correlating ecological processes, pollution impacts, climate change effects, and sustainability indicators.                           |                                             | PO2, PO7               | ---                     |
| <b>CO4</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Assess renewable energy technologies, climate management strategies, environmental policies, and sustainability practices for engineering applications.                   |                                             | PO6, PO7               | ---                     |

|            |                                                                                                                                                                                                            |           |     |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|
| <b>CO5</b> | Perform environmental observations, field studies, sustainability assessments, and activity-based investigations, and interpret the results using scientific methods.                                      | PO8       | --- |
| <b>CO6</b> | Engage in self-learning activities related to environmental management, biodiversity conservation, renewable energy, climate action, and sustainable development and communicate the findings effectively. | PO9, PO11 | --- |

### The Course Articulation Matrix (CAM) for defined COs

|            | <b>PO 1</b> | <b>PO 2</b> | <b>PO 3</b> | <b>PO 4</b> | <b>PO 5</b> | <b>PO 6</b> | <b>PO 7</b> | <b>PO 8</b> | <b>PO 9</b> | <b>PO 10</b> | <b>PO 11</b> | <b>PSO 1</b> | <b>PSO 2</b> | <b>PSO 3</b> |
|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|
| <b>CO1</b> |             |             |             |             |             |             |             |             |             |              |              |              |              |              |
| <b>CO2</b> | 3           |             |             |             |             |             |             |             |             |              |              |              |              |              |
| <b>CO3</b> |             | 3           |             |             |             |             | 3           |             |             |              |              |              |              |              |
| <b>CO4</b> |             |             |             |             |             | 2           | 2           |             |             |              |              |              |              |              |
| <b>CO5</b> |             |             |             |             |             |             |             | 2           |             |              |              |              |              |              |
| <b>CO6</b> |             |             |             |             |             |             |             |             | 2           |              | 2            |              |              |              |

### Activities:

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Conduct field-based and activity-oriented studies related to ecosystems, biodiversity, environmental pollution, renewable energy resources, climate change impacts, carbon footprint assessment, waste management, and sustainability practices, and prepare reports based on observations and findings.<br><b>(CO5) (Individual and Collaborative Team Work)</b>                                                                                                                                                                               |
| 2. | i) A comprehensive environmental impact assessment study on environmental sustainability, public welfare, regulatory compliance, and ethical responsibilities. <b>(CO4) (Independent study)</b><br>ii) Participate in self-learning activities such as seminars, case studies, quizzes, presentations, and literature reviews on environmental conservation, sustainable energy technologies, climate agreements, environmental legislation, SDGs, green buildings, and sustainable transportation systems.<br><b>(CO6) (Independent study)</b> |

### Rubrics for evaluation:CO4

| <b>Sl. No.</b> | <b>Criterion</b>                            | <b>Marks</b> | <b>Excellent (3)</b>                                                                                           | <b>Good (2)</b>                                                                | <b>Satisfactory (1)</b>                                           |
|----------------|---------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1              | Environmental Sustainability Assessment     | 10           | Comprehensive evaluation of environmental impacts and sustainability measures with strong supporting evidence. | Adequate evaluation of major environmental impacts and sustainability aspects. | Limited or incomplete assessment of environmental sustainability. |
| 2              | Public Welfare and Societal Impact Analysis | 5            | Thorough analysis of impacts on public health, safety, and community welfare with clear justification.         | Identifies key societal impacts with moderate analysis.                        | Limited discussion of public welfare and societal impacts.        |

|   |                                  |           |                                                                                           |                                                         |                                                            |
|---|----------------------------------|-----------|-------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------------------------------|
| 3 | Regulatory Compliance Evaluation | 5         | Clearly assesses compliance with relevant environmental laws, regulations, and standards. | Addresses major regulatory requirements with some gaps. | Minimal or inaccurate assessment of regulatory compliance. |
|   | <b>Total</b>                     | <b>20</b> |                                                                                           |                                                         |                                                            |

#### Rubrics for evaluation: CO5

| Sl. No. | Criterion                               | Marks     | Excellent (3)                                                   | Good(2)                            | Satisfactory (1)      |
|---------|-----------------------------------------|-----------|-----------------------------------------------------------------|------------------------------------|-----------------------|
| 1       | Understanding of Environmental Concepts | 10        | Demonstrates thorough understanding and accurate interpretation | Good understanding with minor gaps | Basic understanding   |
| 2       | Data Collection and Observation         | 10        | Accurate, systematic, and comprehensive observations            | Mostly accurate observations       | Adequate observations |
| 3       | Analysis and Interpretation             | 10        | Excellent scientific analysis and interpretation                | Good analysis with minor errors    | Basic analysis        |
| 4       | Report/Presentation Quality             | 10        | Clear, organized, and professional                              | Well organized with minor issues   | Moderately organized  |
|         | <b>Total</b>                            | <b>40</b> |                                                                 |                                    |                       |

#### Rubrics for evaluation: CO6

| Sl. No. | Criterion                      | Marks     | Excellent (3)                             | Good(2)            | Satisfactory (1)       |
|---------|--------------------------------|-----------|-------------------------------------------|--------------------|------------------------|
| 1       | Conceptual Clarity             | 10        | Complete understanding and clarity        | Good understanding | Moderate understanding |
| 2       | Accuracy of Content            | 5         | Scientifically accurate and comprehensive | Mostly accurate    | Some inaccuracies      |
| 3       | Participation and Preparedness | 5         | Highly engaged and well prepared          | Well prepared      | Partially prepared     |
|         | <b>Total</b>                   | <b>20</b> |                                           |                    |                        |

#### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO4</b>   |           |           |            | 20          | 10                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 20          | 10                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);

Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                            |                                                                     |                    |    |         |   |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------|----|---------|---|----|----|
| 26MCC03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | UNIVERSAL HUMAN VALUES<br>B.E. (Common to All Branches)                                                                                                                                                    |                                                                     | SEMESTER           |    |         |   | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                            |                                                                     | Category           | MC | Credits |   |    | 3  |
| Basic awareness of human values, personal behaviour, family relationships, social responsibility, and ethical conduct in daily life. Familiarity with the ideas of self-reflection, harmony, happiness, prosperity, and responsible living will be helpful.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                            |                                                                     | Hours/<br>Semester | L  | T       | P | SL | TH |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                            |                                                                     |                    | 45 | -       | - | 45 | 90 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |                                                                     |                    |    |         |   |    |    |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand the need, purpose, basic guidelines, content, and process of value education through self-exploration and natural acceptance.                                                                |                                                                     |                    |    |         |   |    |    |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To develop awareness of continuous happiness, prosperity, right understanding, relationship, and physical facility as the basic human aspirations.                                                         |                                                                     |                    |    |         |   |    |    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand harmony in the human being by studying the co-existence of the sentient 'I' and the material 'Body', along with Sanyam, health, and prosperity.                                              |                                                                     |                    |    |         |   |    |    |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To understand harmony in family and society through human relationships, trust, respect, justice, fearlessness, prosperity, and universal harmonious order.                                                |                                                                     |                    |    |         |   |    |    |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | To realize harmony in nature and existence and apply holistic understanding of human values to professional ethics, ethical human conduct, sustainable development, and responsible professional practice. |                                                                     |                    |    |         |   |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            | INTRODUCTION TO UNIVERSAL HUMAN VALUES AND HUMAN ASPIRATIONS        |                    |    |         |   |    |    |
| Course Introduction - Need, Basic Guidelines, Content and Process for Value Education. Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations- understanding and living in harmony at various levels.                                                                     |                                                                                                                                                                                                            |                                                                     |                    |    |         |   |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                            | HARMONY IN THE HUMAN BEING: SELF AND BODY                           |                    |    |         |   |    |    |
| Understanding Harmony in the Human Being - Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.                                                                                                                                                                                                                                                      |                                                                                                                                                                                                            |                                                                     |                    |    |         |   |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                            | HARMONY IN FAMILY AND SOCIETY: HUMAN RELATIONSHIPS AND SOCIAL ORDER |                    |    |         |   |    |    |
| Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship Understanding values in human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society Undivided Society, Universal Order- from family to world family. |                                                                                                                                                                                                            |                                                                     |                    |    |         |   |    |    |

|                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------|---------------------|
| <b>UNIT - IV</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                    | <b>HARMONY IN NATURE AND EXISTENCE</b>               |                    |                     |
| Understanding Harmony in the Nature and Existence - Whole existence as Coexistence. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space. Holistic perception of harmony at all levels of existence. |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| <b>UNIT - V</b>                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                    | <b>PROFESSIONAL ETHICS AND UNIVERSAL HUMAN ORDER</b> |                    |                     |
| Implications of the above Holistic Understanding of Harmony on Professional Ethics. Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics, Strategy for transition from the present state to Universal Human Order.                                          |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| <b>L:45, SL:45, Total:90 Hours</b>                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| <b>Weightage:</b><br>Continuous Assessment: 40%<br>End Semester Examinations: 60%                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| <b>REFERENCE BOOKS:</b>                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                            | "Human Values and Professional Ethics", R R Gaur., R Sangal., G P Bagaria, Excel Books, New Delhi, 2010                                                                                                                                            |                                                      |                    |                     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                            | "Human Values", A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.                                                                                                                                                                          |                                                      |                    |                     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                            | "The Story of Stuff", Annie Leonard, 2007 documentary.                                                                                                                                                                                             |                                                      |                    |                     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                            | "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi                                                                                                                                                                               |                                                      |                    |                     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                            | "Small is Beautiful" - E. F Schumacher.                                                                                                                                                                                                            |                                                      |                    |                     |
| <b>E-RESOURCES:</b>                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                    |                                                      |                    |                     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                            | AICTE, "Universal Human Values," All India Council for Technical Education, <a href="https://www.aicte.gov.in/bureaus/universal-human-values-cell">https://www.aicte.gov.in/bureaus/universal-human-values-cell</a>                                |                                                      |                    |                     |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                            | UHV Foundation, "Universal Human Values and Professional Ethics," <a href="https://uhv.org.in">https://uhv.org.in</a>                                                                                                                              |                                                      |                    |                     |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                            | Value Education Cell, "Universal Human Values Resources," <a href="https://fdp-si.aicte-india.org">https://fdp-si.aicte-india.org</a>                                                                                                              |                                                      |                    |                     |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                            | SWAYAM, "Human Values and Professional Ethics," Ministry of Education, Government of India, <a href="https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125">https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125</a>    |                                                      |                    |                     |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                            | Universal Human Values Foundation <a href="https://uhv.org.in/">https://uhv.org.in/</a>                                                                                                                                                            |                                                      |                    |                     |
| <b>COURSE OUTCOMES (COs) /</b><br><b>At the end of the course, the students will have the ability to</b>                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                    |                                                      | <b>Mapping POs</b> | <b>Mapping PSOs</b> |
| <b>CO1</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Remember and understand the basic concepts, purpose, need, process, and guidelines of value education, including self-exploration, natural acceptance, continuous happiness, prosperity, right understanding, relationship, and physical facility. |                                                      | --                 | --                  |
| <b>CO2</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Apply the principles of self-exploration, natural acceptance, right understanding, relationship, and physical facility to assess human aspirations and improve harmony in personal life.                                                           |                                                      | PO6                | --                  |
| <b>CO3</b>                                                                                                                                                                                                                                                                                                                                                                                                    | Analyse harmony in the human being by understanding the co-existence of the sentient 'I' and the material 'Body', the needs of self and body, Sanyam, health, and prosperity.                                                                      |                                                      | PO7                | --                  |

|            |                                                                                                                                                                                                        |      |    |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|
| <b>C04</b> | Examine harmony in family and society by understanding values in human relationships, justice, trust, respect, fearlessness, prosperity, co-existence, and universal harmonious order.                 | PO8  | -- |
| <b>C05</b> | Evaluate harmony in nature and existence by understanding interconnectedness, mutual fulfilment, recyclability, self-regulation, and holistic perception of coexistence at all levels.                 | PO6  | -- |
| <b>C06</b> | Integrate holistic understanding of human values, harmony, and ethical conduct to professional practice by considering societal needs, responsible decision-making, and sustainable human development. | PO11 | -- |

#### The Course Articulation Matrix (CAM) for defined COs

|            | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO 1 | PSO 2 | PSO 3 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| <b>C01</b> |      |      |      |      |      |      |      |      |      |       |       |       |       |       |
| <b>C02</b> |      |      |      |      |      | 2    |      |      |      |       |       |       |       |       |
| <b>C03</b> |      |      |      |      |      |      | 2    |      |      |       |       |       |       |       |
| <b>C04</b> |      |      |      |      |      |      |      | 1    |      |       |       |       |       |       |
| <b>C05</b> |      |      |      |      |      | 3    |      |      |      |       |       |       |       |       |
| <b>C06</b> |      |      |      |      |      |      |      |      |      |       | 3     |       |       |       |
| <b>Avg</b> |      |      |      |      |      | 2.5  | 2    | 1    |      |       | 3     |       |       |       |

#### Activities:

|    |                                                                                                                                                                                                                                                                                                        |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Students shall prepare a short reflective assignment on harmony in nature, interconnectedness, mutual fulfilment, recyclability, self-regulation, and coexistence at different levels of existence. This activity helps students understand the importance of sustainable living and holistic harmony. |
| 2. | Students shall analyse a real-life case study related to professional ethics, responsible decision-making, societal needs, or sustainable human development. This activity develops the ability to apply human values, ethical conduct, and holistic understanding in professional and social life.    |

#### Rubrics for evaluation: C05

| Sl. No. | Criterion                       | Marks | Excellent (9-10)                                                                     | Good (6-8)                                  | Satisfactory (1-5)             |
|---------|---------------------------------|-------|--------------------------------------------------------------------------------------|---------------------------------------------|--------------------------------|
| 1       | Understanding harmony in nature | 10    | Clearly explains harmony, interconnectedness, and mutual fulfilment in nature        | Explains the concept with minor gaps        | Shows limited understanding    |
| 2       | Reflection on coexistence       | 10    | Provides meaningful reflection on coexistence, recyclability, and self-regulation    | Reflection is relevant but needs more depth | Reflection is basic or unclear |
| 3       | Practical relevance             | 10    | Relates harmony in nature to sustainable living and human responsibility effectively | Relates the concept with limited examples   | Practical relevance is weak    |

|   |                            |           |                                                           |                                               |                                              |
|---|----------------------------|-----------|-----------------------------------------------------------|-----------------------------------------------|----------------------------------------------|
| 4 | Presentation of assignment | 10        | Assignment is well-organized, clear, and neatly presented | Assignment is organized but needs improvement | Assignment is incomplete or poorly presented |
|   | <b>Total</b>               | <b>40</b> |                                                           |                                               |                                              |

#### Rubrics for evaluation: CO6

| Sl. No. | Criterion                       | Marks     | Excellent (9-10)                                                      | Good (6-8)                                          | Satisfactory (1-5)                        |
|---------|---------------------------------|-----------|-----------------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|
| 1       | Selection of ethical case study | 10        | Suitable case study is selected with clear ethical relevance          | Case study is relevant but needs minor clarity      | Case study selection is basic or unclear  |
| 2       | Application of human values     | 10        | Human values and ethical principles are applied effectively           | Values are applied with minor gaps                  | Application of values is weak             |
| 3       | Responsible decision-making     | 10        | Provides clear, responsible, and sustainable decision-making approach | Decision-making is acceptable but needs improvement | Decision-making is unclear or incomplete  |
| 4       | Report writing and conclusion   | 10        | Report is well-structured with clear conclusion                       | Report is organized but needs improvement           | Report is incomplete or poorly structured |
|         | <b>Total</b>                    | <b>40</b> |                                                                       |                                                     |                                           |

#### The Internal Assessment Matrix (IAM) for the defined COs:

| CO           | Test I    | Test II   | Activity I | Activity II | Percentage Allocation | Mapping Strength |
|--------------|-----------|-----------|------------|-------------|-----------------------|------------------|
| <b>CO1</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO2</b>   | 24        | 24        |            |             | 24                    | 3                |
| <b>CO3</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO4</b>   | 12        | 12        |            |             | 12                    | 2                |
| <b>CO5</b>   |           |           | 40         |             | 20                    | 2                |
| <b>CO6</b>   |           |           |            | 40          | 20                    | 2                |
| <b>Total</b> | <b>60</b> | <b>60</b> | <b>40</b>  | <b>40</b>   | <b>100</b>            |                  |

Note: Purely as an Example: Strength = 3 (if percentage >20%);  
Strength = 2 (if percentage 10% to 20%); Strength = 1 (if percentage <10%);

|                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--|--------------------|----------|---------|----|----|----|
| 26MCS03                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                     | DESIGN SPRINTS                          |  |                    | SEMESTER |         |    | IV |    |
| Prerequisites                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                     |                                         |  | Category           | SD       | Credits |    | 0  |    |
|                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                     |                                         |  | Hours/<br>Semester | L        | T       | P  | SL | TH |
|                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                     |                                         |  |                    | 0        | 0       | 15 | 15 | 30 |
| COURSE OBJECTIVES                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| 1.                                                                                                                                                                                                                                                                                                                               | Develop key skill areas essential for a product designer from the perspective of design, its inherent complexity, and support them with tools and techniques for rapid prototyping. |                                         |  |                    |          |         |    |    |    |
| 2.                                                                                                                                                                                                                                                                                                                               | Enable the participants to visualize and understand the user experience effectively.                                                                                                |                                         |  |                    |          |         |    |    |    |
| 3.                                                                                                                                                                                                                                                                                                                               | Learn the roles and responsibilities of a designer in creating and shaping user experiences.                                                                                        |                                         |  |                    |          |         |    |    |    |
| 4.                                                                                                                                                                                                                                                                                                                               | Understand how existing products and systems function through the principles of system thinking.                                                                                    |                                         |  |                    |          |         |    |    |    |
| 5.                                                                                                                                                                                                                                                                                                                               | Select and apply various tools, techniques, and practices to support rapid prototyping and product development.                                                                     |                                         |  |                    |          |         |    |    |    |
|                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| UNIT - I                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                     | DESIGN FUNDAMENTALS                     |  |                    |          |         |    |    | 3  |
| Introduction to Visual Design, History and Modernism, Design Thinking methodology, seven elements of design, principles of design, principles of good design, designing a product and a service.                                                                                                                                 |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| UNIT - II                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                     | SYSTEM THINKING AND REVERSE ENGINEERING |  |                    |          |         |    |    | 3  |
| System Thinking for Engineering Problem Solving, Understanding Systems, Examples and understandings, Complex Systems, Reverse Engineering Methodology, Identify building blocks/Components - Re-Engineering a complex system                                                                                                     |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| UNIT - III                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                     | USER INTERFACE & USER EXPERIENCE        |  |                    |          |         |    |    | 3  |
| Introduction to UI/UX, Human-Computer interface, user-centered Design Principles, User research techniques, UX Design workflow, Information Architecture, UI Components, need for UI prototyping, Wireframes.                                                                                                                    |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| UNIT - IV                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                     | MECHANICAL PROTOTYPING                  |  |                    |          |         |    |    | 3  |
| Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Introduction - Working with Fusion 360 - 3D Modeling - 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing. |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| UNIT - V                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                     | ELECTRONIC & SOFTWARE PROTOTYPING       |  |                    |          |         |    |    | 3  |
| Introduction to Lumped Circuits - Electronic Prototyping - Tinker CAD - Designing in KI CAD - PCB design - Source code management and version control - GitHub - GitHub Actions - GitBash - Continuous Integration - Platform as service - Heroku - Build Packs.                                                                 |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| P:15, SL:15, Total:30 Hours                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| Weightage:                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |
| Continuous Assessment 100%                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                     |                                         |  |                    |          |         |    |    |    |

| REFERENCE BOOKS:                                                                           |                                                                                                                                                                                                                                                                                    |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|----------------------|------|-----------------|-------|-------|
| 1.                                                                                         | Thinking in Systems – Donella Meadows, 2015.                                                                                                                                                                                                                                       |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 2.                                                                                         | Rapid Prototyping and Engineering Applications: A Toolbox for Prototype Development – Frank W. Liou, 2007.                                                                                                                                                                         |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 3.                                                                                         | Rapid Prototyping Technology: Selection and Application – Cooper K. G., 2001.                                                                                                                                                                                                      |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 4.                                                                                         | Introduction to Systems Thinking – <a href="https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf">https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf</a>                   |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 5.                                                                                         | Ultimate Guide to Prototyping Tools for Hardware and Product Design – <a href="https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/">https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/</a>  |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| E-RESOURCES:                                                                               |                                                                                                                                                                                                                                                                                    |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 1.                                                                                         | Introduction to Systems Thinking<br><a href="https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf">https://thesystemsthinker.com/wp-content/uploads/2016/03/Introduction-to-Systems-Thinking-IMS013Epk.pdf</a>                  |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 2.                                                                                         | Ultimate Guide to Prototyping Tools for Hardware and Product Design<br><a href="https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/">https://formlabs.com/blog/ultimate-guide-to-prototyping-tools-for-hardware-and-product-design/</a> |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 3.                                                                                         | KiCad Documentation<br><a href="https://docs.kicad-pcb.org/">https://docs.kicad-pcb.org/</a>                                                                                                                                                                                       |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 4.                                                                                         | Tinkercad Circuits Learning Resources<br><a href="https://www.tinkercad.com/learn/circuits">https://www.tinkercad.com/learn/circuits</a>                                                                                                                                           |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 5.                                                                                         | GitHub Actions Documentation<br><a href="https://docs.github.com/en/actions">https://docs.github.com/en/actions</a>                                                                                                                                                                |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| 6.                                                                                         | GitHub Actions Guides<br><a href="https://docs.github.com/en/free-pro-team@latest/actions/guides">https://docs.github.com/en/free-pro-team@latest/actions/guides</a>                                                                                                               |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
| COURSE OUTCOMES (COs) /<br>At the end of the course, the students will have the ability to |                                                                                                                                                                                                                                                                                    |     |     |     |     |     |     |     |     | Mapping<br>POs       |      | Mapping<br>PSOs |       |       |
| CO1                                                                                        | Understand the elements and principles of product and service design.                                                                                                                                                                                                              |     |     |     |     |     |     |     |     | PO9, PO11            |      | -               |       |       |
| CO2                                                                                        | Apply system thinking concepts in reverse engineering.                                                                                                                                                                                                                             |     |     |     |     |     |     |     |     | PO2, PO9             |      | PSO1            |       |       |
| CO3                                                                                        | Apply user research techniques to meet the UX needs of a customer and design a visual prototype.                                                                                                                                                                                   |     |     |     |     |     |     |     |     | PO5, PO9, PO10       |      | PSO1            |       |       |
| CO4                                                                                        | Develop prototyping models using the tools from mechanical prototyping methods.                                                                                                                                                                                                    |     |     |     |     |     |     |     |     | PO3, PO5, PO9        |      | PSO2            |       |       |
| CO5                                                                                        | Develop prototyping models using the tools from electrical and software prototyping methods.                                                                                                                                                                                       |     |     |     |     |     |     |     |     | PO3, PO5, PO9        |      | PSO2            |       |       |
| CO6                                                                                        | Demonstrate design thinking, problem-solving, teamwork, and innovation skills in developing user-centric product prototypes.                                                                                                                                                       |     |     |     |     |     |     |     |     | PO8, PO9, PO10, PO11 |      | PSO3            |       |       |
| The Course Articulation Matrix (CAM) for defined Cos                                       |                                                                                                                                                                                                                                                                                    |     |     |     |     |     |     |     |     |                      |      |                 |       |       |
|                                                                                            | PO1                                                                                                                                                                                                                                                                                | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10                 | PO11 | PSO01           | PSO02 | PSO03 |
| CO1                                                                                        |                                                                                                                                                                                                                                                                                    | -   | -   | -   | -   | -   | -   | -   | 3   | -                    | 2    | -               | -     | -     |
| CO2                                                                                        | -                                                                                                                                                                                                                                                                                  | 3   | -   | -   | -   | -   | -   | -   | 3   | -                    | -    | 3               | -     | -     |
| CO3                                                                                        | -                                                                                                                                                                                                                                                                                  | -   | -   | -   | 3   | -   | -   | -   | 3   | 2                    | -    | 2               | -     | -     |
| CO4                                                                                        | -                                                                                                                                                                                                                                                                                  | -   | 3   | -   | 3   | -   | -   | -   | 2   | -                    | -    | -               | 3     | -     |
| CO5                                                                                        | -                                                                                                                                                                                                                                                                                  | -   | 3   | -   | 3   | -   | -   | -   | 2   | -                    | -    | -               | 3     | -     |
| CO6                                                                                        | -                                                                                                                                                                                                                                                                                  | -   | -   | -   | -   | -   | -   | 3   | 3   | 2                    | 2    | -               | -     | 3     |

**Activities:**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Activity 1: Design Research and Concept Development Sprint</b><br>Observe and analyze existing products and systems, identify user needs through surveys and interviews, apply design principles, system thinking, and reverse engineering concepts, develop user personas, journey maps, sketches, and wireframes, generate and evaluate design alternatives, select suitable solutions, document findings, and present the proposed design concept.  |
| 2. | <b>Activity 2: Prototype Development and Design Sprint Showcase</b><br>Create CAD models and prototypes, integrate mechanical, electronic, and software components, conduct testing and validation activities, evaluate performance, collect feedback and refine the prototype, document development and testing processes, demonstrate the developed prototype, present project outcomes, and showcase innovation, teamwork, and problem-solving skills. |

**Rubrics for evaluation: CO5**

| Sl. No. | Criterion                                   | Marks      | Excellent (3)                                                                                   | Good (2)                                                    | Satisfactory (1)                                                 |
|---------|---------------------------------------------|------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------|
| 1.      | Prototype Design and Development            | 25         | Develops a complete and functional electronic/software prototype meeting all requirements       | Develops a functional prototype with minor limitations      | Develops a basic prototype with significant limitations          |
| 2.      | Application of Tools and Technologies       | 25         | Effectively utilizes prototyping tools, software platforms, and design techniques               | Utilizes tools appropriately with minor errors              | Demonstrates limited proficiency in using tools and technologies |
| 3.      | Testing, Validation, and Documentation      | 25         | Performs comprehensive testing, validation, and provides detailed documentation                 | Performs adequate testing and documentation with minor gaps | Limited testing and incomplete documentation                     |
| 4.      | Innovation, Presentation, and Demonstration | 25         | Demonstrates innovative features and presents the prototype effectively with clear explanations | Demonstrates useful features and presents satisfactorily    | Limited innovation and ineffective presentation of the prototype |
|         | <b>Total</b>                                | <b>100</b> |                                                                                                 |                                                             |                                                                  |

**Rubrics for evaluation: CO6**

| Sl. No. | Criterion                           | Marks | Excellent (3)                                                                                     | Good (2)                                                           | Satisfactory (1)                                                      |
|---------|-------------------------------------|-------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1.      | Design Thinking and Problem Solving | 25    | Demonstrates a thorough understanding of user needs and develops innovative solutions effectively | Demonstrates good understanding with minor gaps in problem-solving | Demonstrates basic understanding with limited problem-solving ability |

|    |                                           |            |                                                                                       |                                                                       |                                                                                  |
|----|-------------------------------------------|------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 2. | Teamwork and Collaboration                | 25         | Actively contributes, collaborates effectively, and supports team objectives          | Participates well with minor collaboration issues                     | Participates minimally with limited teamwork                                     |
| 3. | Innovation and Creativity                 | 25         | Demonstrates highly innovative ideas and creative approaches in product development   | Demonstrates good innovation with moderate creativity                 | Demonstrates limited innovation and creativity                                   |
| 4. | Prototype Demonstration and Communication | 25         | Clearly demonstrates the prototype and communicates ideas confidently and effectively | Demonstrates the prototype adequately with minor communication issues | Demonstrates limited communication skills and ineffective prototype presentation |
|    | <b>Total</b>                              | <b>100</b> |                                                                                       |                                                                       |                                                                                  |