Government College of Engineering, Salem- 11

(An Autonomous Institution affiliated to Anna University, Chennai)

Outcome Based Education

Manual

Table of Contents

Chapter - 1
Institute Vision and Mission

VISION

- We envision our students as excellent Engineers not only in the field of Science and Technology, but also in good citizenship and discipline.
- Our commitment lies in producing comprehensive knowledge seekers and humane individuals, capable of building a strong and developed nation.

MISSION

- To impart update technical education and knowledge.
- To groom our young students to become professionally and morally sound engineers.
- To reach global standards in academics and value based education.

Chapter - 2
Process for Defining Vision and Mission, Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

The department must establish the Vision and Mission through a consultation process involving the stakeholders of the department, considering the societal requirements. The department's Vision and Mission are framed within the department that are derived from the Institutional Vision and Mission statements.

The Programme Assessment Committee (PAC) circulates these statements among the stakeholders of the programme such as Industry, Faculty, Alumni, Parents & Employer and collects the views to refine the draft Vision and Mission statements. These draft statements are forwarded to the Department level committee to look into the relevance and consistency with the Vision and Mission of the institute. The DC consolidates these statements and the statements that are presented to the Board of Studies for suggestions. The process for defining vision and mission flowchart is shown in Figure 2.1.

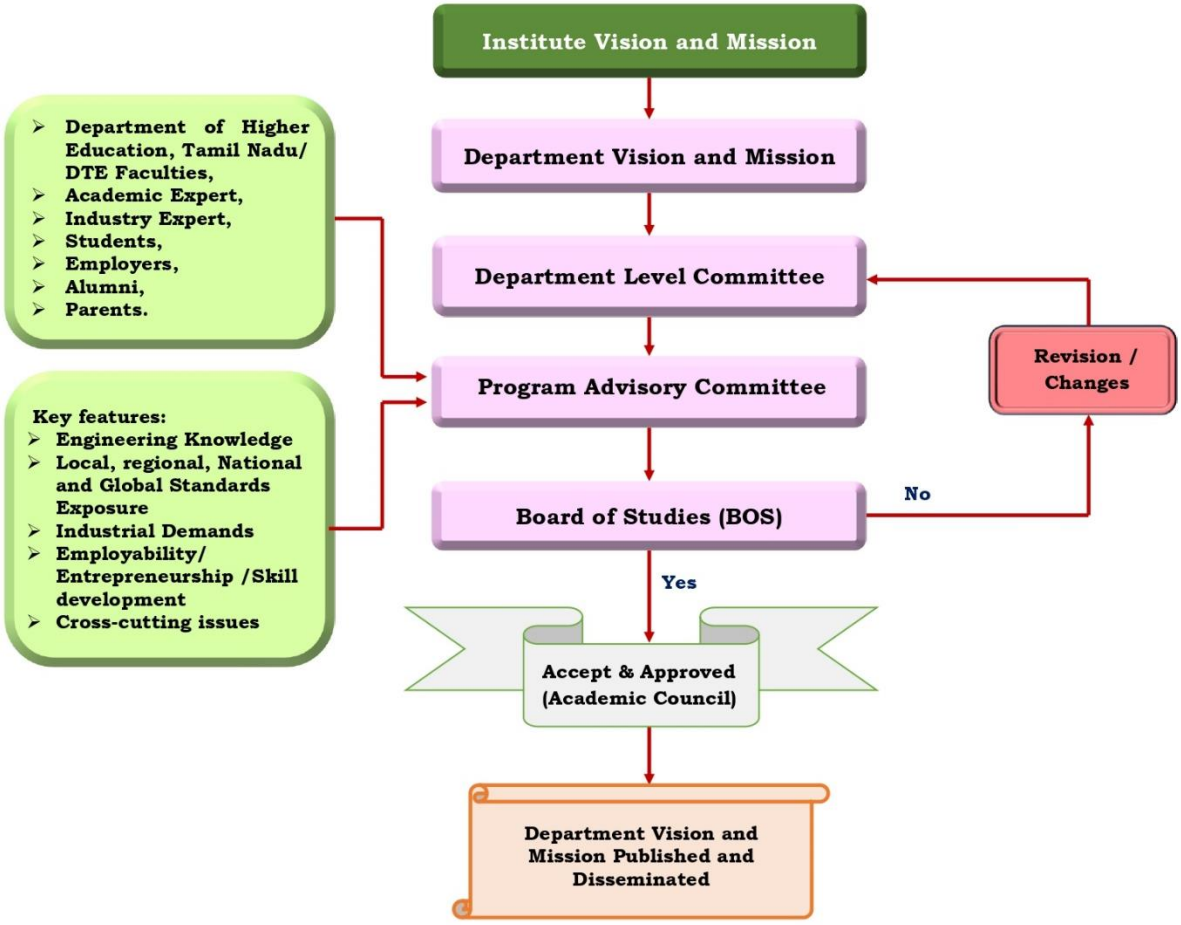

Figure 2.1 Process for Defining Vision and Mission

Chapter - 3
Process for Defining Programme Educational Objectives (PEOs)

Program Educational Objectives are broad statements that determine what the programme is preparing graduates for their career and professional life. These statements are designed inline with the Vision and Mission statements of the institute, Vision and Mission statements of the department and the Programme Outcomes. Programme outcomes are statements that define what graduates are able to do by the time they graduate. The programme aims at achieving the educational objectives through these Outcomes and the Process of defining PEOs. The Process for defining program educational objectives is shown in Figure 3.1.

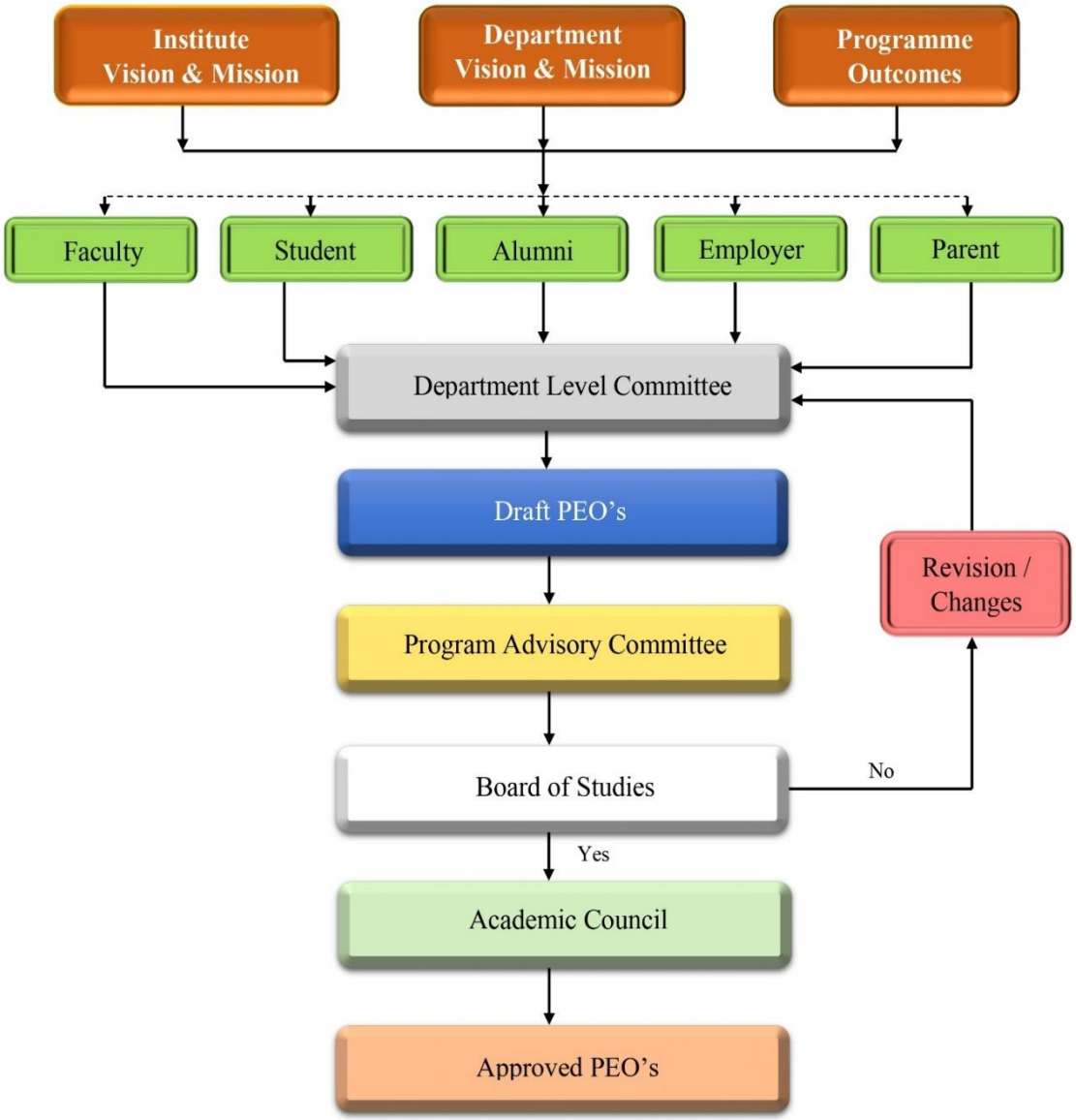

Figure 3.1 Process for Defining Program Educational Objectives

The programme assessment committee will prepare PEOs by collecting views from the stakeholders such as Faculty, Students, Alumni, Employer and Parents. The department advisory committee deliberates on the PEOs submitted by the PAC, recommends modifications and forwards the draft PEOs to the BoS for suggestions. BoS reviews the PEOs and submits its recommendations. The final version of the PEOs are forwarded to the Academic Council by the department for approval.

The approved PEOs are disseminated to all the stakeholders by the department.

Dissemination of Vision, Mission and PEOs

Table 3.1 Dissemination of Vision, Mission and PEOs

Category of Media	Medium/Place of Dissemination	Stakeholders
Print Media	Syllabus Books and Lab Manuals	Students and Faculty
	Department Brochures	Students and Faculty, Alumni
	Course Files	Faculty
Display Media	HOD Office	Students, Faculty, Technical and Non-Technical Staff, All visitors
	Faculty Room	Students, Faculty, Technical & Non-Technical Staff
	Common Areas	Students, Faculty, Technical & Non-Technical Staff
	Laboratories	Students, Faculty, Technical and & Non-Technical Staff
	Notice Boards in the Department	Students, Faculty, Parents, Technical and Non-Technical Staff, Alumni & All visitors
Electronic Media	College Website	Students, Faculty, Alumni, Employers, Parents and Society
Interaction	Induction Program for First yearstudents	Students, Parents, Faculty
	Orientation Program for Lateral Entry students when	Students, Parents, Faculty

	they take admission in Second year	
	Board of Studies Meetings	Faculty, BoS Members, External Experts, Alumni
	Alumni Meet	Alumni
	Parents Teacher Meeting	Students, Parents

Process of Dissemination among Stakeholders

Institute Vision, Mission, Department Vision, Mission and PEOs, POs & PSOs are disseminated as follows:

Table 3.1 Process of Dissemination among stakeholders

S. No.	Stakeholder	Frequency
1	All first year admitted students and parents during the first day of the Induction program through Power Point Presentation by the Head of the Department.	Once every year
2	All lateral entry students admitted in 3rd Semester and parents on the day of joining the program through PowerPoint Presentation by the Head of the Department.	Once every year
4	Students of all years during the semester through technical magazine	Once every year
5	Outgoing students through the exit Survey Questionnaire	Once every year
6	The faculty and society through the workshop, conference brochures and outreach programmes	For every activity
7	Alumni through alumni survey	Once every year
8	The Subject and industry experts through the BoS meetings	Once every year

Chapter - 4
Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

The Institute started adopting Outcome Based Education (OBE) in 2016. The main objective of implementing OBE is to impart education by adopting a student centric approach and deliver outcome oriented teaching for the students. Every programme identifies Program Outcomes (POs), Program Specific Outcomes (PSOs), and Course Outcomes (COs) in accordance with the vision and mission statements of the programme.

Program Outcomes (POs)

Program Outcomes (POs) represent the student learning outcomes that are defined as the knowledge, skills, or behaviours that a student should be able to demonstrate upon completion of the programme and are statements written in accordance to the graduate attributes.

Table 4.1 List of Program Outcomes

PO1	**Engineering knowledge** Apply the knowledge of mathematics, science,engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions.** Design solutions for complex engineering problems and design system components or processes that meet thespecified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to

	complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation,make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are specifically defined outcomes of the programme which the graduates have to acquire by the end of the programme.

At the end of this Programme, students will be able to:

Table 4.2 List of Program Outcomes

Department	Programme Specific Outcomes	
Civil Engineering	**PSO1**	The graduates of this programme will be able to meet the needs of public in the design and execution of quality construction work considering the health, safety, cultural, societal and environmental factors.
	PSO2	The graduates will analyze and design regular and complex structures having acquired the knowledge of building analysis software packages.
	PSO3	The graduates will be able to work effectively as an individual or in a team having acquired leadership skills and manage projects in multidisciplinary environments.
Computer Science and Engineering	**PSO1**	Develop efficient computerized solutions to real world problems through the application of principles in Data structures, Analysis of algorithms, Software Engineering and Object oriented analysis and Design.
	PSO2	Apply the knowledge in Data mining and Big data analytics to infer, predict or prescribe data centric business solutions.
Electronics and Communication Engineering	**PSO1**	To analyse, design and develop solutions for the real time problems and to apply the technical Knowledge for developing quality products for Electronics and Communication based Industry.
	PSO2	To adapt to emerging Information and Communication technologies and to develop innovative ideas and solutions in RF & Communication, Networking, Embedded Systems, and VLSI.
	PSO3	An ability to make use of acquired technical knowledge to get employed in the field of Electronics and Communication and also to become successful Entrepreneur.
Electrical and electronics engineering	**PSO1**	Apply knowledge of mathematics, engineering sciences and multidisciplinary knowledge to the solution of electrical and electronics engineering problems
	PSO2	Apply research-based knowledge, appropriate techniques, IT tools to complex electrical and electronics engineering problems including design, analysis, interpretation of data, and synthesis

		of the information to provide valid conclusions.
	PSO3	Apply ethical principles, management skills and responsibilities for electrical and electronics engineering profession.
	PSO4	Recognize the need of independent and lifelong learning for professional development and personnel growth.
Mechanical Engineering	**PSO1**	Ability to identify, analyze and solve engineering problems in the domains of Design, Thermal and Manufacturing systems.
	PSO2	Ability to apply their knowledge in principle of design and analysis, in execution of automation in mechanical system / processes.
	PSO3	Ability to involve professionally in industries or as an entrepreneur by applying manufacturing and management practices.
Metallurgical Engineering	**PSO1**	understand, analyze the theoretical foundations of Metallurgical Engineering and apply the various techniques and tools to solve the real-world problems.
	PSO2	understand the concepts of metals and materials development and acquire the various skills under different platforms in the field of Metallurgical Engineering.
	PSO3	use the knowledge in multiple domains to identify the research gap in the real-world environment providing link to innovate new ideas and helps to become a successful engineer and entrepreneur.
	PSO4	work effectively as an individual or in a team having acquired leadership skills and manage in multi-disciplinary environments.

The following are the various means for disseminating Program Outcomes (POs), Program Specific Outcomes (PSOs) of all Programmes:

Table 4.3 Dissemination of POs and PSOs

Print Media	Syllabus Books
Display Media	HOD Room
	Faculty Room
	Laboratories
	Notice Boards in the Department
	Department Library
	Other prominent locations in the department
Electronic and Communication Media	Web site - www.gcesalem.edu.in
	Stakeholders Meeting
	Alumni Meet

Chapter - 5
Course Outcomes (COs)

Bloom's Taxonomy:

The original Taxonomy of Educational Objectives, commonly referred to as Bloom's Taxonomy, was created by Benjamin Bloom in 1956, and later revised in 2001. Bloom categorized and classified the cognitive domain of learning into varying levels according to complexity and richness.

In Bloom's Taxonomy from 1956, he outlined six main categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. In 2001, a group of cognitive psychologists, curriculum theorists, instructional researchers, and testing specialists revised the category names of Bloom's Taxonomy from nouns to verbs is shown in Figure 5.1.

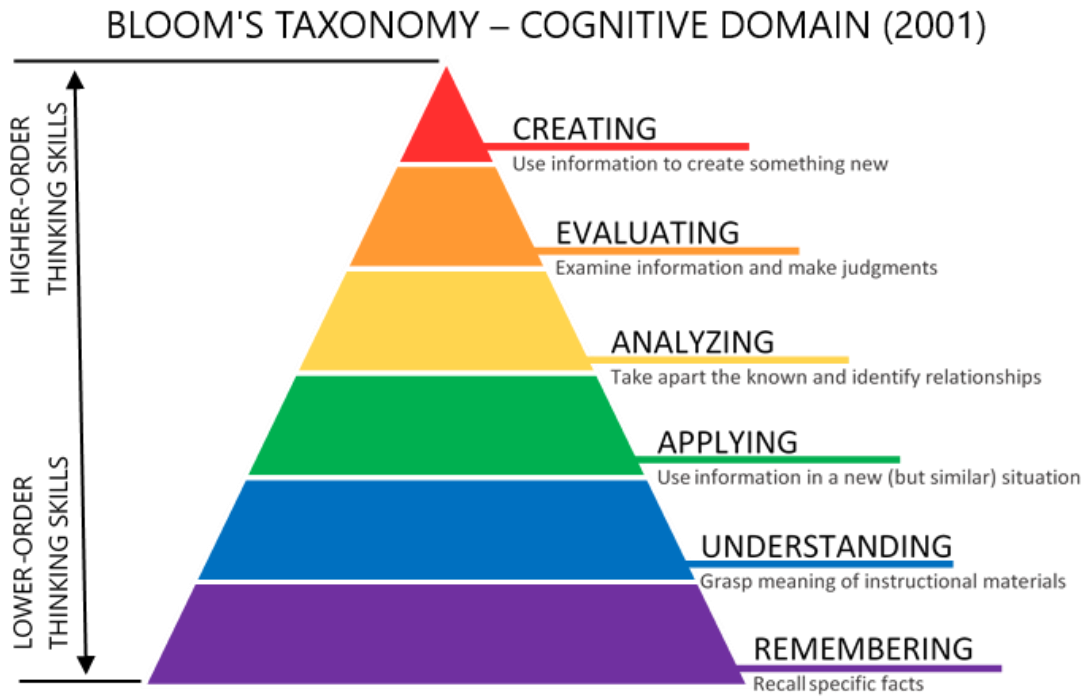

Figure 5.1 Bloom's Taxonomy

Remembering: the basic recall of information presented through various methods. When we "remember" something, we are able to name it, locate it, define it, etc. We are able to take the content and paint a visual for the learner.

Understanding: the demonstration of what we remember. When we "understand" something, we are able to apply that knowledge in a myriad of ways. We may compute, illustrate, or show others how we interpret that particular concept.

Applying: the solving of problems associated with basic understanding: When we "apply" something, we try to understand its relevance in new situations.

Analyzing: the investigation of the concept for which we previously demonstrated understanding. When we "analyze" something, we break it down so that we can find connections that make the parts a whole.

Evaluating: the process in which the content is examined for validity. When we "evaluate" something, we have to prepare for debate and discussion on prior analysis.

KNOWLEDGE DOMAIN VERBS

Rememberin g	Understandin g	Applying	Analyzing	Evaluating	Creating
Recall specific facts.	Grasp meaning of materials.	Use informatio n in a new situation.	Identify schemas or relationships.	Use information to make judgments.	Create or develop something new.
define describe examine identify label list locate match memorize recall recite recognize record reproduce retell select state tabulate tell visualize	associate classify compare contrast convert describe discuss distinguish explain illustrate interpret order predict relate report represent restate select summarize trace transform translate	apply articulate calculate change chart compute construct develop employ examine experiment explain illustrate interpret manipulate modify operate predict produce relate solve transfer	analyze categorize compare connect contrast criticize deduce diagram differentiate discriminate dissect estimate evaluate experiment infer organize plan prioritize question separate survey test	appraise argue assess choose convince critique debate defend editorialize estimate evaluate grade judge justify measure persuade predict rank rate reframe summarize support	adapt assemble compose construct create design develop facilitate hypothesiz e integrate invent modify negotiate plan propose revise role-play schematize simulate speculate support validate

Course Outcomes:

Course Outcomes (COs) are clear statements of what students should be able to demonstrate upon completion of a course. They should be measurable. CO statement should have these three components performance, condition and criteria.

Process of defining Course Outcomes

The course outcomes of each course are prepared by the course coordinator in consultation with the faculty teaching the same course.

The COs must be preparedin accordance with the Bloom's Taxonomy levels. A Course Outcome should Start with an Action verb from Bloom's taxonomy set of verbs. For every course, four to six COs are drafted in accordance with the Curriculum, they are discussed in the Department committee and modified based on the suggestions if any. Approval for the Syllabus and COs is obtained from the Board of Studies (BoS).

Sample Course Outcomes:

18ME303 – Thermodynamics

Table 5.1 Sample CO Statement

CO.NO	Course Outcomes Upon completion of this course, the students will be able to:
CO1	apply the concepts of zeroth, first and second law of thermodynamics.
CO2	analyze the various work and heat interactions for different types of processes for closed and open systems.
CO3	analyse the properties of pure substance and concepts of rankine cycle.
CO4	derive thermodynamic relations for ideal and real gases.
CO5	apply the basic concepts of Psychrometry.

Chapter - 6
CO – PO and CO - PSO Mapping

Level of Correlation

It indicates to what extent a certain component mapped with the other. The correlation between CO - PO describes the level at which a particular PO is addressed through a CO.

Table 6.1 Level of Correlation

Level 3	indicates **High** mapping. *(high correlation towards attainment)*
Level 2	indicates **Moderately** mapping. *(moderate correlation towards attainment)*
Level 1	indicates **Low** mapping. *(low correlation towards attainment)*

Sample CO-PO and CO-PSO Mapping

A sample course outcome statements and sample CO-PO matrix are given in Table 6.1 based on CO statements given in table 5.1.

The CO-PO mapping has been done with correlation levels of 3, 2, 1 and 0. The notation of 3, 2 and 1 denotes substantially (high), moderately (medium) and slightly (low). The meaning of '0' is no correlation between CO and PO.

Example : 18ME303 – Thermodynamics

Table 6.2 Sample CO-PO Matrix

CO/PO	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	1	2	1	1	1	0	0	0	0	0	1	2	1
CO2	2	1	1	2	3	1	1	0	0	0	0	0	1	3	1
CO3	2	1	3	1	2	1	1	0	0	0	0	0	2	1	3
CO4	1	2	2	1	3	1	1	0	0	0	0	0	2	1	2
CO5	1	2	1	3	1	2	1	0	0	0	0	0	1	2	1
Weighted Average	**1.4**	**1.8**	**1.6**	**1.8**	**2**	**1.2**	**1**	**0**	**0**	**0**	**0**	**0**	**1.4**	**1.8**	**1.6**

Programme Articulation Matrix

Program articulation matrix depicts the correlation between all the courses of the programme and Programme Outcomes.

Table 6.3 Sample Programme Articulation Matrix

Semester	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
18MA101	1.7	1.7	1	1	1	1	1	1	1	1	1	1	1	1	1
18PH102	2.7	2.7	0	3	2.3	1	1	0	1	0	0	2.7	2	1.3	3
18ME101	3	2.3	0	1.3	1	0.3	0.3	0	0	0	0	0	0	0	0
18EE103	0.3	1	0.3	1	0.7	0	0	0	0	1	0	0.7	1.7	1.3	1.7
18PH103	3	3	2	3	1	1	2	0	3	0	1	2	1	0	3
18CY102	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0
18EE104	2.7	1.3	0	1.7	1	0	0.3	0.3	0	0	0	0	0	0	0
18EN103	0	0	2	1	0	1	1	1	1	3	2	2	0	1	2
18EN101	0	0	2	1	0	0	2	2	1	3	2	2	0	1	2
18MA201	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1
18CY101	3	0	0	1.3	0	1	0	1	0	2	0	0	0	0	0
18CS101	3	3	3	3	3	2	2	1	1	1	3	3	3	1	0
18EN102	0	0	1.5	1	0	1.5	1	1.5	1.5	3	0.5	1.5	0	0	2
18CS102	3	3	3	3	3	2	2	1	1	1	3	3	3	1.3	0
18ME102	1	1	2	2	1	1	0	1	1	0	0	1	1	1	2
18PH202	3	3	0	2	3	1	1	0	1	0	0	3	2	0	2
18MA204	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
18ME301	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1
18ME302	1	1	0	0	0	0	0	0	0	0	0	0	0.7	0	0
18ME303	1	2	2	2	2	1	1	0	0	0	0	0	2	1	2
18EC308	3	2	1	2	0	0	0	0	1	0	0	0	2	0	1
18ME304	1.5	2	1.5	2	1.5	0	0	1	0	0	0	1	1.5	1.5	1.5
18EC309	3	1.3	0	3	1	0	0	0	2	0	0	2	1	0	0
18ME401	3	2	2	1	1	0	0	0	0	0	0	0	2	2	0
18ME402	3	1	2	1	0	1	0	0	0	0	0	0	3	2	1
18ME403	2	2	1	2	0	0	0	1	0	0	0	0	2	2	1
18ME404	3	2	2	2	0	0	0	0	0	0	0	0	2	1	1
18ME405	0	1	2	1	1	1	1	0	0	0	0	0	2	3	1

18ME406	2	3	2	1	1	0	0	0	0	0	0	0	2	2	1
18ME407	2	3	2	1	1	0	0	0	0	0	0	0	2	2	1
18ME501	2	2	3	2	1	0	1	0	0	0	0	0	3	3	0
18ME502	0.5	0	0	0	0	0	1	0.5	1	0	0	0	0	0	1
18ME503	2	2	1	1.5	0	0	1	0	0	0	0	0.5	0	0	0
18ME504	1	2	3	2	0	0	0	0	0	0	1	0	3	2	1
18MTOE01	1	1.2	1.6	1.8	1.8	0	0	0.2	0.2	0.4	1.4	1.8	2.8	2.4	2.4
18CSOE04	3	3	3	2	1	0	1	0	0	0	2	2	3	2	0
18MEPE53	2	1	2	1	1	2	1	0	0	0	0	0	2	2	1
18ME505	2	2	2	3	0	0	0	0	0	0	0	0	2	3	2
18EN501	0	0	2	2	0	0	2	1	1	3	2	0	0	1	3
18ME506	0	0	2	1.5	0	1	1	2	1.5	3	1	2	0	1	1.5
18ME601	1	1	2	0	2	0	1	0	1	0	2	2	2	2	2
18ME602	3	2	1	0	1	0	0	0	0	0	0	0	2	1	0
18ME603	3	3	2	1	0	0	0	0	0	0	0	0	3	2	0
18MEPE14	2	1	2	1	0	0	1	0	1	0	1	1	1	1	1
18MEPE22	3	3	2	2	0	0	0	0	0	0	0	0	3	2	1
18MEPE23	3	2	2	1	0	0	0	0	0	0	0	0	3	2	2
18EEOE4	1.5	2.2	2.5	2.7	2	1	1.8	1.5	1	1	1	1	2	2.5	1
18MTOE02	1.2	1.8	1.4	1.2	2.2	0.6	0.6	1	0.8	0.4	1.4	1.6	1.2	1.4	1
18MEPE61	2	2	2	1	0	0	0	0	0	0	0	0	1	1	0
18MEPE63	0	0	0	0	0	0	1	2	0	0	0	0	0	1	2
18MEPE65	0	1	0	1	0	0	0	0	0	0	0	0	0	1	2
18ME604	2	2	0	1	2	0	0	0	0	0	0	0	1	2	3
18ME605	1	2	2	0.5	2.5	1.5	2	1	2.5	1	0.5	3	2	2	2.5
18ME701	0	0	0	1	1	0	1	0	0	0	1	1	0	1	1
18MEPE31	1	1	3	1	1	0	0	0	0	0	0	0	1	1	1
18MEPE32	0	0	0	0	0	3	2	3	0	0	0	0	0	0	3
18MEPE46	0	1	1	1	3	0	0	0	2	1	3	0	0	1	1
18CEOE02	0.6	2	3	1	1	3	2.3	1	1	1	1	1	2.3	1	1.6
18MTOE04	1.2	1.8	1.4	1.2	2.2	0.6	0.6	1	0.8	0.4	1.4	1.6	1.2	1.4	1
18ME702	0	0	0	1	0	0	0	1	1	0	1	1	2	1	3
18ME703	2	2	3	2	3	2	2	2	2	2	1	3	2	3	3
18ME801	1.5	2	3	1.5	3	2	2	1.5	2	1.5	0.5	3	1.5	2.5	3
Weighted Average	**1.6**	**1.6**	**1.5**	**1.4**	**1.0**	**0.6**	**0.7**	**0.5**	**0.6**	**0.5**	**0.6**	**0.9**	**1.4**	**1.2**	**1.3**

Chapter – 7
CO Assessment and PO Assessment Tools

Attainment of Course Outcomes

For measuring the attainment of Course Outcomes, various tools are used. The process of CO & PO /PSO attainment is described in Figure 7.1 & 7.2

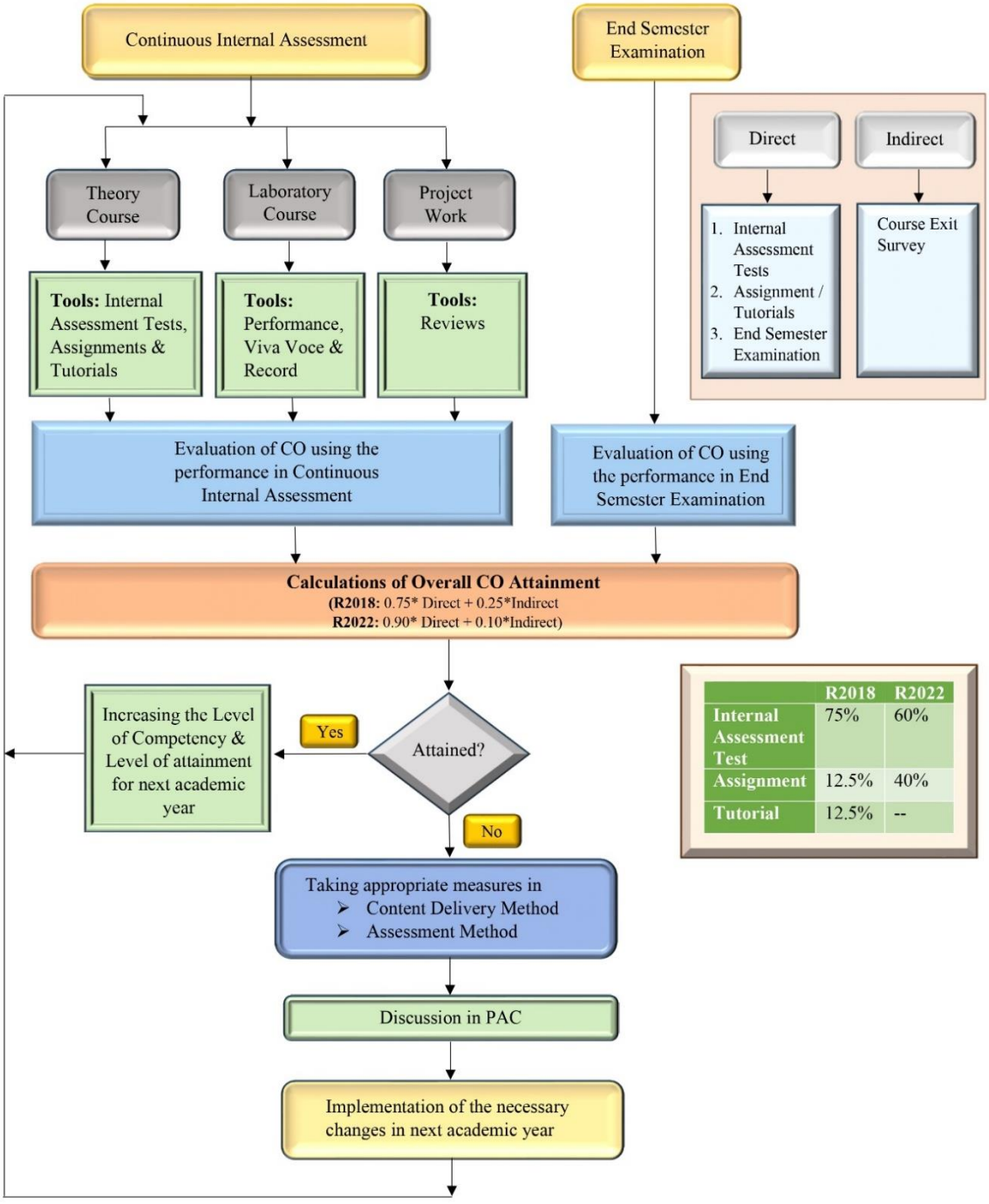

Figure 7.1 Process for CO Attainment

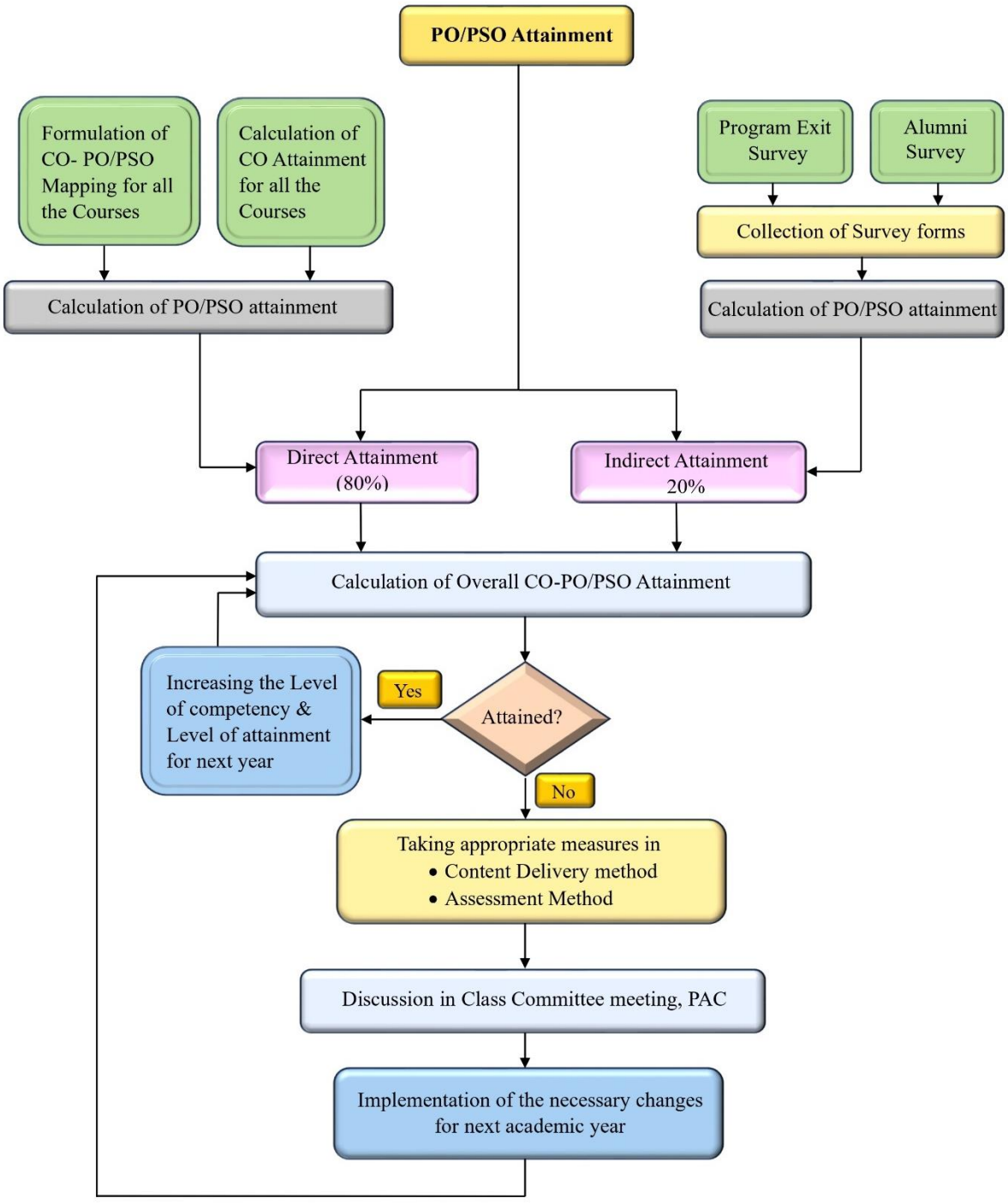

Figure 7.2 Process for PO/PSO Attainment

Direct Assessment:

Table 7.1 List of Evaluation Methods

Evaluation Methods	Process
Unit Tests	Three Internal Assessment Tests are conducted per semester to evaluate the attainment of course outcomes. Each question is mapped with COs and blooms level.
Assignments & Tutorials/Objective Test	The tutorials and assignments are given to the students based on the subject nature. For four credit papers tutorials are mandatory. Tutorial and Assignment sheets are prepared by the faculty member with COs and levels.
Laboratory Courses	The evaluation criteria for each experiment are based on performance, viva-voce and record mark. The attainment of COs is calculated through continuous assessment and model practical performance using laboratory rubrics.
Project Reviews	Three reviews are conducted periodically to monitor and evaluate the progress of the project using project rubrics. Viva-Voce is conducted at the end of the semester.
End Semester Examination	At the end of each semester, Autonomous institutions typically administer final examinations encompassing both theory and laboratory courses. These exams encompass the entire syllabus, ensuring that all Course Outcomes (COs) are thoroughly covered in the question papers.

Theory Courses

For each theory course, faculty member calculates the course outcome attainment using Internal Assessment Test and End Semester Examination. The attainment level will be calculated based on the performance levels of both Internal Assessment Test and End Semester Examination.

Table 7.2 Direct Assessment Tools for Theory Courses

Direct Assessment Tool		Weighted	Frequency
CO Attainment	**Internal Assessment Tests** ➢ Unit Tests (75% Weightage) ➢ Assignment (12.5% Weightage ➢ Tutorial / Objective Test (12.5% Weightage)	40%	Thrice in a Semester
	End Semester Examination	60%	Once in a Semester

Based on the level of CO attainment, the faculty member will decide whether to increase the competency level or change the content delivery method, assessment methods to improve attainment level for the course.

Laboratory Courses:

The practical classes for all the Practical/Laboratory component courses will be assessed continuously. The end semester practical examination for award of marks shall be conducted by both Internal and External examiners. Based on the CO attainment level, the faculty member will decide whether to increase the competency level or enhance the practical knowledge of the students in order to improve attainment level for the laboratory course.

Rubrics for Laboratory

Table 7.3 Rubrics for Laboratory

Rubric	Excellent	Average	Poor	Max Marks
Aim	Excellent understanding of what experiment to be done. **(5 or 4)**	Acceptable understanding of what experiment to be done. **(3 or 2)**	Poor understanding of experiment to be done. **(1)**	
Identification of apparatus/ Software /Materials need.	Have excellent knowledge on necessities of experiment. **(5 or 4)**	Have acceptable knowledge on necessities of experiment. **(3 or 2)**	Poor knowledge on necessities of experiment. **(1)**	
Experimentation	Highly capable of conducting experiment, with minimal or no support. **(13 to 15)**	Able to conduct experiment with quantifiable support. **(8 to 12)**	Unable to conduct experiment. **(1 to 7)**	
Observation & Result	Clearly able to define output and conclude result. **(13 to 15)**	Able to define output but not able to conclude result. **(8 to 12)**	Poor ability to define output **(1 to 7)**	
Record	On-time legibly written record with all requirements and without mistake. **(5 or 4)**	On-time legibly written record but not with all requirements and without mistake. **(3 or 2)**	Poorly written record **(1)**	
Viva voice	Answered almost all questions **(5 or 4)**	Answered some of the questions **(3 or 2)**	Answered a few questions **(1 or 0)**	

Table 7.4 Direct Assessment Tools for Laboratory Courses

Direct Assessment Tool		Weighted	Frequency
CO Attainment	**Internal Assessment** ➢ Experiment/ Record/ Practical Classes Performance (60% Weightage) ➢ Practical Test (40% Weightage)	40%	Every Week
	End Semester Practical Examination	60%	Once in a Semester

Project Work and Viva - Voce:

For project work, Continuous Internal Assessment is based on the performance in the three reviews during the semester by a review committee. The Course Attainment is calculated based on the three reviews and project Viva voce using Project rubrics. The students shall make a presentation on the progress of the project before the committee. The Head of the Department shall constitute the review committee consisting of HOD, Guide and a senior member of faculty. For the project work and viva – voce examination, the maximum marks shall be 200, comprising 80 marks for internal assessment and 120 marks for the end semester examination.

Rubrics for Project

Table 7.5 Rubrics for Project

Review 1 (Rubric 1)				
Rubric	**Good**	**Average**	**Poor**	**Max Mark**
Identification of Project (CO1)	Detailed and extensive explanation of the purpose and need of the project (**5 or 4)**	Average explanation of the purpose and need of the project **(3 or 2)**	Minimal explanation of the purpose and need of the project **(2 or1)**	
Literature Survey (CO2)	Detailed and extensive explanation of the specifications and the limitations of the existing systems (**5 or 4)**	Moderate study of the existing systems; collects some basic information (**3 or 2)**	Minimal explanation of the specifications and the limitations of the existing systems; incomplete information **(2 or1)**	

Presentation (CO5)	Contents of presentations are appropriate and well arranged. Proper eye contact with audience and clear voice with good spoken language **(2)**	Content presentations are appropriate but not well arranged. Satisfactory demonstration, clear voice with good spoken language but eye contact not proper **(1)**	Contents of presentations are not appropriate and not well delivered. Poor delivery of presentation **(0)**	
Review 2 (Rubric 2)				
Planning of work structure (CO3)	Time frame properly specified and being followed. Appropriate distribution of project work (**5 or 4)**	Time frame properly specified or Distribution of project work inappropriate **(3 or 2)**	Time frame not properly specified. Inappropriate distribution of project work	
Methodology & Experimentation (CO4)	Division of problem into modules and good selection of computing framework Appropriate design methodology and properly justification (**5 or 4)**	Either Division of problem into modules or selection of computing framework or Design methodology not properly justified **(3 or 2)**	Modular approach not adopted. Design methodology not defined **(2 or1)**	
Presentation (CO5)	Contents of presentations are appropriate and well arranged. Proper eye contact with audience and clear voice with good spoken language **(2)**	Content presentations are appropriate but not well arranged. Satisfactory demonstration, clear voice with good spoken language but eye contact not proper **(1)**	Contents of presentations are not appropriate and not well delivered. Poor delivery of presentation **(0)**	
Review 3 (Rubric 3)				
Project Demonstration (CO5)	All defined objectives are achieved. Each module working well and properly demonstrated. All modules of project are well integrated and system working is accurate. (**5 or 4)**	Some defined objectives are achieved. Each module working well and properly demonstrated Integration of all modules not done and system working is not very satisfactory **(3 or 2)**	Defined objectives are not achieved. Modules are not in proper working form that further leads to failure of integrated system. **(2 or1)**	

Results and Discussion (CO5)	Clearly connect the results together to validate the design and develops an insightful, supported conclusions and recommendations. (**5 or 4)**	Validates the design based on the achieved results and develops acceptable conclusions. **(3 or 2)**	Unable to connect the results achieved properly and develops conclusions without clarity. **(2 or1)**	
Presentation (CO5)	Contents of presentations are appropriate and well arranged. Proper eye contact with audience and clear voice with good spoken language **(2)**	Content presentations are appropriate but not well arranged. Satisfactory demonstration, clear voice with good spoken language but eye contact not proper **(1)**	Contents of presentations are not appropriate and not well delivered. Poor delivery of presentation **(0)**	
(Rubric 4) Marks by Guide				
Report Preparation (CO5)	Error free, well organized, and properly formatted report communicating all the key concepts. (**5 or 4)**	Error free, relatively organized and adequately formatted report. **(3 or 2)**	Erroneous, poorly organized, and formatted report. **(2 or1)**	
Teamwork (CO4)	Collaborates and communicates in a group situation and integrates the views of others. Reports to the guide regularly and consistent in work. (**5 or 4)**	Exchanges some views but requires guidance to collaborate with others. Not very regular but consistent in the work. **(3 or 2)**	Makes little or no attempt to collaborate in a group situation. Irregular in attendance and inconsistent in work. **(2 or1)**	
Technical Skill(CO4)	Extensive knowledge related to the project. **(4)**	Fair knowledge related to the project. **(3 or 2)**	Lacks sufficient knowledge. **(1)**	
Total				

Rubrics for End semester project

Table 7.6 Rubrics for End Semester Project

Rubric	Good	Average	Poor	Max Marks
Problem Identification (CO1)	Detailed and extensive explanation of the purpose and need of the project (**5 or 4)**	Average explanation of the purpose and need of the project **(3 or 2)**	Minimal explanation of the purpose and need of the project (**2 or1)**	
Literature Survey (CO2)	Detailed and extensive explanation of the specifications and the limitations of the existing systems **(8 to 10)**	Moderate study of the existing systems; collects some basic information (**5 to 7)**	Minimal explanation of the specifications and the limitations of the existing systems; incomplete information **(1 to 4)**	
Planning Methodology and Experimentation (CO3 & CO4)	Well executed Project work plan. Correct Methodology All defined objectives are achieved. Each module working well and properly demonstrated. All modules of project are well integrated and system working is accurate. **(15 to 20)**	Work plan of project is structured fairly. Correct Methodology Some defined objectives are achieved. Each module working well and properly demonstrated Integration of all modules not done and system working is not very satisfactory **(11 to 15)**	Work plan is inappropriate. Methodology nor appropriate Defined objectives are not achieved. Modules are not in proper working form that further leads to failure of integrated system. **(1 to10)**	
Result and Discussion (CO4)	Clearly connect the results together to validate the design and develops an insightful, supported conclusions and recommendations. **(8 to 10)**	Validates the design based on the achieved results and develops acceptable conclusions. **(5 to 7)**	Unable to connect the results achieved properly and develops conclusions without clarity. **(1 to 4)**	
Presentation (CO5)	Contents of presentations are appropriate and well arranged. Proper eye contact with audience and clear voice with good spoken language **(5 or 4)**	Content presentations are appropriate but not well arranged. Satisfactory demonstration, clear voice with good spoken language but eye contact not proper **(3 or 2)**	Contents of presentations are not appropriate and not well delivered. Poor delivery of presentation **(1 or 0)**	
			Total	

Table 7.7 Direct Assessment Tools for Project and Viva-Voce

Direct Assessment Tool		Weighted	Frequency
CO Attainment	**Internal Assessment** ➢ Work Assessed by the Project Guide (50% Weightage) ➢ Work Assessed by the Committee (50% Weightage)	40%	Every Week
	End Semester Practical Examination	60%	Once in a Semester

Chapter – 8
CO Attainment Analysis

Calculation for Attainments of COs and POs:

Mechanism for the attainment of CO:

The student performance in continuous assessment exams is verified for each question.

Table 8.1 Mechanism for the attainment of CO

Assessment Tool			Weighted
CO Attainment	Direct	Continuous internal assessment (40%) + End semester assessment (60%)	75%
	Indirect	Course exit survey	25%
CO Attainment = 75% of Direct assessment + 25% of Indirect assessment			

Direct Assessment Tools for CO Attainment

In view of the threshold assumed for each course, individual course assessment in thus calculated.

Table 8.2 Assessment of Course Outcomes for CIA (Continuous Internal Assessment)

Course outcomes	CO1			CO2			CO3			CO4			CO5		
Measure	IAT (75%)	Assignment (12.5%)	Tut (12.5%)	IAT (75%)	Assignment (12.5%)	Tut (12.5%)	IAT (75%)	Assignment (12.5%)	Tut (12.5%)	IAT (75%)	Assignment (12.5%)	Tut (12.5%)	IAT (75%)	Assignment (12.5%)	Tut (12.5%)
Student Name 1															
Student Name 2															
Student Name 3															

Total Average															

Table 8.3 Assessment of Course Outcomes for ESE (End Semester Examination)

Course outcomes	CO1	CO2	CO3	CO4	CO5	Total Marks
Student Name/Marks						
Student Name 1						
Student Name 2						
Student Name 3						

Total Average						
CO Attainment Level						

Table 8.4 COs Analytic Report

Government College of Engineering, Salem - 11						
Department of Mechanical Engineering						
Regulation 2018		Academic Year 2022 - 2023 (Even Semester)				
Batch 2020 - 2024						
Name of the Faculty						
Target Level	Level 3	>70	Percent of students to get		70	% marks
	Level 2	60-70	Percent of students to get		70	% marks
	Level 1	50-60	Percent of students to get		70	% marks
Weigthage	Test	75.0%	Number of students scored more than		70	17
	Assignment	12.5%	% of students scored more than		70	77.3
	Tutorial	12.5%	Attainment Level			3
Subject Code				Semester:		
Subject Name				No the Students: 22		

SI No	Register No	Name	CO1									Total	% percent
			Test-1						Ass-1		Tut- 1		
			Q1	Q3	Q4	Q6	Q8	Q9	Q1	Q2	Q1	Q2		
			2	2	2	10	10	10	5	5	5	5	29.5	100
1	6177	Student Name1	2	0	0	0	2	0	5	5	5	5	4.3	15
2	6177	Student Name2	2	1.5	2	6	10	6	5	5	5	5	20.4	70
3	6177	Student Name3	2	1.5	2	9	10	10	5	5	5	5	27.1	93
4	6177	Student Name4	2	1.5	0	8	9	6	5	5	5	5	20.8	71
5	6177	Student Name5	2	0	2	6	8	4	5	5	5	5	17.0	59

CO Attainment for CO1

Max. Marks for each Question

Marks earned by student

CO for each Question

CO Attainment Targets

Targets are quantized into certain levels, 3 being the most common number of levels. CO Attainment targets are finalized by the course coordinator before commencing course delivery in a semester.

For Example, we can set a target as below:

Level 3 ← x% Students scoring >= T% of max marks allocated to CO

Level 2 ← y% Students scoring >= T% of max marks allocated to CO

Level 1 ← z% Students scoring >= T% of max marks allocated to CO

Where

T%	The expected Proficiency % based on last three years End semester result to attain a CO.	For ex., it can be set as 70%
x%	The High expected Attainment %.	For ex., it can be set as 70%
y%	The moderate expected attainment %.	For ex., it can be set as 60%
z%	The low expected attainment %.	For ex., it can be set as 50%

Indirect Assessment Tools for CO Attainment

Course Exit Survey (Theory & Practical):

The course exit survey is process of collecting reviews on each course from the students at the end of each semester. It helps to improve the overall aspect of the course in future semesters. The survey covers the overall view about teaching and learning of the respective course. The survey form reveals the following attributes.

Table 8.5 Course Exit Survey Attributes

Course Content	Quality of the content provided, incorporation of Outcome Based Education
Course Delivery	Experience about the teaching methodologies, ICT tools, NPTEL resource utilization
Course Assessment	Methodology of evaluation, feedbacks on assignments and tutorials
General suggestions for improvement	

Table 8.6 Level of Correlation

Level 3	**Overall Percentage more than 70% in course exit analysis**
Level 2	Overall Percentage 60 - 70 % in course exit analysis
Level 1	Overall Percentage 50 - 60 % in course exit analysis

Format of Course Exit Survey Report

CO.No	**CO Description**	**Course Exit survey questions**	**Number of Students given Level rating**					**Total**	**% attainment**	**Attainment Level**
			1	**2**	**3**	**4**	**5**			
1										
2										

Sample Overall CO - Attainment

Course Outcomes	CIA	ESE	Direct Assessment (a)	Indirect Assessment (Course Exit Survey) (b)	Overall CO Attainment = 0.75 (a) + 0.25 (b)
CO1	2	3	2.6	3	2.7
CO2	1	3	2.2	3	2.4
CO3	2	3	2.6	3	2.7
CO4	3	3	3	3	3
CO5	2	3	2.6	3	2.7

COs Analytic Report

Academic Year	COs	Threshold	Target (%)		Attainment (%)	CAY - Explanation for fixing new threshold and target	Proposed action plan
2022-2023	CO1		Level 3			Based on three years internal assessment and end semester examination performance, 70% marks are set as threshold marks	1.
	CO2						2.
	CO3		Level 2				3.
	CO4		Level 1				
	CO5						

Chapter – 9
POs & PSOs Attainment Analysis

Attainment of Program Outcomes and Program Specific Outcomes

Mechanism for the attainment of PO:

Using CO-PO mapping, the mapped POs are considered for assessment by:

$$\text{PO Attainment} = \frac{\text{(Overall CO Attained * Weighted Average of PO)}}{\text{Maximum CO Attainment Level}}$$

Table 9.1: Course Outcome Mapping with Program Outcomes

COs/POs	CO Attainment	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1																
CO2																
CO3																
CO4																
CO5																
Average	Overall CO Attainment															

3 – High; 2 – Medium; 1- Low

Table 9.2: PO Attainment for Particular Courses

Attainment	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Weighted Average															
PO Direct Attainment Level															
Percentage															

Indirect Assessment Tools for PO & PSO Attainment

PO attainment levels and PSO attainment levels are based on attainment levels of direct and indirect assessment tools. For the overall attainment of each PO and PSO, 80% weightage is given to direct assessment and 20% weightage is given to indirect assessment.

	Assessment Tools	Assessment Criteria	Data Collection Frequency
PO & PSO Attainment (20%)	Program Exit Survey (10%)	Analysis of Responses	Once every year
	Alumni Survey (5%)	Level of Achievement	Once every year
	Employer Survey (5%)	Performance of Alumni	Once every year

Level 3	**Overall Percentage more than 70% in Survey**
Level 2	Overall Percentage 60 - 70 % in Survey
Level 1	Overall Percentage 50 - 60 % in Survey

Format of PO Exit Survey Report

S.No	PO Exit Survey Questionnaires	Number of Students given Level rating					Total	% attainment	Attainment Level
		1	2	3	4	5			
1.		e	d	c	b	a			
2.									
3.									
4.									
5.									

Format of PSO Exit Survey Report

PSO .No	PSO Exit Survey Questionnaires	Number of Students given Level rating					Total	% attainment	Attainment Level
		1	2	3	4	5			
1.		e	d	c	b	a			
2.									
3.									

Format of Alumni Survey Report

S.No	PO Exit Survey Questionnaires	Number of Students given Level rating					Total	% attainment	Attainment Level
		1	2	3	4	5			
1.		e	d	c	b	a			
2.									
3.									
4.									
5.									

Format of Parent Survey Report

S.No	PO Exit Survey Questionnaires	Number of Students given Level rating					Total	% attainment	Attainment Level
		1	2	3	4	5			
1.		e	d	c	b	a			
2.									
3.									
4.									
5.									

Format of Employer Survey Report

S.No	PO Exit Survey Questionnaires	Number of Students given Level rating					Total	% attainment	Attainment Level
		1	2	3	4	5			
1.		e	d	c	b	a			
2.									
3.									
4.									
5.									

$$\% \text{ Attainment of PO \& PSO} = \frac{(5 * a) + (4 * b) + (3 * c) + (2 * d) + (1 * e)}{\text{Total no of Students responded X 5}} \text{ X 100}$$

Where a = The Number of students who have provided a rating is 5.

b= The Number of students who have provided a rating is 4.

c= The Number of students who have provided a rating is 3.

d= The Number of students who have provided a rating is 2.

e= The Number of students who have provided a rating is 1

Indirect Assessment Method

Attainment	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Students PO & PSO Exit Survey															
Attainment Level															
10%															
Employer Survey															
Attainment Level															
10%															
Alumni Survey															
Attainment Level															
5%															
20% Indirect Attainment															

Indirect Attainment (20%) = Students PO & PSO Exit Survey (10%) +
Employer Survey (5%) +
Alumni Survey (5%)

POs/ PSOs Attainment rating

Stake holders	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Students PO & PSO Exit Survey															
Direct Attainment (80%)															
Indirect Attainment (20%)															
Total (Direct A+ Indirect B)															
Target Level															
Attainment Status	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No	Yes / No

The target level of achievement for Program Outcomes (POs) and Program Specific Outcomes (PSOs) is set as 70% of a weighted average.

If both POs and PSOs exceed this target level, it can be concluded that they have been attained. In the subsequent year, the target level shall be increased.

If the target levels for Program Outcomes (POs) and Program Specific Outcomes (PSOs) are not achieved, Program Advisory Committees and Department Level Committees headed by HOD will implement necessary actions.

Appendix

Survey Formats