OBE MANUAL V3

ABSTRACT

This manual depicts the OBE philosophy and process in the institution.

Muthoot
Institute of Technology & Science

VISION

To be a centre of excellence for learning and research in engineering and technology, producing intellectually well-equipped and socially committed citizens possessing an ethical value system.

MISSION

- Offer well-balanced programme of instruction, practical exercise and opportunities in technology.
- Foster innovation and ideation of technological solutions on sustainable basis.
- Nurture a value system in students and engender in them a spirit of inquiry.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **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.
5. **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.
6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **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

INDEX

ABOUT MUTHOOT INSTITUTE OF TECHNOLOGY AND SCIENCE

Muthoot Institute of Technology and Science (MITS: http://mgmits.ac.in/), is promoted by Muthoot M. George Institute of Technology, is a Section 25 Company within the Muthoot Group. It is a self-financing Engineering College, situated in the Industrial suburb of Kochi, close to the Smart City and Info Park. Started in 2013 with a clear vision to become a centre of excellence in learning, we have made some remarkable achievements and stand first among the self-financing Engineering colleges in Kerala in terms of academic results in Kerala Technological University (KTU). We train our students to be professionally capable, taking up new challenges and exploring latest technologies.

Institute Objectives

- **Academic Excellence**: To provide high-quality education that ensures students achieve academic excellence in engineering and related fields.
- **Research and Innovation:** To foster a culture of research, innovation, and creativity among students and faculty, encouraging cutting-edge research and development activities.
- **Industry Collaboration**: To establish and maintain strong collaborations with industries to ensure curriculum relevance, provide internship opportunities, and enhance employability through practical exposure.
- **Ethical and Social Responsibility**: To instil ethical values and a sense of social responsibility among students, preparing them to contribute positively to society and the environment.
- **Skill Development**: To equip students with the necessary technical, analytical, and soft skills required for their professional growth and adaptability in a dynamic global environment.
- **Lifelong Learning**: To encourage and support continuous learning and professional development among students and alumni, promoting a culture of lifelong learning.
- **Inclusive Education**: To provide an inclusive educational environment that supports diversity and offers equal opportunities for all students, regardless of their background.
- **Community Engagement**: To actively engage with the local community through outreach programs, partnerships, and service projects that address local and regional challenges.
- **Enhance Infrastructure and Facilities**: Continuously upgrade campus facilities, laboratories, and resources to provide a conducive learning environment and support cutting-edge research.

CHAPTER 1
INTRODUCTION

Purpose of the Manual: To outline the policies, procedures, and best practices for conducting assessments in Muthoot Institute of Technology and Science.

Scope: Applies to all undergraduate and postgraduate programs in the college.

Objectives of Assessment:

- Evaluate student learning and performance.
- Provide feedback to students and faculty.
- Ensure alignment with program learning outcomes.
- Support continuous improvement in teaching and learning.

Muthoot Institute of Technology and Science (MITS) has formal arrangements to ensure that learners are assessed and their learning achievements are recognized against agreed and published criteria, and that the regulations are applied fairly and consistently across the departments. These arrangements are laid out in the “Assessment Manual” for the Undergraduate Programme.

The Assessment Manual includes guiding principles, policies, procedures, processes, regulations and criteria for the design, conduct, marking and verification of formative and summative assessments.

CHAPTER 2
ASSESSMENT DESIGN

2.1 POLICY

The MITS's assessment design policy and procedure provides a framework to ensure uniformity of the principles and methods by which assessments are prepared so that students are tested according to a recognized standard across all departments. The aim is to develop and implement valid and reliable assessments that enable each student to showcase their level of achievement in terms of acquired knowledge, understanding, and skills, using diverse methods within each course. Overall, there must be a clear step-by-step development within courses (as detailed in the course plan), and year-on-year progression (as detailed in the programme specification), of academic achievement and demonstration of knowledge, skills, and graduate attributes.

The following guiding principles are applicable to all courses:

1. Assessments should be designed to ensure that students have the opportunity to develop and be evaluated on all the course outcomes (COs) specified in the course plan. Each course plan must outline the COs, and students are required to demonstrate a designated level of achievement in these outcomes to determine their attainment.
2. With respect to any course, a valid assessment method measures most appropriately, achievement of the CO. For example, in order to demonstrate acquisition of a technical skill, the assessment method of choice would be demonstration of that skill; however it may not always be so simple. A reliable assessment method would be expected to give the same results if repeated under the same conditions: for example, if two Assessors awarded the same grade for any one assignment of a student.
3. Course assessments must include formative methods for assessing all COs so that students receive guidance on how to approach an assessment task and also feedback on their learnings to aid additional knowledge acquisition within a course (e.g. quizzes, tests and assignments). Along with this summative assessments are also conducted at the end of a course or learning period to measure students' overall achievement and learning outcomes. Its primary purpose is to determine whether students have met the educational objectives. Summative assessments typically include final exams, projects etc. These assessments are crucial for assigning final grades, certifying competency, and providing feedback for curriculum improvement.

2.2 TRANSPARENCY OF ASSESSMENT

Muthoot Institute of Technology and Science is committed to ensure that the guidelines, schedule and methods of all assessments used during any course, to assess and evaluate the students' achievement of the course outcomes, are clearly defined and transparent in all aspects.

Under this policy, at the beginning of the semester students should be given a clear schedule of the course assessments together with information on the topics and COs covered by each assessment and the assessment and evaluation criteria and guidelines used in the course. During the semester, students should be given sufficient notice of these assessment criteria before submitting their work.

In order to ensure transparency of assessment, the criteria against which pieces of work are assessed (e.g. tests, quizzes, assignments, etc.) are clearly documented (in the form of marking criteria or marking rubrics; and scheme of evaluation and model answers) and these are made available to students.

2.3 PROCEDURE

1. The course instructor must ensure that the course syllabus/specification is distributed to all students during the first class of each course and that this document is also made available on the E-Learning platform.

2. The course instructor/co-ordinator must ensure that the course plan (which details the aim of the course, objectives, COs, teaching and assessment methods and schedule), is verified before the beginning of the course.

3. The course instructor must ensure that all assessment methods include clearly defined marking criteria, with each question explicitly linked to the corresponding course outcomes (COs). Additionally, marks allocated to each question should be clearly specified. Complex questions containing multiple components should be subdivided and marks need be allotted to each component of the question. In addition: (i) solutions should be prepared for multiple choice questions or true/false type questions; (ii) model answers should be prepared for short answer type questions, essay questions, case studies and non-research-based projects; (iii) institute-wide marking rubrics should be employed to evaluate oral presentations/participation and projects.

4. During the first class or whenever any assessment is provided to students, the course

instructor must explain (and where appropriate provide information sheets) on the

following:

- Question format comprising the assessment including assessment criteria.
- Details of how the assessment method relates to the learning outcomes developed through the course
- The weightage of the assessment tasks and sub-tasks.
- Marking rubrics for the evaluation of oral participation and research projects
- The submission dates and methods of submission and collection
- Whether the assessment is individual or team-based
- In the case of team assessments, the responsibilities of each individual team member in completing each task and the degree of collaboration required
- Expectations regarding word count or other length requirements.

CHAPTER 3
OUTCOMES AND OBJECTIVES

The assessment is carried out by measuring the attainment of different outcomes of the programme. The outcomes considered are

3.1 COURSE OUTCOME

A course outcome outlines the key skills, knowledge, and competencies students are expected to achieve upon completing a course. These outcomes are typically designed to align with broader program goals and often include measurable objectives. The CO statements are defined by considering the course content covered in each module of a course. It is the concerned faculty's discretion to fix the number of CO's. The keywords used to define COs are based on Bloom's Taxonomy.

3.2 PROGRAMME OUTCOMES

Program outcomes are broad statements that describe what students are expected to achieve by the time they graduate from a particular academic program. These outcomes are aligned with the goals of the institution and often reflect industry standards and accreditation requirements. The POs statements are provided by the Accreditation Agencies of the country (National Board of Accreditation (NBA) in India) and these are in line with the Graduate Attributes defined by the Accreditation Board for Engineering and Technology, Inc. (ABET). Graduates Attributes (GAs) are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. GAs form a set of individually assessable outcomes of the programme. The NBA laid down the graduate attributes relating to programme outcomes and is to be derived by the program.

3.3 PROGRAM SPECIFIC OUTCOMES

Program Specific Outcomes (PSOs) refer to the abilities, skills, and knowledge that students are expected to acquire upon graduating from a particular academic program. These outcomes are tailored to the specific discipline or field of study and align with the broader Program Educational Objectives (PEOs) and Program Outcomes (POs).

3.4 PROGRAMME EDUCATIONAL OBJECTIVES

Programme educational objectives (PEOs) are broad statements that describe the career and professional accomplishments after significant years of graduation that the programme is preparing graduates to achieve. These are also unique and fixed for a particular programme in an Institute.

3.5 RELATING THE OUTCOMES

Figure 3-1 shows the building block of CO - PO/PSO - PEO relationship. After CO statements are developed by the faculty handling the course, CO's will be mapped with the possible PO's based on the relationship existing between them. But it is not necessary to map all the COs with all the POs and if there is no mapping it may be left blank. Anyhow, it is mandatory that all COs should be mapped with at least one of the POs/PSOs which are specified in the program. The mapping of COs with POs / PSOs are generally expressed in a tabular form.

Figure 3-1 Relating the outcomes

CHAPTER 4
ATTAINMENT CALCULATION

4.1 COURSE OUTCOMES

1. The course outcomes must state the major knowledge skills, attitude and ability that students will acquire from the course.
2. Course outcome should be expressed in terms of measurable and/or observable behaviours.
3. Course outcomes should be prepared by a faculty and approved by PAC in a program and should drive program outcomes.
4. Course outcomes should begin with an action verb (incorporating Blooms Taxonomy levels).
5. A detailed Course plan including the Course outcomes should be prepared well before the beginning of the semester.
6. Any revision in Course outcomes in future shall be documented with justification and approval from PAC.
7. Nomenclature of Course Outcome is done using the course code as provided by the University.

4.2 CO-PO/PSO CORRELATION MATRICES

1. Each course outcome should be mapped to program outcomes and program specific outcomes in the required format mentioning the various correlation levels.
   - Level 1- Low
   - Level 2- Medium
   - Level 3- High
   - If there is no correlation put '-' or keep blank.
2. Justification of the mapping is to be provided by course instructor and it should be approved by PAC.
3. Average of CO-PO/PSO mapping has to be taken for obtaining Course-PO correlation values.

Table 4.1 CO-PO correlation matrix of the course MET402

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MET402.1	3	3	3	1				1		1		1
MET402.2	3	2	3									1
MET402.3	3	3	3	1	1			1	2		1	2
MET402.4	3	3	3	1	1			1	2		1	2
MET402.5	3	3	3	1	1							1
MET402	**3**	**3**	**3**	**1**	**1**			**1**	**1**	**1**	**1**	**1**

Note: Similar table need to be prepared for PSO also

In the above table, last row represents Course-PO correlation values.

Course-PO correlation = (Sum of individual CO correlation with that PO)/ (Total number of COs of the course)

If the average value so obtained has decimal value in the range,

- 0.1 to 1.4 it will be rounded to 1
- 1.5 to 2.4 will be rounded to 2
- 2.5 to 3.0 will be rounded to 3

4.3 PROGRAM LEVEL COURSE-PO/PSO CORRELATION MATRIX

Programme level Course-PO/PSO correlation matrix is prepared by using the Course-PO correlation values of all courses in the curriculum as shown below

Table 4.2 Course-PO correlation values of all courses

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAT101												
PH100												
.....												
.....												
.....												
MET492												

Similar table may be prepared for Course-PSO correlation also.

4.4 COURSE OUTCOME ATTAINMENT

1. The course instructor should describe the assessment processes used to gather the data upon which the evaluation of Course Outcome is based
2. Examples of data collection processes may include, but are not limited to
   - Specific exams
   - Multiple Learning activities
   - Continuous Evaluation in laboratory classes
   - Project evaluation,
   - Seminar Evaluation
3. Program shall have set target levels (bench marks) for all courses.
4. The course instructor should record the attainment of course outcomes of his /her course with respect to set target score (bench marks)

5. The target score(minimum bound) shall be set considering previous instance of the course, performance history of students and difficulty of the course, with the approval from PAC.
6. Target scores are set for each CO as per the following procedure:

- If the average CO attainment over the past three years, ie, ((CAYm1+CAYm2+CAYm3)/3) ≥2, the target score shall be increased by 5 (ie., 55% if the already set value is 50%), keeping the target levels (bench marks) same as that in the previous year.
- Once the target score is increased by 5, that value is maintained for 3 academic years. If any of the CO fails to attain the required level (≥2), the target score is sustained and this procedure is repeated in the subsequent year.
- For practical courses set the minimum target score/cut off as 60% and an increment of "5" (ie., 65% if the already set value is 60%), can be given if the required target level is met (If avg. CO attainment ≥ 2.4).

Level is the set percentage of students scoring the **set target score** in percentage.

If 50% is the set target score (Minimum bound) of that course.

- Level 3 is 80% of students scoring 50% of marks.
- Level 2 is 70% of students scoring 50% of marks
- Level 1 is 60% of students scoring 50% of marks

4.5 CO ATTAINMENT CALCULATION

The assessment tools for the attainment of CO is given in Table 4.3, 4.4 and 4.5

Table 4.3 Assessment Tools for Theory Courses

<table>
<tr><td rowspan="3">Direct assessment (Weightage:90%)</td><td rowspan="2">Internal Assessment (wt:70%)</td><td rowspan="2">Assessment tools</td><td>Internal Examinations (Minm. Weightage: 60%)</td></tr>
<tr><td>Learning Activities (Assignments, tutorials, seminars, etc.,)</td></tr>
<tr><td>External Assessment (wt:30%)</td><td colspan="2">University exam</td></tr>
<tr><td>Indirect assessment (wt:10%)</td><td colspan="3">Course Exit survey</td></tr>
</table>

Table 4.4 Assessment Tools for Laboratory Courses

	Assessment tool	**Weightage**
Internal Assessment	Continuous Evaluation	100%

Table 4.5 Assessment Tools for Seminar/Project Courses

	Assessment tool	**Weightage**
Internal Assessment	Continuous Evaluation	100%

4.5.1 Direct attainment (Internal assessments)

The direct evaluation of Course Outcomes (COs) is carried out through multiple internal assessments. While conducting an assessment activity, each question / component in the activity is mapped to the corresponding COs. For example a sample question paper of an Internal Examination showing the question – CO Mapping is shown in Figure 4.1. While setting the question paper care should be given to ensure that the choice questions should come under the same CO.

Table 4.6 illustrates the CO attainment process of an Internal Examination. By setting the target score/cut off marks, the number of students who scored more than the target score/ cut off mark for each question is obtained and the percentage of students above cut off is calculated. The attainment of that question is calculated based on the set levels.

Then the CO attainment is calculated by taking the weighted average of all the questions mapped to that CO. The weightage to the questions are fixed based on taxonomy level/marks allotted to the specific question. Table 4.7 shows the weightage assigned to different questions coming under the same CO.

Muthoot Institute of Technology & Science

Name : .....

Roll No. : .....

DEPARTMENT OF MECHANICAL ENGINEERING
Internal Exam 2
VIth Semester
MET304 - DYNAMICS AND DESIGN OF MACHINERY
ME 2021

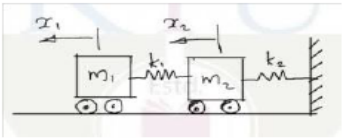
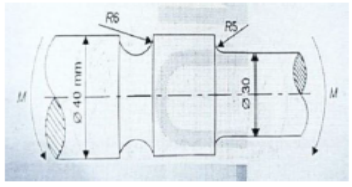
Total Mark: 50 **Total Time: 1 Hrs : 30 Mins**

Course Outcome (CO)	
After completion of this course, the students will be able to	
CO3	Determine the natural frequencies of a two degree of freedom vibrating system and to obtain the stresses in a structural member due to combined loading
CO4	Design machine elements subjected to fatigue loading and riveted joints

PART A
Answer all questions

No.	Questions	Marks	CO
1.	Successful engineering solutions rely on a structured design approach. How would you outline the key steps involved in the design process?	3	CO3
2.	In engineering design, stress concentration can lead to component failure under loading conditions. What strategies can be employed to minimize stress concentration in mechanical components?	3	CO3
3.	Explain the mode shapes of a vibrating system.	3	CO3
4.	Why is the endurance limit an important parameter in fatigue analysis, and what key factors influence its value in engineering materials?	3	CO4
5.	In engineering structures, riveted joints are widely used for their strength and reliability. What are the possible failure modes of a riveted joint?	3	CO4
6.	Draw a triple riveted lap joint with zig-zag arrangement and mark the following parameters (i) pitch, (ii) margin, (iii) transverse pitch and (iv) diametrical pitch.	3	CO4

PART B
Answer any two questions by choosing convenient optional sets

No.	Questions	Marks	CO
7.	Find the natural frequencies and mode shapes of a two-degree freedom system shown in figure. The masses are $m_1 = m_2 = 10$ kg and the stiffness values are $k_1=k_2=2$ kN/mm.  Figure 1	16	CO3
	OR		
8.	Determine the maximum stress on the shaft shown in figure, which is subjected to a bending moment of 550Nm  Figure 2	16	CO3
9.	A ground shaft of diameter D is having a notched portion of r=0.1D. It is made of steel having torsional yield strength of 300MPa and torsional endurance stress of 210 MPa. The size and surface factors are 0.85 and 0.87 resp. The notch sensitivity factor is 0.95. The shaft is to sustain a twisting moment that fluctuates between 900Nm to -300Nm. Find the diameter of the shaft taking FoS= 3.	16	CO4
	OR		
10.	Design a double riveted butt joint with equal widths of cover plates to join two plates of thickness 10 mm. The allowable stress for the material of the rivets and for the plates are as follows: For plate material in tension, σt = 80 MPa, for rivet material in compression, σc = 120 MPa, for rivet material in shear, τ = 60 MPa.	16	CO4

Challenging Questions
(Optional those who attempt shall be given due credit.)

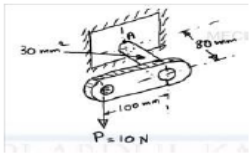
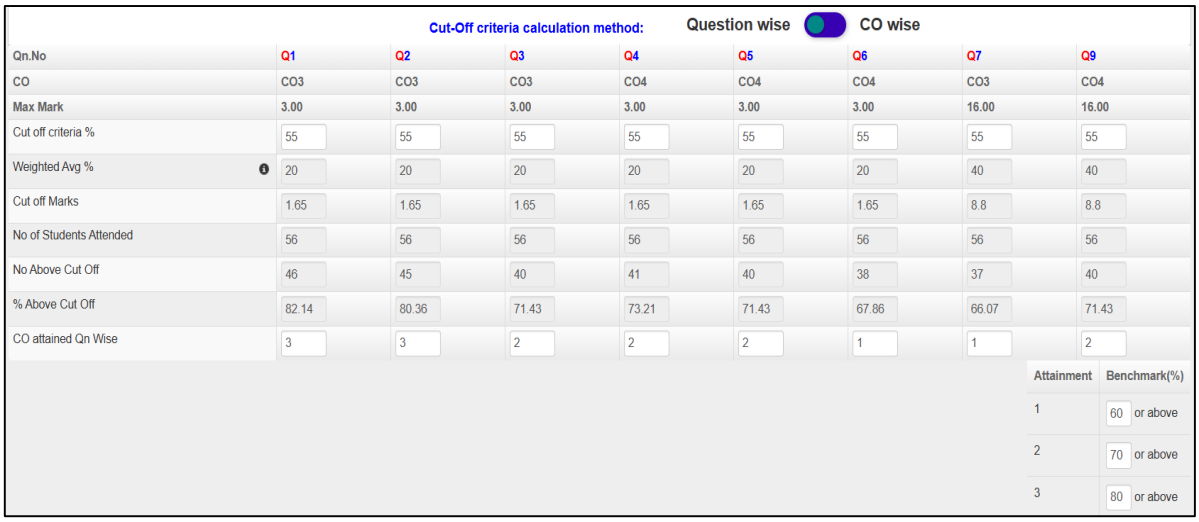
No.	Questions	Marks	CO
11.	Calculate the stress at point A on the fixed end of a rod of length 80 mm and cross-sectional area 30 mm2 shown in figure. 	5	CO3

Figure 4.1 Sample Question Paper

Table 4.6 CO attainment process of an Internal Examination

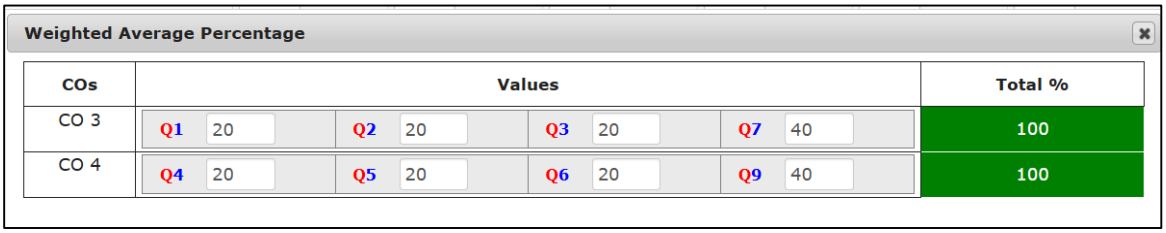


Cut-Off criteria calculation method: Question wise CO wise

Qn.No	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q9
CO	CO3	CO3	CO3	CO4	CO4	CO4	CO3	CO4
Max Mark	3.00	3.00	3.00	3.00	3.00	3.00	16.00	16.00
Cut off criteria %	55	55	55	55	55	55	55	55
Weighted Avg %	20	20	20	20	20	20	40	40
Cut off Marks	1.65	1.65	1.65	1.65	1.65	1.65	8.8	8.8
No of Students Attended	56	56	56	56	56	56	56	56
No Above Cut Off	46	45	40	41	40	38	37	40
% Above Cut Off	82.14	80.36	71.43	73.21	71.43	67.86	66.07	71.43
CO attained Qn Wise	3	3	2	2	2	1	1	2

Attainment	Benchmark(%)
1	60 or above
2	70 or above
3	80 or above

Table 4.7 Setting Weightages to Individual Questions



Weighted Average Percentage

COs	Values	Total %
CO 3	Q1 20 Q2 20 Q3 20 Q7 40	100
CO 4	Q4 20 Q5 20 Q6 20 Q9 40	100

Sample Calculation:

From the question paper it is evident that Q1, Q2, Q3, Q7& Q8 are mapped to CO3.

Now, consider Question 1.

- Maximum mark for the question is 3 and the target score/cut off (%) is set as 55. Thus cut off mark = 0.55*3= 1.65.
- Out of 56 students attended the questionQ1, 46 scored above the target score/cut off mark.
- Considering 55% as the target score and the set levels as 60%, 70% and 80% respectively for Level 1, Level 2 and Level 3,

Percentage of students who scored above the cut off mark is 82.14% (46/56)> 80%. Thus the attainment for Q1 is 3.

- Similarly attainment for other questions mapped to CO3 are calculated.
- Now for calculating the final attainment of CO3 for this particular examination, questions which are mapped to CO3 are sorted out.

- From the question paper it is evident that Q1, Q2, Q3, Q7 and Q8 are mapped to CO3. Q7 and Q8 are choice questions and the best was considered for attainment calculation

$$Attainment\ of\ each\ CO_i = \frac{\sum_j (CO_{ij} \times W_j)}{\sum W_j}$$

Where, COij - attainment of COi corresponding to each question

Wj - Weightage of individual questions to the particular COi.

Thus the final attainment of CO3 from Internal Examination 2 is calculated as $= \frac{(0.2*3+0.2*3+0.2*2+0.4*1)}{(0.2+0.2+0.2+0.4)} = 2$

Likewise, the CO attainment table for all assessment activities are generated and then consolidated. In the consolidated CO attainment – table, (Table 4.8) the total CO attainment is also calculated using the weightage assigned to each assessment activity.

If the value is 'blank', it is not evaluated while considering the weightage.

If the value is '0', it is to be evaluated while considering the weightage.

Sample table is provided below.

Table 4.8 Setting Weightage to CO in Evaluations

	CO1	CO2	CO3	CO4	CO5
CO attainment- Internal Exam 1, March 2024	0.45	0.2			
Weightage - Internal Exam 1, March 2024	60	100			
CO attainment- Assignment Test 1	0				
Weightage - Assignment Test 1	40				
CO attainment- Internal Exam 2			2	1.8	
Weightage - Internal Exam 2			60	60	
CO attainment- Assignment Assignment 2			3	3	
Weightage - Assignment Assignment 2			40	20	
CO attainment- Assignment Assignment 3				2	0
Weightage - Assignment Assignment 3				20	100

The overall attainment of a particular CO based on internal assessment is calculated as

$$Overall\ Attainment\ of\ each\ COi = \frac{\sum (CO_{ij} \times W_j)}{\sum W_j}$$

For example attainment of CO4 from the above table is calculated as,

$$Attainment\ of\ CO4 = \frac{(1.8 * 0.6 + 3 * 0.2 + 2 * 0.2)}{(0.6 + 0.2 + 0.2)} = 2.08$$

4.5.2 Direct attainment (External Assessment)

All COs are given equal weightage for University results since, marks obtained by a student for each questions are not available.

Percentage of marks corresponding to each grade are defined by University as shown in Table 4.9:

Table 4.9 Percentage of marks corresponding to each grade (defined by University)

Grades	Grade Point (GP)	% of Total Marks obtained in the course
S	10	90% and above
A+	9.0	85% and above but less than 90%
A	8.5	80% and above but less than 85%
B+	8.0	75% and above but less than 80%
B	7.5	70% and above but less than 75%
C+	7.0	65% and above but less than 70%
C	6.5	60% and above but less than 65%
D	6.0	55% and above but less than 60%
P (Pass)	5.5	50% and above but less than 55%
F (Fail)	0	Below 50% (CIE+ESE) or below 40% for ESE
FE	0	Failed due to lack of eligibility criteria
I	0	Could not appear for the end semester examination but fulfills the eligibility criteria

For CO attainment calculation through external assessment, same procedure as internal assessment may be followed.

4.5.3 Total CO attainment (Direct component)

Total CO attainment (direct)

$$= (0.7) \times (\text{Internal CO attainment}) + (0.3) \times (\text{External CO attainment})$$

From Table 4.10 direct attainment of CO4 is calculated as (2.08*0.7+3.0*0.3)= 2.36

Table 4.10 Calculation of CO attainment (Direct component)

CO	Direct Attainment		
	Internal (70%)	External (30%)	Total
CO1	0.27	3.00	1.09
CO2	0.2	3.00	1.04
CO3	2.4	3.00	2.58
CO4	2.08	3.00	2.36
CO5	0	3.00	0.90

4.5.4 Indirect Attainment

For final CO attainment of each course 90% weightage is given for direct assessment and 10% weightage is given for indirect assessment. The indirect assessment is done by conducting a course exit survey among the students at the end of each course. A sample questionnaire is shown in Table 4.11.

Table 4.11 Course Exit Survey- Sample Questions

Name	CE-MET304-ME 2021	Description	Not set
Type	Course Exit Survey	Survey Id	CE183-May-2024
Department	MECHANICAL ENGINEERING	Start Date	10/05/2024
Status	Active	End Date	15/05/2024

Question	CO	Option	Mark	Users Opted	Opted %	Average
1. Did you get enough knowledge to do engine force analysis and to draw turning moment diagrams?	CO1	Yes	3.00	51	94.44 %	2.93
		No	2.00	2	3.7 %	
		Don't know	1.00	1	1.85 %	
2. Do you have a basic idea on how to analyze free and forced vibrations of single degree of freedom systems?	CO2	Yes	3.00	52	96.3 %	2.94
		No	2.00	1	1.85 %	
		Don't know	1.00	1	1.85 %	
3. Do you know how to determine the natural frequencies of a two degree of freedom vibrating system and to obtain the stresses in a structural member due to combined loading?	CO3	Yes	3.00	49	90.74 %	2.85
		No	2.00	2	3.7 %	
		Don't know	1.00	3	5.56 %	
4. Do you have a fundamental knowledge on the design machine elements subjected to fatigue loading and the design process involved in the case of riveted joints	CO4	Yes	3.00	51	94.44 %	2.93
		No	2.00	2	3.7 %	
		Don't know	1.00	1	1.85 %	
5. Do you know how to design welded joints and close coiled helical compression springs?	CO5	Yes	3.00	47	87.04 %	2.81
		No	2.00	4	7.41 %	
		Don't know	1.00	3	5.56 %	

Cut off percentage for each CO is set as 60% of maximum CO attainment (0.6*3=1.8) and levels are set as 60%, 70% and 80% for level 1, level 2 and level 3 respectively.

ie, Indirect CO attainment is 3, if 80% of students opting more than the cut off level,

CO attainment is 2, if 70% of students opting more than the cut off level,

and CO attainment is 1, if 60% of the students opting more than the cut off level

Thus, as per table 4.11, Indirect attainment for each CO is 3.

4.5.5 Overall Attainment

Overall attainment for each CO is calculated by giving 90% weightage to Direct assessment and 10% weightage to Indirect assessment. For example in table 4.12, overall attainment of CO4 is calculated as,

Overall attainment of CO4= (2.36*0.9+3*0.1)= 2.4

Table 4.12 CO- Overall Attainment

CO	Direct Attainment(90.00)%			Indirect Attainment(10.00)%	Overall Attainment
	Internal(70.00)%	External(30.00)%	Total		
CO1	0.27	3.00	1.09	3.00	1.28
CO2	0.2	3.00	1.04	3.00	1.24
CO3	2.4	3.00	2.58	3.00	2.62
CO4	2.08	3.00	2.36	3.00	2.42
CO5	0	3.00	0.90	3.00	1.11

4.6 ATTAINMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

PO/PSO attainment calculation is explained below with an example.

PO/PSO Attainment of Individual course

$$Attainment\ of\ PO/PSO = \frac{\sum CO_i M_i}{\sum M_i}$$

Where, COi is the overall attainment of the course and Mi is the correlation value of CO-PO PSO mapping.

PO-PSO attainment matrix for the course MET304 can be written as

Table 4.13 CO-PO&PSO attainment matrix

CO	Learning Domain	Overall Attainment	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	Cognitive	1.28	3	3	2	-	-	-	-	-	-	-	-	1	2	2	-
CO2	Cognitive	1.24	3	3	3	-	-	-	-	-	-	-	-	1	2	2	-
CO3	Cognitive	2.62	3	3	2	-	-	-	-	-	-	-	-	1	2	2	-
CO4	Cognitive	2.42	3	3	2	-	-	-	-	-	-	-	-	1	2	2	-
CO5	Cognitive	1.11	3	3	2	-	-	-	-	-	-	-	-	1	2	2	-
Average CO-PO Attainment			1.73	1.73	1.69	-	-	-	-	-	-	-	-	1.73	1.73	1.73	-

$$\text{Hence, } P01 \text{ attainment} = \frac{3\times1.28+3\times1{,}24+3\times2.62+3\times2.42+3\times1.11}{3+3+3+3+3} = 1.73$$

Similarly, values can be obtained for all others POs and PSOs.

4.6.1. Programme level PO/PSO attainment matrix

The programme should consolidate attainment of POs and PSOs from all courses.

The attainment levels by direct (students' academic performance) and indirect methods are to be presented through Program level Course-PO & PSO attainment matrix as indicated in Table 4.14.

Table 4.14 Course-PO&PSO matrix

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MAT101												
PHT100												
…												
….												
….												
MET492												
Direct Attainment												
Indirect Attainment												

The direct attainment of a PO/PSO is determined by taking average of PO/PSO attainment of selected courses addressed to that PO. Fractional numbers may be used.

4.7 INDIRECT ATTAINMENT

Indirect attainment level of PO/PSO is determined through a number of assessment methods. These activities and their subsequent weightage assigned for PO/PSO evaluation are shown in Table 4.15.

Table 4.15 Activities mapped to indirect attainment of PO&PSO and their weightages

Sl.No	Assessment Method	Criteria	Weightage
1	Activity Points	National Initiatives participations Sports and games participation Cultural activities participation Professional society initiatives Entrepreneurship and innovation Leadership and Management	50%
2	Surveys	Student exit survey	20%
3	Technical Events	Participation in Technical talks, seminars, workshops add-on courses etc.	30%

4.7.1 Course Outcomes for activity points:

COs for activity points are defined commonly for all the branches and are as follows

CO1: Able to implement sustainable solutions to societal challenges through community initiatives.

CO2: Able to exhibit leadership skills in managing teams and collaboration with peers.

CO3: Able to collate opportunities and innovative ideas towards an entrepreneurial thinking.

CO-PO Mapping

The above defined COs are then mapped with POs as shown in Table 4.16

Table 4.16 CO-PO mapping for activity points

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	2	2	3	3	3	3	2	3	2
CO2			1	1	2			3	3	3	2	2
CO3	2	2	2	2	2	3	3	3	3	3	3	2

To evaluate COs, feedback is collected as per the performance indicators given in Table 4.17. Based on their feedback, attainment for each CO is evaluated. Then the PO attainment of the activity points are calculated in the same way as discussed in section 4.6.

Performance indicators:

Rate your proficiency in:

Table 4.17 Questionnaire for collecting feedback from students (For activity points)

Questions\Ratings	Mapped COs	Good	Fair	Needs improvement
Aptitude to participate community service activities, applying engineering knowledge to benefit society	1,2			
Ability to analyse situations, evaluate alternatives, and make informed decisions that align with the goals	1,2,3			
Ability to set goals, motivate team members, make strategic decisions, and lead by example in various engineering contexts	2,3			
Ability to inspire and form teams towards innovation and entrepreneurship	2,3			
Ability to participate in cultural programs and activities that foster unity and understanding among diverse groups	1,2			

4.7.2 COs for Invited Technical talks/ Seminars/ Workshops:

The CO's for Technical events are defined as,

CO1: Able to relate theoretical knowledge with real-world problems.

CO2: Able to realise the importance of continuous learning and professional development in *[Branch]* Engineering

CO3: Able to exhibit the art of technical presentations and notes.

CO4: Able to analyse the outcome through peer review sessions and feedback

Table 4.18 CO-PO Mapping for Technical talks/ Seminars/ Workshops

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	2	2	2	2	2	2	2	3	2	1	2
CO2			1	1	2			2	3	2	1	3
CO3								3	3	3	1	2
CO4								2	3	3	1	2

The CO attainment of Technical events are also calculated with the same procedure as given in section 4.7.1. Table 4.18 shows the CO-PO mapping and Table 4.19 shows the questionnaire given for collecting feedback from students.

However, for department specific add-on courses both COs and mapping can be defined within the department itself.

Performance indicators:

Rate yourself:

Table 4.19 Questionnaire for collecting feedback from students (For technical events)

Questions \ Ratings	COs	High	Medium	Low
Able to relate theoretical concepts learned and real-world problems	1			
Able to identify topics for self-learning and improvement	2			
Able to prepare technical presentations and notes	3			
Able to actively participate in peer reviews and feedbacks	4			

4.7.3 Exit Survey

At the end of the programme, an exit survey is conducted to assess the overall effectiveness of the B.Tech program and gather valuable feedback from graduating students. It serves as a key mechanism for continuous improvement, accreditation compliance, and curriculum enhancement.

The primary objectives of the Program Exit Survey are:

✓ To assess the extent to which Program Outcomes (POs) and Program Specific Outcomes (PSOs) have been achieved.

✓ To evaluate the students' perception of their learning experience and career preparedness.

✓ To identify strengths and areas for improvement in curriculum, teaching methodologies, and industry exposure.

✓ To use the collected data for continuous quality enhancement of the program.

Detailed procedure is given the example given below

EXAMPLE: INDIRECT ATTAINMENT CALCULATION

(i) Sample calculation – PO attainment: Activity points

COs for activity points are defined as

CO1: Able to implement sustainable solutions to societal challenges through community initiatives.

CO2: Able to exhibit leadership skills in managing teams and collaboration with peers.

CO3: Able to collate opportunities and innovative ideas towards an entrepreneurial thinking.

Mapping of questions given in Table 4.17 with each CO is

Qn/CO	CO1	CO2	CO3
1	2.	1	
2	2	1	1
3		2	1
4		2	2
5	1	2	

Consolidation of feedback collected for questions given in table 4.17 is

Q.No/Ranking	Good	Fair	Needs Improvement	3 point scale
	3	2	1	
1	20	19	13	2.1
2	14	28	10	2.1
3	24	17	11	2.3
4	10	23	19	1.8
5	36	7	9	2.5

Consolidated feedback index for Q. NO: 1 is (20*3+19*2+13*1)/(20+19+13)= 2.1

CO attained for activity points is calculated by taking the weighted average.

Q. No	CO1	CO2	CO3	3 point scale
1	2	1		2.1
2	2	1	1	2.1
3		2	1	2.3
4		2	2	1.8
5	1	2		2.5
Attainment	**2.19**	**2.18**	**2.00**	

For CO1 attainment is calculated as (2*2.1+2*2.1+1*2.5)/(2+2+1) = 2.19

PO-PSO attainment is obtained using the same method, i.e. by taking weighted average

CO attained	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2.2	2	2	2	2	2	3	3	3	3	2	3	2
2.2			1	1	2			3	3	3	2	2
2.0	2	2	2	2	2	3	3	3	3	3	3	2
PO/PSO attainme	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1

(ii) PO Attainment :Technical Events

COs defined for technical events are

CO1: Able to relate theoretical knowledge with real-world problems.

CO2: Able to realise the importance of continuous learning and professional development in [Branch] Engineering.

CO3: Able to exhibit the art of technical presentations and notes.

CO4: Able to analyse the outcome through peer review sessions and feedback.

The CO-PO-PSO mapping is given in table 4.18 and the feedback collected for the questions in table 4.19 is

FEEDBACK ANALYSIS				Three Point Scale
Q. No.	High	Medium	Low	
	3	2	1	
1	35	20	5	2.50
2	22	30	8	2.23
3	20	37	3	2.28
4	31	28	1	2.50

Based on the feedback collected the feedback index is calculated for each question using the same method as explained before and the PO attainment for the technical activity is calculated using weighted average method.

Three Point Scale	CO	PO/PSO Attainment											
		PO											
		1	2	3	4	5	6	7	8	9	10	11	12
2.50	1	2	2	2	2	2	2	2	2	3	2	1	2
2.23	2			1	1	2			2	3	2	1	3
2.28	3								3	3	3	1	2
2.50	4								2	3	3	1	2
Attainment		2.5	2.5	2.4	2.4	2.4	2.5	2.5	2.4	2.4	2.4	2.4	2.4

(iii) PO Attainment :Program Exit Survey

Sample questionnaire for getting exit feedback is

Q.No	Question /Rating	Excellent(3)	Good(2)	Satisfactory(1)
1	HOW DO YOU RATE THE CAPABILITIES ACQUIRED IN FOUR YEARS			
	a. Communication & Interpersonal Skills			
	b. Technical Knowledge			
	c. Ethics			
	d. Service to the society			
	e. Industrial Exposure			
2	HOW DO YOU RATE THE FOLLOWING QUALITIES OF THE PROGRAMM			
	a. Industry Exposure			
	b. Experiential Learning & interaction with outside world			
	c. Quality on add on courses.			
3	HOW DOES THIS PROGRAMME ENABLE YOUR OVERALL DEVELOPMENT IN ...			
	a. Engineering skills and problem solving capabilities			
	b. Co-curricular/Extracurricular activities			
	c. Industry readiness			
	d. Use of updated technologies & simulation tools			
	e. Ethics			
	f. Career Guidance & Placement opportunities			
4	HOW DOES THIS PROGRAMME HELP YOU TO ACQUIRE KNOWLEDGE IN FUTURE THROUGH			
	a. Research oriented approach			
	b. Strong foundation in relevant field			
	c. Peer learning			
	d. Flexibility in thought process			
5	HOW DO YOU RATE THE CURRICULUM OF THE UNIVERSITY ON THE FOLLOWING ASPECTS			
	a. Industry readiness			
	b. Self learning			
	c. Provide real-time Engineering solution			

Each question is mapped to the relevant POs and the mapping matrix is

Q.no/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1	1			2	1	2		2		1
2	2	1	1		2					1		2
3	2	2	2		1			2	2	2	1	
4	2	2	1	1					1	1		1
5						2	1					1

Sample response collected for the above questions is shown in the table given below

QUESTION No.		Excellent	Good	Satisfactory	POINTS
		3	2	1	
1	a	11	35	6	2.10
	b	13	30	9	2.08
	c	20	24	8	2.23
	d	15	29	8	2.13
	e	8	24	20	1.77
					2.06
2	a	7	25	20	1.75
	b	9	19	24	1.71
	c	12	31	9	2.06
					1.84
3	a	15	30	7	2.15
	b	12	29	11	2.02
	c	8	25	18	1.80
	d	10	26	16	1.88
	e	15	26	8	2.14
	f	15	30	7	2.15
					2.03
4	a	10	30	12	1.96
	b	13	24	15	1.96
	c	11	30	10	2.02
	d	14	25	12	2.04
					2.00
5	a	7	31	14	1.87
	b	18	28	6	2.23
	c	10	27	15	1.90
					2.00

Average response index for each question is calculated and the PO-PSO a attainment for the Program exit survey is calculated using weighted average methods as shown below

Q.No./ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	
1	2	1	1			2	1	2		2		1	2.06
2	2	1	1		2					1		2	1.84
3	2	2	2		1			2	2	2	1		2.03
4	2	2	1	1					1	1		1	2
5						2	1					1	2
Attainment	2.0	2.0	2.0	2.0	1.9	2.0	2.0	2.0	2.0	2.0	2.0	1.9	

Now, the overall indirect attainment is calculated by giving weightages to each assessment and is calculated out as

Final indirect attainment = 50%(Activity points) + 30% (Technical Events) + 20%(Exit feedback)

Overall PO/PSO attainment for the batch is

Final PO/PSO Attainment = 80%(Direct) + 20% (Indirect)

CHAPTER 5

ENHANCING OBE IMPLEMETATION THROUGH EXPANDED LEARNING DOMAINS (FOR 2024 SCHEME)

With the evolving demands of industry and academia, the recent syllabus revision by KTU included Project-Based Learning (PBL), Skill Enhancement Courses, Health and Wellness, Lab embedded courses etc. in the curriculum. These additions align with Outcome-Based Education (OBE) principles by fostering a more holistic learning experience that integrates knowledge, skills, and personal development. To enhance adherence to OBE, it is crucial to incorporate all three learning domains—Cognitive, Affective, and Psychomotor—into the curriculum design, delivery, and assessment strategies.

The need for expanded learning domains in OBE

Modern engineering and technology education demand competencies that extend beyond theoretical knowledge. Graduates must demonstrate:

- Cognitive skills (understanding and applying knowledge).
- Affective skills (professional ethics, teamwork, leadership, and adaptability).
- Psychomotor skills (hands-on proficiency, laboratory skills, prototyping, and fabrication).

By adopting these domains, institutions can produce graduates who are not only knowledgeable but also industry-ready and socially responsible professionals.

Alignment of expanded learning domains with OBE Philosophy

Learning Domain	Alignment with OBE	Implementation in Curriculum
Cognitive (Knowledge-based)	Understanding, applying, analyzing, evaluating, and creating knowledge.	Classroom lectures, problem-solving, case studies, projects.
Affective (Attitude & Ethics)	Development of professional behavior, teamwork, and communication.	Group discussions, role-playing, ethics training, industry interactions.
Psychomotor (Skill-based)	Application of technical skills in real-world scenarios.	Lab sessions, industrial training, hands-on workshops, prototype development.

Strategies incorporated for integrating new learning domains into OBE

To achieve a more comprehensive learning experience, the following strategies are adopted:

- Redesigning Course Outcomes (COs) to include affective and psychomotor skills.
- Assessment methods beyond written examinations incorporating peer & self-assessments, practical demonstrations, faculty observations, surveys and self-reflection reports etc.
- Strengthening student-centered learning & continuous feedback

    - Implement self-assessment and peer reviews to measure affective learning.
    - Surveys & reflections on skill-based and health-related courses to ensure student well-being and motivation.
    - Faculty mentoring for personalized competency development across different domains.

Following are the steps involved for the assessment of **Lab Embedded courses** for first year students (2024 admission batch):

Step 1: Defining Course outcomes in all domains

Define the course outcomes (COs) in such a way that each CO should reflect a specific level of learning from Cognitive, Affective (attitude, ethics & teamwork) and Psychomotor (hands-on skills & execution) domains. Each CO should be assessed using suitable methods. Table 5.1 shows course outcomes defined for the subject 'Chemistry for Information Science and Electrical Science' for S1 students.

Table 5.1 Defining Corse outcomes for the course Chemistry for Information Science and Electrical Science:

CO	Description	Bloom's taxonomy level	Dave's taxonomy level	Krathwohl's taxonomy level	Cut Off %
CO1 . GXCYT122	Apply the basic concept of electrochemistry and corrosion to explore the possible applications in various engineering fields.	Applying(P)	Manipulation	Valuing	50%
CO2 . GXCYT122	Describe the synthesis, structure, properties and applications of nanomaterials, polymers and organic electronic materials in different industries.	Understanding(U)			50%
CO3 . GXCYT122	Apply the knowledge of instrumental methods and spectroscopic techniques for characterizing chemical compounds and nanomaterials.	Applying(P)	Manipulation	Valuing	50%
CO4 . GXCYT122	Choose various water treatment and waste management methods to solve different environmental issues sustainably.	Applying(P)	Manipulation	Valuing	50%

Step 2: CO-PO mapping

After defining the COs, CO-PO mapping is done in all the three learning domains (Table 5.2).

Table 5.2 CO-PO mapping in all the three learning domains

CO	Learning Domain	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Cognitive	3	3		2	2	2		2	3			2
	Psychomotor					2							
	Affective						3		3	3			
CO2	Cognitive	3	2	2		2							2
CO3	Cognitive	3	3	3	3	2			2	3			2
	Psychomotor				2	2			2				
	Affective									3			
CO4	Cognitive	3	3	3		2	3	3	3	3			2
	Psychomotor					2			2				
	Affective							3		3			
PO Average		3	2.75	2.67	2.33	2	2.67	3	2.33	3	0	0	2

Step 3: CO attainment for the theory part

For evaluating Course Outcomes (COs) for the theoretical part, the same procedure as explained in session 4.5.1 is being used. A sample question paper and CO attainment procedure is shown in table 5.3 and table 5.4.

Table 5.3 Sample question paper used for assessing the theory part

Muthoot Institute of Technology & Science

Name : .....

Roll No. : .....

DEPARTMENT OF BASIC SCIENCE AND HUMANITIES
SECOND INTERNAL EXAMINATION DECEMBER 2024
Ist Semester
GXCYT122 - CHEMISTRY FOR INFORMATION SCIENCE AND ELECTRICAL SCIENCE
Batch: ECE,EEE,CS-AI,CS-CY,CS-AI&DS

Total Mark: 40 **Total Time: 2 Hrs**

Course Outcome (CO)	
After completion of this course, the students will be able to	
CO3	Apply the knowledge of instrumental methods and spectroscopic techniques for characterizing chemical compounds and nanomaterials.
CO4	Choose various water treatment and waste management methods to solve different environmental issues sustainably.

PART A Answer All Questions				
No.	**Question**	**Marks**	**CO**	**BL**
1.	The concentration of methylene blue dye in aqueous solution is 10M. The absorbance is found to be 0.209 when this solution is placed in a 1.00 cm cuvette and 258 nm radiation passed through it. Calculate the specific absorptivity of methylene blue solution.	3	CO3	3
2.	Draw the molecular energy level diagram of butadiene and benzene.	3	CO3	2
3.	A sample of water on analysis gives following results: Ca^{2+} =30 mg/L, Mg^{2+}=18 mg/L, HCO_3^-=244 mg/L, Na^+=11.5 mg/L. Calculate the temporary and permanent hardness of water sample.	3	CO4	3
4.	Explain the break point of chlorination with a suitable diagram.	3	CO4	2
PART B Answer all questions by choosing convenient optional sets.				
No.	**Question**	**Marks**	**CO**	**BL**
5. a)	Give the instrumentation of UV-Visible spectrophotometer and explain the components in it. Comment on the role of conjugation in the wavelength of absorption with the help of examples.	9	CO3	2
5. b)	Explain the principle, instrumentation and working of SEM.	5	CO3	1
	OR			
6. a)	Draw and explain the various modes of vibration possible for CO_2 and H_2O. Explain any four applications of IR spectroscopy elaborately.	9	CO3	2
6. b)	Explain the instrumentation and working of dielectric thermal analysis.	5	CO3	1
7. a)	Explain primary, secondary and tertiary process involved in sewage water treatment with the help of flow diagram.	9	CO4	1

Table 5.4 CO attainment calculation for IE2

Cut-Off criteria calculation method: Question wise CO wise

Qn.No	Q1	Q2	Q3	Q4	Q5a	Q5b	Q7a	Q7b
CO	CO3	CO3	CO4	CO4	CO3	CO3	CO4	CO4
Max Mark	3.00	3.00	3.00	3.00	9.00	5.00	9.00	5.00
Cut off criteria %	50	50	50	50	50	50	50	50
Weighted Avg %	15	15	15	15	35	35	35	35
Cut off Marks	1.5	1.5	1.5	1.5	4.5	2.5	4.5	2.5
No of Students Attended	73	73	73	73	73	73	73	73
No Above Cut Off	56	62	18	37	66	66	71	67
% Above Cut Off	76.71	84.93	24.66	50.68	90.41	90.41	97.26	91.78
CO attained Qn Wise	2	3	0	0	3	3	3	3

CO	CO3	CO4
Attainment	2.85	2.1

Step 4: CO attainment for the lab component of the subject

The lab component of the subject is evaluated by following continuous evaluation. The evaluation parameters are fixed by the concerned faculty and the process is done for each experiment. A sample evaluation procedure is shown in table 5.5 and 5.6.

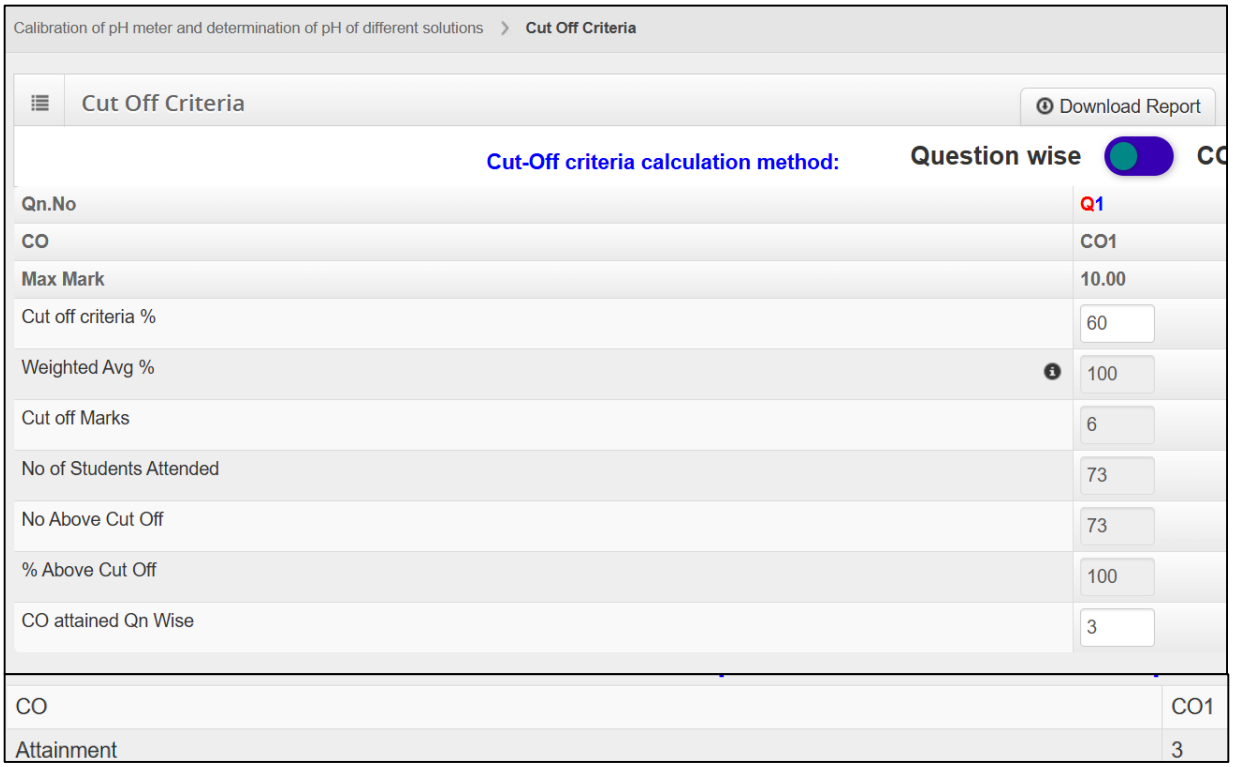
Table 5.5 Evaluation parameters used for continuous assessment

Select Experiment: Calibration of pH meter and determination of pH of different solutions

+ Add Evaluation Params

Roll No	Name	PRE LAB(2.00)	EXPERIMENT CONDUCT(2.00)	RECORD(3.00)	VIVA (3.00)
1	ABHAI GIRISH	2.00	2.00	3.00	2.00
2	ABHIJITH KRISHNAN R	2.00	2.00	3.00	3.00
3	ABHINAV K V	2.00	2.00	3.00	2.00
4	ADITHYA RADHAKRISHNAN	2.00	2.00	3.00	3.00
5	ADITYA V S	2.00	2.00	2.00	2.00
6	AFIA V A	2.00	2.00	3.00	3.00

Table 5.6 CO attainment for a single experiment



Calibration of pH meter and determination of pH of different solutions › **Cut Off Criteria**

Cut Off Criteria — Download Report

Cut-Off criteria calculation method: Question wise CO

Qn.No	Q1
CO	CO1
Max Mark	10.00
Cut off criteria %	60
Weighted Avg %	100
Cut off Marks	6
No of Students Attended	73
No Above Cut Off	73
% Above Cut Off	100
CO attained Qn Wise	3

CO	CO1
Attainment	3

Step 5: Overall CO attainment (Through Internal Assessments)

Overall CO attainment based on internal assessments is calculated by taking all evaluation mapped to that particular CO into account. Weightages are given to each assessment based on their relevance and the final attainment for that particular CO is obtained by taking the weighted average. Refer section 4.5.1 for the detailed procedure. The attainment for each CO thus obtained is shown in table 5.7.

Step 6: CO attainment (Direct component)

For calculating the direct component of CO attainment 70% weightage is given to attainment through internal assessments and 30% weightage is given to the external assessment (End semester examination result). The procedure is explained in section 4.5.2 and 4.5.3.

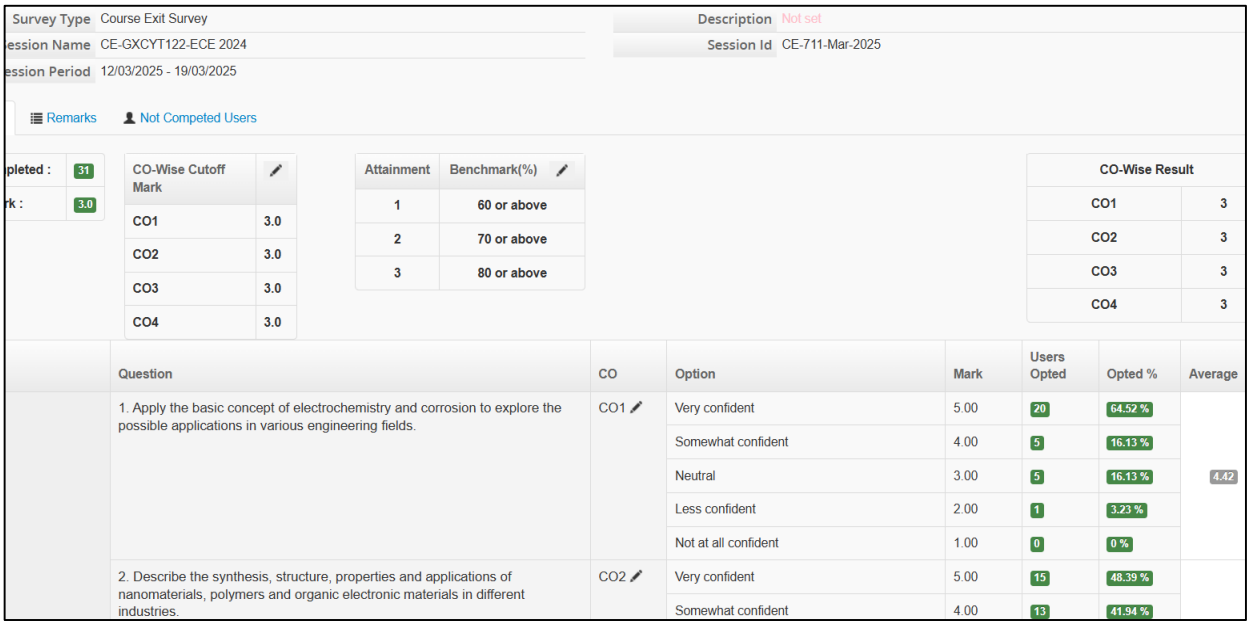
Table 5.7 CO attainment (Through Internal Assessments)

Do you want to Combine all lab evaluation to a single evaluation ? NO

	CO1	CO2	CO3	CO4
CO attainment- Series Exam 1	0.5	0		
Weightage	60	100		
CO attainment- SECOND INTERNAL EXAMINATION DECEMBER 2024			2.85	2.1
Weightage			60	60
CO attainment- Calibration of pH meter and determination of pH of different solutions - GXCYT122(B)	3			
Weightage	10			
CO attainment- Determination of cell constant and measurement of conductivity of solutions - GXCYT122(B)	3			
Weightage	10			
CO attainment- Estimation of Iron in iron ore - GXCYT122(B)	3			
Weightage	10			
CO attainment- Estimation of total hardness of water - GXCYT122(B)				3
Weightage				20
CO attainment- Estimation of Dissolved Oxygen in the given water sample by Winkler's method - GXCYT122(B)				3
Weightage				20
Overall Attainment	1.5	0	2.91	2.46

Step 5: CO attainment (Indirect Component)

During indirect assessment, student surveys are conducted at the end of the course to capture students' perceptions of their learning experiences across cognitive, affective, and psychomotor domains. When combined with direct assessment methods, it provides a holistic evaluation of CO attainment, ensuring continuous improvement in Outcome-Based Education (OBE). Figures 5.1, 5. 2 and 5. 3 shows sample questionnaire set for evaluating the three learning domains. Take care to set the cut-off mark and target levels while analyzing the data.



Survey Type: Course Exit Survey
Description: Not set
ession Name: CE-GXCYT122-ECE 2024
Session Id: CE-711-Mar-2025
ession Period: 12/03/2025 - 19/03/2025

Remarks | Not Competed Users

pleted : 31
rk : 3.0

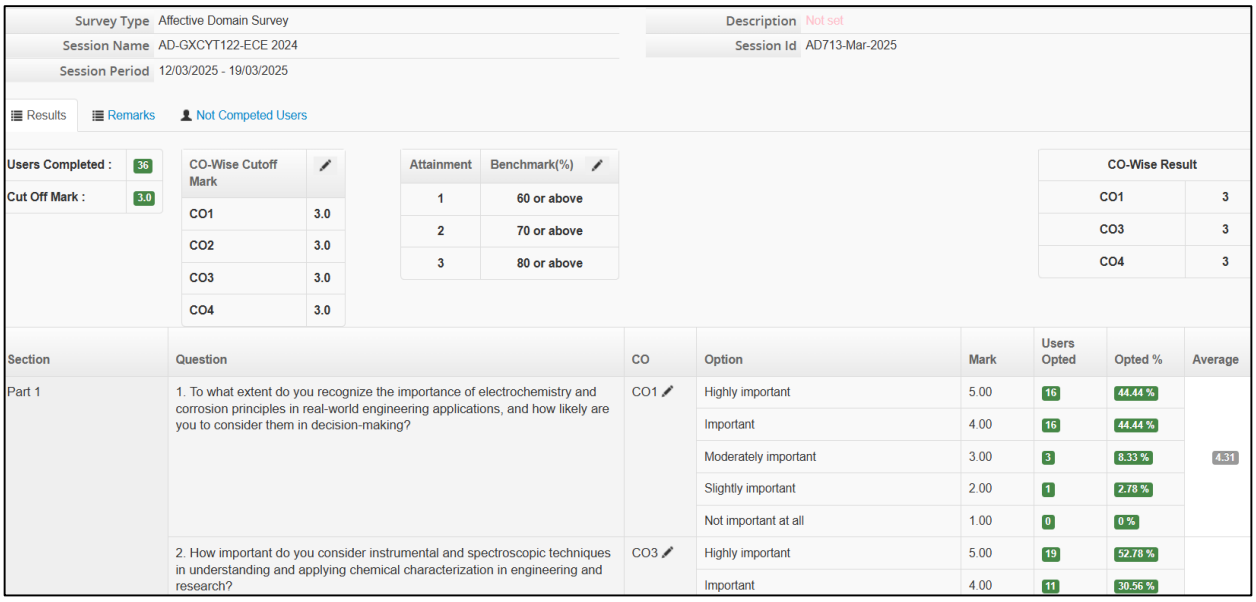
CO-Wise Cutoff Mark	
CO1	3.0
CO2	3.0
CO3	3.0
CO4	3.0

Attainment	Benchmark(%)
1	60 or above
2	70 or above
3	80 or above

CO-Wise Result	
CO1	3
CO2	3
CO3	3
CO4	3

Question	CO	Option	Mark	Users Opted	Opted %	Average
1. Apply the basic concept of electrochemistry and corrosion to explore the possible applications in various engineering fields.	CO1	Very confident	5.00	20	64.52 %	4.42
		Somewhat confident	4.00	5	16.13 %	
		Neutral	3.00	5	16.13 %	
		Less confident	2.00	1	3.23 %	
		Not at all confident	1.00	0	0 %	
2. Describe the synthesis, structure, properties and applications of nanomaterials, polymers and organic electronic materials in different industries.	CO2	Very confident	5.00	15	48.39 %	
		Somewhat confident	4.00	13	41.94 %	

Figure 5.1 Sample questionnaire for course-exit survey



Survey Type: Affective Domain Survey
Description: Not set
Session Name: AD-GXCYT122-ECE 2024
Session Id: AD713-Mar-2025
Session Period: 12/03/2025 - 19/03/2025

Results | Remarks | Not Competed Users

Users Completed : 36
Cut Off Mark : 3.0

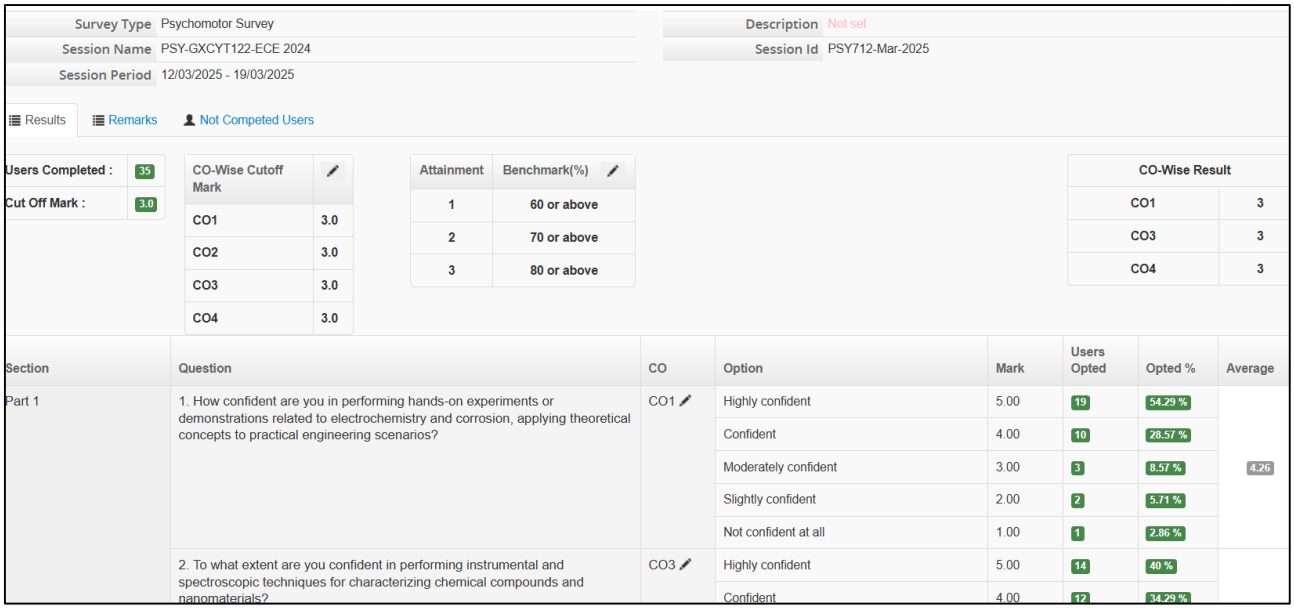
CO-Wise Cutoff Mark	
CO1	3.0
CO2	3.0
CO3	3.0
CO4	3.0

Attainment	Benchmark(%)
1	60 or above
2	70 or above
3	80 or above

CO-Wise Result	
CO1	3
CO3	3
CO4	3

Section	Question	CO	Option	Mark	Users Opted	Opted %	Average
Part 1	1. To what extent do you recognize the importance of electrochemistry and corrosion principles in real-world engineering applications, and how likely are you to consider them in decision-making?	CO1	Highly important	5.00	16	44.44 %	4.31
			Important	4.00	16	44.44 %	
			Moderately important	3.00	3	8.33 %	
			Slightly important	2.00	1	2.78 %	
			Not important at all	1.00	0	0 %	
	2. How important do you consider instrumental and spectroscopic techniques in understanding and applying chemical characterization in engineering and research?	CO3	Highly important	5.00	19	52.78 %	
			Important	4.00	11	30.56 %	

Figure 5.2 Sample questionnaire for affective domain survey



Survey Type	Psychomotor Survey
Session Name	PSY-GXCYT122-ECE 2024
Session Period	12/03/2025 - 19/03/2025
Description	Not set
Session Id	PSY712-Mar-2025

Results | Remarks | Not Competed Users

Users Completed :	35
Cut Off Mark :	3.0

CO-Wise Cutoff Mark	
CO1	3.0
CO2	3.0
CO3	3.0
CO4	3.0

Attainment	Benchmark(%)
1	60 or above
2	70 or above
3	80 or above

CO-Wise Result	
CO1	3
CO3	3
CO4	3

Section	Question	CO	Option	Mark	Users Opted	Opted %	Average
Part 1	1. How confident are you in performing hands-on experiments or demonstrations related to electrochemistry and corrosion, applying theoretical concepts to practical engineering scenarios?	CO1	Highly confident	5.00	19	54.29 %	4.26
			Confident	4.00	10	28.57 %	
			Moderately confident	3.00	3	8.57 %	
			Slightly confident	2.00	2	5.71 %	
			Not confident at all	1.00	1	2.86 %	
	2. To what extent are you confident in performing instrumental and spectroscopic techniques for characterizing chemical compounds and nanomaterials?	CO3	Highly confident	5.00	14	40 %	
			Confident	4.00	12	34.29 %	

Figure 5.1 Sample questionnaire for psychomotor domain survey

Step 6: Overall CO attainment (Direct+ Indirect component)

Overall CO attainment is calculated from the direct component and indirect component by assigning suitable weightages to both. Faculty members can determine the weightage distribution between direct and indirect assessment components, ensuring a rational balance based on the nature of the course (theory, lab, or project-based). The Course Exit Survey weightage is fixed at 10% of the total CO attainment

Table 5.8 CO attainment (Direct+ Indirect component)

CO	Internal 70.0 %	External 30.0 %		Direct Attainment 70.0 %	Indirect Assessment			Overall Attainment
					Course Exit 10.0 %	Psychomotor 10.0 %	Affective Domain 10.0 %	
CO1	1.5	0		1.05	3.00	3.00	3.00	1.64
CO2	0	0		0.00	3.00			0.90
CO3	2.91	0		2.04	3.00	3.00	3.00	2.33
CO4	2.46	0		1.72	3.00	3.00	3.00	2.11

Step 7: PO/PSO attainment

Follow the procedure given in section 4.6.

Note: For lab courses which does not contain any theory element, the final CO attainment calculation need to be based on internal assessments or continuous evaluation (contributes to 100% of direct component) and exit surveys (Indirect component). Finally, 70% weightage is given for direct component and 30% weightage to the indirect component for getting overall CO attainment. For PO/PSO, the same procedure as explained section 4.6 is followed.