GOVERNMENT COLLEGE OF ENGINEERING, Salem - 11

(An Autonomous Institution affiliated to Anna University, Chennai)

B.E. DEGREE IN CIVIL ENGINEERING

CURRICULUM FOR 2018 REGULATIONS

FIRST SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18MA101	Matrices and Calculus	BS	40	60	100	3	1	0	4
2	18PH101	Physics – Mechanics	BS	40	60	100	3	1	0	4
3	18EE101	Basic Electrical and Electronic Engineering	ES	40	60	100	3	1	0	4
4	18ME101	Engineering Graphics and Design	ES	40	60	100	1	0	4	3
		PRACTICAL								
5	18PH103	Physics Laboratory	BS	40	60	100	0	0	3	1.5
6	18CY102	Chemistry laboratory	BS	40	60	100	0	0	3	1.5
7	18EE102	Basic Electrical and Electronics Engineering Laboratory	ES	40	60	100	0	0	2	1
8	18EN103	Professional Communication Laboratory	HS	40	60	100	0	0	2	1
		Mandatory courses (non- credit)								
9	18MC101	Induction program	MC							
		TOTAL		320	480	800	10	3	14	**20**

SECOND SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18EN101	Professional English	HS	40	60	100	2	0	0	2
2	18MA205	Differential Equations and Transforms	BS	40	60	100	3	1	0	4
3	18CY101	Chemistry	BS	40	60	100	3	1	0	4
4	18CS101	Fundamentals of Problem Solving and C Programming	ES	40	60	100	3	0	0	3
		PRACTICAL								
5	18EN102	Professional English Laboratory	HS	40	60	100	0	0	2	1

6	18CS102	Computer Practice Laboratory	ES	40	60	100	0	0	4	2
7	18ME102	Workshop Manufacturing Practices	ES	40	60	100	1	0	4	3
		TOTAL		280	420	700	12	2	10	**19**

THIRD SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18MA302	Statistics and Numerical Methods	BS	40	60	100	3	1	0	4
2	18CY301	Biology for Engineers	BS	40	60	100	2	1	0	3
3	18ES205	Mechanics of Solids	ES	40	60	100	3	0	0	3
4	18CE301	Mechanics of Fluids	PC	40	60	100	3	0	0	3
5	18CE302	Surveying & Geomatics	PC	40	60	100	3	0	0	3
		Theory cum Practical								
6	18EN301	Effective Technical Communication	HS	60	40	100	2	0	2	3
		PRACTICAL								
7	18CE303	Surveying Practical	PC	40	60	100	0	0	4	2
8	18CE304	Computer Aided Building Drawing	PC	40	60	100	0	0	4	2
		TOTAL		340	460	**800**	16	2	10	**23**

FOURTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18CE401	Strength of Materials	PC	40	60	100	3	1	0	4
2	18CE402	Design of Steel Structural Elements	PC	40	60	100	3	0	0	3
3	18CE403	Engineering Geology	PC	40	60	100	2	0	0	2
4	18CE404	Water Supply Engineering	PC	40	60	100	3	0	0	3
5	18CE405	Applied Hydraulics and Fluid Machinery	PC	40	60	100	3	0	0	3
6	18CE406	Concrete Technology	PC	40	60	100	3	0	0	3

		PRACTICAL								
7	18CE407	Material Testing & Evaluation Lab	PC	40	60	100	0	0	4	2
8	18CE408	Hydraulic Engineering Laboratory	PC	40	60	100	0	0	4	2
		Mandatory courses (non-credit)								
9	18CEMC01	Disaster Preparedness & Planning	MC	-	-	-	2	-	-	-
		TOTAL		320	480	**800**	19	1	8	**22**

FIFTHSEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18CE501	Basic Structural Analysis	PC	40	60	100	3	0	0	3
2	18CE502	Mechanics of Soils	PC	40	60	100	3	0	0	3
3	18CE503	Water Resources Engineering	PC	40	60	100	3	0	0	3
4	18CE504	Design of Reinforced Concrete Elements	PC	40	60	100	3	0	0	3
5	18CE505	Waste Water Engineering	PC	40	60	100	3	0	0	3
6	18CE506	Transportation Engineering	PC	40	60	100	3	0	0	3
		PRACTICAL								
7	18CE507	Geotechnical Laboratory	PC	40	60	100	0	0	4	2
8	18CE508	Environmental Engineering laboratory	PC	40	60	100	0	0	4	2
		Mandatory courses(non-credit)								
9	18MC301	Indian Constitution	MC	-	-	-	2	-	-	-
		TOTAL		320	480	**800**	20	0	8	**22**

SIXTHSEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18CE601	Advanced Structural Analysis	PC	40	60	100	3	0	0	3
2	18CE602	Foundation Engineering	PC	40	60	100	3	0	0	3

3	18CE603	Engineering Economics, Estimation and Costing	PC	40	60	100	3	0	0	3
4	18CE604	Professional Practices, Ethics and Building by-laws	HS	40	60	100	2	0	0	2
5	18CEPExx	Professional Elective - I	PE	40	60	100	3	0	0	3
6	18CEPExx	Professional Elective – II	PE	40	60	100	3	0	0	3
		PRACTICAL								
7	18CE605	Concrete Laboratory	PC	40	60	100	0	0	4	2
8	18CE606	Computer Aided Design and Drawing (Concrete & Steel)	PC	40	60	100	0	0	4	2
		TOTAL		320	480	**800**	17	0	8	**21**

SEVENTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18CEOExx	Open Elective – I	OE	40	60	100	3	0	0	3
2	18CEOExx	Open Elective - II	OE	40	60	100	3	0	0	3
3	18CEPExx	Professional Elective - III	PE	40	60	100	3	0	0	3
4	18CEPExx	Professional Elective – IV	PE	40	60	100	3	0	0	3
		PRACTICAL								
5	18CE701	Internship/Industrial training/Academic attachment*	EEC	100		100				2
6	18CE702	Design project	EEC	60	40	100	0	0	12	4
		TOTAL		320	280	600	12	0	12	**18**

*Students will undergo Internship/Industrial training/Academic attachment during the VI Semester vacation (minimum of four weeks) and evaluation will be done during VII Semester

EIGHTH SEMESTER

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
		THEORY								
1	18CE801	Construction Management	PC	40	60	100	3	0	0	3
2	18CEPExx	Professional Elective - V	PE	40	60	100	3	0	0	3
3	18CEPExx	Professional Elective - VI	PE	40	60	100	3	0	0	3

		PRACTICAL								
4	18CE802	Project Work	EEC	60	40	100	0	0	12	6
		TOTAL		180	220	400	9	0	12	**15**

Civil Engineering Scheme of Instruction

Course component	**Credits**	**Curriculum Content (% of total number of credits of the programme)**
Humanities and Social Sciences	9	5.63
Engineering Sciences	19	11.9
Basic Sciences	26	16.25
Professional Core	70	43.75
Professional Elective	18	11.25
Open Elective	06	3.75
Empl.Enhancement Courses	12	7.5
Mandatory Course (Zero Credit)	0	0
Total	160	100

HS = Humanities and Social Sciences
BS = Basic Sciences
ES = Engineering Sciences
PC = Professional Core
PE = Professional Elective
OE = Open Electives
EEC = Employability Enhancement Courses

LIST OF ELECTIVES FOR B.E. CIVIL ENGINEERING

Professional Electives (PE)

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
Transportation Engineering										
1	18CEPE01	Traffic Engineering	PE	40	60	100	3	0	0	3
2	18CEPE02	Airports, Docks and Harbors Engineering	PE	40	60	100	3	0	0	3
3	18CEPE03	Integrated Traffic Planning and Management	PE	40	60	100	3	0	0	3
Construction Engineering and Management										
4	18CEPE04	Smart Materials and Smart Structures	PE	40	60	100	3	0	0	3
5	18CEPE05	Construction Techniques and Equipments	PE	40	60	100	3	0	0	3
6	18CEPE06	Project Safety Management	PE	40	60	100	3	0	0	3
7	18CEPE07	Repair and Rehabilitation of Structures	PE	40	60	100	3	0	0	3
Environmental Engineering										
8	18CEPE08	Industrial Waste Management	PE	40	60	100	3	0	0	3
9	18CEPE09	Hazardous Waste Management	PE	40	60	100	3	0	0	3
10	18CEPE10	Air Pollution Monitoring and Control	PE	40	60	100	3	0	0	3
11	18CEPE11	Municipal Solid Waste Management	PE	40	60	100	3	0	0	3
12	18CEPE12	Marine Pollution Monitoring and Control	PE	40	60	100	3	0	0	3
13	18CEPE13	Environmental Impact Assessment	PE	40	60	100	3	0	0	3
Hydraulics										
14	18CEPE14	Open Channel Flow	PE	40	60	100	3	0	0	3
15	18CEPE15	River Engineering	PE	40	60	100	3	0	0	3
16	18CEPE16	Groundwater Engineering	PE	40	60	100	3	0	0	3
Hydrology & Water Resources Engineering										
17	18CEPE17	Irrigation Engineering	PE	40	60	100	3	0	0	3

18	18CEPE18	Water Shed Management	PE	40	60	100	3	0	0	3
19	18CEPE19	Hydrology	PE	40	60	100	3	0	0	3
Structural Engineering										
20	18CEPE20	Design of Bridges	PE	40	60	100	3	0	0	3
21	18CEPE21	Modern Structural Analysis	PE	40	60	100	3	0	0	3
22	18CEPE22	Storage Structures	PE	40	60	100	3	0	0	3
23	18CEPE23	Pre stressed Concrete Structures	PE	40	60	100	3	0	0	3
24	18CEPE24	Advanced Steel Structures	PE	40	60	100	3	0	0	3
25	18CEPE25	Tall Buildings	PE	40	60	100	3	0	0	3
26	18CEPE26	Prefabricated Structures	PE	40	60	100	3	0	0	3
27	18CEPE27	Design of Composite Structures	PE	40	60	100	3	0	0	3
28	18CEPE28	Coastal Structures	PE	40	60	100	3	0	0	3
29	18CEPE29	Dynamics and Earthquake Resistant Design of Structures	PE	40	60	100	3	0	0	3
30	18CEPE30	Industrial Structures	PE	40	60	100	3	0	0	3
31	18CEPE31	Ferrocement Technology	PE	40	60	100	3	0	0	3
32	18CEPE32	Finite Elements Analysis	PE	40	60	100	3	0	0	3
33	18CEPE33	Experimental Techniques and Instrumentation	PE	40	60	100	3	0	0	3
Geotechnical Engineering										
34	18CEPE34	Ground Improvement Techniques	PE	40	60	100	3	0	0	3
35	18CEPE35	Introduction to Soil Dynamics and Machine Foundation	PE	40	60	100	3	0	0	3
36	18CEPE36	Soil Structure Interaction	PE	40	60	100	3	0	0	3
37	18CEPE37	Subsurface Investigation and Instrumentation	PE	40	60	100	3	0	0	3
38	18CEPE38	Fundamentals of Remote Sensing and GIS	PE	40	60	100	3	0	0	3
39	18CEPE39	Advanced Surveying Techniques	PE	40	60	100	3	0	0	3

Open Electives (OE)

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
1	18CEOE01	Environmental Management	OE	40	60	100	3	0	0	3
2	18CEOE02	Disaster Mitigation and Management	OE	40	60	100	3	0	0	3
3	18CEOE03	Repair and Rehabilitation of Building Elements	OE	40	60	100	3	0	0	3
4	18CEOE04	Mechanics of Deformable bodies	OE	40	60	100	3	0	0	3

Mandatory Courses (MC)

Sl. No.	Subject Code	Course Title	CAT	CA Marks	End Sem. Marks	Total Marks	Credits			
							L	T	P	C
1	18CEMC01	Induction Program	MC	-	-	-	0	0	0	0
2	18CEMC02	Disaster Preparedness & Planning	MC	-	-	-	2	0	0	0
3	18MC301	Indian Constitution	MC	-	-	-	2	0	0	0

18EN301	Effective Technical Communication	L	T	P	C
		2	0	2	3

Course Objectives:

To help students

1.	• to participate actively in technical writingactivities.
2.	• to apply technical information and knowledge in practicaldocuments.
3.	• to revise and edit draftseffectively
4.	• to develop professional workhabits.

Methodology		**L**

- Technical Writing – writing reports - project report and event report, newsletter,technical articles, draft writing, official notes, business letters, progress reports, and minutes of meetings.
- Basics of grammar – tenses, phrasal verbs, punctuations, prepositions, study ofadvanced grammar – sentences cohesion and coherence, Idioms andphrases.
- Developing Professional work habits, Self-development and Assessment, Personalgoal setting, career planning, E-mail etiquettes, Telephoneetiquettes.
- Interview preparation, power-point presentation, groupdiscussions.
- Speaking on advanced technical topics, project review, public speaking, defendingopinions, review of newspaperarticles.

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	*:*	Prepare error free technical document reports and drafts efficiently.
CO2	*:*	Wirte technical documents grammatically sound
CO3	*:*	Be creative in setting targets in the work place.
CO4	*:*	Answer questions posed by interiviewers confidentially
CO5	*:*	Form opinions, orgnaise ideas, illustrate points, explain and defend viewpoint.

Text Books/ Reference Books:

1.	David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2.	Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3.	Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4.	Evans, D, Decision maker, Cambridge University Press, 2010.
5.	Sanjay kumar and Pushp Lata, Language and Communications skills for engineers, Oxford University press, India, 2018
6.	Muralikrishna, C and Sunita Mishra, Communication Skills for engineers, Pearson Education India ltd, 2011
7.	Ronald Carter, Michael Mc Carthy, Geraldine Mark and Anne O Keeffe, English Grammar Today, Cambridge University Press, India, 2016.

18MA302	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Course Objectives:

1.	To understand the statistical averages and fitting of curves.
2.	To gain the knowledge of significance test for large and small samples.
3.	To obtain the knowledge about numerical interpolation, differentiation and integration.
4.	To acquire knowledge of numerical solution to first order ordinary differential equations using single step and multi step methods.
5.	To gain the knowledge of numerical solution to second order partial differential equations by using explicit and implicit methods.

Unit I	BASIC STATISTICS	12	+	0

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	12	+	0

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	12	+	0

Solution of Algebraic and Transcendental equations by Newton-Raphson method- Solution of system of equations by Gauss Elimination and Gauss Seidal iterative methods - Interpolation using Newton's ForwardandBackwardformulae.Interpolationwithunequalintervals:Newton'sdivideddifference 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	12	+	0

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	12	+	0

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.

Total= 60 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Learn about statistical averages and fitting the curves by Least Square Method
CO2	:	Acquire the techniques of interpolation.
CO3	:	Familiar with the numerical differentiation and integration
CO4	:	Solve the initial value problems for ordinary differential equations.
CO5	:	Find the numerical solution of partial differential equation by using Finite difference method.

Text Books:

1. Veerarajan T, "Probability and Random Process (With Queuing theory)", 4thEdition, Tata McGraw

	Hill Education Pvt. Ltd., New Delhi, 2016.
2.	Kandasamy.P, Thilagavathy.K, Gunavathi.K, “Numerical Methods” S.Chand& Co., New Delhi, 2005.
3.	Gupta, S.C. and Kapur, V.K., “Fundamentals of Mathematical Statistics”, S.Chand and Sons, New Delhi, 11thEdition 2014
Reference Books:	
1.	Fruend John, E. and Miller Irwin, “Probability and Statistics for Engineers”, 8thEdition, Prentice Hall India (P) Ltd, 2010.
2.	Gerald, C. F. and Wheatley, P.O., “Applied Numerical Analysis” , Sixth Edition , Pearson Education Asia , New Delhi – 2002
3.	M.K.Venkataraman, “Numerical Methods”, National Publishing Company,2000
4.	Jain M.K.Iyengar, K & Jain R.K., “Numerical Methods for Scientific and Engineering Computation ”, New Age International (P) Ltd, Publishers 2003

18CY301	BIOLOGY FOR ENGINEERS	L	T	P	C
		2	1	0	3

Course Objectives:

1. To introduce students to modern biology with an emphasis on evolution of biology as a multi-disciplinary field and to make them aware of biological principles. The course will facilitate the students to:
   - Realize that all forms of life have the same buildingblocks.
   - Convey that without catalysis life would not have existed onearth.
   - Know the analysis of biological processes at the reduction level
   - Comprehend the fundamental principles of energy transactions are the same in physical and biologicalworld.

   Understand the fundamentals about the molecular basis of coding and decoding

Unit I	BIOMOLECULES	9	+	0

Carbohydrates- classification - Glucose properties and structural elucidation –fructose, sucrose, starch - structure only; Amino acids- classification- amphoteric nature of amino acids - zwitter ion - isoelectric point reactions of amino acids; Vitamins - general characteristics- classification- function and deficiency diseases.

Unit II	ENZYMES	9	+	0

Nomenclature - structure of enzymes – enzyme cofactors- properties of enzymes(catalytic properties, specificity, reversibility, sensitiveness to heat and inhibitors, colloidal nature)- mechanism of the enzyme action- lock and key mechanism and koshland induced fit mechanism -Factors affecting rate of enzyme reaction(temperature, pH, substrate concentration, enzyme concentration, water inhibitors, end product accumulation)- enzyme kinetics –michaelis-menten equation.

Unit III	MACROMOLECULES	9	+	0

Proteins- classification- structure of proteins- primary, secondary, tertiary and quaternary structure- properties of proteins- physical and chemical properties- colour reaction of proteins (biuret reaction, millions reaction, xanthoproteic reaction, ninhydrin reaction, azo dye reaction Hopkins Cole reaction) -Protein synthesis- mechanism of protein synthesis.

Unit IV	METABOLISM	9	+	0

Thermodynamics as applied to biological systems - exothermic and endothermic versus endergonic and exergonic reactions- concept of equilibrium constant and its relation to standard free energy- spontaneity -structure of ATP; Glycolysis- definition- flow chart- steps involved in glycolysis- preparatory phase and pay off phase- kinds of reactions in glycolysis; Photosynthesis- definition- significance photosynthetic- pigments types- structure of pigments factors affecting photosynthesis- external and internal factors.

Unit V	NUCLEIC ACIDS	9	+	0

Types-Structural components of nucleic acids- acid, pentose sugar and nitrogenous base- nucleoside – nucleotide and its functions - single and double helical structure of DNA-comparison between DNA and RNA- types of RNA- transcription -mRNA, tRNA and rRNA and their function - replication of DNA- genetic codecharacteristics

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Appreciate that all types of life have the identical structural units
CO2	:	Highlight the idea that without catalysis, living beings would not have existed on earth.
CO3	:	Be familiar with the investigation of biological processes at the reduction level.
CO4	:	Figureoutthat the primaryprinciplesofenergytransactionsarealikeinphysicaland biological world.
CO5	:	Recognize the ground rules about the molecular basis of coding and decoding.

Text Books:	
1.	FJ.L.Jain, Sanjay jain and Nitin jain- "Fundamentals of Biochemistry" - Sixth edition, S.Chand and company Ltd., Ram nagar, 2005.
2.	Dr.A.V.S.S.Rama Rao-" Text book of Biochemistry"- Text book of Biochemistry- First edition- UBS Publishers' Distributors Pvt. Ltd., 2008
3.	U. Satyanarayana –" Biochemistry"-5th edition – Sri Padmavathi Publications Ltd.,2017.
Reference Books:	
1.	Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B.-" Biology: A global approach"- Pearson Education Ltd
2.	Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H-" Outlines of Biochemistry"- John Wiley and Sons
3.	By Nelson, D. L.; and Cox- "Principles of Biochemistry"- V Edition- M. M.W.H. Freeman and Company
4.	Stent, G. S.; and Calender-" Molecular Genetics"- Second edition - R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

18ES205	MECHANICS OF SOLIDS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	Understand the vectorial and scalar presentation of forces and momentum
2.	Understand the mechanical behaviour of materials.
3.	Understand the concept of stress and strain in different types of structures with different loading conditions.
4.	Familiarize about in the determination of shear force and bending moment in various types of beams with different loading conditions.
5.	Solve practical problems related to springs and shafts

Unit I	PROPERTIES OF SURFACE	9	+	0

System of forces – areas and volumes – centroid – centre of gravity – theorem of Pappus – Guildinus – First, second and product moment of inertia of various sections – Parallel axis and perpendicular axis theorem – polar moment of inertia – principal moment of inertia of plane areas

Unit II	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9	+	0

Stress and strain due to axial force – elastic limit – Hookes's law – factor of safety – lateral strain – Poisson's ratio – volumetric strain – changes in dimensions and volumes- shear stress – shear strain – relationship between elastic constants. Stepped bars – uniformly varying sections – composite bar – stresses due to temperature. Strain energy due to axial force- proof resilience and modulus of resilience

Unit III	SHEAR FORCE AND BENDING MOMENT DIAGRAMS	9	+	0

Relationship between load, shear force and bending moment – shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads and concentrated moment – maximum bending moment and point of contraflexure.

Unit IV	STRESSES DUE TO BENDING AND SHEAR	9	+	0

Theory of simple bending and assumptions – analysis of beams for stresses – stresses distribution at acrosssectionduetobendingmomentandshearforceforcantilever,simplysupportedand overhanging beams with different loading conditions.

Unit V	TORSION AND COMPLEX STRESSES (Two dimensions only)	9	+	0

Theory of torsion and assumptions – derivation of torsion formula – polar modulus – stresses in solid and hollow circular shafts – power transmitted by a shaft.
State of stress at a point – normal and tangential stresses and their planes – principal stresses and their planes – plane of maximum shear stress – analytical method

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Determine the resultant forces and moment for the given system
CO2	:	Analyse planar and spatial systems of forces and determine the centroid and moment of inertias.
CO3	:	Thorough understanding of fundamental concepts of stress and strain in mechanics of solids and structures

CO4	:	The ability to analyse the beams to determine shear force and bending moments
CO5	:	Sufficient knowledge in design shafts to transmit required power and springs for its maximum energy

Text Books:	
1.	Bhavikatti S S strength of materials, Vikas Publishing House Pvt ltd., New delhi, Second edition 2013
2.	Rajput RK, Strength of materials ,S.Chand& Company ltd, New Delhi, 2018
3.	Bansal R.K., Engineering Mechanics, Laxmi Publications (P) Ltd., 2015.
4.	Kottiswaran N, Engineering Mechaics, Sri Balaji Publications, 2010.
5.	Bansal R.K., Strength of materials , Laxmi Publications (P) Ltd., 20016.
Reference Books:	
1.	Beer and Johnson, Vector Mechanics for Engineers: Statics and Dynamics Tata Mc Graw Hill, 2017
2.	Kumar K.L., Engineering Mechanic, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.
3.	Punmia B C Jain and Jain AK, Strength of materials and theory of structures, vols. I and II, XI Edition, Laxmi Publications P Ltd, New Delhi 2017
4.	Ramamurtham S and Narayanan R, Strength of Materials, Dhanpat Rai Publishing Company Pvt Ltd, Reprint 2014

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	3	1	3	2	1	2	2	2	2	3	--
CO2	3	3	3	3	3	1	3	2	1	2	-	2	3	3	--
CO3	3	3	3	3	1	2	3	2	--	3	-	3	2	2	--
CO4	3	3	3	3	3	2	3	1	2	3	-	2	3	3	--
CO5	3	3	3	3	2	1	2	2	2	2	--	3	3	3	--

1 – Slightly
2 – Moderately
3 - Strongly

18CE301	MECHANICS OF FLUIDS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the basic property of fluid
2.	To gain knowledge of fluid static dynamic and kinematics
3.	To understand and solve the problem related to equations of motions
4.	To understand and solve the boundary layer problems
5.	To study the application of similitude

Unit I	FLUID PROPERTIES	9	+	0

Fluid and Fluid properties – density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension. Pressure – Pascal's law - Relationship between pressures – pressure measurements by manometers.

Unit II	FLUID STATICS & KINEMATICS	9	+	0

Fluid Statics: Hydrostatic forces on plane and curved surfaces – Total pressure and centre of pressure – equilibrium of floating and submerged bodies - Meta centre – metacentric height.
Fluid Kinematics: Flow visualization – types of flow – lines of flow - velocity and acceleration - Continuity equation (one, two and three dimensional forms) – Stream function – velocity potential function – flow nets – Measurement of Velocity

Unit III	FLUID DYNAMICS	9	+	0

Equations of motion – Euler's equation of motion along a streamline - Bernoulli's equation – applications – Venturi meter, Orifice meter, Pitot tube, Laminar flow – viscous flow through pipes and between parallel plates – Hagen- Poiseuille equation. Turbulent flow – Darcy-Weisbach formula – Moody diagram.

Unit IV	FLOW THROUGH PIPES AND BOUNDARY LAYER	9	+	0

Major and minor losses of flow in pipes – Hydraulic Gradient Line – Total Energy Line - Pipes in series and in parallel – power transmission through pipes.
Definition of boundary layer – Thickness and classification – separation of boundary layer – Methods of preventing the separation.

Unit V	DIMENSIONAL AND MODEL ANALYSIS	9	+	0

Dimensional Analysis – Rayleigh's method, Buckingham's Pi-Theorem. Model analysis – Types of Similitude – Dimensionless numbers – Model Laws – classification of Models - Scale effect.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand the fundamentals of Fluid Mechanics
CO2	:	Determine the properties of fluid and pressure and their measurement
CO3	:	Compute forces on immersed plane and curved plates
CO4	:	Apply continuity equation and energy equation in solving problems on flow through conduits
CO5	:	Compute the frictional loss in laminar and turbulent flows

Text Books:

1.	Bansal R.K., *Fluid Mechanics and Hydraulic Machines,* 9th Edition, Laxmi Publications(P) Ltd, New Delhi, 20013
2.	Modi P.N., Seth S.M., *Hydraulics and Fluid Mechanics Including Hydraulic Machines*, 14th Edition, Standard Book House, 2002.
3.	Rajput R.K., *A text book of Fluid Mechanics in SI Units*, S.Chand and Company, New Delhi, 2008

Reference Books:	
1.	Streeter, Victor L. and Wylie, Benjamin E., *Fluid Mechanics*, McGraw-Hill Ltd., 2010
2.	Jain AK, Fluid mechanics including hydraulic machines, Khanna Publication, 2015
3.	White FM, Fluid mechanics, Tata Mc Graw Hill, New Delhi, 2017
4.	Fox, Robert W. and Macdonald, Alan,T., *Introduction to Fluid Mechanics*, John Wiley & Sons, 1995
5.	Subramanya K, Flid mechanics and hydraulic machines, Tata Mc Graw Hill, New Delhi 2010

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
CO2	2	2	2	2	2	2	2	1	1	1	1	1	1		1
CO3	1	1	1	2	1	2	1	1	1	1	1	1	1		1
CO4	2	1	2	2	2	1	2	1	1	1	1	1	1		2
CO5	1	1	1	2	1	2	1	1	1	1	1	1	1		1

1 – Slightly
2 – Moderately
3 - Strongly

18CE302	SURVEYING AND GEOMATICS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the importance of surveying in the field of civil engineering
2.	To study the basics of linear/angular measurement methods like chain surveying, compass surveying
3.	To know the basics of levelling and theodolite survey in elevation and angular measurements
4.	To understand tacheometric surveying in distance and height measurements
5.	To get introduced to modern advanced surveying techniques involved such as Total station and GPS
6.	Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,

Unit I	INTRODUCTION TO CHAIN AND COMPASS SURVEYING	9	+	0

Definition- Classifications - Basic principles- Classification - Field work and office work - Types of chain - methods of ranging a line – Maps-Scale, adjustment in wrong observations- uses of chain, cross - staff and optical square - sources and limits of error and their correction. Magnetic and true north, magnetic declination and its variation - Bearings - Prismatic compass - Surveyor's compass - compass survey - local attraction and its elimination - Traversing.

Unit II	LEVELLING AND ITS APPLICATIONS	9	+	0

Level line - Horizontal line - Datum - Bench marks -Levels and staves - temporary and permanent adjustments – Methods of levelling - Fly levelling - Check levelling - Procedure in levelling - Booking -Reduction - Curvature and refraction - Reciprocal levelling – Contouring - Methods - Characteristics and uses of contours

Unit III	THEODOLITE SURVEYING	9	+	0

Theodolite surveying – Study oftheodolite – Temporary and permanent adjustments – Measurementofhorizontalangelsbyreiterationandrepetition–Measurementofverticalangles- Trigonometrical surveying -Traversing – Co-ordinate system-Closing error and distribution – Conditions for closure - Omitted measurements- Triangulation of survey

Unit IV	TACHEOMETRIC SURVEYING AND CURVES	9	+	0

Tacheometric surveying – Principles – Methods – Stadia system –Fixed and Movable hair methods – Methods with staff held vertical and normal – Analytic lens – Subtense bar – Tangential method. Curves -Elements of simple, compound, Reverse and Transition curve – length of curve – Vertical curves with application.

Unit V	CONSTRUCTION AND MODERN FIELD SURVEY SYSTEMS	9	+	0

Procedures for setting out a building - pipelines - sewers – Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Use conventional surveying tools such as chain/tape, compass, level in the field of civil engineering applications such as structural plotting and highway profiling
CO2	:	Apply the procedures involved in field work and to work as a surveying team
CO3	:	Plan a survey appropriately with the skill to understand the surroundings

CO4	:	Take accurate measurements, field booking, plotting and adjustment of errors can be understood
CO5	:	Invoke advanced surveying techniques over conventional methods in the field of civil engineering

Text Books:	
1.	*Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.*
2.	Punmia B.C., *Surveying, Vols. I, II and III,* Laxmi Publications, 1989.
Reference Books:	
1.	Clark D., *Plane and Geodetic Surveying*, Vols. I and II, C.B.S. Publisher and Distributors, Delhi, Sixth Edition,1971.
2.	James M.Anderson and Edward M.Mikhail, *Introduction to Surveying*, McGraw-Hill Book Company, 1985.
3.	Wolf P.R., *Elements of Photogrammetry*, McGraw-Hill Book Company, Second Edition, 1986.
4.	Robinson A.H., Sale R.D. Morrison J.L. and Muehrche P.C., *Elements of Cartography*, John Wiley and Sons, New York, Fifth Edition, 1984.
5.	HeribertKahmen and Wolfgang Faig, *Surveying*, Walter de Gruyter, 1995.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	2	1	2	2	2	2	1	2	2	2
CO2	2	3	3	1	2	2	1	3	2	1	1	1	2	3	1
CO3	3	1	2	3	2	3	1	3	2	3	1	2	1	3	3
CO4	2	1	3	2	1	3	2	1	1	1	1	2	3	2	1
CO5	3	2	3	2	3	1	2	1	2	3	3	2	1	1	2

1 – Slightly
2 – Moderately
3 - Strongly

18CE303	SURVEYING PRACTICAL	L	T	P	C
		0	0	4	2

Course Objectives:

1	To know the importance of basic surveying equipment
2	To able to measure the linear and angular measurements with help of various equipment
3	To identify points in both vertical and horizontal plane by using Dumpy level
4	To estimate the stadia constants in stadia diaphragm
5	To able to handle the modern equipment such as EDM,GPS and Total station

List of Experiments:

1. Measurements of length using chain, Cross-staff and its accessories
2. Distance between the two inaccessible points using compass and compasstraversing
3. Plane table surveying: Radiation andIntersection
4. Differential Levelling using Dumpy level – Reduction by Rise and Fall & Height of Collimation Method
5. Road project –Longitudinal Sectioning and Cross Sectioning
6. Contouring
7. Theodolitetraversing
8. Heights and distances – Inaccessible stations – Single planemethod
9. Heights and distances – Inaccessible stations – Double planemethod
10. StadiaTacheometry
11. TangentialTacheometry.
12. SubtenseBar
13. Setting out works - Simple curve (right/left-handed).
14. Study of EDM &GPS
15. Setting out works – Buildings, Area Calculation using TotalStation

Total = 60 Periods

Course Outcomes:

At the end of the course the student will be able to

CO1	:	handling the equipment Theodolite to find out the horizontal and vertical angles
CO2		find out the elevation of the required points with respect to reference plane
CO3		use the modern equipment like EDM, GPS and Total station with its applications
CO4		learn to set out the simple curve in the field
CO5		learn to set out the foundation of a building in the field

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	2	2	1	3	1	2	1	2
CO2	2	1	2	1	2	2	1	3	2	1	1	3	2	3	1
CO3	3	1	2	3	2	3	1	3	2	3	1	2	1	3	3
CO4	1	1	2	2	1	3	2	1	3	1	1	2	3	2	1
CO5	3	2	2	2	3	1	2	1	2	3	3	3	1	1	2

1 – Slightly
2 – Moderately
3 - Strongly

18CE304	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
		0	0	4	2

Course Objectives:

1.	To impart knowledge on development and control rules satisfying orientation and functional requirements
2.	At the end of this course the student should be able to draft the building drawings manually
3.	At the end of this course the student should be able to draft the building drawings by using Computer

EXPERIMENTS

1.	Part-A Building drawing in accordance with development and control rules satisfying orientation and functional requirements for the following: (20 hours) 1. Residential buildings with load bearing walls (RCCroof) 2. RCC framedstructures 3. Office buildings (RCCroof) 4. Industrial Buildings-North light roof truss 5. Perspective view for smallbuildings
2.	Part-B Fundamental Commands of Drafting Software to Draft the building Drawings (10 Hours) Building drawing in accordance with development and control rules satisfying orientation and functional requirements using computer aided software for the following : (20 Hours) 1. Residential buildings with load bearing walls (RCCroof) 2. RCC framedstructures 3. Office buildings (RCC roof) Perspective view for smallbuildings

Total 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	The students will be able to draft the plan, elevation and sectional views of the buildings manually
CO2	:	The students will be able to draft the plan, elevation and sectional views of the buildings using computer softwares.
CO3	:	The students will be able to draft the plan, elevation and sectional views of the framed buildings using computer softwares.
CO4	:	The students will be able to draft the plan, elevation and sectional views of the industrial structures using computer softwares.

Reference Books:

1.	Verma B.P., Building Drawing- Khanna publishers.
2.	IS: 962-1967 Code of Practice for Architectural and Building Drawing.

E-References:

1.	https://nptel.ac.in/courses/112102101/- Computer Aided Design (NPTEL)
2.	https://www.autodesk.in/campaigns/autocad-tutorials-
3.	https://knowledge.autodesk.com/support/civil-3d/getting-startedl-

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	1	2	2	3	3	2	3	3	3	2
CO2	3	3	2	1	2	1	2	2	3	3	2	3	3	3	2
CO3	3	3	2	2	3	1	2	2	3	3	2	3	3	3	2
CO4	3	3	2	2	3	1	2	2	3	3	2	3	3	3	3
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CE401	STRENGTH OF MATERIALS	L	T	P	C
		3	1	0	4

Course Objectives:

1.	To study the different methods of determining deflection of determinate and indeterminate beam.
2.	To anlayse the column with different end conditions
3.	To impart knowledge on analysis of simple and special structures to find internal forces / stresses using various theorems / theories

Unit I	DEFLECTION OF DETERMINATE BEAMS	9	+	3

Governing differential equation –Double integration method- Macaulay's method Moment Area method -Strain energy and Dummy unit load approaches – Castigliano's first and second theorems.

Unit II	STATICALLY INDETERMINATE BEAMS	9	+	3

Propped cantilever beams – Fixed beams – Continuous beams – Theorem of three moments – Calculation of reactions – Bending Moment and Shear Force diagrams

Unit III	THEORY OF COLUMNS	9	+	3

Members subjected to axial Load – Slenderness ratio – End conditions – Buckling load for columns- Euler's theory – Assumptions and limitations – Rankin-Gordon formula – Empirical formula – Straight line formula – Columns subjected to eccentric loading

Unit IV	UNSYMMETRICAL BENDING AND SHEAR CENTRE	9	+	3

Stresses due to unsymmetrical bending of beams for symmetrical sections – Shear Centre - Definition – Shear centre for sections symmetrical about one axis – Moment of Inertia – Product of Inertia – Principal axes and Principal moment of Inertia – Deflection of beams due to unsymmetrical bending

Unit V	THIN ,THICK CYLINDERS AND ELASTIC FAILURES	9	+	3

Lame's equation – Hoop stress and radial stress distribution – Compound cylinders – Wire wound cylinders.

THEORIES OF ELASTIC FAILURE: Maximum principal stress theory – Maximum principal strain theory – Maximum shear stress theory - Maximum strain energy theory – Maximum shear strain energy theory – simple problems

Complex stresses – Stress at point- normal and tangential stresses and their planes – principal stress and planes – analytical method

Total (45+15)= 60 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply the principle of various theorems in measurement of slope and deflection
CO2	:	Different stress developed in thin, thick cylinders and spherical shells
CO3	:	Visualize the behavior of column for combined bending and axial loading
CO4	:	Demonstrate the different theories of failure for brittle and ductile materials
CO5	:	Apply the different methods in unsymmetrical bending analysis

Text Books:

1.	Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2007
2.	Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.

Reference Books:	
1.	Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi 1995.
2.	Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 1997.
3.	Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
4.	Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 2003
5.	William A .Nash, “Theory and Problems of Strength of Materials”, Schaum’s Outline Series, Tata McGraw Hill Publishing company,2007

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	2	2	2	3	2	3	3	3	1
CO2	3	3	3	2	1	1	2	2	3	3	2	3	3	3	--
CO3	3	3	3	2	1	1	2	2	2	3	2	3	3	3	--
CO4	3	3	3	3	2	2	1	2	2	3	2	3	3	3	--
CO5	3	3	3	3	1	1	2	2	3	2	3	3	3	3	--

1 – Slightly
2 – Moderately
3 - Strongl

18CE402	DESIGN OF STEEL STRUCTURAL ELEMENTS (Use of IS 800 – 2007 & Steel tables are permitted)	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections
2.	To study the behaviour and design of compression and tension members using simple and built-up sections
3.	To understand behaviour of flexural members and the design laterally restrained beams
4.	To study the design of bolted and welded connections and arranging field visit to industries

Unit I INTRODUCTION **9 + 0**

CONCEPTS OF STRUCTURE: Structural form: Classification of structures based on function, material and shape - different structural systems - basic structural requirements - stability, strength and stiffness. STRUCTURAL LOADS: Dead load - live load - wind load – dynamic and seismic load – thermal load – settlement load – buoyant load – snow load. DESIGN CONCEPTS: Design Process: Codes of practice -Working Stress Method - Limit State Method of Design - Probabilistic approach to design - load and resistance factor design. STEEL STRUCTURES: Introduction: Material - properties of steel– behavior- structural steel sections – Limit State Design Concepts– Loads on Structures – load combinations – partial safety for materials – load safety factors. Other properties: durability – fatigue – fire protection.

Unit II CONNECTIONS **9 + 0**

Metal joining methods using welding, bolting – Design of bolted and welded joints – weld symbols – strength of fillet and butt welds - Efficiency of joints – High Tension bolts

Unit III TENSION MEMBERS **9 + 0**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

Unit IV COMPRESSION MEMBERS **9 + 0**

Types of compression members – Theory of columns – Current codal provision for compression member design – Slenderness ratio – Design of compression members – Design of lacing and batten – Design of column bases – Gusseted base

Unit V BEAMS **9 + 0**

Laterally supported beams: classification of sections – simple and compound sections – calculation of plastic modulus of section – flexural strength of beams- design considerations – behavior of web under shear – shear check – deflection check- bearing strength of web – buckling strength of web- web buckling –web crippling.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply the IS code of practice for the design of steel structural elements
CO2	:	Analyze the behavior of bolted connections and design them to tension, compression and bending members.
CO3	:	Design compression and tension members using simple and built-up sections

CO4	:	Design of steel beams with end conditions.

Text Books:	
1.	*Duggal S.K., Limit State Design of Steel Structures, Tata McGraw-Hill Publishing Company , New Delhi, 2010.*
2.	Subramanian N., *Design of Steel Structures*, First edition, OXFORD university press, 2008
3.	Jayagopal L S, 'Structural Steel Design", Vikas Publications, 2012
Reference Books:	
1.	Bhavikatti S. S., *Design of Steel Structures by Limit Method*, I.K. International Pvt Ltd, New Delhi, 2009.
2.	Ramchandra S., & Virendra Gehlot ., *Limit State Design of Steel Structures*, Standard Publication, New Delhi, 2009.
3.	*Teaching Resources for Structural Steel Design* – Vol. I & II, INSDAG, Kolkatta.
4.	*IS 800:2007 Code of practice for general construction steel*
5.	*SP 6 IS Structural steel Design Illustrated Hand book*

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	1	1	1	1	1	1	2	3	3	2
CO2	3	3	1	1	2	1	1	1	1	1	1	1	2	2	1
CO3	3	1	2	2	1	1	2	1	1	1	2	1	2	1	1
CO4	1	2	3	1	1	2	1	1	1	2	2	1	1	1	2
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CE403	ENGINEERING GEOLOGY	L	T	P	C
		2	0	0	2

Course Objectives:

1.	To understand the importance of geological knowledge such as earth, earthquake, volcanism.
2.	To apply this knowledge in projects such as construction of dams, tunnels, bridges, roads, airport and harbor as well as to choose types of foundations

UNIT I PHYSICAL GEOLOGY 9 + 0

Introduction to role of geology in civil engineering – Various core and applied branches of geology – Interior structure of earth and composition – Introduction to Continental drifting & Plate Tectonics, Earthquakes and Volcanoes – Weathering and types – Geological work of river, wind, and groundwater.

UNIT II MINERALOGY 9 + 0

Elementary knowledge on symmetry elements of important Crystallographic systems – Physical properties of common rock forming minerals – Properties and Engineering significance of the following minerals – Quartz family, Feldspar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet and Clay minerals — Elementary knowledge on Ore minerals, Coal and Petroleum.

UNIT III PETROLOGY 9 + 0

Classification of rocks - Description, Occurrence, Distribution and Engineering properties of the following rocks: Igneous rocks – Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite, Basalt and Rhyolite; Sedimentary rocks – Sandstone, Limestone, Shale, Conglomerate and Breccia; Metamorphic rocks - Quartzite, Marble, Slate, Phyllite, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY 9 + 0

Attitudes of beds – Introduction to Geological maps and their importance in civil engineering projects - Uses of Clinometer and Brunton compass in geological mapping - Genesis and Classification of the following geological structures; Folds, faults and joints.

Unit V GEOLOGICAL INVESTIGATIONS FOR CIVIL ENGINEERING 9 + 0

Introduction to Aerial and Satellite Remote sensing – Role of Geophysical investigations in civil engineering projects – Electrical resistivity and Seismic methods - Geological conditions necessary for the construction of Dams, Tunnels, Bridges and Road cuttings – Types, Causes and prevention of Landslides – Coastal erosion and coastal protection.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Identify the problems associated with underground excavations
CO2	:	Classify the rock mass using the reference data
CO3	:	Understand the failure criteria of rocks
CO4	:	Understand various natural hazards, their causes andeffects.

Text Books:

1.	Parbin Singh. A Text Book of Engineering and General Geology, S.K.Kataria and Sons, Delhi, Sixth Edition, 1998
2.	Garg S.K. Physical and Engineering Geology, Khanna Publishers, Delhi, Third Edition, 1999

Reference Books:

1.	Mahapatra G.B. A Text Book of Geology, CBS Publishers & Distributers, New Delhi, Third Edition, 2000.

2.	*Bell F.G. Fundamentals of Engineering Geology, BS Publications, Hyderabad, 2005.*
3.	*Gokhale K.V.G.K. Principles of Engineering Geology, BS Publications, Hyderabad, 2005*
4.	*Mahapatra G.B. A Text Book of Physical Geology, CBS Publishers & Distributers, Delhi, 1999*
5.	*P.C. Varghese Engineering Geology for Civil Engineers, PHI Leaarning Pvt. Ltd., New Delhi*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2		3	2					1	3		
CO2	1	1	2	3			2						3		
CO3	2	2	3	2		3	2					1	3		
CO4	2	2	3	2		3	2					1	3		

1 – Slightly
2 – Moderately
3 - Strongly

18CE404	WATER SUPPLY ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

To equip the students with the principles and design of water treatment and distribution.

Unit I	SOURCES OF WATER	9	+	0

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

Unit II	CONVEYANCE FROM THE SOURCE	9	+	0

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

Unit III	WATER TREATMENT	9	+	0

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation –Clarifloccuator-Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management –Construction, Operation and Maintenance aspects.

Unit IV	ADVANCED WATER TREATMENT	9	+	0

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances.

Unit V	WATER DISTRIBUTION AND SUPPLY	9	+	0

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs – Functions – Network design – Economics – Analysis of distribution networks -Computer applications – Appurtenances – Leak detection.
Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
CO2	:	an understanding of water quality criteria and standards, and their relation to public health
CO3	:	the ability to design and evaluate water supply project alternatives on basis of chosen selection criteria

Text Books:

1.	Garg, S.K. Environmental Engineering, Vol.IKhanna Publishers, New Delhi, 2010.
2.	Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3.	Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.

Reference Books:

1.	Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2.	Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Plant.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2		2	3	3	3		1	2	1	3	1	1
CO2	1	1	2			3	3	3			2	1	3		1
CO3	3	3	3	2	1	3	3	3		1	2	1	3	1	1

1 – Slightly
2 – Moderately
3 - Strongly

18CE405	APPLIED HYDRAULICS AND FLUID MACHINERY	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To study open channel flow characteristics including hydraulic jump and surges.
2.	To study the performance characteristics of hydraulic machines
3.	To impart knowledge on basic concepts of open channel flow and types of flow.
4.	To impart knowledge about Classification of pumps and Air vessels, indicator diagrams.
5.	To develop the abilities to analyse flow characteristics in open channel and design hydraulic machines.

Unit I OPEN CHANNEL FLOW **9 + 0**

Open channel flow – Types and regimes of flow – Wide open channel – Specific energy – Critical flow and its computation. Uniform flow – Velocity measurement – Manning's and Chezy's formula – Determination of roughness coefficients – Determination of normal depth and velocity – Most economical sections.

Unit II VARIED FLOW **9 + 0**

Dynamic equations of gradually varied flow – Assumptions – Draw down and back water curves - Characteristics of flow profiles –– Profile determination – Graphical integration, direct step and standard step method - Hydraulic jump – Types – Energy dissipation – Flow through transitions.

Unit III MOMENTUM PRINCIPLE **9 + 0**

Impulse Momentum equation – Application of linear momentum principle – Impact of jet – force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases – angular momentum principle – construction of velocity vector diagrams – jet propulsion of ships.

Unit IV HYDRAULIC TURBINES **9 + 0**

Classification – working principles and design of Pelton wheel, Francis and Kaplan turbines – Velocity triangles – efficiencies – draft tube - theory and types – Specific speed – operating characteristics – Governing of turbines.

Unit V PUMPS **9 + 0**

Classification - Centrifugal pump – working principle –velocity triangle - minimum speed to start the pump – multistage pumps – Specific speed - performance curves – Reciprocating pump– components and working – slip - indicator diagram and its variation - air vessel – working principle of Jet pump, Submersible pump and Gear pump.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Visualize fluid flow phenomena observed in Civil Engineering systems such as flow in a pipe, flow measurement through orifices, mouth pieces, notches and weirs
CO2	:	Analyze fluid flows in open channel hydraulics and devices such as weirs and flumes
CO3	:	Apply dimensional analysis
CO4	:	To study types of centrifugal Pumps, work done and efficiency of the different types centrifugal pumps and also study about performance of pumps & characteristic curves
CO5	:	To study about specific speed and performance characteristics of different types of turbines

Text Books:

1. Ramamirtham S., *Fluid Mechanics and Hydraulics and Fluid Machines*, Dhanpat Rai and Sons,

	Delhi, 2014.
2.	Bansal R.K., *Fluid Mechanics and Hydraulic Machines*, 9thEdition, Laxmi Publications(P) Ltd, New Delhi, 2018.
Reference Books:	
1.	Subramanya K., *Flow in Open channels*, Tata McGraw-Hill Publishing Company, 1994.
2.	*Rama Durgaiah D., Fluid Mechanics and Machinery, New Age International Publishers, New Delhi, 2002.*
3.	Rajput R.K., *A text book of Fluid Mechanics in SI Units*, S.Chand and Company, New Delhi, 2016.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	1	2	1	1	1	1	1	2		1
CO2	1	1	2	1	2	1	2	1	1	1	1	1	2	1	1
CO3	1	1	1	1	1	1	2	1	1	1	1	1	2		1
CO4	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1
CO5	2	1	2	1	2	1	2	1	1	1	1	1	1		2

1 – Slightly
2 – Moderately
3 – Strongly

18CE406	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of this course ,

1. The student shall have a good knowledge about constituent materials.
2. To get awareness about the properties of fresh and hardened concrete.
3. To understand the concept and procedure for concrete mix design as per IS code standards.
4. To know the types of special concretes.
5. To acquire awareness about quality control in concrete.

Unit I	MATERIALS AND THEIR PROPERTIES	9	+	0

Cement – constituents – tests on cement – types of cement – aggregates – M-Sand – properties and uses – classification of aggregates – properties and tests on aggregates – gradation – quality of water – admixtures – accelerators – retarders.

Unit II	PROPERTIES OF FRESH AND HARDENED CONCRETE	9	+	0

Properties of fresh concrete – workability – segregation – bleeding – properties of hardened concrete – strength – stress-strain characteristics – modulus of elasticity – shrinkage – creep – thermal conductivity – permeability – test for tension, compression and flexure – non-destructivetests.

Unit III	CONCRETE MIX DESIGN	9	+	0

Nominal mixes – design mixes – factors influencing the design – Theory and problems - ACI method, DOE method and IS method.

Unit IV	SPECIAL CONCRETES AND CONCRETING METHODS	9	+	0

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, vacuum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Light weight concrete – ready mix concrete – fibre reinforced concrete.

Unit V	QUALITY CONTROL	9	+	0

Frequency of sampling – statistical analysis of test results – standard deviation – coefficient of variation – characteristic strength – acceptance and rejection criteria.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Test all the concrete materials as per IS code
CO2	:	Design the concrete mix using ACI and IS code methods
CO3	:	Determine the properties of fresh and hardened of concrete
CO4	:	Design special concretes for specific applications
CO5	:	Ensure quality control while testing/ sampling and acceptance criteria

Text Books:

1. Neville A.M *Properties Of Concrete*, Pearson publication, 2012
2. Shetty M.S*Concrete technology, Volume I & II*, S.Chand and Company Ltd,Deihi 2003
3. Santhakumar A.R *Concrete Technology*, Oxford university Press, NewDelhi, 2007
4. Mehta K.P *Concrete Technology*, Chand & Co, NewDelhi, 2006

Reference Books:

1. *Indian Standard Recommended Guide lines for Concrete Mix Design*, IS:10262 – 2009 , Bureau

	of Indian Standards, NewDelhi.
2.	Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete IS:383-1970 R2011, Bureau of Indian Standards, NewDelhi.
3.	Gambhir.M.L,*Concrete technology*, Volume I & II , Tata McGraw-HillBookCompany,Third print, 2003
4.	Krishnaraju N. *Design of Concrete Mixes*, CBS publishers. NewDelhi, 2002.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				1	2	1	1	1	1	2	1	1	1		1
CO2			2	2	1	1			1	1			2		1
CO3					1	1	1			1			1		1
CO4				1		1									1
CO5						1		1	1				3		1

1 – Slightly
2 – Moderately
3 - Strongly

18CE407	MATERIAL TESTING & EVALUATION LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1.	At the end of this course the student should be able to evaluate the elastic constants of the materials
2.	At the end of this course the student should be able to determine the strength of concrete and other properties.

EXPERIMENTS

1.	Tension test on mild steel specimen
2.	Deflection test on simply supported beam
3.	Deflection test on double cantilever beam
4.	Double shear test on mild steel rod
5.	Torsion test
6.	Test of springs i) Compression Spring ii) Tension spring
7.	Compression test on concrete cube
8.	Crushing test on bricks
9.	Hardness test on metals like mild steel, brass and aluminum
10.	Split tensile test on concrete
11.	Charpy Impact test

Total (P)= 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens
CO2	:	Determine the strength of concrete
CO3	:	Find the compressive strength of concrete cubes and bricks
CO4	:	Find stiffness of open coiled and closed coiled springs

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	-	1	1	2	1	-	-	2	1	1
CO2	2	1	1	2	1	2	1	2	2	1	-	1	2	1	1
CO3	2	1	1	2	1	2	1	2	2	1	-	1	2	1	1
CO4	2	1	1	1	1	1	1	1	2	1	-	1	1	1	1
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CE408	HYDRAULIC ENGINEERING LABORATORY	L	T	P	C
Course Objectives:		**0**	**0**	**4**	**2**
1	At the end of this course the student should be able to evaluate co-efficient of discharge of various sections				
2	At the end of this course the student should be able to evaluate the characteristics of pumps and turbines				
List of Experiments:					
1	Determination of co-efficient of discharge of flow through orifice				
2	Determination of co-efficient of discharge of flow thorough mouth piece				
3	Determination of co-efficient of discharge of flow over notches				
4	Determination of co-efficient of discharge for venturimeter				
5	Determination of co-efficient of discharge for orificemeter				
6	Determination of friction factor of pipes				
7	Determination of minor losses in pipes				
8	Study on performance characteristics of Pelton wheel turbine				
9	Study on performance characteristics of Kaplan turbine				
10	Study on performance characteristics of Centrifugal pump				
11	Study on performance characteristics of reciprocating pump				
12	Study on performance characteristics of jet pump				
13	Study on performance characteristics of self-priming pump				
14	Study on performance characteristics of gear oil pump				
	Total = 60 Periods				
Course Outcomes:					
At the end of the course the student will be able to					
CO1	: To measure flow in pipes and determine frictional losses.				
CO2	: Apply dimensional analysis for design of experimental procedures				
CO3	: Calibrate flow measuring devices used in pipes, channels and tanks				
CO4	: Determine fluid and flow properties				
CO5	: Characterize laminar and turbulent flow				
CO6	: To develop characteristics of pumps and turbines.				

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	1	1	1	1	1	1	2	3	3	2
CO2	3	3	1	1	2	1	1	1	1	1	1	1	2	2	1
CO3	3	1	2	2	1	1	2	1	1	1	2	1	2	1	1
CO4	1	2	3	1	1	2	1	1	1	2	2	1	1	1	2
CO5	1	1	2	2	1	1	1	3	1	2	1	2	1	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEMC01	DISASTER PREPAREDNESS AND PLANNING	L	T	P	C
		2	0	0	0

Course Objectives:

1.	Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2.	Critically evaluate disaster risk reduction and humanitarian response policy and practice from multipleperspectives.
3.	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflictsituations.
4.	Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Unit I **REPERCUSSIONS OF DISASTERS AND HAZARDS** **9 + 0**

Introduction, Disaster-Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts, And Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor, Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease, Epidemics, War and Conflicts.

Unit II **DISASTER PRONE AREAS IN INDIA** **9 + 0**

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches, Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami.

Unit III **DISASTER PREPAREDNESS AND MANAGEMENT** **9 + 0**

Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard, Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Unit IV **DISASTER MITIGATION** **9 + 0**

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Unit V **REHABILITATION OF ENVIRONMENT** **9 + 0**

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	*:*	To identify the different disasters and its causes.
CO2	*:*	To identify the vulnerable areas of disasters in India.
CO3	*:*	To get knowledge about preparedness during disasters.
CO4	*:*	To analyse the risk in disasters.
CO5	*:*	To know the corrective measures to mitigate disasters.

Text Books:

1.	Sahni, Pardeep, “Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi. 4th Edition, 2011.
2.	Goel S.L, “Disaster Administration and Management Text and Case Studies”, Deep & Deep

	Publication Pvt. Ltd., New Delhi, 2007.
Reference Books:	
1.	Nishith, R and Singh, A.K, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company,2007.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	1	3	3	3	3	2	2	2
CO2	3	1	2	1	2	13	1	3	1	2	1	1	1	3	1
CO3	1	3	2	1	2	1	3	1	2	1	3	2	3	1	1
CO4	1	1	1	2	2	2	2	2	2	1	3	1	3	3	1
CO5	1	2	1	2	3	2	1	3	3	2	3	1	2	1	1

1 – Slightly
2 – Moderately
3 - Strongly

18CE501	BASIC STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To impart knowledge on force responses on beams, trusses, arches, suspension bridges analytically and using influence lines. To impart knowledge on Plastic analysis of structures.

Unit I	INDETERMINANCIES AND INFLUENCE LINES FOR STATICALLY DETERMINATE BEAMS ROLLING LOADS	9	+	0

Concept of Determinancy and Indeterminancy-static and Kinematic indeterminancies-examples - single concentrated load moving on the span – UDL longer than the span – UDL shorter than the span – two concentrated loads at a fixed distance apart - several concentrated loads(CONCEPT ONLY) – equivalent UDL. Influence lines for reactions, shear force and bending moment – Calculation of shear force and bending moment at a point – Calculation of position of load for maximum shear force and bending moment – Uniformly distributed load shorter than the span on simply supported beam – Concentrated loads - Absolute maximum shear force and bending moment.

Unit II	INFLUENCE LINES FOR STATICALLY INDETERMINATE BEAMS	9	+	0

Clark Maxwell's theorem of reciprocal deflection – Betti's theorem- Muller's Breslau's Principle and its applications to determine the influence lines for continuous beams(two span only)
Analysis of plane trusses with maximum two redundant members by displacement and force methods-Trusses with lack of fit-Thermal stresses.

Unit III	THREE HINGED, TWO HINGED ARCHES	9	+	0

Symmetrical arches – Analysis of three hinged and two hinged arches – shear force Normal thrust and bending moment – Effect of rib – shortening – Parabolic arch subjected to UDL.

Unit IV	CABLES AND SUSPENSION BRIDGES	9	+	0

Analysis of cable under concentrated loads - Analysis of cable under UDL – Shape of cable under self-weight – Anchorage of suspension cables – shear force and bending moment in three hinged stiffened girders – Maximum bending moment due to single concentrated load – UDL - Two hinged stiffening girders.

Unit V	PLASTIC ANALYSIS OF STRUCTURES	9	+	0

Plastic moment capacity of sections – Plastic section modulus – Shape factor for rectangular, triangular, circular and hollow circular sections – Plastic hinge concept – Load factor – Plastic analysis – Basic theorems – Principle of virtual work – Determination of collapse load for simply supported beam, propped cantilever beam, fixed beam, continuous beam subjected to concentrated load and UDL – Collapse load for single storey single bay portal frames.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Use various classical methods for analysis of indeterminate structures
CO2	:	Determine the effect of support settlements for indeterminate structures
CO3	:	Apply the concepts of ILD and moving loads on determinate structures

CO4	:	Know the performance of cables and suspension bridges under external loads
CO5		Analysis the various structures in plastic behavior

Text Books:	
1.	Devdas Menon "Structural Analysis", Narosa Publishers, 2010.
2.	Thandavamoorthy T.S., "Structural Analysis", Oxford Publishers, 2011.
3.	Punmia B.C., *Theory of structures - Vol. II*, Laxmi Publications (P) Ltd, 2004.
4.	Negi L.S. and Jangid R.S., *Structural Analysis*, Tata McGraw - Hill Publishing Company,New Delhi, 2007
Reference Books:	
1.	Ramamurtham S "*Theory of structures",Dhanpat Raj Publications*
2.	*Timoshenko S.P. and Young D.H., Theory of Structures, McGraw – Hill Book Company, New Delhi, 1965.*
3.	Gupta S.P.,Pandit G.S and Rajesh Gupta, *Theory of structures-Vol I & II*, Tata McGraw-Hill Publishing Company Limited, New Delhi,1999
4.	Reddy C.S., *Basic Structural Analysis*, Tata McGraw-Hill Publishing Company Limited, New Delhi,1999

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2	3	1	2	3	2	3	1	3	1	2	1	1	1	3	1
CO3	1	3	2	3	2	1	3	1	2	1	3	2	3	1	1
CO4	3	3	3	2	1	2	2	2	2	1	3	1	1	1	1
CO5	1	1	3	3	3	2	1	1	1	2	1	1	1	1	1

1 – Slightly
2 – Moderately
3 - Strongly

18CE502	MECHANICS OF SOILS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	Find index properties of soil, identify and classify the soil based on index properties.
2.	Acquire knowledge on the effect of ground water table on soil and to estimate stress distribution in soil.
3.	Learn the concept of permeability and seepage in soil including flow net.
4.	Gain knowledge on compaction and consolidation in soil and to find strength of soil.

Unit I BASIC PROPERTIES OF SOILS — 9 + 0

Soil formation – Soil problems in Engineering – Physical properties of soil – Phase relations – Index properties of soil – Grain size distribution – Atterberg's limits – Classification of soils – BIS classification – Field identification.

Unit II STRESSES IN SOILS — 9 + 0

Soil water –Static pressure in water-Effective stress concepts in soils – Capillary phenomenon – Vertical stress distribution in soils – Boussinesq equation – Vertical stress distribution diagrams - Line load – Uniformly loaded areas – Newmark's Influence Chart – Construction and Use – Approximate methods – Isobars – Westergaard's Analysis-ContactPressure.

Unit III PERMEABILITY AND SEEPAGE — 9 + 0

One dimensional flow through soil – Permeability – Darcy's Law – field and laboratory test- flow through stratified soil – Factors affecting permeability of soil.
Seepage pressure – Quick sand condition – Two dimensional flow – Laplace equation – Electrical analogy – Flow net – Methods of construction, properties and applications – application of sheet pile cut off and earth dam – Phreatic line.

Unit IV COMPACTION AND CONSOLIDATION — 9 + 0

Compaction – laboratory tests – Standard Proctor's Compaction test – Modified Proctor's Compaction – Moisture density relation – factors affecting compaction – Field compaction methods – Compaction control.
Consolidation – Components of settlement – Laboratory test – Terzaghi's One Dimensional Consolidation – Definition – Normally consolidated clay – Over Consolidated clay – Under Consolidated clay – e -log ρ relationship – Boundary condition – Time factor – Time rate of consolidation -√t and log t methods-Factors influencing compression behavior of soils.

Unit V SHEAR STRENGTH — 9 + 0

Shear strength of soil – importance and use – Mohr – Coulomb's theory – Laboratory test – Direct shear test – Triaxial Compression test – Types of Triaxial test based on drainage conditions – Unconfined Compression Test – Vane Shear test – Factors affecting the ShearStrength.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand the importance of soil mechanics in civil engineering and to classify the soil based on the tests conducted.
CO2	:	Do proper stress estimation for various types of foundation loads.
CO3	:	Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram
CO4	:	Solve practical problems related to consolidation settlement and time rate of settlement
CO5	:	Estimate shear strength of soil using the parameters obtained from different lab tests.

Text Books:	
1.	Punmia B.C *Soil Mechanics and Foundations*, Laxmi Publications Pvt. Ltd., New Delhi, 2017.
2.	Gopal Ranjan and Rao A.S.R*., Basic and Applied Soil Mechanics*, New Age International Publishers (P) Ltd., New Delhi, 2016.
3.	Venkataramaiah, C., *Geotechnical Engineering*, New Age International Publishers, New Delhi, 2017.
Reference Books:	
1.	Arora K.R., *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 2009.
2.	BrajaM.Das, *Fundamentals of Geotechnical Engineering*, Thomson Asia Pst.Ltd, Singapore,2005.
3.	BrajaM.Das ,*Principles of Geotechnical Engineering*, Thomson Asia Pst.Ltd, Singapore,2008.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	1	3	0	0	0	1	0	3	0	0
CO2	3	2	3	3	2	1	3	0	0	0	1	0	3	0	0
CO3	3	3	2	3	2	1	3	0	0	0	1	0	3	0	0
CO4	3	3	3	2	1	1	3	0	0	0	1	0	3	0	0
CO5	3	3	2	2	1	1	3	0	0	0	1	0	3	0	0

1 – Slightly
2 – Moderately
3 - Strongly

18CE503	WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To know the importance of hydraulic cycle, as water is the main source for the nature. Storage of water by means of reservoir and wells are taught.
2.	To impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth
3.	To impart the knowledge of various irrigation techniques.
4.	To undertstand the designs of various distribution system
5.	To deveop the abilities to know the distribution system.

Unit I	SURFACE WATER HYDROLOGY	9	+	0

Hydrologic cycle – Surface Water potential in India -Rain gauges – Types of rain gauges -Average rainfall over a basin by arithmetic mean, Thiessen polygon and Isohyetal method – Run off – Run off process – abstractions- Infiltration, evaporation, transpiration, interception and depression storage – Estimation of Run off by empirical formula and infiltration indices. Storm Hydrograph and Unit Hydrograph – Flood estimation by Dicken's formula.

Unit II	RESERVOIR PLANNING	9	+	0

Importance of Reservoirs - Purpose of storage work – Large Reservoirs in India and Tamil Nadu - Types of reservoirs– Investigation for reservoir planning – Selection of site for a reservoir – Zones of storage in reservoirs – Single and multipurpose reservoir – Determination of capacity of reservoir - Reservoir sedimentation and their control – Reservoir losses – Basics of flood routing.

Unit III	GROUND WATER HYDROLOGY	9	+	0

History of Groundwater Development in the world and India - Occurence of ground water – types of aquifers – storage coefficient – coefficient of transmissibility – Steady radial flow into a well located in unconfined and confined aquifers – description of various types of open and tube wells – Yield from an open well by constant level pumping test and recuperation test – Estimation of Yield (steady state condition) - Site selection for a tube well.

Unit IV	DISTRIBUTION SYSTEM	9	+	0

Classification of canals – canal alignment – Kennedy's theory – Wood table – Lacey's theory – Design of canal cross sections – Comparisons of two theories – Use of Garret's diagram in channel design – Balancing depth of cutting – Design procedure for an irrigation channel – Longitudinal section of canal and schedule of area statistics – types of canal cross sections – component parts of a cross section – Construction and maintenance of canals – Canal lining – GIS application in distribution system.

Unit V	WATER LOGGING, DRAINAGE AND RIVER CONTROL	9	+	0

Water logging – importance, Causes and effects of water logging– Remedial measures – Drainage – Advantages – Types of drainage system – Rivers and their behavior – Objectives – Classification and method of river training works - GIS application.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Design various channel systems
CO2	:	Design head and cross regulator structures
CO3	:	Identify various types of reservoir and their design aspects
CO4	:	By the Establishes the understanding of cross drainage works and its design
CO5	:	Design different types of dams

Text Books:	
1.	Linsley R.K. and Franzini J.B, *Water Resources Engineering*, McGraw-Hill Inc, 2002.
2.	Sharma R.K. and Sharma T.K., *Hydrology and Water Resources Engineering*, Dhanpat Rai and Sons, 2017.
3.	Punmia B.C. and Pande B.B.Lal, *Irrigation and water Power Engineering*, Laxmi Publications Pvt Ltd., New Delhi,2016.
4.	Santhosh Kumar Garg, *Hydrology and Water Resources Engineering* , Khanna Publications Pvt.Ltd.,New Delhi, 2002.
Reference Books:	
1.	Chow V.T. and Maidment, *Hydrology for Engineers*, McGraw-Hill Inc., Ltd., 2000.
2.	*Raghunath H.M., Hydrology, Wiley Eastern Limited,New Delhi,1990.*
3.	*Subramanya K., Engineering Hydrology, Tata-McGraw Hill , 1993.*
4.	*Sahasrabudhe S.D., Irrigation Engineering and Hydraulics Structures, Katson Publications, 1990.*
5.	*Das M.M., Saikia M.D., Hydrology, Prentice Hall of India, 2008.*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	2	2	1	1	1	1	1	2	3	1
CO2	2	2	1	2	2	2	2	1	1	1	1	1	2	3	1
CO3	2	2	1	1	1	2	2	1	1	1	1	1	2	3	2
CO4	2	2	1	1	1	1	2	1	1	1	1	1	1	3	1
CO5	2	1	2	2	2	1	2	1	1	1	1	1	1	3	2

1 – Slightly
2 – Moderately
3 - Strongly

18CE504	Design of Reinforced Concrete Elements	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the concepts of different design philosophies related to Reinforced concrete design and to study stress-strain behaviours of concrete and steel.
2.	To gain the knowledge of limit state design for flexure,shear,torsion and bond.
3.	To study the behaviour of columns subjected to axial load,eccentric load and use of interaction diagrams.
4.	To design the isolated foundation and staircases.

UNITI	DESIGN PHILOSOPHIES	9	+	0

Standard concrete mixes for RCC works – Types of reinforcements – Plain and deformed bars – Concepts of Working Stress Method, Ultimate Load Method and Limit State Method – Characteristic Strength and load – Partial Safety Factor – Stress-Strain behaviour of concrete and steel – Advantages – Codal specifications.

UNIT II	LIMIT STATE DESIGN FOR FLEXURE	9	+	0

Analysis, design and detailing of singly and doubly reinforced rectangular and flanged beams – Analysis, design and detailing of one way and two way rectangular slabs subjected to uniformly distributed load for various boundary conditions and corner effects.

UNIT III	LIMIT STATE DESIGN FOR,SHEAR,TORSION,BOND & ANCHORAGE	9	+	0

Design requirements as per IS code – Behaviour of RC beams in shear and torsion – Design and detailing of RC members for combined bending, shear and torsion- Behaviour of RC members in bond and anchorage

UNITIV	LIMIT STATE DESIGN OF COLUMNS	9	+	0

Types of columns – Braced and Unbraced columns – Design of short column for axial, uniaxial and biaxial bending – Interaction diagrams – Design concepts of long columns – Standard method of detailing RC columns.

UnitV	LIMIT STATE DESIGN OF FOOTINGS & STAIRCASES	9	+	0

Design of wall footing – Design of isolated footing – Square, Rectangular and Circular shape for axial load – Eccentrically loaded isolated footing – Design of staircase(ordinary & dog-legged).

Total (45+0)= 45 Periods

(Use of IS 456-2000 and tables and charts from SP16 are permitted)

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply the fundamental concepts of different design philosophies. Use IS code of practice to design the basic reinforced concrete elements
CO2	:	Analysis, design and to present detailing of reinforcement for flexure members.
CO3	:	Analysis, design and to present detailing of Slab and beam elements for bond, anchorage, shear and torsion.
CO4	:	Analysis ,design and detailing of Columns
CO5		Analysis ,design and detailing of Footings and staircases.

Text Books:

1.	"Reinforced Concrete Design" Unnikrishnan Pillai S &Devdas Menon, McGraw Hill Education (India) Private Ltd,Chennai 2018.
2.	Limit state Design of Reinforced Concrete Varghese P.C, 2013 PH1 Learning P.Ltd. Delhi.

Reference Books:

1.	Sinha S.N. Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., New Delhi ,2017.
2	Punmia B.C., Ashok Kumar Jain & Arun Kumar Jain ., Limit State Design of Reinforced Concrete, Laxmi Publications Pvt. Ltd., New Delhi, 2016.
3.	Karve S.R and Shah V.L. Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune 2017.
4.	Krishna Raju N., Design of Reinforced Concrete Structures, CBS Publishers & Distributors, NewDelhi,2017.
5.	IS 456:2000 Plain and Reinforced concrete Code of practice (Third Revision).
6.	SP :16 Design aids for Reinforced Concrete to IS 456-1978.
7.	SP : 34 – 1987 Hand book on Concrete Reinforcement and Detailing.
8.	IS 875(Part 1)-1987: Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures. Part 1: Dead Loads--Unit Weights of Building Materials and Stored Materials (Second Revision)
9.	IS 875(Part 2)-1987: Code of Practice for Design Loads (Other Than Earthquake) For Buildings and Structures. Part 2: Imposed Loads (Second Revision)
10.	IS 875(Part3)-2015: Wind Loads on Buildings andStructures
11.	IS 875(Part4)-1984:snowloads
12.	IS 875(Part5)-1987:special loads and combinations

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	3	2	1	1	1	1	1	1	2	2	3	1
CO2	3	3	1	1	2	2	1	1	1	1	1	1	3	2	2
CO3	3	1	2	2	1	1	2	1	1	2	2	1	2	1	1
CO4	1	2	3	1	2	1	1	1	1	2	2	1	1	1	2
CO5	1	1	2	1	1	1	1	3	1	2	1	2	1	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CE505	WASTE WATER ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	The subject aims to give the students, the knowledge about the sewage water and waste water treatment.
2.	Students are introduced to the new world of waste water treatment technologies which prevails in the current scenario.
3.	Students, at the end of the semester will have complete ability to analysis the type of sewage and the treatment to be carried out to reuse the water.

Unit I	SEWERAGE SYSTEM	9	+	0

Definition – classification – systems of sewerage – quantity of sewage – Fluctuation in flow pattern – estimation and storm runoff – design flow for separate and combined system – hydraulics ofsewers – self cleansing velocities – full flow / partial flow conditions – sewer sections – material for sewers - sewerjoints–jointingmaterials–sewerlayingunder variousconditions–testonsewers–sewer maintenance – sewer appurtenances –sewage pumping – types of pumps.

Unit II	WASTE WATER CHARACTERISTICS & PRIMARY TREATMENT	9	+	0

Characteristics and composition of sewage – physical and chemical analysis – DO and BOD and their significances – cycles of decomposition – fundamentals of microbiology of wastewater – preliminary and primary treatment – screens – skimming tank – grit chamber – design of proportional flow weir– principle, types of sedimentation – design of sedimentation tanks.

Unit III	BIOLOGICAL TREATMENT OF WASTEWATER	9	+	0

Basic principles of biological treatment – Activated sludge process – recirculation – diffuser – mechanical aeration – Process modifications – oxidation ditch – Trickling filter – Principles and design –NRC equation – RBC Principle – Principles and design of waste stabilization ponds – Principle and design of a lagoon - septic tanks and effluent disposal system.

Unit IV	SLUDGE MANAGEMENT & HOUSE DRAINAGE	9	+	0

Objectives of sludge treatment – properties and characteristics of sludge – sludge thickening – sludge digestion – drying beds – conditioning and dewatering – sludge disposal – Sanitary fixtures and fitting – Pipe system – general layout of house drainage – street connections.

Unit V	SEWAGE DISPOSAL	9	+	0

Methods – dilution – self purification of streams – oxygen sag curve – Streeter Phelp's model - wastewater reclamation techniques – land disposal – sewage farming – deep well injection – Eutrophication – recycles and reuse of wastewater.

Total 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Network of pipes, pumps, and force mains for the collection of wastewater, or sewage, from a community.
CO2	:	Water Negatively affected in quality by humans by changing its physical and chemical properties like colour, odor.
CO3	:	Harnesses the action of bacteria and other microorganisms to clean water
CO4	:	It is an integral part of any modern municipal waste water treatment
CO5	:	Biological processes are used to remove contaminants and produce treated wastewater that is safe enough for release into the environment.

Text Books:	
1.	Garg S.K., *Waste Water Engineering*, Khanna publishing Co., New Delhi - 2007.
2.	Punmia B.C., Ashok Jain, *Environmental Engineering(Vol.-II),Wastewater Engineering*, Laxmi Publications, New Delhi , 2008.
Reference Books:	
1.	Duggal K.N., *Elements of Public Health Engineering*, S.Chand and Co., 2007.
2.	*Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1983.*
3.	*Hand Book on Water Supply and Drainage*, SP 35, B.I.S., New Delhi,1987.
4.	Metcalf and Eddy,M.C., *Wastewater Engineering – Treatment &Reuse*,TataMcGraw-Hill Publications, New Delhi,2003.
5.	Birdie G.S., *Water Supply and Sanitary Engineering*, DhanpatRai and sons, 2007.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	1	2	3	2			3		3	2	2
CO2		1	3		1	3	3	2			3		3		
CO3			2		1	3	3	2			3		3		1
CO4			2		1	3	3	2			3		3		2
CO5			3		1	3	3	2	1		3		3		3

1 – Slightly
2 – Moderately
3 - Strongly

18CE506	TRANSPORTATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	The objective of the course is to educate the students on various components of highway engineering
2.	To educate the design concepts of components of railway engineering.
3.	The course enables the students to develop skill on evaluation and maintenance.

UNITI	HIGHWAY PLANNING AND ALIGNMENT	9	+	0

Highway Development in India - Jayakar Committee Recommendations and Realisations- Requirements of Ideal Alignment- Factors Controlling Highway Alignment-Engineering Surveys for Alignment -Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques)-Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Kerbs, Shoulders and Footpaths [IRC Standards], Cross sections of different Class of Roads.

UNITII	GEOMETRIC DESIGN OF HIGHWAYS	9	+	0

Design of Horizontal Alignments – Superelevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems] Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves-SightDistances - Factors affecting Sight Distances, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD]-Geometric Design of Hill Roads [IRC Standards Only]

UNITIII	HIGHWAY MATERIALS, CONSTRUCTION, MAINTENANCE AND OPERATION	9	+	0

Desirable Properties of Highway Materials-Bitumen - Penetration, Ductility, Viscosity, Binder content and Softening point Tests.Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications]Highway Drainage [IRC Recommendations]Types of defects in Flexible pavements –Surface defects, Cracks,Deformation,Disintegration – Symptoms, Causes and Treatments.Types of Pavement, Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks Spalling of Joints and Mud Pumping – and Special Repairs.

UNITIV	RAILWAY PLANNING AND DESIGN	9	+	0

Role of Indian Railways in National Development -Engineering Surveys for Track Alignment – Obligatory points - Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments)Permanent Way, its Components and Functions of each Component:Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps -Sleepers – Functions, Materials, Density. Ballasts – Functions, Materials, Ballastless Tracks Geometric Design of Railway Tracks – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves (Derivations of Formulae and Problems)

Unit V	RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION	9	+	0

Points and Crossings - Design of Turnouts, Signalling, Interlocking, Construction & Maintenance – Conventional, Modern methods and Materials, Track Drainage Track Modernisation– Automated maintenance and upgrading, Technologies, Re-laying of Track, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings.

		Total 45 Periods
Course Outcomes:		
Upon completion of this course, the students will be able to:		
CO1	:	Carry out surveys involved in planning and highway alignment
CO2	:	Design cross section elements, sight distance, horizontal and vertical alignment
CO3	:	Determine the characteristics of pavement materials
CO4	:	On completing the course, the students will have the ability to Plan and Design various civil Engineering aspects of Railways.
Text Books:		
1.		Khanna K., Justo C.E.G., *Highway Engineering* revised 10th edition Khanna Publishers, Roorkee, 2014.
2.		Kadiyali L. R, *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, 2019.
3.		ChandolaS.P.Transportation Engineering-2019
Reference Books:		
1.		Sharma S.K., *Principles Practice and Design of Highway Engineering*, S.Chand& Co Ltd. New Delhi, 2006.
2.		Guidelines of Ministry of Road Transport and Highways, Government of India.
3.		Agarwal M.M., *Indian Railway Track*, 14th Edition, Prabha and Co., New Delhi, 2002.
4.		Saxena S.C. Highway & Traffic Engineering, 2014.
E-References:		
1.		https://nptel.ac.in/downloads/105101087/- Transportation Engineering (Highways)
2.		https://nptel.ac.in/courses/105107123/- Transportation Engineering (Railways)
3.		https://nptel.ac.in/courses/105101087/19- Pavement design

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1			1				1	1	3		1
CO2	2	2	2		2		1				1	1	3		
CO3	1	1		1									1		
CO4	3	2	1	1			1	1			1		3		1
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CE507	GEOTECHNICAL LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1.	To learn the methods of finding index properties of soil by conducting various tests in the laboratory.
2.	To Classify the type of soil based on the index properties of soil.
3.	To Study the methods to stabilize or improve the properties of soil by adding admixtures.
4.	To find the shear parameters and shear strength of soil from laboratory and field tests.

EXPERIMENTS

1.	Determination of Moisture Content by Oven drying method
2.	Determination of Moisture Content by Pycnometer method
3.	Determination of Grain Size Distribution by Sieve Analysis
4.	Determination of Specific Gravity of Soil grains
5.	Determination of Relative Density of Sand
6.	Determination of Atterberg's Limits of Soil
7.	Determination of OMC and Maximum Dry Density by Standard Proctor Compaction Test
8.	Determination of Field Density by Core Cutter Method
9.	Determination of Field Density by Sand Replacement Method
10.	Determination of Permeability of soil by Constant Head Method
11.	Determination of Permeability of soil by Variable Head Method
12.	Determination of Shear Parameters of non-cohesive soil by Direct Shear Test
13.	Determination of Shear Parameters of Cohesion less soil by Vane Shear Test
14.	Determination of Shear Parameters of Cohesive soil by Unconfined Compression Test
15.	Determination of CBR Value by California Bearing Ratio Test
16.	Determination of Grain Size Distribution by Hydrometer Analysis (Demonstration)
17.	Determination of Settlement in soil due to primary consolidation by One Dimensional Consolidation Test (Demonstration)
18.	Determination of Shear Parameters of Cohesive soil by Tri axial Compression Test (Demonstration)
19.	Determination of Safe Bearing Capacity of soil by Standard Penetration Test (Demonstration)
20.	Determination of Ultimate Bearing Capacity and Probable Settlement by Plate Load Test (Demonstration)

Total 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Learn to find the index properties properties of soil by conducting laboratory tests.
CO2	:	To Identify and to classify the type of soil.
CO3	:	To stabilize soil by adding admixtures
CO4	:	To find the shear parameters and shear strength of soil from laboratory and field tests.

Reference Books:

1.	IS 2720 Part I to Part XXVIII – Code of Practices for testing the soil,2005.
2.	Apparao K.V.S and Rao V.C.S., "Soil Testing Laboratory Manual & Question Bank", University Science Press, New Delhi, 2017.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	0	1	0	1	1	1	2	3	3	1
CO2	3	3	3	3	3	1	1	2	1	0	1	1	3	3	2
CO3	3	3	3	3	3	3	3	1	0	0	0	2	3	3	1
CO4	3	3	3	3	3	2	3	1	1	0	1	1	3	2	1

1 – Slightly
2 – Moderately
3 – Strongly

18CE508	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives: The objectives of this course is to

1.	Introduce the students about how the common environmental experiments relating to water and wastewater quality are performed.
2.	Quantify the dosage requirement for coagulation process
3.	Determine the physical, chemical and biological characteristics of water and wastewater
4.	Be aware of the procedure for determining ph and turbidity values for water and sewage by the students.
5.	Make the students to get know which tests are appropriate for given environmental problems.

EXPERIMENTS

1.	Determination of pH value for the given water sample
2.	Determination of Turbidity value for the given water sample
3.	Determination of Alkalinity present in the given sample of water
4.	Determination of Hardness(Total, temporary and permanent) present in the given water sample
5.	Determination of Chlorides present in the given sample of water
6.	Determination of Sulphates present in the given sample of water
7.	Determination of Total, Dissolved, Suspended, Volatile and Fixed Solids
8.	Determination of Optimum coagulant dose using jar test apparatus
9.	Determination of Residual Chlorine present in the given water sample
10.	Determination of Dissolved Oxygen present in the given water sample
11.	Determination of B.O.D for the given sample
12.	Determination of C.O.D for the given sample

Total 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
CO2	:	Obtain the necessary background for subsequent courses in environmental engineering.
CO3	:	Quantify the concentration of salts in water andwastewater
CO4		Recommend the degree of treatment required for the water and wastewater
CO5		Examine the conditions for the growth of micro-organisms

Reference Books:

1.	Environmental Engineering Laboratory Manual, B Kotaiah, N Kumara Swamy, 1994,Charotar Books Distributors
2.	NEERI. 1988. *Manual o f Water and Waste Analysis,* National Environmental Engineering Research Institute, Nagpur, Maharastra (India)
3.	*Chemistry for Environmental Engineering and Science* ,Sawyer, C. N., McCarty, P. L., and Perkin, G.F., , 5th edition McGraw-Hill Inc., 2002

E-References:

1.	https://studylib.net/doc/18517687/lab-manual---civil-and-environmental-engineering

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2	1	2				1			2		1
CO2				2	1	1	1		1	1		1	1		
CO3					1	1	1						1		1
CO4					1	1	1						1		
CO5						1							1		

1 – Slightly
2 – Moderately
3 - Strongly

18MC301	Indian Constitution	L	T	P	C
		2	0	0	0

Course Objectives:

1. Learn the salient features of the Indian Constitution.
2. List the Fundamental Rights and Fundamental Duties.
3. Present a systematic analysis of all dimensions of Indian Political System.
4. Understand the power and functions of the Parliament, the Legislature and the Judiciary.

UNITI

Union and its Territory – Citizenship–Fundamental Rights–Directive Principles of State Policy–Fundamental Dutie

UNITII

The Union–The States–The Union Territories–The Panchayats–The Municipalitie

UNITIII

The Co-operative Societies–The scheduled and Tribal Areas–Relations between the Union and the States–Finance, Property, Contracts and Suits–Trade and Commerce within the territory of India.

UNITIV

Services under the Union, the States – Tribunals – Elections– Special Provisions –Relating to certain Classes.

Unit V

Languages–Emergency Provisions – Miscellaneous–Amendment of the Constitution.

Course Outcomes:

On completion of the course, students will

understand the emergence and evolution of the Indian Constitution

Explain the key concepts of Indian Political System.

Describe the role of constitution in a democratic society.

Present the structure and functions of the Central and State Governments, the Legislature and the Judiciary

Reference Books:

1) SubhashC.Kashyap, *Our Constitution*, National Book Trust, 2017.

2) Durga Das Basu, *Introduction to the Constitution of India,* Lexis Nexis, 2015.

3) M.V.Pylee, *Constitutional History of India,* S.Chand publishing, 2010

4) Granville Austin, *The Indian Constitution: Cornerstone of a Nation,* Oxford University Press, 1999.

18CE601	ADVANCED STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of this course is to

1.	impart Knowledge on students about advanced methods of analysis of structures
2.	impart Knowledge on students about the analysis of structures using slope deflection and moment distribution methods
3.	Understand about the matrix method and its applications for computer-based analysis of structure.
4.	Know about the basics of Finite Element Method and its application
5.	Make the students to analyse the indeterminate structures by using various methods

Unit I	**SLOPE DEFLECTION METHOD**	**9**	**+**	**0**

Slope deflection equations-Analysis of continuous beams-Analysis of single storey single bay rectangular portal frames with and without side sway.

Unit II	**MOMENT DISTRIBUTION METHOD**	**9**	**+**	**0**

Analysis of continuous beams - Carry over factor – Distribution factor – Analysis of single storey single bay – Symmetry and anti-symmetry structures.

Unit III	**MATRIX FLEXIBILITY METHOD**	**9**	**+**	**0**

Analysis of continuous beams, Indeterminate frames and trusses with maximum two degrees of static indeterminacy.

Unit IV	**MATRIX STIFFNESS METHOD**	**9**	**+**	**0**

Analysis of continuous beams, Indeterminate frames and trusses with maximum two degrees of kinematic indeterminacy.

Unit V	**FINITE ELEMENT METHOD**	**9**	**+**	**0**

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements.

Total (L+T)= 45 Periods

Course Outcomes:

Upon completion of this course, The students will

CO1	:	Have the knowledge on classical methods (SDM & MDM) of analysis of indeterminate structures.
CO2	:	:understand the concepts of FEM
CO3	:	understand the procedures to be followed for various methods of analysis of indeterminate structures
CO4	:	Be able to Analyse indeterminate structures using force and displacement matrix methods
CO5	:	Be able to analyse the indeterminate structures and frames by using classical and modern method of analysis

Text Books:

1.	Punmia B C., *Theory of Structures Vol. II*, Laxmi Publications (P) Ltd., New Delhi. 2004.
2.	Devados Menon, *Structural Analysis*, Narosa Publishing House, NewDelhi, 2009.
3.	Rajasekaran S., Sankara Subramanian G., Computational Structural Mechanics, PHI, India, 2010.
4.	Vaidyanathan, R. and Perumal, P., "structural Analysis – Vol. II", Laxmi Publications, New Delhi, 2016

Reference Books:

1.	Negi L.S and JangidR.S.,*Structura Analysis*, Tata McGraw-Hill Publishing Company

	Limited,NewDelhi,1997
2.	*Manickaselvam V.K., Elements of Matrix and Stability Analysis of structures , Khanna Publishers, 1999, New Delhi.*
3.	Pandit G.S and Gupta S.P.,*Structural Analysis-A matrix approach,* TataMcGraw-Hill Publishing Company Limited,NewDelhi, 2006.
4.	DevadosMenon,*Advanced Structural Analysis*, Narosa Publishing House, NewDelhi, 2009.
E-References:	
1.	https://nptel.ac.in/downloads/105105109/

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	3										2	
CO2	1	2		2										2	
CO3	1	2		1										3	
CO4	1			3										2	
CO5	1			3										3	

1 – Slightly
2 – Moderately
3 - Strongly

18CE602	FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1. At the end of the course student will acquire the knowledge in soil exploration .
2. At the end of the course student will know about the bearing capacity, shallow and deep foundations
3. At the end of the course student will know about the earth pressure and stability of slopes3.

Unit I SOIL EXPLORATION AND SELECTION OF FOUNDATION 9 + 0

Soil exploration methods – Disturbed and Undisturbed sampling – Samplers – Depth of Exploration – Number and Spacing of boreholes – Sounding tests – Standard Penetration Test, Static Cone and Dynamic Cone Penetration Tests – Bore log.
Requirements of good foundation – factors governing location and depth- Types of foundation – Choice of foundation – Floating Foundation – Foundation on Expansive soil.

Unit II BEARING CAPACITY OF SOIL AND SETTLEMENT 9 + 0

Bearing Capacity – Terzhaghi's Bearing Capacity Equation – Types of Failure – Effect of Water Table – Skempton's Formula – Bearing Capacity based on IS method- Effect of eccentricity of load on bearing capacity of soil – Bearing Capacity based on 'N' value - Allowable bearing pressure – Plate Load test – Methods of Improving Bearing Capacity of soil.
Settlement – immediate and time dependent settlement – Differential settlement – Causes – BIS Code provisions – Proportioning of Footing.

Unit III PILE FOUNDATION 9 + 0

Classification of Piles – Functions – Merits – Load Carrying Capacity – Static Analysis – Dynamic Analysis – Pile load test – Pile group – Spacing and Group action – Efficiency of Pile group – Engineering News Formula – Hammers – Settlement – Negative Skin Friction – uplift capacity - Construction of Under Reamed Pile Foundation.

Unit IV STABILITY OF SLOPES 9 + 0

Stability of Slopes – Infinite and Finite Slopes – Types of Failure – Culmann's methods –Swedish Slip Circle Method – Friction Circle method – Bishop's method – Taylor's Stability Number – Slope protective measures.

Unit V EARTH PRESSURE ON RETAINING WALLS 9 + 0

Plastic equilibrium in soils – Active and Passive states – Rankine's theory – Cohesionless and cohesive soils – Couloumb's wedge theory – Earth pressure on retaining walls of simple configurations – Stability of retaining walls.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Characterise soil investigation for any civil engineering construction
CO2	:	Analyse earth retaining structures for any kind of soil medium
CO3	:	Estimate bearing capacity using IS code methods
CO4	:	Design proper foundations for any kind of shallow foundation system
CO5	:	Estimate pile and pile group capacity for any kind of soil including group efficiency and negative

Text Books:

1. Punmia B.C Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., New Delhi, 2017.
2. Purushothama Raj P, *Soil Mechanics and Foundation Engineering*, Perason Education, 2008
3. Gopal Ranjan and Rao A.S.R., *Basic and Applied Soil Mechanics*, New Age International Publishers (P) Ltd., New Delhi, 2016.

4.	*Venkataramaiah, C., Geotechnical Engineering, New Age International Publishers, New Delhi, 1995.*
5.	Punmia B.C *Soil Mechanics and Foundations*, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
Reference Books:	
1.	Swamisaran, *Analysis and Design of Structures – Limit State Design*, Oxford IBH Publishing Co-Pvt. Ltd., New Delhi, 1998.
2.	Som N.N and Das S.C*., Theory and Practice of Foundation Design*, Prentice Hall Pvt. Ltd., New Delhi, 2003.
3.	Arora K.R., *Soil Mechanics and Foundation Engineering*, Standard Publishers and Distributors, New Delhi, 1997.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	1	3	1	2	0	0	0	3	0	0
CO2	3	3	3	2	2	2	3	1	2	0	0	0	3	0	0
CO3	3	3	3	3	2	2	3	1	2	0	0	0	3	0	0
CO4	3	3	3	2	1	2	3	1	2	0	0	0	3	0	0
CO5	3	3	2	3	1	1	3	1	2	0	0	0	3	0	0

1 – Slightly
2 – Moderately
3 – Strongly

18CE603	ENGINEERING ECONOMICS, ESTIMATION& COSTING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	An idea of how structures are built and projects are developed on the field.
2.	An understanding of modern construction practices.
3.	A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics.
4.	A basic ability to plan, control and monitor construction projects with respect to time and cost.
5.	An idea of how to optimise construction projects based on costs.
6.	An idea how construction projects are administered with respect to contract structures and issues.
7.	An ability to put forward ideas and understandings to others with effective communication processes.

UNIT I	BASIC ECONOMICS	9	+	0

Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

UNIT II	FINANCING	9	+	0

Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

UNIT III	COST AND BREAK EVEN ANALYSIS	9	+	0

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

UNIT IV	INDIAN ECONOMY	9	+	0

Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

Unit V	ESTIMATION AND COST ANALYSIS OF STRUCTURES	9	+	0

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of material requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

Total (L+T)= 45 Periods

Course Outcomes:		
Upon completion of this course, the students will be able to:		
CO1	:	Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
CO2	:	Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
CO3	:	Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
CO4	:	Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
CO5		Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
CO6		Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

Text Books:	
1.	Dewett K.K. & Varma J.D., Elementary Economic Theory, S Chand
2.	Prasad L.M., Principles and Practice of Management, S Chand & Sons, 2010
3.	Dutta, B.N., Estimating and Costing in Civil Engineering, UBS Publishers & Distributors Pvt. Ltd., 2007
4.	Kohli, D.D and Kohli, R.C., A Text Book of Estimating and Costing (Civil), S.Chand& Company Ltd., 2007
Reference Books:	
1.	Barthwal R.R., *Industrial Economics - An Introductory Text Book*, New Age
2.	*Khan M.Y. and Jain P.K., Financial Management, McGraw-Hill Publishing Co., Ltd*
3.	*Varshney R.L. and Maheshwary K.L., Managerial Economics, S Chand and Co*
4.	*Harold Koontz & Heinz Weihrich, Essentials of Management, T.M.H. Publications, 2007*
5..	*PWD Data Book.*
6.	*Tamilnadu Transparencies in Tender Act, 1998.*
7.	*Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996.*

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	1	-	-	-	-	1	3	2	-
CO2	-	-	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3	3	-	2	-	2	3	-	-	2	-	-	-	-	-	3
CO4	-	-	-	-	2	3	-	-	2	-	3	-	-	-	2
CO5	1	-	1	-	-	-	-	-	-	-	-	-	1	-	3

1 – Slightly
2 – Moderately
3 - Strongly

18CE604	PROFESSIONAL PRACTICE, ETHICS & BUILDING BY-LAWS	L	T	P	C
		2	0	0	2

Course Objectives:

1	To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.
2	To develop some ideas of the legal and practical aspects of their profession.

Unit I	PROFESSIONAL PRACTICE –RESPECTIVE ROLES OF VARIOUS STAKEHOLDERS :	9	+	0

Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards ofpractice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress,IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards);Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics,Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics ; Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

Unit II	GENERAL PRINCIPLES OF CONTRACTS MANAGEMENT:	9	+	0

*Indian Contract Act, 1972 andamendments*covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders,Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed;Variations& Changes in Contracts; Differing site conditions; Cost escalation; Delays,Suspensions& Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance;Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping,Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms.

Unit III	ARBITRATION,CONCILIATION AND ADR (Alternative Dispute Resolution) system:	9	+	0

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and courtassistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration,confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Unit IV	ENGAGEMENT OF LABOUR & OTHER CONSTRUCTION-RELATED LAWS:	9	+	0

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece

rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017					
Unit V	**LAW RELATING TO INTELLECTUAL PROPERTY:**		**9**	**+**	**0**
Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957,Meaning of copyright – computer programs, Ownership of copyrights and assignment,Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition,Rights and obligations of patentee, Duration of patents – law and policy considerations,Infringementand related remedies.					
Total (45+0)= 45 Periods					
Course Outcomes:					
Upon completion of this course, the students will be able to:					
CO1	:	To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession.			
CO2	:	To give a good insight into contracts and contracts management in civil engineering, dispute resolution mechanisms; laws governing engagement of labour			
CO3	:	To give an understanding of Intellectual Property Rights, Patents			
CO4	:	To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.			
Text Books:					
1	Dutt (1994), Indian Contract Act, Eastern Law House				
2	Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration				
Reference books					
1	Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset				
2	Avtarsingh (2002), Law of Contract, Eastern Book Co.				

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		3			3	3	3	1	1	3	3	1		2
CO2	1				2	1	3	3	2	1	2	3	3		3
CO3			1		2	1		3	3	1	3	3	2		3
CO4	2			1	2	2	1	3	2	2	2	3	2		3

1 – Slightly
2 – Moderately
3 - Strongly

18CE605	CONCRETE LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1.	This course will help students to know about the properties of different building materials.
2.	To implement the idea of material properties in order to make mix design and for design of various building members.
3.	To prepare the students to effectively link theory with practice and application and to demonstrate background of the theoretical aspects in concrete technology
4.	To prepare the students to have hands on experiments and to have exposure to equipment and machines
5.	To motivate the students to take up higher studies and innovative research projects

EXPERIMENTS

1.	Determination of Normal consistency and setting time tests on cement
2.	Determination of Fineness test on cement
3.	Determination of Soundness test on cement
4.	Determination of Aggregate Crushing and Impact Value
5.	Determination of Aggregate Abrasion Test
6.	Determination of Specific gravity of Cement
7.	Concrete mix Design using IS method
8.	Determination of Compressive strength of cement
9.	Determination of Slump test on fresh concrete
10.	Determination of Compaction factor test on fresh concrete
11.	Determination of quality of Hardened concrete using Ultrasonic concrete tester (NDT)
12.	Determination of compressive strength of concrete cubes by Rebound Hammer tester (NDT)

Total = 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Know the techniques to characterize various construction materials through relevant tests.
CO2	:	test all the concrete materials as per IS code
CO3	:	design the concrete mix using IS code
CO4	:	Determine the properties of fresh and hardened concrete
CO5	:	Conduct tests on concrete using NDT methods

Reference Books:

1.	Building and Construction Materials: Testing and Quality Control- Testing and Quality Control ,M. L. Gambhir,Dhanpat Rai & sons New – Delhi,2014
2.	Laboratory manual on concrete technology; Hemant Sood, CBS Publishers,First edition ,2016
3.	Concrete Technology (Theory & Practice) S.ChandPublications,Eighth edition,2018

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2	2				2				2		2
CO2				2			1						2		2
CO3				2			1						2		2
CO4					2		2						1		1
CO5					2		2						1		1

1 – Slightly 2 – Moderately 3 - Strongly

18CE606	COMPUTER AIDED DESIGN AND DRAWING (Concrete and Steel)	L	T	P	C
		0	0	4	2

Course Objectives:

1. This course will help students to perform structural design for different elements implanting manually and through drafting process.

EXPERIMENTS

1.	Design and drawing of RCC cantilever retaining wall with reinforcement details
2.	Design and drawing of Counterfort retaining wall with reinforcement details
3.	Design and drawing of RCC slab with reinforcement details
4.	Design and drawing of RCC Tee beam bridges for IRC Loading with reinforcement details
5.	Design and drawing of RCC Circular overhead water tank with reinforcement details
6.	Design and drawing of RCC rectangular underground water tank with reinforcement details
7.	Design and drawing of Plate girder bridge with detailed drawings on connections
8.	Design and drawing of Truss girder bridge with detailed drawing on connection

Total = 60 Periods

Course Outcomes:

After the successful completion of the practical session, the students will be able to

CO1	:	Acquire hands on experience on designing the concrete structures
CO2	*:*	Acquire hands on experience on designing the steel structures
CO3	*:*	Preparation of structural drawings of concrete structures technically
CO4	*:*	Preparation of structural drawings of steel structures technically
CO5	*:*	Analyse the RCC and Steel structures with safe limits and checking the design.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	1	1	2	1	1	1	2	3	3	2
CO2	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO3	3	1	2	2	1	1	1	1	1	1	2	1	2	1	1
CO4	1	2	3	1	1	2	1	1	1	2	2	1	1	1	2
CO5	1	1	2	2	3	1	1	2	1	2	1	2	1	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CE801	Construction Management	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of this course is to

1.	Learn basic concepts about planning
2.	Study about the legal implications of contract, common, and regulatory law to manage a construction project
3.	Understand construction accounting and cost control
4.	Understand construction risk management and quality assurance and control
5.	Train the students with the latest and the best in the rapidly changing fields of Construction Engineering, Technology and Management

UNIT I	CONSTRUCTION PLANNING	9	+	0

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems

UNIT II	SCHEDULING PROCEDURES AND TECHNIQUES	9	+	0

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedence - Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software

UNIT III	COST CONTROL MONITORING AND ACCOUNTING	9	+	0

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information

UNIT IV	QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	9	+	0

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

Unit V	ORGANIZATION AND USE OF PROJECT INFORMATION	9	+	0

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

Total (L+T)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the nuances of management functions
CO2	:	Analyze the framework of a business organization
CO3	:	Adopt an empirical approach toward business situations
CO4	:	Apply various Project Management techniques
CO5		Implement roles of team players

Text Books:

1.	Chitkara, K.K. *Construction Project Management Planning, Scheduling and Control*, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2.	Punmia B.C. and Khandelwal, Project planning and Control with PERT and CPM, Laxmi

	Publications, New Delhi, 2002.
Reference Books:	
1.	Ghalot P.S., Dhir D.M., Construction Planning and Management,Wileyeastern Limited, 1992.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2	1	1	1	3	1	2	1	3	3		1	3
CO2	1	3	2	1			3		2		3	3	3	3	3
CO3		3	2	1	2	1	3	1	2	2	3	3	1	3	3
CO4	1	1	2	2	2		3		2	2	3	3	3	3	3
CO5	1		3				3	1	2		3	3	1	3	3

1 – Slightly
2 – Moderately
3 - Strongly

LIST OF ELECTIVES FOR B.E CIVIL ENGINEERING

PROFESSIONAL ELECTIVES

TRANSPORTATION ENGINEERING

18CEPE01	**TRAFFIC ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1.	The students acquire comprehensive knowledge of traffic surveys and studies suchas 'Volume Count', 'Speed and delay', 'Origin and destination', 'Parking', 'Pedestrian' and 'Accident surveys'
2.	They achieve knowledge on design of 'at grade' and 'grade separated' intersections.
3.	They also become familiar with various traffic control and traffic management measures.

UNIT I	**INTRODUCTION**	**9**	**+**	**0**

Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

UNIT II	**TRAFFIC SURVEYS AND ANALYSIS**	**9**	**+**	**0**

Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Problems

UNIT III	**TRAFFIC CONTROL**	**9**	**+**	**0**

Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

UNIT IV	**GEOMETRIC DESIGN OF INTERSECTIONS**	**9**	**+**	**0**

Conflicts at Intersections, Classification of Intersections at Grade, - Channelized and Unchannelized Intersection - Grade Separators (Concepts only), Principles of Intersection Design, Elements of Intersection Design, Channelization and Rotary design (Problems), Grade Separators

Unit V	**TRAFFIC MANAGEMENT**	**9**	**+**	**0**

Traffic Management- Traffic System Management (TSM) and Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply the principles of the transportation planning process and demand estimation
CO2	:	Analyse the trip production and trip attraction models
CO3	:	Analyse the growth factor, gravity and opportunity models
CO4	:	Apply the mode choice behaviour and mode split models

Text Books:

1.	Khanna K., Justo C.E.G., *Highway Engineering* revised 10th edition Khanna Publishers, Roorkee, 2014.
2.	Kadiyali L. R, *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, 2019.

Reference Books:

1.	Subhash C.Saxena, A Course in Traffic Planning andDesign,Dhanpat Rai

	Publications, New Delhi, 1989.
2.	Saltar S.A., Highway Traffic Analysis and Design, Prentice Hall, New Jersey, 2002.
3.	Guidelines of Ministry of Road Transport and Highways, Government of India.
4.	Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management
E-References:	
1.	https://nptel.ac.in/courses/105101008/1- Fundamentals of Traffic flow
2.	https://nptel.ac.in/courses/105101008/27- Intersection control
3.	https://nptel.ac.in/courses/105101008/50- Traffic engineering and management

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2		1		1				1	1	3		1
CO2		1	2	2			1				1		3		
CO3	1	1		1	1				1				1		
CO4			1	1	1		1	1	1		1		1		1
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE02	AIRPORTS, DOCKS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	The course imparts the knowledge of planning and design of airports, docks and harbour structure
2.	The course imparts the knowledge of construction of airports, docks and harbour structure
3.	The course imparts the knowledge of maintenance of airports, docks and harbour structure

UNIT I	AIRPORT PLANNING AND DESIGN	9	+	0

Advantages and Limitations of Air Transport, Components of Airports-Airport Planning – Air traffic potential, Site Selection, Design of Components, Cost Estimates, Evaluation and Institutional arrangements-Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Drainage.

UNIT II	TAXIWAY DESIGN AND AIRPORT LAYOUTS	9	+	0

Taxiway Design – Geometric Design Elements, Minimum Separation Distances, Design Speed, Airport Drainage -Airport Zoning - Clear Zone, Approach Zone, Buffer Zone, Turning Zone, Clearance over Highways and Railways-Airport Layouts – Apron, Terminal Building, Hangars, Motor Vehicle Parking Area and Circulation Pattern, Case studies of Airport Layouts-Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities.

UNIT III	VISUAL AIDS AND AIR TRAFFIC CONTROL	9	+	0

Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings-Air Traffic Control – Basic Actions, Air Traffic Control Network Helipads, Hangars, Service Equipments.

UNIT IV	HARBOUR ENGINEERING	9	+	0

Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports Requirements and Classification ofHarbours
Site Selection & Selection Investigation – Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Littoral Transport with Erosion and Deposition, Anchoring Grounds, Geological Characteristics, Winds & Storms- Proximity to Towns/Cities, Utilities, Construction Materials, Coast Lines

Unit V	DOCKS AND OTHER STRUCTURES	9	+	0

Dry and Wet Docks,, Planning and Layouts- Entrance, Position of Light Houses, Navigating Terminal Facilities – Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Navigational Aids Coastal Structures- Piers, Breakwaters, Wharves, Jetties, Quays, Spring Fenders Coastal Shipping, Inland Water Transport and Container Transportation. Pipe Ways, Rope Ways.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Plan for airport, harbour, docks and coastal structures
CO2	:	Design for airport and its components
CO3	:	Construct airport, docks and harbour
CO4	:	Protect the harbour, docks and coastal structures

Text Books:

1.	Khanna S.K, Arora M.G, *Airport Planning and Design,* NemchandAnd Brothers, Roorkee, 2007.
2.	Bindra S P., *A Course in Docks and Harbour Engineering*, Dhanpat Rai and Sons, New Delhi, 1992.

3.	Hasmukh PranshankerOza, Gautam H. Oza., Dock and Harbour Engineering Charotar Publishing House, 1999
Reference Books:	
1.	RangwalaS.C ,Rangwala P.C , *Airport Engineering,* Charotar Publishing House Pvt. Limited, 2008
2.	Shahani P.B., *Airport Techniques*, 2nd edition, Oxford Publications, New Delhi
3.	Srinivasan R., *Harbour, Dock and Tunnel Engineering*, Charotar Publishing House, Anand, India, 1995.
4.	Norman J. Ashford , Paul H. Wright, *Airport Engineering*, John Wiley & Sons Inc; 1st edition
E-References:	
1.	https://nptel.ac.in/courses/114106025/ - Ocean Engineering (Harbour and Docks)
2.	https://nptel.ac.in/courses/105104098/7- Advanced Transportation Engineering (Runway design)
3.	https://nptel.ac.in/courses/105107123/- Transportation Engineering II (Air Transports)

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2	2		2	3		1		1	3	3		1
CO2	3		2	3		3	3		1		1	3	3		1
CO3	3		2	2		3	3		1		1	3	3		1
CO4	3		3	2		3	3		1		1	3	3		1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE03	INTEGRATED TRAFFIC PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To give an overview of Traffic engineering and traffic regulation
2.	To impart knowledge on traffic management and traffic safety
3.	To develop knowledge in the integrated approach in traffic planning

UNIT I	TRAFFIC PLANNING AND CHARACTERISTICS	9	+	0

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country ,regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

UNIT II	TRAFFIC SURVEYS	9	+	0

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT III	TRAFFIC DESIGN AND VISUAL AIDS	9	+	0

Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

UNIT IV	TRAFFIC SAFETY AND ENVIRONMENT	9	+	0

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

Unit V	TRAFFIC MANAGEMENT	9	+	0

Area Traffic Management System - Traffic System Management (TSM) with IRC standards –- Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyse traffic problems and plan for traffic systems various uses
CO2	:	Perform surveys and forecast traffic
CO3	:	Design Channels, Intersections, signals and parking arrangements
CO4	:	Develop Traffic management Systems

Text Books:

1.	Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013
2.	Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.
3.	Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd.1996.

Reference Books:

1.	Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011

2.	Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
3.	SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994
4.	John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996
E-References:	
1.	https://nptel.ac.in/courses/105101008/5- Traffic measurement procedures
2.	https://nptel.ac.in/courses/105101008/17- Traffic flow modelling
3.	https://nptel.ac.in/courses/105101008/48- Intelligent transportation system

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	0	1	1	1	1	1	3	3	3	1
CO2	2	3	1	2	1	0	3	3	2	2	1	0	3	0	1
CO3	3	3	3	3	3	0	3	2	2	2	1	1	3	3	3
CO4	3	2	1	3	3	0	3	2	2	3	3	3	1	2	1

1 – Slightly
2 – Moderately
3 - Strongly

CONSTRUCTION ENGINEERING AND MANAGEMENT

18CEPE04	SMART MATERIALS AND SMART STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of this course is to

1.	Learn about different types of smart materials
2.	Study about advanced measuring instrument
3.	Understand about sensors and its functions
4.	Study about various actuator materials and their role
5.	Learn about Data acquisition system

Unit I	**INTRODUCTION**	**9**	**+**	**0**

Introduction to smart materials and structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

Unit II	**MEASURING TECHNIQUES**	**9**	**+**	**0**

strain measuring techniques using electrical strain gauges, types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

Unit III	**SENSORS**	**9**	**+**	**0**

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors– Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

Unit IV	**ACTUATORS**	**9**	**+**	**0**

Actuator techniques – Actuator and actuator materials – Piezoelectric and electrostrictive material – Magnetostructure material – Shape memory alloys – Electro orheological fluids– Electromagnetic actuation – Role of actuators and actuator materials.

Unit V	**SIGNAL PROCESSING AND CONTROL SYSTEMS**	**9**	**+**	**0**

Data acquisition and processing – Signal processing and control for smart structures – Sensors as geometrical processors – Signal processing – Control system – Linear and Non-linear.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply the knowledge on the self diagnosis, functions and response of various smart materials
CO2	:	Acquire thorough knowledge on instrumentation for measuring strains, load and deflection
CO3		Apply the concepts of sensors parameters and characteristics
CO4		Have an insight into actuator techniques, SMA
CO5	:	Demonstrate the concepts of signal processing and control system

Text Books:

1. L. S. Srinath – *Experimental Stress Analysis* – Tata McGraw-Hill, 1998
2. Brain Culshaw – *Smart Structure and Materials Artech House* – Borton. London-1996

Reference Books:

1.	J. W. Dally & W. F. Riley – *Experimental Stress Analysis* – Tata McGraw-Hill,1998

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	2	2	3	2	2	2	2	0	2
CO2	3	2	3	2	3	2	2	2	3	2	2	2	2	0	2
CO3	2	3	1	3	2	3	3	3	2	3	1	3	3	1	3
CO4	3	2	3	3	2	3	2	2	2	3	0	1	1	1	2
CO5	2	3	3	2	3	1	3	2	3	2	3	1	2	1	3

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE05	CONSTRUCTION TECHNIQUES AND EQUIPMENTS	L	T	P	C
		3	0	0	3

Course Objectives:

1. The main objective of this course is to impart basic knowledge in Construction methods, equipments, machineries and fire safety principles.

Unit I	MODERN CONSTRUCTION METHODS	9	+	0

Open excavation, shafts and tunnels, pier and caisson foundation . Basement construction - construction Methods – supporting the excavations- control of ground water- requirements of form work – economy in form work – materials for forms – arrangements forms for slabs, beams, columns, walls, culverts, stairs etc – removal of forms - shoring and underpinning- basement waterproofing.

Unit II	CONSTRUCTION TECHNIQUES	9	+	0

Construction Methods for Bridges, roads, railways, dams, harbours, river works and pipelines - Construction techniques for Earth moving, excavating , drilling, blasting, tunneling and hoisting and erection

Unit III	CONSTRUCTION EQUIPMENTS	9	+	0

Equipment for: Earth moving, excavating, drilling and blasting.
Equipment for: Dredging, tunneling, hoisting, erection and dewatering - Equipment for Flooring – dewatering and floors finishing.
Equipment for production of concrete – Crushers- feeders- screening equipment – batching and mixing equipment – Conveyors – Vibrators – Concrete mixers - hauling, pouring and pumping equipment – transporters.

Unit IV	MACHINERIES AND ELECTRICAL SYSTEMS IN BUILDINGS	9	+	0

Lifts and Escalators – Special features required for physically handicapped and elderly. Basics of electricity-Single/Three phase supply-Protective devices in electrical installations – Earthing for safety–Typesofearthing–ISspecifications-Planningelectricalwiringforbuilding-Mainand distribution boards.

Unit V	ILLUMINATION & FIRE SAFETY	9	+	0

Luminous flux-Candela-Solid angle illumination-Utilisationfactor-Depreciation factor-MSCP-MHCP-Lans of illumination-Classification of lighting- Artificial light sources-Spectral energy distribution-Luminous efficiency-Color temperature-Color rendering.
Design of modern lighting-Lighting for stores, offices, schools, hospital and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.
Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Know the different construction techniques and methods.
CO2	:	Select,maintain and operate hand and power tools and equipments used in the bridges,roads,railways and dams.
CO3	:	Know the methods and techniques involved in the construction of various sub structures.
CO4	:	Understand the importance of electric safety in buildings
CO5	:	Know the principles on illumination and fire safety.

Text Books:	
1.	Antil J M., *Civil Engineering Construction*, McGraw Hill Book Co., 1982
2.	Peurifoy, R.L.,Ledbette. W.B *Construction Planning , Equipment and Methods* McGraw Hill Co, 2000
3.	Ratay., R.T Hand Book of *Temporary Structures in Construction*, McGraw Hill,1984 Ambrose E.R., *Heat Pumps and Electric Heating* , John Wiley and Sons,Inc.,New York 1968
4.	Hopkinson and Kay J.D. ,*The lighting of buildings* , Faber and Faber, London
Reference Books:	
1.	Koerner ,R.M,*Construction& Geotechnical Methods in Foundations Engineering*, McGraw Hill, 1984
2.	Varma M., *Construction Equipment and its Planning & Application*, Metropolitain Books Co., 1979
3.	Smith R.C, Andres, C.K *Principles and Prentice of Heavy Construction*, Prentice Hall, 1986
4.	Francis D.K.Ching – *Architecture, Form, Space and Order*-V.N.R NY., 1999
5.	William Severns H. and Julian Fellows R. *Air-Conditioning and Refrigeration*, John Wiley and Sons,London,1988
6.	Taylor MAP and Young W, "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.
7	*National Building Code*

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	2	2	2	2	2	3	3	3	2
CO2	2	2	3	2	2	2	2	2	2	2	2	2	2	-	-
CO3	2	2	2	2	2	1	1	1	2	2	2	2	3	3	-
CO4	3	3	2	2	3	2	2	1	2	3	2	3	3	2	2
CO5	3	2	3	3	3	3	3	2	2	2	2	3	3	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE06	PROJECT SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To study the various safety concepts and requirements applied to construction projects
2.	To learn the details about safety programmes
3.	To understand the contractual obligations
4.	To study the various methods of designing for safety
5.	To acquire a knowledge about owners and designers outlook

Unit I	CONSTRUCTION ACCIDENTS	9	+	0

Accidents and their Causes –Human Factors in Construction Safety – Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications.

Unit II	SAFETY PROGRAMMES	9	+	0

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives

Unit III	CONTRACTUAL OBLIGATIONS	9	+	0

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping.

Unit IV	DESIGNING FOR SAFETY	9	+	0

Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.

Unit V	OWNERS' AND DESIGNERS' OUTLOOK	9	+	0

Owner's responsibility for safely – Owner preparedness – Role of designer in ensuring safety – Safety clause in design document.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	know various constructions safety concepts.
CO2	:	Carryout various safety programmes
CO3	:	Challenge contractual obligations task

Text Books:

1.	Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
2.	.Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

Reference Books:

1.	Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil Nadu. Health Management, Prentice Hall Inc.,2001.
2.	Chris Hendrickson and Tung Au, *Project Management forConstruction – Fundamentals Concepts for Owners, Engineers, Architects and Builders,*Prentice Hall, Pitsburgh,2000.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	1	1	1	1	1	1	-	1	1	1
CO2	2	1	2	1	1	1	1	3	1	2	1	1	1	1	1
CO3	1	1	1	1	-	1	3	1	3	3	3	2	1	1	1

1 – Slightly 2 – Moderately 3 - Strongly

18CEPE07	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives: The objectives of this course is to

1.	study the various types and properties of repair materials
2.	learn various distress and damages to concrete structures
3.	understand the importance of maintenance of structures
4.	assess the damage to structures using various tests
5.	learn various repair techniques of damaged structures, corroded structures

Unit I	MAINTENANCE AND REPAIR STRATEGIES	9	+	0

Maintenance, repair and rehabilitation, Facts of Maintenance, importance of Maintenance various aspects of inspection , assessment procedure for evaluating a damaged structure, causes of deterioration.

Unit II	SERVICEABILITY AND DURABILITY OF CONCRETE	9	+	0

Quality assurance for concrete construction, concrete properties- strength, permeability, thermal properties and cracking- effects due to climate, temperature, chemical, corrosion- Design and construction errors-effects of cover thickness and cracking.

Unit III	MATERIALS AND TECHNIQUES FOR REPAIR	9	+	0

Special concretes and mortar, concrete chemical, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fibre reinforced concrete, rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vaccum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.

Unit IV	REPAIRS,REHABILITATION AND RETROFITTING OF STRUCTURES	9	+	0

Strengthening of Structural elements, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

Unit V	DEMOLITION TECHNIQUES	9	+	0

Demolition methods by machines,explosives,Advanced techniques-Demolition sequences,dismantlingtechniques,safety precautions in dismantling and demolition, Engineered demolition techniques for dilapidated structures- case studies

Total (L+T)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	demonstrate the condition of structures
CO2	:	Inspect and evaluate the damaged structure
CO3	:	Implement the repairing techniques of a structure
CO4		Identify and Use different materials for repairing works
CO5	:	Demonstrate the dismantling and demolishing structures

Text Books:

1.	Shetty, M.S.,*Concrete Technology- Theory and Practice*, S. Chand and company, New Delhi,2019
2.	Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991.
3.	CPWD: Handbook on Repair & Rehabilitation of R.C.C. Buildings, CPWD, Govt. of India , 2002, updated reprint 2011

Reference Books:

1.	SanthakumarA.R,*TrainingCoursenotesonDamageAssessmentandRepair in Lowcost*

	housing, "RHDC.NBO" Anna University, july 1992.
2.	RaikarR.N.,*Learningfromfailures- deficienciesindesign,constructionandservices*– R &D centre (SDCPL), raikar bhavan, Bombay,1987
3.	Palaniyappan, N., *Estate management*, Anna Institute of Management, Chennai,1992.
4.	Lakshmipathy, M. etal., *Lecture notes of workshop on Repairs and Rehabilitation of structures*, 29-30thoctober 1999.
E-References:	
1.	https://nptel.ac.in/courses/114106035/38

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	1	1	3	2	2	1	1	1	1	1	2
CO2	3	1	3	2	2	3	2	3	1	2	1	1	1	3	1
CO3	1	3	2	1	3	1	3	1	2	1	3	2	3	1	1
CO4	3	3	2	2	1	2	2	2	2	1	3	1	1	1	2
CO5	1	1	2	3	3	2	1	1	1	2	1	1	2	1	2

1 – Slightly
2 – Moderately
3 - Strongly

ENVIRONMENTAL ENGINEERING

18CEPE08	INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	This subject deals with the pollution from major industries and methods of controlling the same. The students are expected to know about the polluting potential of major industries in the country and the methods of controlling the same.

Unit I	INTRODUCTION	9	+	0

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

Unit II	CLEANER PRODUCTION ORGANISATION	9	+	0

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications

Unit III	POLLUTION FROM MAJOR INDUSTRIES	9	+	0

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steelplants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts

Unit IV	TREATMENT TECHNOLOGIES	9	+	0

Equalization – Neutralization – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering - Disposal

Unit V	HAZARDOUS WASTE MANAGEMENT	9	+	0

Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured land fills.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the polluting potential of major industries
CO2	:	Carry out various methods to control the pollutants

Text Books:

1.	M.N.Rao&A.K.Dutta, *Wastewater Treatment*, Oxford - IBH Publication, 1995.
2.	W .W. Eckenfelder Jr., *Industrial Water Pollution Control*, McGraw-HillBook Company, NewDelhi, 2000.

Reference Books:

1.	T.Shen, *Industrial Pollution Prevention*, Springer, 1999
2.	R.L.Stephenson and J.B.Blackburn, Jr., *Industrial Wastewater Systems Hand book*, Lewis Publisher, New Yark, 1998
3.	H.M.Freeman, *Industrial Pollution Prevention Hand Book*, McGraw-Hill Inc., New Delhi,1995.
4.	Bishop, P.L., *Pollution Prevention: Fundamental & Practice*, McGraw-Hill, 2000.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		3		1	3				2			2		
CO2	3	2	3			3					2		2		2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE09	HAZARDOUS WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To impart knowledge and skills in the collection, storage, transport, treatment, disposal and recycling options for hazardous wastes including the related engineeringprinciples, design criteria, methods and equipments

Unit I	SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK	9	+	0

Types and Sources of hazardous wastes – Need for hazardous waste management – Salient features of Indian legislations on management and handling of hazardous wastes, biomedical wastes, nuclear wastes - lead acid batteries, electronic wastes, plastics and fly ash – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participationfor waste management.

Unit II	WASTE CHARACTERIZATION AND SOURCE REDUCTION	9	+	0

Waste generation rates and variation - Composition, physical, chemical and biological properties of hazardous wastes – Hazardous Characteristics – TCLP tests – waste sampling and characterization plan - Source reduction of wastes – Waste exchange - Extendedproducer responsibility - Recycling and reuse

Unit III	STORAGE, COLLECTION AND TRANSPORT OF WASTES	9	+	0

Handling and segregation of wastes at source – storage and collection of hazardous wastes – Analysis of Collection systems -Need for transfer and transport – Transfer stations Optimizing waste allocation – compatibility, storage, labeling and handling of hazardous wastes –hazardous waste manifests and transport.

Unit IV	WASTE PROCESSING TECHNOLOGIES	9	+	0

Objectives of waste processing – material separation and processing technologies - biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration - solidification and stabilization of hazardous wastes - treatment of biomedical wastes - Health considerations in the contextof operation of facilities, handling of materials and impact of outputs on the environment

Unit V	WASTE DISPOSAL	9	+	0

Waste disposal options –Disposal in landfills -Landfill Classification, types and methods –site selection -design and operation of sanitary landfills, secure landfills andlandfill bioreactors –leachate and landfill gas management –landfill closure and environmental monitoring –Rehabilitation of open dumps –landfill remediation

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand the characteristics of different types of solid and hazardous wastes and the factors affecting variation
CO2	:	Define andexplain important concepts in the field of solid waste management and suggest suitable technical solutions for treatment of municipal and industrialwaste

CO3	:	Understand the role legislation and policy drivers play in stakeholders' response to the waste and apply the basic scientific principles for solving practical waste management challenges

Text Books:	
1.	George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.
2.	Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vansandEnvironmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, NewYork, 2001.
Reference Books:	
1.	1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2000.
2.	2. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore,2002.
3.	3. Paul TWilliams, Waste Treatment and Disposal, Wiley, 2005

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	1	2		3	2		1		1	2	2		2
CO2		2	1	2		2	2	1	1		1	2	2		1
CO3		1	1	1		2	2	2	1		1	2	3		2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE10	AIR POLLUTION MONITORING AND CONTROL	L	T	P	C
		3	0	0	3

Course Objectives:

1.	This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.
2.	In general, the project brings: Contribution to the overall sustainability of the area. Improvement of overall waste management in the area.
3.	Increased recycling levels and reduction of organic waste in landfills.

Unit I	SOURCES AND EFFECTS OF AIR POLLUTANTS	9	+	0

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

Unit II	DISPERSION OF POLLUTANTS	9	+	0

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications

Unit III	AIR POLLUTION CONTROL	9	+	0

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

Unit IV	AIR QUALITY MANAGEMENT	9	+	0

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

Unit V	NOISE POLLUTION	9	+	0

Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Causes of air pollution
CO2	:	Effects of air and noise pollution
CO3	:	Effective air pollution management

Text Books:

1. Anjaneyulu, D., *Air Pollution and Control Technologies*, AlliedPublishers,Mumbai, 2002.
2. Rao, C.S., *Environmental Pollution Control Engineering*, Wiley Eastern Ltd., New Delhi, 1996.

Reference Books:

1. RaoM.N., and Rao H. V. N., *Air Pollution Control*, Tata-McGraw-Hill, New Delhi, 1996.
2. W.L.Heumann, *Industrial Air Pollution Control Systems*, McGraw-Hill, New York, 1997
3. Mahajan S.P., *Pollution Control in Process Industries*, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
4. Peavy S.W., Rowe D.R. and Tchobanoglous G. *Environmental Engineering*, McGraw Hill, New Delhi, 1985.
5. Garg, S.K., *Environmental Engineering Vol. II*, Khanna Publishers, New Delhi

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1	2	2		1	1	1	1	1	2	2	1		2
CO2	1	2	2	2	2	2	2		1	2	3	3	3		2
CO3	2	3	3	2	2	2	2	1	1	2	3	3	3		2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE11	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	This subject covers the various sources and characterisation of municipal solid wastes and the on-site/off-site processing of the same and the disposal methods.
2.	The student is expected to know about the various effects and disposal options for the municip solidwaste.
3.	Provide efficient and economical refuse collection, recycling, and disposal services.

Unit I	SOURCES AND TYPES OF MUNICIPAL SOLID WASTES	9	+	0

Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization-Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects- Public awareness- Role of NGOs- Legislation.

Unit II	ON-SITE STORAGE & PROCESSING	9	+	0

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

Unit III	COLLECTION AND TRANSFER	9	+	0

Methods of Collection – types of vehicles – Manpower requirement – collection routes- transfer stations – selection of location, operation & maintenance; options under Indian conditions.

Unit IV	OFF-SITE PROCESSING	9	+	0

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

Unit V	DISPOSAL	9	+	0

Dumping of solid waste; sanitary lands fills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Sources and characterization of municipal solid wastes
CO2	:	On-site/off-site processing of municipal solid wastes and disposal methods.
CO3	:	Effective municipal solid waste management

Text Books:

1. George Tchobanoglousetc.al.,*Integrated Solid Waste Management*, McGraw-Hill,Publishers, 1993.

Reference Books:

1. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, *WasteManagement*, Springer, 1994.
2. *Manual on Municipal Solid Waste Management*, CPHEEO, Ministry of Urban Development, Government of India,NewDelhi, 2000
3. R.E.Landreth and P.A.Rebers, *Municipal Solid Wastes – problems and Solutions*,Lewis Publishers, 1997
4. Peavy S.W., Rowe D.R. and Tchobanoglous G. *Environmental Engineering*, McGraw Hill, New Delhi, 1985.
5. Garg, S.K., *Environmental Engineering Vol. II*, Khanna Publishers, New Delhi

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	2	1	2	2			1	2	1	3		2
CO2		2	3	3	1	3	2	1	2	2	3	2	2		3
CO3	2	3	3	3	1	3	3	1	3	2	3	2	3		3

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE12	MARINE POLLUTION MONITORING AND CONTROL	L	T	P	C
		3	0	0	3

Course Objectives:

1.	This subject educated the students about Coastal and Marine environment, ocean dynamics, sources of marine pollution and methods for monitoring, modeling and control.
2.	The subject deals with the method for monitoring the marine pollution.
3.	The subject cover modelling and controlling methods of marine pollution.

Unit I	MARINE ENVIRONMENT	9	+	0

Seas and oceans, Continental area, Coastal zone, Properties of sea water, Principles of Marine Geology, coastal features –Beaches, Estuaries, Lagoons– The oceans andclimate

Unit II	OCEAN HYDRODYNAMICS	9	+	0

Wave Theory, Waves in shallow waters –Refraction, Diffraction and Shoaling, Approximations for deep and shallow water conditions –Tidal Classification-
General circulation of ocean waters-Ocean currents -Coastal sediment transport -
Onshore offshore sediment transport -Beach formation and coastal processes -Tsunamis, storm surge, El Nino effect.

Unit III	MARINE POLLUTION SOURCES AND EFFECTS	9	+	0

Sources of Marine Pollution –Point and non-point sources, Pollution caused by Oil Exploration, Dredging, Offshore Structures, Agriculture Impacts of pollution onwater quality and coastal ecosystems –Marine discharges and effluent standards

Unit IV	MONITORING OF MARINE POLLUTION	9	+	0

Basic measurements -Sounding boat, lead lines, echo sounders –current meters -tide gauge -use of GPS –Measurement of coastal water characteristics –sea bed sampling
–Modeling of Pollutant transport and dispersion -Oil Spill Models -Ocean Monitoring satellites – Applications of Remote Sensing and GIS in monitoring marine pollution

Unit V	MARINE POLLUTION CONTROL AND ICZM	9	+	0

Design of out falls -Pollution Control strategies –Selection of optimal Outfall locations -National and International Treaties, Coastal Zone Regulation–Total Maximum Daily Load applications –Protocols in Marine Pollution – ICZM and Sustainable Development

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Abilitytoknowaboutmarineenvironmentandwouldhavelearntthephysicalconcepts lying behind the oceanic curents and natural processes of various activities happening over the marineenvironment.
CO2	:	Acquired knowledge on the marine pollution and the effect of the same on the ecology
CO3	:	Should have gained knowledge on remote sensing and various other techniques for measuring and monitoring oceanic environmentparameters
CO 4	:	Should have acquired knowledge on control of marine pollution and sustainable development

Text Books:

1.	Marine Pollution (5thEdition) R.B. Clark, C. Frid and M Atttrill Oxford Science Publications,

	2001
2.	Marine pollution Dr.P.C.Sinha ,Anmol Publications Pvt. Ltd, 1998
Reference Books:	
1.	Problems of Marine Pollution : India and Canada, Raghavan, Sudha , Eastern Book Corporation,Delhi, India,
2.	Laws, E.A., Aquatic pollution, an introductory text. John Wiley and Sons, Inc., New York, 2000

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			1	2	2	2	1				1	1	1		2
CO2	1		2	2	2	3	1			1	1	2	1		2
CO3	1	2	2	2	2	3	2		2		1	2	1		2
CO4	1	1	2	2	2	3	1	1		2	1	3	1		2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE13	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	This subject deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same.
2.	The student is expected to know about the various impacts of development projects on environment and the mitigating measures.
3.	The subject deals with to identify, predict and evaluate the economic, environmental and social impact of development activities.

Unit I	**INTRODUCTION**	9	+	0

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA.

Unit II	**METHODOLOGIES**	9	+	0

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case studies

Unit III	**PREDICTION AND ASSESSMENT**	9	+	0

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna- Mathematical models- public participation – Rapid EIA.

Unit IV	**ENVIRONMENTAL MANAGEMENT PLAN**	9	+	0

Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000

Unit V	**CASE STUDIES**	9	+	0

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Impacts of development projects on environment
CO2	:	Mitigating measures on environmental impact accessment
CO3	:	Safe environmental plan to avoid Impacts on water, air, land, flora and fauna

Text Books:

1. Canter, R.L., *Environmental Impact Assessment*, McGraw-Hill Inc., New Delhi, 1996.

Reference Books:

1. Shukla, S.K. and Srivastava, P.R., *Concepts in Environmental Impact Analysis*, Common Wealth Publishers, New Delhi, 1992.
2. John G. Rau and David C Hooten (Ed)., *Environmental Impact Analysis Handbook*, McGraw-Hill Book Company, 1990
3. Judith Petts, *Handbook of Environmental Impact Assessment Vol. I & II*, BlackwellScience, 1999.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	3	3	2	1	1	3	1	1	1	3	1	2
CO2	1	3	2	3	3	2	1		1	1	1	1	3		2
CO3	1	3	2	3	3	2	1		1	1	1	1	3		2

1 – Slightly 2 – Moderately 3 - Strongly

HYDRAULICS

18CEPE14	OPEN CHANNEL FLOW	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To introduce Open Channel Flow to students, explaining the types of open channel and their behaviours, the causes and principles of such behaviours, and applications open channels.
2.	To impart knowledge about Hydraulic Slope and Hydraulic Curve.
3.	To impart knowledge about Critical depth and velocity, Hydraulic jumps.
4	To apply fundamental concepts and techniques of hydraulics and hydrology in the analysis and operation of water resources systems
5.	To analyse flow characteristics in open channel and design hydraulic machines.

Unit I	**INTRODUCTION**	**9**	**+**	**0**

Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections.
Energy-depth relations: Concept of specific energy, specific force, critical flow, critical depth, hydraulic exponents, and channel transitions.

Unit II	**GRADUALLY VARIED FLOW (GVF)**	**9**	**+**	**0**

Equationofgraduallyvariedflowanditslimitations,flowclassificationandsurfaceprofiles,Control sections. Computation methods and analysis: Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curvedchannels.

Unit III	**Rapidly Varied Flow (RVF)**	**9**	**+**	**0**

Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater
Rapidly varied unsteady flow: Equation of motion for unsteady flow, "Celerity" of the gravity wave, deep and shallow water waves, open channel positive and negative surge.

Unit IV	**Spatially Varied Flow (SVF)**	**9**	**+**	**0**

Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, Flow over side-weir and Bottom-rack.

Unit V	**Flow measurement:**	**9**	**+**	**0**

Flow measurement by sharp crested and broad crested weirs, critical depth flumes, sluice gate, Free overfall Flumes – Parshall flume, Venturiflume, Cut throat flume

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the causes of soil erosion
CO2	:	Carry out conservation measures in a watershed
CO3	:	Know about water harvesting and groundwater recharging structures

Text Books:

1. Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008.

2.	Murthy, V.V.N., Land and Water Management, Khalyani Publishers, 2009.
Reference Books:	
1.	Muthy, J. V. S., Watershed Management, New Age International Publishers, 1998.
2.	*Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 1998.*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	2	1	2	2	1	1	1	1	1	2	1	1
CO2	1	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO3	1	2	2	1	2	2	2	2	1	1	1	1	2	1	2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE15	RIVER ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To acquire a wide knowledge on rivers required to make an integrated river basic management plan based on natural & social sciences and engineering& technology.
2.	To know the relation to river systems, long term environmental changes of rivers and their factors, river flows and river channel processes, river and lake ecological systems.
3.	To study the recent characteristics of flood disasters, integrated river basinplanning including flood control,
4.	To understand the sustainable reservoir management, nature restoration, and sediment transport management
5.	To develop the abilities to design the protection works.

Unit I	INTRODUCTION	9	+	0

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes.

Unit II	BEHAVIOUR OF RIVER	9	+	0

Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control

Unit III	MECHANICS OF RIVER	9	+	0

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration.

Unit IV	ANALYSES AND DESIGN OF RIVER	9	+	0

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data.

Unit V	River Training and Protection Works	9	+	0

River Training and Protection Works: Introduction, Classification of River Training, Types of River training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Design various channel systems
CO2	:	Design head and cross regulator structures
CO3	:	Identify various types of reservoir and their design aspects

Text Books:

1.	Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008.
2.	Murthy, V.V.N., Land and Water Management, Khalyani Publishers, 2009.

Reference Books:

1.	Muthy, J. V. S., Watershed Management, New Age International Publishers, 1998.
2.	*Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 1998.*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	2	2	2	2	1	1	1	1	1	2	1	1
CO2	1	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO3	1	2	2	2	2	2	2	2	1	1	1	1	2	1	2

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE16	GROUND WATER ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To prepare the students for a successful career as hydrologist and water resources engineers.
2.	To develop the ability among students to synthesis data and technical concepts for application in ground water resources engineering
3.	To study the quality of groundwater. Well solutions in confined, leaky, and unconfined aquifers.
4.	To study the nature, hydrology, mechanics, technology of ground water engineering
5.	have the abilities to manage and develop groundwater resources

Unit I	FUNDAMENTALS OF GROUNDWATER	9	+	0

Introduction – Groundwater in Hydrological cycle - Vertical distribution of groundwater – Porosity and types – Permeability - Laboratory tests - Aquifers and types – Confined; Uncofined and Semi-confined – Springs and types.

Unit II	GROUNDWATER FLOW AND WELL HYDRAULICS	9	+	0

Darcy's Law – Specific yield – Specific retention - Storage coefficient – Transmissivity – General groundwater floe equations – Steady and unsteady flow – Steady unidirectional flow in confined and unconfined aquifers – Steady radial flow in confined and unconfined aquifers – Unsteady radial flow in confined aquifer – Theis Method – DupuitForchheimer assumptions- Jacob method- Recovery test

Unit III	GROUNDWATER EXPLORATION	9	+	0

Introduction to geophysical methods – Electrical resistivity methods – Wenner and Schlumberger methods of groundwater exploration – Seismic Reflection and Refraction Methods – Remote sensing techniques for groundwater exploration – Well logging and types - Collector wells and Infiltration galleries.

Unit IV	GROUNDWATER QUALITY	9	+	0

Chemistry of groundwater – Major ions and Trace elements in groundwater – Drinking water quality – BIS and WHO Standards - Classification of groundwater based on Hardness and TDS – Irrigation water quality – Salinity and alkalinity hazard – SAR, Percent Sodium and Residual Sodium Carbonate – Water quality representation diagrams - Sea water intrusion-causes and control

Unit V	GROUNDWATER DEVELOPMENT	9	+	0

Watershed management - Conjunctive use - Artificial recharge of groundwater – Small scale and Large scale rain water harvesting techniques – Case studies.

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the causes of soil erosion
CO2	:	Carry out conservation measures in a watershed
CO3	:	Know about water harvesting and groundwater recharging structures

Text Books:

1.	Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008.
2.	Murthy, V.V.N., Land and Water Management, Khalyani Publishers, 2009.

Reference Books:

1.	Muthy, J. V. S., Watershed Management, New Age International Publishers, 1998.
2.	*Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 1998.*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO2	2	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO3	2	2	2	2	2	2	2	2	1	1	1	1	2	1	2
CO4															
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

HYDROLOGY & WATER RESOURCE ENGINEERING

18CEPE17	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.	The main objective of this course is to impart basic knowledge in Irrigation Engineering and Water Management.
2.	To take up the basic concepts of irrigation and construction of various hydraulic structures.
3.	To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management.
4.	To study the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.
5.	To develop the abilities to know the land development and irrigation management.

Unit I	INTRODUCTION	9	+	0

Need, advantages and disadvantages of Irrigation - Environmental effects - Types of Irrigation systems - Gravity irrigation, canals, Tanks, Wells and Irrigation galleries - Water lifts. Soil -water - plant relationship: Soil and its function - Physical properties of soil and their importance in relation to irrigation - Classes and availability of soil water - Movement of water in soils - Measurement of soil moisture - Crop growth and moisture relationship - Salt problems in soil and effect of salts on plant growth.

Unit II	IRRIGATION REQUIREMENT	9	+	0

Evaporation, Evapo transpiration, Consumptive use and its estimation - Crop factor - Lysimeters - Effective rain fall and irrigation requirements - Water requirements of various crops - Duty of water - Quality of irrigation water.

Unit III	METHODS OF IRRIGATION	9	+	0

Surface, subsurface and overhead methods - Check basin, border & furrow, Drip and sprinkler irrigation - Irrigation efficiency, Depth, Rate and frequency of irrigation - Irrigation schedule.

Unit IV	DESIGN OF CHANNELS	9	+	0

Design of unlined and lined channels for irrigation - Location and design of canal regulation structures - Cross drainage structures - Measuring devices.

Unit V	LAND DEVELOPMENT AND IRRIGATION MANAGEMENT	9	+	0

Reclamation and management of saline and alkaline soils, water logging, Causes and remedial measures - Design, construction and maintenance of drainage systems. Management of irrigation system - water charge assessment and water use management.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Assess the irrigation needs of crops
CO2	:	Design weirs on pervious foundation
CO3	:	Design gravity dam and earthen dam
CO4	:	Design the canal systems
CO5	:	Select and design canal fall

Text Books:

1.	PunmiaB.C.andLal ,B.B., *Irrigation and Water Power Engineering,* Standard Publishers & Distributors, New Delhi, 2016.
2.	Sharma R.K., and Sharma. T.K., *Irrigation Engineering* ,S.Chand& Company Ltd, New Delhi, 2002.
3.	SahasraBudhe,Irrigation Engineering and Hydraulic Structures, S.K.Kataria& Sons,

	NewDelhi-110002;2012
Reference Books:	
1.	A.M.Michael, *Irrigation Theory and Practice*, Vikas Publishing House Pvt. Ltd., 2004.
2.	*Hansen V.E., et.al., Irrigation Principles and Practices, John Wiley & Sons, 2001.*
3.	*Sharma R.K., Text Book of Irrigation Engineering and Hydraulic Structures, Oxford & IBH Publishing Co., 2007.*
4.	*Michael A.M., Irrigation Theory and Practice, Vikas Publishing House, New Delhi, 2004.*
5.	Das M.M, Saikia, M.S *Irrigation and water power Engineering*, PHI, Learning, (P) Ltd, New Delhi, 2009.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	1	1	1	1	1	2	3	1
CO2	2	2	2	2	2	2	2	1	1	1	1	1	2	3	1
CO3	2	2	1	2	1	2	2	1	1	1	1	1	2	3	1
CO4	2	2	1	2	1	1	2	1	1	1	1	1	1	3	1
CO5	2	1	2	2	2	1	2	1	1	1	1	1	1	3	2

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE18	WATER SHED MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To impart basic knowledge in Water shed Management.
2.	To Identify the causes of soil erosion
3.	To know the conservation measures in a watershed
4.	To design the water harvesting and groundwater recharging structures
5.	To learn the methods and design of water shed structures.

Unit I	INTRODUCTION	9	+	0

Introduction, concept of Watershed, need for Watershed Management, concept of sustainable development.

Unit II	WATER SHED CONCEPTS	9	+	0

Hydrology of small Watersheds – Determination of Runoff – Emperical formulae – Flood estimation by Dicken's formula – Watershed Management.

Unit III	METHODS OF IRRIGATION	9	+	0

Principles of soil erosion, causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds – prevention of soil erosion.

Unit IV	DESIGN OF CHANNELS	9	+	0

Control of soil erosion, methods of soil conservation – structural and non-structuralmeasures. Principles of water harvesting, methods of rainwater harvesting, design of rainwater harvesting structures.

Unit V	LAND DEVELOPMENT AND IRRIGATION MANAGEMENT	9	+	0

Artificial recharge of groundwater in small watersheds, methods of artificial recharge. Reclamation of saline soils, Micro farming, Biomass management on the farm.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the causes of soil erosion
CO2	:	Carry out conservation measures in a watershed
CO3	:	Know about water harvesting and groundwater recharging structures

Text Books:

1.	Chatterjee, S. N., Water Resources Conservation and Management, Atlantic Publishers, 2008.
2.	Murthy, V.V.N., Land and Water Management, Khalyani Publishers, 2009.

Reference Books:

1.	Muthy, J. V. S., Watershed Management, New Age International Publishers, 1998.
2.	*Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 1998.*

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO2	2	2	2	2	2	2	2	1	1	1	1	1	2	1	2
CO3	1	2	2	2	2	2	2	2	1	1	1	1	2	1	2
CO4															
CO5															

18CEPE19	HYDROLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the components of the hydrological cycle.
2.	To know the mechanics of rainfall, its spatial and temporal measurement and their applications will be understood.
3.	To analyse and study the applications of probability distribution of rainfall and run off shall also be understood.
4.	To develop the ability among students to synthesis data and technical concepts for application in hydrology and water resources engineering
5.	To learn simple methods of flood routing and basics of ground water hydrology.

Unit I	PRECIPITATION	9	+	0

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation.

Unit II	ABSTRACTION FROM PRECIPITATION	9	+	0

Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of Infiltration – Infiltration Indices – Effective rainfall.

Unit III	HYDROGRAPHS	9	+	0

Factors affecting Hydrograph – Base flow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different durations - Synthetic Unit Hydrograph

Unit IV	FLOODS AND FLOOD ROUTING	9	+	0

Flood frequency studies – Recurrence interval – Gumbel's method – Flood routing – Reservoir flood routing – Muskingum's Channel Routing – Flood control

Unit V	: GROUND WATER HYDROLOGY	9	+	0

Types of aquifers – Darcy's law – Dupuit's assumptions – Confined Aquifer – Unconfined Aquifer – Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the concepts of hydrograph, S-hydrograph, Unit hydrograph and IUH
CO2	:	Estimate the hydrological parameters
CO3	:	Carry out statistical and probability analysis of hydrological data
CO4	:	Demonstrate the concepts of hydrological systems
CO5	:	Develop regression models for the analysis of hydrological data

Text Books:

1	Chow V.T. and Maidment, Hydrology for Engineers, McGraw-Hill Inc., Ltd., 2000
2	Subramanya K., Engineering Hydrology, Tata McGraw-Hill Publishing Co., Ltd., 2017
3.	Raghunath H.M., Hydrology, Wiley Eastern Ltd., 2011

Reference books

1	Singh V.P., Hydrology, McGraw-Hill Inc., Ltd., 2000
2	Jaya Rami Reddy P., A text book of Hydrology, Laxmi Publications Pvt Ltd.,2008
3	Patra K.C.Hydrology and Water resources Engineering, Narosa publishing house, Newdelhi-2006

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	1	1	1	1	1	2		1
CO2	2	2	2	2	2	2	2	1	1	1	1	1	2		1
CO3	1	2	1	2	1	2	2	1	1	1	1	1	2		1
CO4	1	2	1	2	1	1	2	1	1	1	1	1	1		1
CO5	2	1	2	2	2	1	2	1	1	1	1	1	1		2

1 – Slightly
2 – Moderately
3 – Strongly

STRUCTURAL ENGINEERING

18CEPE20	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To study various types of bridges and its loading conditions.
2.	To analyze and design of several types of bridges and their sub structures.
3.	To design of various types of bearings.

Unit I	GENERAL INTRODUCTION AND SHORT SPAN RC BRIDGES	**9**	**+**	**0**

Types of bridges and loading standards - Choice of type - I.R.C. specifications for road bridges – Design of RCC solid slab bridges - analysis and design of slab culverts , Tee beam and slab bridges.

Unit II	LONG SPAN RC BRIDGES	**9**	**+**	**0**

Design principles of continuous girder bridges, box girder bridges, balanced cantilever bridges – Arch bridges – Box culverts – Segmental bridges.

Unit III	PRESTRESSED CONCRETE BRIDGES	**9**	**+**	**0**

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

Unit IV	STEEL BRIDGES	**9**	**+**	**0**

General – Railway loadings – dynamic effect – Railway culvert with steel beams – Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

Unit V	BEARINGS AND SUBSTRUCTURES	**9**	**+**	**0**

Different types of bearings – Design of bearings – Design of piers and abutments of different types – Types of bridge foundations – Design of foundations

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyze and design of short span RC bridges
CO2	:	Have a thorough knowledge on the design principles of Long span RC bridges
CO3	:	Analyze and design of Prestressed Concrete bridges
CO4	:	Analyze and design of Steel bridges
CO5	:	Design Bearings and sub structures of bridges.

Text Books:

1.	Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2004
2.	Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 2001.
3.	Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008
4.	Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.

Reference Books:

1.	Phatak D.R., "Bridge Engineering", Satya Prakashan, New Delhi, 1990
2.	Rajagopalan. N. "Bridge Superstructure", Alpha Science International, 2006

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	3	2	1	1	1	1	1	1	2	2	3	1
CO2	3	3	1	1	2	2	1	1	1	1	1	1	3	2	2
CO3	3	1	3	3	1	1	2	1	1	2	2	1	2	1	1
CO4	1	2	3	3	2	1	1	1	1	2	2	1	1	1	2
CO5	1	1	2	1	1	1	1	3	1	2	1	2	1	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE21	MODERN STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To Study the Energy Concepts in Structures.
2.	To acquire knowledge in model analysis of structures, analysis of structures by stiffness and flexibility methods
3.	To have a basic knowledge about the finite element analysis ofstructures.
4.	To make students to analyse the frames and grids through matrix methods approach.
5.	To enable the students to have basic knowledge in analysis of structures through energy theorems.

Unit I **ENERGY CONCEPTS IN STRUCTURES** **9 + 0**

Introduction – Strain Energy – Symmetry of the Stiffness And Flexibility Matrices – Strain Energy in Terms of Stiffness And Flexibility Matrices – Stiffness And Flexibility Coefficients in Terms of Strain Energy – Additional properties of [a] and [k] – another Interpretation of coefficients $a_{ij}$and k_{ij}– Betti'slaw–ApplicationsofBetti'slaw:Forcesnotatthecoordinates–Strainenergyinsystems and in Elements.

Unit II **THE FLEXIBILITY METHOD** **9 + 0**

Statically Determinate Structures –Indeterminate Structures-Choice of Redundant Leading to Ill and Well Conditioned Matrices-Transformation to One Set of Redundant to Another-Internal Forces due to Thermal Expansion and Lack of Fit-Reducing the Size of Flexibility Matrix-Application to Pin-Jointed Plane Truss-Continuous Beams-Frames-Grids.

Unit III **THE STIFFNESS METHOD** **9 + 0**

Introduction-Development of Stiffness Method- Stiffness Matrix for Structures with zero Force at some Coordinates-Analogy between Flexibility and Stiffness-Lack of Fit-Stiffness Matrix with Rigid Motions-Application of Stiffness Approach to Pin Jointed Plane Trusses-Continuous Beams-Frames-Grids-Space Trusses and Frames.

Unit IV **MODEL ANALYSIS** **9 + 0**

Structural similitude, Model material and model making., use of models, model analysis, structural and dimensional analysis, Buckingham Pi theorem, applications, Muller Breslau principle for indirect model analysis, use of Begg'sEney's and R.P.I. deformeters and moment indicator, design of models for direct and indirect analysis.

Unit V **INTRODUCTION TO FINITE ELEMENT METHOD** **9 + 0**

Discretisation of a structure-element functions-selection of element fields-development of nodal load vectors-numbering systems. Computation of nodal displacements-advantages of finite element method. Application of finite element method to one and two- dimensional plane stress strain elements.

Total (L+T)=45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	To apply the knowledge of mathematics, science, and engineering to understand about the determinate-indeterminate structures.
CO2	:	To identify, formulate and solve engineering problems using matrix methods.
CO3	:	To use the model analysis for engineering practice.
CO4	:	To use the finite element method for engineering practice.
CO5	:	To apply various theorems and their applications in analyzing structures.

Text Books:

1.	Dr. Devadas Menon., “Advanced Structural Analysis”, Narosa Publishing House, New Delhi, 2009
2.	Pandit G.S. and Gupta S.P., “Structural Analysis-A Matrix Approach”, Tata McGraw-Hill PublishingCompany Limited, New Delhi, 1997
3.	Dr. T.P. Ganesan, “Model analysis of Structures’, Universities Press Hyderabad, 2000.
4.	Rajasekaran.S., “Finite Element Analysis in Engineering Design”, Wheeler Publishing,2000.
Reference Books:	
1.	K. Rubinstein.F.M., “ Matrix Computer Methods of Structural Analysis”, Prentice Hall, Inc. N.J., 1966
2.	Reddy C.S., “Basic Structural Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997
3.	Krishnamoorthy C.S., “Finite Element Analysis- Theory and Programming”, Second Edition, Tata McGraw Hill Publishing Co.,2004.
E-References:	
1.	https://nptel.ac.in/courses/105106050/

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2			1	1	1					3	1
CO2	3	3	1	1	2									3	
CO3				2			1							2	
CO4	1		1	1	1		1							2	1
CO5	1	1		2	2		1							2	

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE22	STORAGE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To introduce the student to basic theory and concepts of design of storage structures like steel and concrete tanks, bunkers and silos.
2.	Design of Steel, Concrete and Prestressed Concrete Water Tanks
3.	Design of Steel and Concrete Bunkers and Silos.

UNIT I	STEEL WATER TANKS	9	+	0

Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of Pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging and foundation.

UNIT II	CONCRETE WATER TANKS	9	+	0

Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of Intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of underground tanks – Design of base slab and side wall – Check for uplift.

UNIT III	STEEL BUNKERS AND SILOS	9	+	0

Design of square bunker – Jansen's and Airy's theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder –stiffeners.

UNIT IV	CONCRETE BUNKERS AND SILOS	9	+	0

Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams – Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction

Unit V	PRESTRESSED CONCRETE WATER TANKS	9	+	0

Principles of circular prestressing – Design of Prestressed concrete circular water tanks.

Total (L+T)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Learn the basic theory and concepts of designing the steel and concrete storage structures like Water tank, Bunkers and silos
CO2	:	Design of Steel and Reinforced Concrete Water tanks
CO3	:	Design of Steel and Reinforced Concrete Bunkers and Silos
CO4	:	Design of Prestressed Concrete Water tank

Text Books:

1.	Rajagopalan K., "Storage Structures", Tata McGraw Hill, New Delhi, 1998.
2.	Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, New Delhi, 1998.

Reference Books:

1.	Punmia B.C, Ashok Kumar Jain, Arun K.Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
2.	Gambhir. M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012.

E-References:

1.	You tube – Technical Civil – Design of Water Tanks(different types) - Part 1 to Part 9

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2	1			3		1	1		2	3		
CO2	3		2	1			3		1	1		2	3		
CO3	3		2	1			3		1	1		2	3		
CO4	3		2	1			3		1	1		2	3		

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE23	PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the importance of prestressing technique in concrete structures
2.	To estimate the losses and defelction in prestressed member due to effect of prestress
3.	To able to design the prestressing members subjected flexure, shear and bond
4.	To able to design the end blocks of prestressing members by different method
5.	To apply the prestressing technique in different application

Unit I	INTRODUCTION	9	+	0

Principles – Pretensioning – Post tensioning – Types of prestressing – Systems of prestressing – Comparison of prestressed concrete with reinforced concrete Materials characteristics of concrete – Characteristics of high tensile steel.
Theory and behaviour of prestressed concrete beams in bending – calculating fibre stresses for various sections (Rectangle, I, T) of simply supported beam due to prestressing force, dead load and external live load – Stress method – Moment of Resistance method – Load balancing method.

Unit II	LOSSES AND DEFLECTIONS	9	+	0

Various losses in prestressed concrete members – causes for losses in prestressed concrete – calculatio of losses – losses due to elastic shortening of pretensioned and post tensioned members – losses due to creep, shrinkage of concrete – relaxation losses – friction and anchorage losses.
Deflection of prestressed concrete flexural members due to prestressing force, dead load, live load – BIS Code provisions – Effect of tendon Profile on deflection – Calculation of elastic short term deflection for simply supported beams – deflections due to creep effect – calculation of long term deflection.

Unit II	DESIGN OF PRESTRESSED CONCRETE BEAMS	9	+	0

Pre Tensioned and Post Tensioned simply supported rectangle, I and T sections- Stress method – Desig for flexure, bond and shear- IS Codeprovisions.

Unit IV	DESIGN OF END BLOCKS	9	+	0

Introduction – Stress distribution in end block – Anchorage zone stresses – Guyon and Magnellmethod.

Unit V	CIRCULAR PRESTRESSING, TENSION MEMBERS & CONTINUOUS BEAMS , COMPOSITE AND PARTIAL PRESTRESSING	9	+	0

Design of prestressed concrete pipes and tanks – Tension members - Poles and sleepers – Continuous beams – Concordant Cable Profile.
Types of composite construction – Transformation of composite sections – flexural analysis ofcomposite simply supported beams – calculation of stresses – Partial prestressing.

Total (45+0)= 45 Period

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Differentiate pre-tesioned and post – tensioned prestressed concrete
CO2	:	Design a prestressed concrete beam accounting for losses and deflection
CO3	:	Design the prestressing members subjected to stress function
CO4	:	Design the anchorage zone for post tensioned members
CO5	:	Know the partial and circular prestressing technique in various structures.

Text Books:

1. Sinha, N.C and Roy. S.K., *Fundamentals of prestressed concrete* S.Chand and Co. Ltd1998.
2. Krishnaraju.N., *Prestressed Concrete*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002

3	Raja Gopalan N. “Prestressed Concrete”, Narosa Publishing House, New Delhi, 2002.
Reference Books:	
1.	Lin , T.Y., and Ned .Burns, *Design of prestressed concrete structures*, John Wiley & Sons, International Edition, New York, 1995.
2.	Dayaratnam.P., *Prestressed Concrete Structures*, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi, 1982
3.	Mallic S.K. and Gupta A.P., *Prestressed concrete*, Oxford and IBH publishing Co. Pvt. Ltd. 1997.
4.	Ramaswamy G.S., *Modern prestressed concrete design*, Arnold Heinimen, New Delhi, 1990

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	2	2	1	1	1	1	1	2
CO2	3	1	3	3	2	1	2	1	1	2	1	1	3	2	1
CO3	1	1	3	3	2	1	3	2	2	1	1	1	3	1	3
CO4	1	1	3	3	1	2	2	1	1	1	2	1	3	1	2
CO5	3	1	2	1	1	2	1	-	1	1	2	2	2	1	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE24	ADVANCED STEEL STRUCTURES	L	T	P	C
(Use of IS 800 – 2007, IS 6533-1971, IS 801 & IS 811 & Steel tables are permitted)		3	0	0	3

Course Objectives:

1.	To introduce the student to basic theory and concepts of beam to column connections, built-up girders, and light gauge structures.
2.	Behaviour and design of beam-columns.
3.	Different configuration of roof truss, and its components behaviour and design of members of truss..

Unit I	**CONNECTIONS**	**9**	**+**	**0**

Design of bolts and weld connections (Stiffened and Seated connections) – Beam to Beam Connections-Beam to Column Connections

Unit II	**BUILT-UP GIRDER**	**9**	**+**	**0**

Design of Plate girders bolted and welded –Design of stiffeners and splices-Gantry girder

Unit III	**BEAM-COLUMNS**	**9**	**+**	**0**

Introduction-Behaviour of Beam-columns-Elastic-Torsional buckling-nominal strength-instability in the plane of bending- beam-column under biaxial loading-interaction equations for local capcity check-code design procedure-problems.

Unit IV	**: ROOF TRUSS**	**9**	**+**	**0**

Roof Trusses – different configuration of truss-Roof and Side coverings – Design of purlin and elements of truss; end bearing

Unit V	**LIGHT GAUGE STEEL STRUCTURES**	**9**	**+**	**0**

Types of cross sections - local buckling and lateral buckling - concepts of elastic width – design of compression and tension members, beams, deflection of beams and design of beam webs.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	design welded plate girder and other components and Gantry girder
CO2	:	Connections between beam and columns
CO3	:	carry out wind load calculations for tall structures and design of steel chimneys
CO 4		design the cold-formed steel beams and columns.

Text Books:

1.	Duggal S.K., *Limit State Design of Steel Structures*, Tata McGraw-Hill Publishing Company , New Delhi, 2010.
2.	Subramanian N., *Design of Steel Structures*, First edition, OXFORD university press, 2008
3.	Bhavikatti S S., *Design of Steel Structures by Limit Method*, I.K. International Pvt Ltd, New Delhi, 2009.

Reference Books:

1.	Chandra R., *Limit State Design of Steel Structure Vol – I & II*, Scientific Publisher, New Delhi,2009.
2.	Ramachandra S., & Virendra Gehlot D.,*Limit State Design of Steel Structures* –, **Standard Publication, New Delhi,2009**
3.	Dayaratnam P., *Design of Steel Structures*, Second Edition, S. Chand & Company, 2003

4.	*Teaching Resources for Structural Steel Design – Vol.I& II*, INSDAG, Kolkatta
5.	*IS 800:2007 Code of practice for general construction steel*
6.	*SP 6 IS Structural steel Design Illustrated Hand book*
7.	*IS 875:1987 Code of practice for Design loads (other than earthquake) forbuildings and structures (Part – I) Dead loads (Part – II) Live loads (Part – III) Wind loads(2015)*
8.	*IS: 801-1967, Code of practice for use of cold-formed light gauge steel structural members in general building construction*
9.	*IS: 811-1987, Cold Formed Light Gauge Structural Steel Sections.*

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	1	1	1	2	1	1	2	3	3	2
CO2	3	3	1	1	2	1	1	1	1	1	1	1	2	2	1
CO3	2	1	3	2	1	1	2	1	1	1	2	1	2	1	1
CO4	1	2	3	1	1	2	1	1	1	2	2	1	1	1	2
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE25	TALL BUILDINGS	L	T	P	C
		3	0	0	3

Course Objectives:

1. The design aspects and analysis methodologies of tall buildings is introduced. The stability analysis of tall buildings is another imperative in this course.

Unit I	DESIGN CRITERIA AND MATERIALS	9	+	0

Development of High Rise Structures - General Planning Considerations - Design philosophies - Materials used for Construction - High Strength Concrete - High Performance Concrete - Self Compacting Concrete - Glass - High Strength Steel.

Unit II	LOADING	9	+	0

Gravity Loading - Dead Load - Live Load - Live load reduction technique - Impact Load - Construction Load - Sequential Loading. Lateral Loading - Wind load - Earthquake Load. Combination of Loads.

Unit III	BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS	9	+	0

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems - Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubular structures, cores, outrigger - braced and hybrid mega systems.

Unit IV	ANALYSIS AND DESIGN	9	+	0

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

Unit V	STABILITY OF TALL BUILDINGS	9	+	0

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	behaviour of tall buildings subjected to lateral building.
CO2	:	Rudimentary principles of designing tall buildings as per the existing codes.
CO3	:	Stability evaluation of tall buildings with respect to various factors

Text Books:

1. Bryan Stafford Smith, Alex coull, “Tall Building Structures, Analysis and Design”, John Wiley and Sons, Inc., 1991.
2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 2011

Reference Books:

1. Lin.T.Y, StotesBurry.D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.
2. Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.
3. Wolfgang Schueller "High Rise Building Structures", John Wiley and Sons, New York 1977

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	1	1	1	1	1	-	-	-	1	1	2	2
CO2	3	3	3	3	1	1	2	-	-	1	1	1	1	1	1
CO3	1	1	3	3	2	1	3	1	-	1	1	1	1	1	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE26	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

At the end of this course the student shall be able to appreciate modular construction, industrialised construction and shall be able to design some of the prefabricated elements and also have the knowledge of the construction methods using these elements

Unit I	INTRODUCTION	9	+	0

Need for prefabrication – Principles – Materials – Modular coordination – Standarization – Systems – Production – Transportation – Erection.

Unit II	PREFABRICATED COMPONENTS	9	+	0

Behavior of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

Unit III	DESIGN PRINCIPLES	9	+	0

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

Unit IV	JOINTS IN STRUCTURAL MEMBERS	9	+	0

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

Unit V	DESIGN FOR ABNORMAL LOADS	9	+	0

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Understand the principles of prefabrication behavior and construction of structural components
CO2	:	Design the joints in structural connections and have a knowledge of codal provisions to design the structure for abnormal loads
CO3	:	Design the joints in structural connections and have a knowledge of codal provisions to design the structure for abnormal loads

Text Books:

1	CBRI, *Building materials and components*, India, 1990
2	Gerostiza C.Z., Hendrikson C. and Rehat D.R., *Knowledge based process planning for construction and manufacturing*, Academic Press Inc., 1994

Reference books

1	Koncz T., *Manual of precast concrete construction, Vols. I, IIandIII,* Bauverlag,GMBH,1971.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	1	1	1	-	-	-	1	3	1	1
CO2	2	1	3	3	1	1	1	-	-	1	1	1	3	2	1
CO3	1	1	3	3	2	1	3	1	-	1	1	1	3	2	1

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE27	DESIGN OF COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To study the behaviour and design of Steel concrete composite elements and structures.
2.	To investigate the failure and fracture characteristics

Unit I	INTRODUCTION	9	+	0

Introduction to steel - concrete composite construction – Composite action – Serviceability and - Construction issues.

Unit II	DESIGN OF CONNECTIONS	9	+	0

Shear connectors – Types – Design of connections in composite structures – Degree of shear connection – Partial shear interaction.

Unit III	DESIGN OF COMPOSITE MEMBERS	9	+	0

Design of composite beams, slabs, columns, - design of composite trusses.

Unit IV	COMPOSITE BOX GIRDER BRIDGES	9	+	0

Introduction - behaviour of box girder bridges - design concepts.

Unit V	CASE STUDIES	9	+	0

Case studies on steel - concrete composite construction in buildings - seismic behaviour of composite structures.

Total= 45 Periods

Course Outcomes:

CO1	On the completion of this course students will be in a position to gain knowledge about the composite structures
CO2	They will be able to design connections in composite structures
CO3	At the end of this course students will be in a position to design composite beams, columns and trusses
CO4	students will be in a position to design box-girder bridges including the related connections
CO5	They will get exposure on case studies related to steel-concrete constructions of buildings.

Text Books:

1.	Johnson R.P., “Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings”, Vol.I, Blackwell Scientific Publications, 2004.
2.	Oehlers D.J. and Bradford M.A., “Composite Steel and Concrete Structural Members, Fundamental behaviour”, Pergamon press, Oxford, 1995.

Reference Books:

1	Owens.G.W and Knowles.P, ”Steel Designers Manual”, Steel Concrete Institute(UK), Oxford Blackwell Scientific Publications, 1992.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	2	2	3	2	2	2	2	0	2
CO2	2	2	2	2	3	2	1	2	3	2	2	2	2	0	2
CO3	3	3	3	3	3	3	3	1	2	3	1	3	3	1	3
CO4	3	2	1	3	2	2	2	2	2	3	0	1	1	1	2
CO5	2	2	3	2	3	2	3	2	3	2	3	1	2	1	3

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE28	COASTAL STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	Study the concept of wave theories, forces and analysis of offshore structures.
2.	Develop an understanding of basic concepts in coastal engineering such as the linear and non linear wave theory, energy propagation in waves.
3.	Design simple coastal structures such as helipads, jacket tower etc.
4.	Make the students to design platforms, mooring cables and pipe lines.
5.	Make the students to know about the modeling of foundation, fixed jacket platform etc.

UNIT I	WAVE THEORIES	9	+	0

Wave generation process, small, finite amplitude and nonlinear wave theories.

UNIT II	FORCES OF OFFSHORE STRUCTURES	9	+	0

Wind forces, wave forces on small bodies and large bodies - current forces and use of Morison equation.

UNIT III	OFFSHORE SOIL AND STRUCTURE MODELLING	9	+	0

Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling

UNIT IV	ANALYSIS OF OFFSHORE STRUCTURES	9	+	0

Static method of analysis, foundation analysis and dynamics of offshore structures.

Unit V	DESIGN OF OFFSHORE STRUCTURES	9	+	0

Design of platforms, helipads, Jacket tower, analysis and design of mooring cables and pipe lines.

Total (L+T)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO 1	:	Determine the forces due to ocean waves
CO 2	:	Analyze and design offshore structures
CO 3	:	Construct platform, helipads, jackets, towers etc.,
CO 4	:	Design offshore structures
CO 5	:	Differentiate different offshore structures and todo foundation and structure modelling

Text Books:

1.	API RP 2A-WSD, Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design - API Publishing Services, 2005
2.	Chakrabarti, S.K., Handbook of Offshore Engineering by, Elsevier, 2005.
3.	Chakrabarti, S.K., Hydrodynamics of Offshore Structures, WIT press, 2001

Reference Books:

1.	Jawson.T.H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983.
2.	James F. Wilson, Dynamics of Offshore Structures, John Wiley & Sons, Inc, 2003.
3.	Reddy, D.V. and Arockiasamy, M., Offshore Structures, Vol.1 and Vol.2, Krieger Publishing Company, 1991.

4.	Turgut Sarpkaya, Wave Forces on Offshore Structures, Cambridge University Press, 2010.
E-References:	
1.	https://nptel.ac.in/courses/114106035/

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2		1	2	2	2	2				2		1
CO2		2	1	2			1		2			1	1	2	
CO3				1	1			1	1	1	2		2	2	1
CO4			2				1							2	1
CO5				1	2		1		1	1	1	1			21

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE29	DYNAMICS AND EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To study the theory of vibrations
2.	To learn about the multiple degree of freedom system
3.	To understand the knowledge about seismic effect on building
4.	To acquire a knowledge about peak acceleration and liquefaction
5.	To study about the design methodology

Unit I	THEORY OF VIBRATIONS	9	+	0

Difference between static forces and dynamic excitation – Concept of inertia and damping – Types of Damping – Degrees of freedom – SDOF Idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral

Unit II	MULTIPLE DEGREE OF FREEDOM SYSTEM	9	+	0

Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

Unit III	ELEMENTS OF SEISMOLOGY	9	+	0

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

Unit IV	RESPONSE OF STRUCTURES TO EARTHQUAKE	9	+	0

Response and design spectra – Design earthquake – Concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

Unit V	DESIGN METHODOLOGY	9	+	0

IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.

Total = 45 Periods

Course Outcomes:

1	Apply the basics of Earthquake Engineering
2	Demonstrate the dynamics of structural system under earthquake load
3	Analyze the influence of the structural / geometrical design in building characteristics
4	Demonstrate the cyclic loading behaviour of RC steel and pre-stressed concrete elements
5	Apply codal provisions on different types of structures

Text Books:

1.	Damodarasamy S.R. and Kavitha S. Basics of Structural Dynamics and Aseismic Design, PHI learning private Ltd, New Delhi-1, 2009

Reference Books:

1.	D Paz, M., Structural Dynamics – Theory & Computation, CSB Publishers & Distributors, Darga Ganj, New Delhi-2, 2004.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	3	3	3	2	2	2	3	3	3	1
CO2	3	3	3	3	3	3	3	3	2	2	2	3	3	3	1
CO3	3	3	3	3	3	3	3	3	2	2	2	3	3	3	1
CO4	3	3	3	3	3	2	3	2	2	2	2	3	3	3	1
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE30	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	At the end of this course the student shall be able to design the important industrial structures
2.	At the end of course functional requirements of the building
3.	At the end course the student should be able to understand the design of steel and RC structures and prefabrication.

Unit I	PLANNING	9	+	0

Classification of Industries and Industrial structures – General requirements for industries lik cement, chemical and steel plants – types of frames – bracings – crane girders and columns workshop sheds - -Planning and layout of buildings and components.

Unit II	FUNCTIONAL REQUIREMENTS	9	+	0

Lighting – Ventilation – Accounts – Fire safety – Guidelines from factories act.

Unit III	DESIGN OF STEEL STRUCTURES	9	+	0

Industrial roofs – Crane girders – Mill buildings – Design of bunkers and silos

Unit IV	DESIGN OF R.C. STRUCTURES	9	+	0

Concrete Silos and bunkers – Chimneys – Principles of folded plates and shell roofs(Theory only) – Machin foundations (Theory only).

Unit V	PREFABRICATION	9	+	0

Principles of prefabrication – Prestressed precast roof trusses- Functional requirements for Precas concreteunits

Total (45+0)= 45 Periods

Course Outcomes:

1	Students will gain the knowledge about lighting, fire safety and ventilation
2	Students will gain the knowledge on the advanced structures namely bunkers, silos
3	Students will gain the knowledge in the need of prefabrication with current trend.

Text Books:

1.	Duggal S.K., *Limit State Design of Steel Structures*, Tata McGraw-Hill Publishing Compan New Delhi, 2010.
2	Subramanian N., *Design of Steel Structures*, First edition, OXFORD universitypress, 2008.
3	Reinforced *Concrete Structural elements* – P. Purushothaman.

Reference Books:

1.	Henn W. *Buildings for Industry, vols.I and II*, London Hill Books, 1995
2.	*Handbook on Functional Requirements of Industrial buildings*, *SP32 – 1986,* Bureau of Indian Standards, New Delhi 1990
3.	Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3	2	1	1	1	2	1	1	2	3	3	2
CO2	3	3	1	1	2	2	1	1	1	2	1	1	2	2	1
CO3	2	1	3	2	1	1	2	1	1	1	2	1	2	1	1
CO4															
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE31	FERROCEMENT TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To impart knowledge on the material properties of ferrocement, construction methods
2.	To implement design of ferrocement technology in building construction, hydraulic structures and soil retaining structures.

Unit I	INTRODUCTION	9	+	0

Definition, historical background, Constituent materials-cement mortar, skeletal steel, mesh reinforcement-Types of meshes, distinct characteristics of ferrocement versus reinforced concrete, Similarities between ferrocement and reinforced concrete applications.

Unit II	MECHANICALPROPERTIES:	9	+	0

Behaviour of ferrocement in tension, cracking and multiple cracking behavior, maximum elongation at failure, stress at first cracking, elastic modulus in tension, behaviour of ferrocement in bending-load versus deflection response, impact strength, leakage, fireresistance, durability.

Unit III	PRACTICAL DESIGN GUIDELINES:	9	+	0

Allowable stresses under maximum service load, maximum crack width, fatigue life, durability and corrosion, deflection limitation. Practical design parameters for ferrocement - cover, thickness and mesh opening, skeletal reinforcement depth, minimum volume fraction of reinforcement, minimum volume fraction in water retaining structures, fibers, number of mesh layers, bending members – hybrid fiber reinforcement, wire diameter, fineness of matrix. Guidelines for good construction.

Unit IV	FERROCEMENT IN BUILDING CONSTRUCTION:	9	+	0

Construction methods-Skeletal Armature method, Closed mould method, Integral Mould method, Open mould method- ferrocement precast walls, hollow floors, hollow beams, roofing units, earthquake resistant structures, cost comparision with conventional construction.

Unit V	HYDRAULIC AND SOIL RETAINING STRUCTURES IN FERROCEMENT:	9	+	0

Water retaining structures- Design and method of fabrication and casting, storage tanks of various types, foot bridges-canal lining. Soil retaining structure - Ferrocement counterfort retaining wall, Ferrocement containers for storing granular materials, Method of precasting.

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	To give a good insight about the ferrocement technology
CO2		To gain the knowledge about the mechanical properties of ferrocement
CO3	:	To give an understanding of construction methods

CO4	:	The students will be able to design the ferrocement structures
CO5		To make the students understand the hydraulic structures and soil retaining structures

Text Books:	
1	B R Paul and R P Pama. Published by International Ferrocement Information Centre. A.I.T.Bangkok, Thailand
2	State-of-the-art report and guide for Design,Construction and Repairs of Ferrocement; ACI committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA
Reference books	
1	Ferrocement and laminated cementitious composites A E Naaman. Publisher: Techno-press, Ann Arbor, Michigan, U S A
2	Ferrocement- Materials and applications; Publication SP 61, A C I Detroit. U S A

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	2	2	2	3	2	2	2	2	0	2
CO2	2	2	2	2	3	2	1	2	1	2	2	2	2	0	2
CO3	3	3	2	3	3	3	3	3	2	3	1	3	3	1	3
CO4	3	3	3	3	2	3	2	2	2	3	2	1	1	1	2
CO5	2	3	1	2	3	2	3	3	3	2	3	1	2	1	3

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE32	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	At the end of this course the student shall have a basic knowledge of finite element method and shall be able to analyse linear elastic structures that he has studied about in core courses, using finite element method.

Unit I	ELEMENTS OF ELASTICITY	9	+	0

Basic principles of structural mechanics – Equations of equilibrium – Strain displacementrelations –Stressstrainrelations–Planestressandplanestraincases–PrinciplesofVirtualworkand minimum potential energy.

Unit II	DIRECT STIFFNESS METHOD	9	+	0

Steps in direct method of FEA – Element stiffness matrix – Global stiffness matrix – Boundary conditions – Problems on simple beams and Trusses.

Unit III	FINITE ELEMENTS	9	+	0

Discretization - Basic element shapes - Element properties – Node numbering procedure – Convergence requirements – Generalised co-ordinates – Natural co-ordinates – Shape functions for linear & quadratic models – Stiffness matrix – Nodal load vector – Static condensation – Simple problems.

Unit IV	INTRODUCTION TO ISOPARAMETRIC ELEMENTS	9	+	0

Concept of sub, iso, super parametric elements – Gauss quadrature – Examples in one and two dimensional elements

Unit V	SOLUTION TECHNIQUES	9	+	0

Different solvers – Variational approach – Weighted mean residual methods like Collocation method, Subdomain method, Galerkin method and Least square method – Simple problems only.

Total = 45 Periods

Course Outcomes:

1	Students who successfully complete this course will have demonstrated an ability toPerform finite element formulations for simple engineering problems.
2	Analyze linear 1D problems like bars and trusses; 2D structural problems using CST element and analyse the axi-symmetric problems with triangular elements.
3	write shape functions for 4 and 8 node quadrilateral, 6 node triangle elements and apply numerical integration to solve; 1D and 2D; stiffness integrations
4	Solve linear 2D structural beams and frames problems; 1Dheat conduction and convection heat transfer problems.
5	Evaluate the Eigenvalues and Eigenvectors for stepped bar and beam, explain nonlinear geometric and material non linearity.

Text Books:

1.	Tirupathi R. Chandrupatla and Ashok D. Belugundu , “Introduction to Finite Elements in Engineering”, Third Edition, Prentice Hall India Pvt Ltd, 2011
2	P.Seshu, “Textbook of Finite Element Analysis”, Prentice Hall India Pvt Ltd, 2008.

Reference Books:

1.	Rajasekaran.S., “Finite Element Analysis in Engineering Design”, Wheeler Publishing,2000.
2.	S.S.Rao, “The Finite Element Method in Engineering”, Buttersworth-Heinemann publishing, 2000

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	1	3	1	1	0	1	0	2	3	1
CO2	3	3	2	3	2	1	3	1	1	0	1	0	2	3	1
CO3	3	3	2	3	3	1	2	1	1	0	1	0	2	3	1
CO4	3	3	2	3	3	1	3	1	1	0	1	0	2	3	1
CO5	3	3	2	3	2	1	2	1	1	0	1	0	2	3	1

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE33	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

1	To make students aware of various measurement techniques and experimental planning an procedures adopted in laboratory.

Unit I	STRAIN GAUGES	9	+	0

Definition of Gauge length, sensitivity and range – Characteristics of an ideal strain gauge – Different types of mechanical strain gauges for use in metal and concrete specimens – Optical strain gauge – Acoustic strain gauge – Pneumatic strain gauge – Merits anddemerits.

Unit II	ELECTRICAL STRAIN GAUGES	9	+	0

Inductance, capacitance and piezo-electric gauges – Bonded and unbounded resistance gauges and their application in stress analysis – Fixing technique and measurement of strains – Rosettes – Determination of principal strains using rosettes – Use of Murphy‟s construction for drawing circle of strains – Mohr‟s stress circle – Analyticalsolution.

Unit III	PHOTOELASTICITY	9	+	0

*Principles – Maxwell"*sstress optic law – Plane and circularly polarised light and their use in photo elasticity – Polariscopes – Diffusion type, lense type and reflection type polariscopes –Isochromatics and Isoclinics – Model materials – Calibration methods for finding material fringe value – Model fringe value – Examples of beam flexure and *diametrically loaded circularplates.*

Unit IV	MODEL ANALYSIS	9	+	0

Direct and indirect models – Laws of structural similitude – Choice of scales – Limitation of model studies - Buckingham piktheorem – Dimensional analysis – Model materials – Begg‟sdeformeter and its use in model analysis – Simple design of models for direct *and indirect model analysis.*

Unit V	BRITTLE COATINGS	9	+	0

Historical review – Stress Coat – Ceramic coatings – Application – Moire fringe method of stres analysis.

Total = 45 Periods

Course Outcomes:

1	Students will be able toSelect the appropriate strain gauges for strain measurements
2	Principles behind the photo elasticity
3	Knowledge in model analysis and predict the behavior of prototypes.

Text Books:

Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi,2004.

1.	T.K.Roy, "Experimental Analysis of Stress and Strains", S.Chand and Company Ltd., New Delhi, 2000.
2.	Hetenyi. M., Hand Book of Experimental Stress Analysis, John Wiley and Sons Inc., New York, 1966.

Reference Books:

1.	J.W.Dally and W.F.Riley, "Experimental Stress Analysis", McGraw Hill Book, New York, 1990. Delhi, 2001.
2.	L.S. Srinath, "Experimental Stress Analysis", Tata-McGraw Hill Book Company, New

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	1	1	2	1	1	1	1	1	1	1	1	-	1
CO2	1	1	1	1	2	1	1	1	1	1	1	1	1	-	1
CO3	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1
CO4															
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

GEOTECHNICAL ENGINEERING

18CEPE34	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

1.	The student is expected to identify basic deficiencies of various soil deposits
2.	To learn the various techniques of drainage and dewatering
3.	To know about various in-situ treatment of soil samples
4.	To study the details about earth reinforcement
5.	To understand about the grouting techniques

Unit I	: **INTRODUCTION**	**9**	**+**	**0**

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnicalproblemsinalluvial,lateriteandblackcottonsoils-Selectionofsuitableground improvement techniques based on soil condition.

Unit II	: **DRAINAGE AND DEWATERING**	**9**	**+**	**0**

Drainage techniques - Well points - Vacuum and electro-osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogeneous deposits (Simple cases only).

Unit III	**: INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS**	**9**	**+**	**0**

In-situ densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation – Vibro-flotation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

Unit IV	**EARTH REINFORCEMENT**	**9**	**+**	**0**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and otherworks.

Unit V	**GROUT TECHNIQUES**	**9**	**+**	**0**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils.

Total= 45 Periods

Course Outcomes:

At the end of the course the student will be able to

CO1	:	Demonstrate the various ground improvement techniques
CO2	:	Carry out insitu treatment of cohesionless and cohesive soils
CO3	:	Apply the geotextile material in practice
CO4	:	Know the grouting equipment and monitoring

Text Books:

1	Purushothama Raj P., Ground Improvement Techniques, Tata McGraw- Hill Publishing Company, New Delhi, 1995
2	Koerner R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill, 1994.
3	Moseley M.P., Ground Improvement , Blackie Academic and Professional, Chapman and Hall, Glasgow, 1993

REFERENCE:

1	Jones J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1995

2	Koerner R.M., Design with Geosynthetics, (3rdEdition) Prentice Hall, New Jersey

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	1	3	2	3	2	2	2	2	2	2	-	1
CO2	2	1	2	1	2	2	3	2	1	2	2	1	3	-	1
CO3	2	1	2	1	2	2	3	2	1	1	2	2	2	-	1
CO4	2	1	2	1	2	2	3	2	1	1	2	2	2	-	1
CO5															

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE35	INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

Course Objectives:

1.	Assess dynamic properties of soil.
2.	Demonstrate various vibration isolation techniques.
3.	Design of Machine foundation.

UNIT I	INTRODUCTION	9	+	0

Vibration of elementary systems - vibratory motion - single degree freedom system-free and forced vibration with and withoutdamping.

UNIT II	WAVES AND WAVE PROPAGATION	9	+	0

Wave propagation in an elastic homogeneous isotropic medium - Raleigh, shear and compression waves-waves in elastic half space.

UNIT III	DYNAMIC PROPERTIES OF SOILS	9	+	0

Elastic properties of soils - coefficient of elastic, uniform and non-uniform compression – shear - effect of vibration dissipative properties of soils - determination of dynamic properties of soil - codal provisions.

UNIT IV	DESIGN PROCEDURES	9	+	0

Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines.

Unit V	VIBRATION ISOLATION	9	+	0

Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location-isolation by barriers- active passive isolation tests

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Assess dynamic properties of soil.
CO2	:	Demonstrate various vibration isolation techniques.
CO3	:	Design of machine foundation.

Text Books:

1.	Swamisaran, “Soil Dynamics and Machine Foundations”, Galgotia Publications Pvt.Ltd.,1999
2.	S.Prakesh& V.K Puri, Foundation for machines, McGraw-Hill 1999
3.	Srinivasulu, P & Vaidyanathan, Hand book of Machine Foundations, McGraw-Hill, 1996.

Reference Books:

1.	Kameswara Rao, “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing, New Delhi,1998.
2.	IS code of Practice for Design and Construction of Machine Foundations, McGraw-Hill, 1996.
3.	Moore P.J., “Analysis and Design of Foundation for Vibration”, Oxford and IBH, 1995.
4.	Kameswara Rao, “Dynamics Soil Tests and Applications”, Wheeler Publishing, New Delhi, 2003

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	1	0	0	0	2	2	3	3	0
CO2	3	3	3	3	3	3	2	1	0	1	1	1	3	2	0
CO3	3	3	3	3	3	3	1	0	0	0	1	1	3	3	1

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE36	SOIL STRUCTURE INTERACTION	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To understand the mechanism of soils, their interactive behaviour, analysis, its influences in the design parameters through design charts and software packages.

Unit I	SOIL-FOUNDATION INTERACTION	9	+	0

Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface, behaviour, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour.

Unit II	PLATE ON ELASTIC MEDIUM	9	+	0

Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

Unit III	PLATE ON ELASTIC MEDIUM	9	+	0

Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions.

Unit IV	ELASTIC ANALYSIS OF PILE	9	+	0

Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

Unit V	LATERALLY LOADED PILE	9	+	0

Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts

Total (45+0)= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Know about soil response models
CO2	:	Analyze beams of finite length
CO3	:	Know about numerical analysis of finite plate and elastic analysis of pile

Text Books:

1.	Saran, S, Analysis and desaign of substructures, Taylor & Francis Publishers, 2006.
2.	Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 199
3	McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geotechnics (6th Edition), Prentice Hall, 2002.
4	Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
5	Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980
6	Bowels J.E., “Analytical and Computer Methods in Foundation”, McGraw Hill Book Co. New York.

Reference Books:

1.	Scott, R.F. Foundation Analysis, Prentice Hall, 1981.

2.	Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.
3.	ACI 336, Suggested Analysis and Design Procedures for CombinedFootingsand Mats, American Concrete Institute, Dehit,1988.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	2	1	0	1	2	3	1	1
CO2	3	3	3	3	3	3	3	2	1	0	1	2	3	1	1
CO3	3	3	3	3	3	3	2	2	1	0	1	2	3	1	1

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE37	SUBSURFACE INVESTIGATION AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

1	To understand the importance of site investigation.
2	To know the techniques of soil exploration.
3	To collect and preserve soil samples and the field tests to be conducted.
4	To introduce the instrumentation in soil engineering.

Unit I SCOPE AND OBJECTIVES OF EXPLORATION 9 + 0

Scope and objectives, planning and exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods.

Unit II EXPLORATION TECHNIQUES 9 + 0

Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, stabilization of boreholes, bore logs.

Unit III SOIL SAMPLING 9 + 0

Sampling, disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

Unit IV FIELD TESTING IN SOIL EXPLORATION 9 + 0

Field tests, penetration tests, procedures and methods, data interpretation, Field vane shear, Insitu shear and bore hole shear test, pressuremeter test, utility, correction and data interpretation, plate load test–monotonic and cyclic; field permeability test.

Unit V INSTRUMENTATION 9 + 0

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, piezometers and slope indicators, inclinometer, case studies.

Total = 45 Periods

Course Outcomes:

CO1	Know the scope and objectives of soil exploration.
CO2	Aware of different exploration techniques available to explore soil.
CO3	Know methods of sampling and to preserve them.
CO4	Choose suitable methods to do subsurface investigation and to interpret the data collected.
CO5	Aware of the instruments to be used for sub surface investigation.

Text Books:

1.	Hunt, R.E., Geotechnical Engineering Investigation Manual, McGraw Hill, 2005.
2.	Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a NostrandReinhold 2010
3.	Alam Singh and Chowdhary, G.R., Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation, CBS Publishers and Distributors,NewDelhi, 2015.

Reference Books:

1.	Mair, R.J. and Wood, P.M., Pressuremeter Testing Methods and Interpretation, Butter-worths, 2013
2.	Dunnicliff, J., and Green, G.E., Geotechnical Instrumentation for Monitoring Field Performance, John Wiley, 2008
3.	Day, R.N., Geotechnical and Foundation Engineering, Design and Construction, McGraw-HiLLS,2015.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	1	2	0	0	1	1	2	3	2	1
CO2	3	3	3	3	1	0	1	0	0	0	0	1	3	3	2
CO3	3	3	3	3	3	1	2	0	0	0	0	0	3	2	0
CO4	3	3	3	3	3	0	1	0	0	3	3	3	3	2	1
CO5	3	3	3	3	3	1	1	1	1	1	0	1	3	1	1

1 – Slightly
2 – Moderately
3 – Strongly

18CEPE38	FUNDAMENTALS OF REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To possess knowledge on Remote Sensing Techniques and their applications in civil engineering projects.
2.	To Know about main Remote Sensing Systems and programs (sensors, platforms, etc.) and assess its potential to spatial analysis
3.	To Know and use GIS and its geo-processes and functions.
4.	To Use diverse techniques and instruments adequately to measure, locate and find bearingson a map and in afield.
5.	To Understand main concepts that define Geographic Information Systems

Unit I	INTRODUCTION	9	+	0

Definition and types of remote sensing – Wave and Quantum theories – Radiation principle - Components of Electromagnetic Spectrum – Energy balance equations – Components of ideal and real remote sensing system – Energy interaction with Atmosphere – Different types of scattering and absorption - Atmospheric windows – Energy interaction with surface features – Spectral signatures of Vegetation, soil andwater.

Unit II	PLATFORMS AND SENSORS	9	+	0

Aerial and space platforms – Aerial camera - Vertical and Oblique Aerial Photographic techniques - Classification of Satellites based on orbits and purposes - Synoptivity and Repetivity – Resolution and Types - Multistage, Multisensor, Multispectral, Multitemporal and Multipurposeconcepts.
Orbital and sensor characteristics of the following remote sensing satellites; LANDSAT, SPOT, IRS and IKONOS.

Unit III	IMAGE INTERPRETATION	9	+	0

Visual Interpretation of Satellite Imageries – Elements of interpretation - Interpretation keys – Digital image processing – Image Rectification and Restoration - Image Enhancement - Image Classification – Filtering – Low and High Pass filters

Unit IV	GEOGRAPHICAL INFORMATION SYSTEM	9	+	0

Components of GIS – Hardware, Software and Organizational set up – Data – Spatial and Non spatial – Maps – Types of Maps – Types of Georeferencing - Data input – Digitization – Scanning – Data Editing – Raster and Vector data analysis – Overlaying, Buffering – Generation of DEM - Data presentation

Unit V	APPLICATIONS OF REMOTE SENSING AND GIS	9	+	0

Merits and Limitations of Remote Sensing – Applications of Remote Sensing and GIS in the following fields; Surveying, Water resources, Geological mapping, Route location, Site selection for major civil engineering projects, Disaster and mitigation studies, Coastal zone management and Environmental Engineering

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves
CO2	:	Apply the concepts of satellite and sensor parameters and characteristics of different platforms

CO3	:	Apply the concepts of DBMS in GIS
CO 4	:	Analyze raster and vector data and modelling in GIS
CO 5	:	Apply GIS in land use, disaster management, ITS and resource information system

Text Books:	
1.	Thomas M. Lillesand, RaiphW.Kiefer, *Remote Sensing and Image Interpretation*, John Wiley and Sons, New York, Seventh Edition, 2015.
2.	Peter A. Burrough, Rachael A. McDonnell. Principles of Geographical Information Systems, Oxford University Press, Third Edition, 2015.
Reference Books:	
1.	Robert A. Schowengerdt, *Remote Sensing-Models and Methods for Image Processing,* Academic Press – An Imprint of Elsevier, California, Second Edition, 2006.
2.	Paul J. Curran, *Principles of Remote Sensing*, English Language Book Society/Longman, 1988.
3.	Anji Reddy M., *Text Book of Remote Sensing and Geographical Information System*, BS Publications, Hyderabad, Third Edition, 2006.
4.	Anand P.A, Rajesh Kumar V., *Principles of Remote Sensing & GIS*, Sri Vengateswara Publishers, Kumbakonam, First Edition, 2003.
E-References:	
1.	**https://nptel.ac.in/courses/105102015/**

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	2	-	1	-	-	1	-	-	3	2	1
CO2	2	-	1	2	-	-	-	-	-	-	-	-	1	3	1
CO3	-	-	-	-	-	-2	-	-	1	2	-	-	-	-	1
CO4	-	1	-	-	-	-	-	-	-	3	3	1	1	3	1
CO5	1	-	1	-	-	-	1	-	-	1	2	-	1	1	3

1 – Slightly
2 – Moderately
3 - Strongly

18CEPE39	ADVANCED SURVEYING TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

1. At the end of the course the student will possess knowledge about advanced techniques in surveying.
2. The students will understand the basic principle behind the surveying techniques.

Unit I	BASICS OF SURVEYING	9	+	0

Methods of measuring distance, historical development, basic principles, classifications, applications and comparison with conventional surveying.

Unit II	FUNDAMENTALS OF ELECTRONICS	9	+	0

Fundamentals of electronics, resonant circuits, semiconductors, Lasers, Cathode ray tube, photo multiplier tube, transducers, oscillators, frequency mixing, modulation and demodulation, Kerrcell modulator, measurement of phase difference, reflectors and power sources.

Unit III	PROPAGATION OF ELECTROMAGNETIC WAVES	9	+	0

Definition, classification, applications, propagation properties, wave propagation at lower and higher frequencies. Refractive index, factors affecting, computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions, reference refractive index.

Unit IV	ELECTROMAGNETIC DISTANCE MEASURING SYSTEM	9	+	0

Electro-optical system, measuring principle, working principle, sources of error, infrared EDM instruments, Laser EDM instruments and total station. Microwave system, measuring principle, working principle, sources of error, microwave EDM instruments, comparison withElectro-optical system.

Unit V	MODERN EQUIPMENTS	9	+	0

Total Station-Applications In various fields-Basics of Geographical information system (GIS) and Geographical Positioning system (GPS), Principles, Applications.

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Apply advanced surveying techniques in different fields of civil engineering
CO2	:	Select the advanced surveying technique which is best suited for a work
CO3	:	Apply total station and EDM in distance measurement and traversing
CO4	:	Demonstrate the principles of the earth surface, its projections and different coordinates involved in map making
C05	:	Apply GPS in transportation engineering, structural engineering and land use planning

Text Books:

1. Burnside, C.D. *Electromagnetic distance measurement* Crosby Lock wood staples, U.K. 1971.

Reference Books:

1. Rueger, J.M. *Electronic Distance Measurement*, Springer-Verlag, Berlin, 1990.
2. Laurila, S.H. *Electronic Surveying in Practice*, John Wiley and Sons Inc, 1983.
3. Soastamoinen, J.J. Surveyor's guide to electro-magnetic Distance Measurement, Adam Hilger Ltd., 1967.

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	2	2	1	3	2	2	3	1	3	2	3
CO2	2	3	3	1	3	2	1	3	2	1	1	1	2	3	1
CO3	3	1	2	3	2	3	1	3	2	3	1	2	1	3	3
CO4	2	1	3	2	1	3	2	1	1	1	1	2	3	2	1
CO5	3	1	3	2	2	1	2	3	2	3	3	2	3	1	2

1 – Slightly
2 – Moderately
3 - Strongly

OPEN ELECTIVES

18CEOE01	Environmental Management	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To impart an understanding of systems approach to Environmental Management as per ISO 14001 and skills for environmental performance in terms of legal compliance, pollution prevention and continual improvement.

Unit I	ENVIRONMENTAL MANAGEMENT STANDARDS	9	+	0

Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption –Tools, Business strategy drivers and Barriers -Evolution of Environmental Stewardship –Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources.

Unit II	PREVENTIVE ENVIRONMENTAL MANAGEMENT	9	+	0

Pollution control Vs Pollution Prevention - Opportunities and Barriers –Cleaner production and Clean technology, closing the loops, zero discharge technologies
Four Stages and nine approaches of Pollution Prevention -Getting management commitment – Analysis of Process Steps-source reduction, raw material substitution, toxic use reduction and elimination, process modification – material balance – Technical, economical and environmental feasibility evaluation of Pollution Prevention options in selected industries –Preventive Environmental Management over Product cycle.

Unit III	ENVIRONMENTAL MANAGEMENT SYSTEM	9	+	0

EMS, ISO 14000 - EMS as per ISO 14001–benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review –environmental aspect and impact analysis – legal and other requirements-objectives and targets –environmental management programs –structure and responsibility –training awareness and competence-communication –documentation and document control – operational control –monitoring and measurement –management review.

Unit IV	ENVIRONMENTAL AUDIT	9	+	0

Environmental audit – role of auditing – history – definitions audit methodology – evaluation audit results – audit reports – case studies.

Unit V	APPLICATIONS	9	+	0

Applications of EMS , Waste Audits and Pollution Prevention- cost benefit analysis in environmental Problems.
Water quality management – concepts – riparian rights – monitoring programmes – technology transfer – common effluent treatment concept.
Air quality management – emission inventory – ambient air quality in the region – spotting of violations – corrective measures – technology transfer.
Solid waste management – land pollution from solid and liquid wastes - spotting of violations – corrective measures – technology transfer.

Total (45+0)= 45 Periods

Course Outcomes: On completion of the course, the student is expected to be able to	
1	Understand the necessity of environmental management that will be caused by projects or industries.
2	Gain the Knowledge about the legal requirements of Environmental management and auditing.
3	Lead pollution prevention assessment team and implement waste minimization options.
4	Develop, Implement, maintain and Audit Environmental Management systems for Organisations.

Text Books:

1.	1.Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems –a step by step guide" Earthscan Publications Ltd, London, 1999.
2.	ISO 14001/14004: Environmental management systems –Requirements and Guidelines – International Organisation for Standardisation, 2004.

Reference Books:

1.	1.ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002.
2.	Paul LBishop „Pollution Prevention: Fundamentals and Practice", McGraw -Hill International, Boston,2000.
3.	Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1				3	3					1	1	1	2
CO2						3	3	2		1		1		1	2
CO3		2	1			3	3		3	1	1	1			2
CO4		1	1		2	3	3			1	1	1	1	1	2

1 – Slightly
2 – Moderately
3 - Strongly

18CEOE02	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1.	To provide students an exposure to disasters, their significance and types.
2.	To ensure that students begin to understand the relationship between vulnerability disasters, disaster prevention and risk reduction
3.	To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)

Unit I	INTRODUCTION TO DISASTERS	9	+	0

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability- Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don‟ts during various types of Disasters.

Unit II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9	+	0

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

Unit III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9	+	0

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

Unit IV	DISASTER RISK MANAGEMENT IN INDIA	9	+	0

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

Unit V	DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9	+	0

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management

Total = 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:		
CO1	:	Differentiate the types of disasters, causes and their impact on environment and society
CO2	:	Assess vulnerability and various methods of risk reduction measures as well as mitigation
CO3	:	Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

Text Books:	
1.	Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2.	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
Reference Books:	
1.	Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2.	Government of India, National Disaster Management Policy,2009.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	1		3	2	1	1	1	1	1	2	1	1
CO2	1	2	3	1	1	3	3	1	1	1	1	1	3	1	2
CO3	1	2	3	1	2	3	2	1	1	1	1	1	2	1	2

1 – Slightly
2 – Moderately
3 - Strongly

18CEOE03	REPAIR AND REHABILITATION OF BUILDING ELEMENTS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To get the knowledge on causes of deterioration of structure2. To know about the assessment of distressed structures3.To get the knowledge on maintenance of building systems, 4.To know about the repairing of structures and 5. To gain knowledge about the techniques involved in the demolition procedure

Unit I	MAINTENANCE AND REPAIR STRATEGIES	9	+	0

Maintenance, repair and rehabilitation, Facts of Maintenance, importance of Maintenance various aspects of inspection , assessment procedure for evaluating a damaged structure, causes of deterioration.

Unit II	MAINTENANCE OF ELECTRICITY AND DOMESTIC WATER PUMP SYSTEMS	9	+	0

Load rating of lighting devices and usual house hold appliances, electric supply from street line to building,devices for alternate supply during power failure, importance of earth leakage circuit breaker (ELCB),Maintenance of electric system inbuildings.

General specifications of water pumps, centrifugal pumps, jet pumps and submersible pumps, general rules in operation of water pumps. Maintenance of the sump.

Unit III	MATERIALS AND TECHNIQUES FOR REPAIR	9	+	0

Materials for Repair: Special concretes and mortar concrete chemicals construction chemicals Expansive cement polymer concrete sulphur infiltrated concrete Ferro cement Fibre reinforced concrete Rust eliminators and polymers coating for rebars foamed concrete dry packvacuum concrete asphalt sheeting Techniques for Repairs Gunniting, grouting and Shotcrete Epoxyinjection

Unit IV	REPAIRS,REHABILITATION AND RETROFITTING OF BUILDING SYSTEMS	9	+	0

Repairs of RC beams and columns damaged by steel corrosion,repair of rising dampness in walls,repair of efflorescence effect,repair of cracks in concrete structures,repair of rain water,ground water leakage in buildings.

Unit V	DEMOLITION TECHNIQUES	9	+	0

Engineered demolition techniques for dilapidated structures- case studies

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.
CO2	:	Know how to Maintain and repair the building systems like electricity,plumbing etc.
CO3	:	Know how of the Concrete repair industry equipped with variety of repair materials and

		techniques.
CO 4		know what to do the various repair works in building systems.
CO 5	:	Demonstrate the dismantling and demolishing structures
Text Books:		
1.	Varghese P.C., *Maintenance Repair Rehabilitation and Minor Works of Buildings*, PHI Learning pvt.ltd.,New Delhi,2014	
Reference Books:		
1.	Santhakumar A.R, *Training Course notes on Damage Assessment and Repair in Low cost housing*, "RHDC.NBO" Anna University, july 1992.	
2.	Shetty, M.S.,*Concrete Technology-Theory and Practice*, S. Chandand company, New Delhi,1992	
2.	RaikarR.N.,*Learningfromfailures- deficienciesindesign,constructionandservices*– R &D centre (SDCPL), raikar bhavan, Bombay,1987	
3.	Palaniyappan, N., *Estate management*, Anna Institute of Management, Chennai,1992.	
4.	Lakshmipathy, M. etal., *Lecture notes of workshop on Repairs and Rehabilitation of structures*, 29-30thoctober 1999.	

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					1	1	1	1	1	1	2	1	1		1
CO2					2	1	1	1	1	1	2	1	1		1
CO3					2	1	1	1	1	1	1	1	2		1
CO4					2	1	1	1	1				1		1
CO5					1	2	1	2	2	2	1	1	1		1

1 – Slightly
2 – Moderately
3 – Strongly

18CEOE04	MECHANICS OF DEFORMABLE BODIES	L	T	P	C
		3	0	0	3

Course Objectives:

To get the knowledge on simple stresses, Hooke's Law, Bending and Shear, Bending stress, Torsion and Springs, Mechanical behaviour of materials under static and dynamic loading

Unit I	**SIMPLE STRESSES , BEHAVIOUR OF COMPOSITE SECTIONS , THERMAL STRESSES**	**9**	**+**	**0**

Mechanical properties of solids –Hooke's law ,principle of super position ,Bars of varying sections – Elastic constants – composite sections – determination of stress , strain , deformation – Temperature stress ,strain

Unit II	**BENDING AND SHEAR**	**9**	**+**	**0**

Types of beams – shear force and bending moment. Theory of simple bending- Analysis of stress-load carrying capacity. Shear stress distribution of simple beams of different cross sections

Unit III	**TORSION AND SPRINGS**	**9**	**+**	**0**

Torsion of circular shaft - Hollow and solid circular section, torsional rigidity-stepped shaft-Twist and torsional stiffness-compound shaft-shafts springs-Stiffness and deflection of helical springs , leaf spring

Unit IV	**MECHANICAL BEHAVIOUR OF MATERIALS UNDER STATIC LOADS**	**9**	**+**	**0**

Tension tests – stress – strain diagram , Elastic and plastic regions – True stress – strain properties in tension – fracture under tensile loads – compression and Torsion tests – stress concentration – Residnal stresses

Unit V	**MECHANICAL BEHAVIOUR OF MATERIALS UNDER DYNAMIC LOADS**	**9**	**+**	**0**

Fatigue loading and Fatigue fracture – Fatigue tests – Empirical relations between variable stress and mean stress – Fatigue stress concentration Factors – Cumulative Damage – Endurance limit – Impact – notched - Bar Impact tests , Charpy Impact tests – Izod Impact tests – Elevated temperature – Creep tests – Isochronous curves – stress Relaxation – Parametric methods

Total= 45 Periods

Course Outcomes:

Upon completion of this course, the students will be able to:

CO1	:	Analyse the mechanical behavior of static & dynamic loads
CO2	:	Know how to analyse bending and shear of various beams, stress strain and deformation of structures

Text Books:

1.	James M.Gere , Mechanics of Materials, Brooke/Cole Thomson Learning, 5 Ed., 2001.
2.	Dr.R.Vaithiyanathan , Dr.P.Perumal&Lingeswari ", Mechanics of Solids and Structures Volume-I" Sci- tech publications, India(Pvt) Chennai-17.

3.	Srinath L.S; - Strength of materials – Macmillan India Limited – New Delhi,2017
Reference Books:	
1.	Popov.E.P., "Engineering Mechanics of solids", Prentice- Hall of India, New Delhi
2.	Beer F.P and Johnston R, "Mechanics of Materials", McGraw- Hill book Co, Third Edition
2.	Timoshenko S.P., "Elements of Strength of Materials", Tata McGraw- Hill, New Delhi
3.	Nash W.A., "Theory and Problems in Strength of Materials", Schuam outline Series, McGraw- Hill Book Co., New York.
4.	Rajput. R.K., "Strength of Materials", S. Chand &Co,Delhi, Third Edition, 2003.

CO-PO-PSO MAPPING

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2					2	1	2	2			3
CO2	3	3		2					2	1	2	2			3

1 – Slightly
2 – Moderately
3 - Strongly