



# **NEW HORIZON COLLEGE OF ENGINEERING**

Autonomous College Permanently Affiliated with VTU, Approved by AICTE & UGC  
Accredited by NAAC with 'A' Grade, Accredited by NBA



## **Outcome Based Education (OBE) Process Manual**

# NEW HORIZON COLLEGE OF ENGINEERING

## Outcome Based Education (OBE) Process Manual

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## 1. OBE OVERVIEW

Outcome Based Education (OBE) is an educational model that forms the base of a quality education system. There is no single specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set **goals**. The faculty may adapt the role of instructor, trainer, facilitator, and/or mentor, based on the outcomes targeted. OBE ensures alignment between educational objectives, instructional strategies, and assessment methods, thereby enhancing the effectiveness and efficiency of teaching and learning processes. OBE promotes the development of critical thinking, problem-solving, and communication skills, which are crucial for students' academic and professional advancement.

### IMPORTANCE OF OBE

Outcome-based education (OBE) holds significant importance in modern educational practices. Emphasis of outcome-based education (OBE) system is on quantifying what the students are capable of doing and learning outcomes of the students is one of the key components. By focusing on the specific skills and knowledge students should acquire by the end of a program, it offers several potential benefits for both students and educators. The key points about the importance of OBE:

#### For Students:

1. **Increased Focus and Motivation:** Clear learning outcomes provide students with a roadmap, helping them understand what's expected and stay motivated.
2. **Enhanced Relevance:** By aligning outcomes with real-world demands, OBE ensures students develop skills applicable to future careers or further studies.
3. **Active Participation and Self-Directed Learning:** Students take ownership of their learning journey, identifying their strengths and weaknesses and seeking tailored support.
4. **Improved Assessment and Feedback:** Assessments directly target learning outcomes, providing clearer feedback and helping students track their progress.

#### For Educators:

1. **Effective Curriculum Design:** OBE guides curriculum development, ensuring content and activities directly contribute to achieving desired outcomes.
2. **Targeted Instruction and Support:** Educators can tailor their teaching methods and assessments to individual student needs and learning styles.
3. **Continuous Improvement:** Data from assessments helps educators evaluate program effectiveness and make data-driven changes to improve student learning.

4. **Enhanced Transparency and Accountability:** Clearly defined outcomes promote transparency for students, parents, and stakeholders

### **KEY COMPONENTS OF OBE**

The Graduate Attributes of all programmes are adopted from the Washington Accord in line with the Vision and Mission of the Institution. Curricula and syllabi of all the programmes are framed by considering the inputs or guidelines from UGC/AICTE, Professional bodies, Stakeholders, Department Vision and Mission, POs, PSOs, PEOs and University Regulations. The syllabus for each course has been designed to meet the Compliance of the curriculum for attaining the POs and PSOs defined for the Program and Course Outcomes are framed for all courses. The mappings between CO and PO have been prepared for all the courses available in the curriculum.

1. Vision and Mission of the Institution
2. Vision and Mission of the Department
3. Programme Educational Objectives (PEOs)
4. Graduate Attributes (GAs)
5. Programme Outcomes (POs)
6. Programme Specific Outcomes (PSOs)
7. Course Outcomes (COs)

**Table 1.1 Definition of Key components of OBE**

<b>Key Components</b>	<b>Description</b>
Programme	Specialization or discipline of a degree
Graduates Attributes (GAs)	Potential to acquire competence to practice at the appropriate level.
Programme Outcomes (POs)	Describe what students are expected to know and would be able to do by the time of graduation.
Program Educational Objectives (PEOs)	Describe the expected career and professional accomplishments of graduates from a specific program, typically several years after graduation.
Programme Specific Outcomes (PSOs)	Describe what the graduates of a specific

	engineering program should be able to do.
Course Outcomes (COs)	Statements that describe what students are expected to know and able to do at the end of a course.
Course End Survey Analysis	Technique to measure the attainment of Cos.
Rubrics	Scoring guides that assessed and articulate specific components.

## **2. VISION, MISSION, QUALITY POLICY AND CORE VALUES OF THE INSTITUTION**

### **VISION OF INSTITUTION**

1. To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

### **MISSION OF INSTITUTION**

1. To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
2. To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
3. To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

### **QUALITY POLICY OF INSTITUTION**

1. To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level.

### **VALUES**

- |                     |                    |                          |
|---------------------|--------------------|--------------------------|
| 1. Academic Freedom | 2. Integrity       | 3. Inclusiveness         |
| 4. Innovation       | 5. Professionalism | 6. Social Responsibility |

### 3. PROGRAM OUTCOMES (POs)

Program outcomes describe what students are expected to know and would be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.

<b>PO1</b>	<b>Engineering Knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO2</b>	<b>Problem Analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO3</b>	<b>Design/Development of Solutions:</b> 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.
<b>PO4</b>	<b>Conduct Investigations of Complex Problems:</b> 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.
<b>PO5</b>	<b>Modern Tool Usage:</b> 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.
<b>PO6</b>	<b>The Engineer and Society:</b> 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.
<b>PO7</b>	<b>Environment and Sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO9</b>	<b>Individual and Team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO10</b>	<b>Communication:</b> 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.
<b>PO11</b>	<b>Project Management and Finance:</b> 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.
<b>PO12</b>	<b>Life-long Learning:</b> 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.

## 4. OBE FRAMEWORK OF THE INSTITUTION

The OBE framework serves as a strategic roadmap for educational institutions, shaping the teaching and learning experience to empower graduates for success in the global arena. By aligning program outcomes with industry standards and fostering skills sought by international employers, it equips graduates to excel in their professions and navigate diverse career paths across the world.

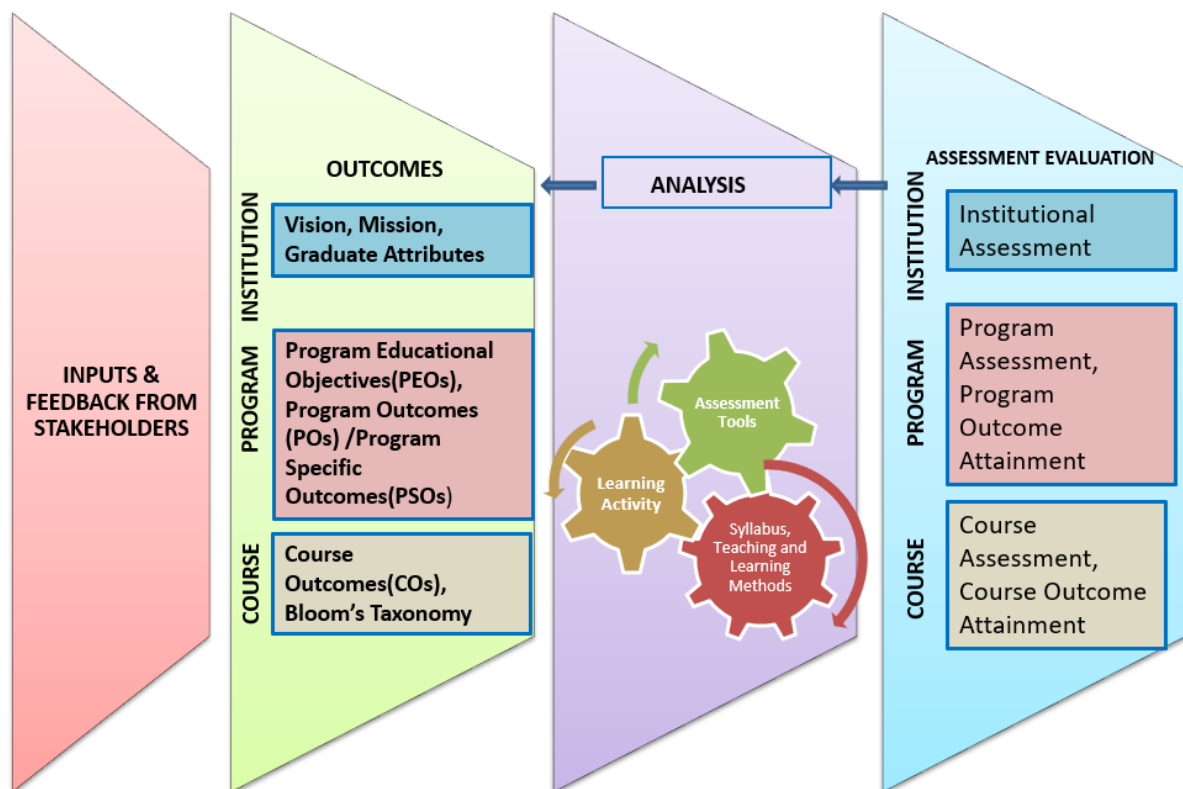


Figure 4.1 OBE Framework

### TEACHING LEARNING PROCESS AT THE INSTITUTE:

#### I. Pre-Semester Preparation (2-4 weeks before)

##### 1. Competency Matrix Development:

- HoD and faculty collaborate to define desired competencies for each program and course.
- Competencies are aligned with Program Educational Objectives (PEOs) , Program Outcomes (POs) and Program Specific outcomes(PSOs).



## **2. Course Preference Forms:**

- Faculty submit preferences for teaching specific courses based on their expertise and alignment with their competencies.

## **3. Course Allotment:**

- HoD considers faculty preferences, competencies, and course requirements.
- Faculty confirmation of their assigned course ensures alignment and acceptance.

## **4. Curriculum, Lesson Plans, and Course Files:**

- Faculty develop detailed curriculum documents, lesson plans, and course files aligned with subject objectives, COs, and assessment strategies.
- HoD reviews and authenticates these documents for consistency and quality.

## **II. During Semester**

### **1. Course File/Lesson Plan Verification:**

- Program Coordinator (PC) verifies completeness and quality of course files and lesson plans before the semester begins.

### **2. Teaching Approval:**

- HoD grants final approval for faculty to teach assigned courses based on verified documents and competence assurance.

### **3. Activity Execution:**

- All planned activities (lectures, labs, discussions, assessments) are implemented as per the approved curriculum and lesson plans.

### **4. Student Competency Identification:**

- Faculty continuously assess student progress and identify any gaps in achieving learning outcomes.
- Appropriate interventions and support are provided based on individual needs.

## **III. End of Semester**

### **1. Classroom and Lab Implementation Audit:**

- HoD observe classroom and lab sessions to ensure alignment with objectives and effective use of OBE practices.

### **2. Difficulty Resolution:**

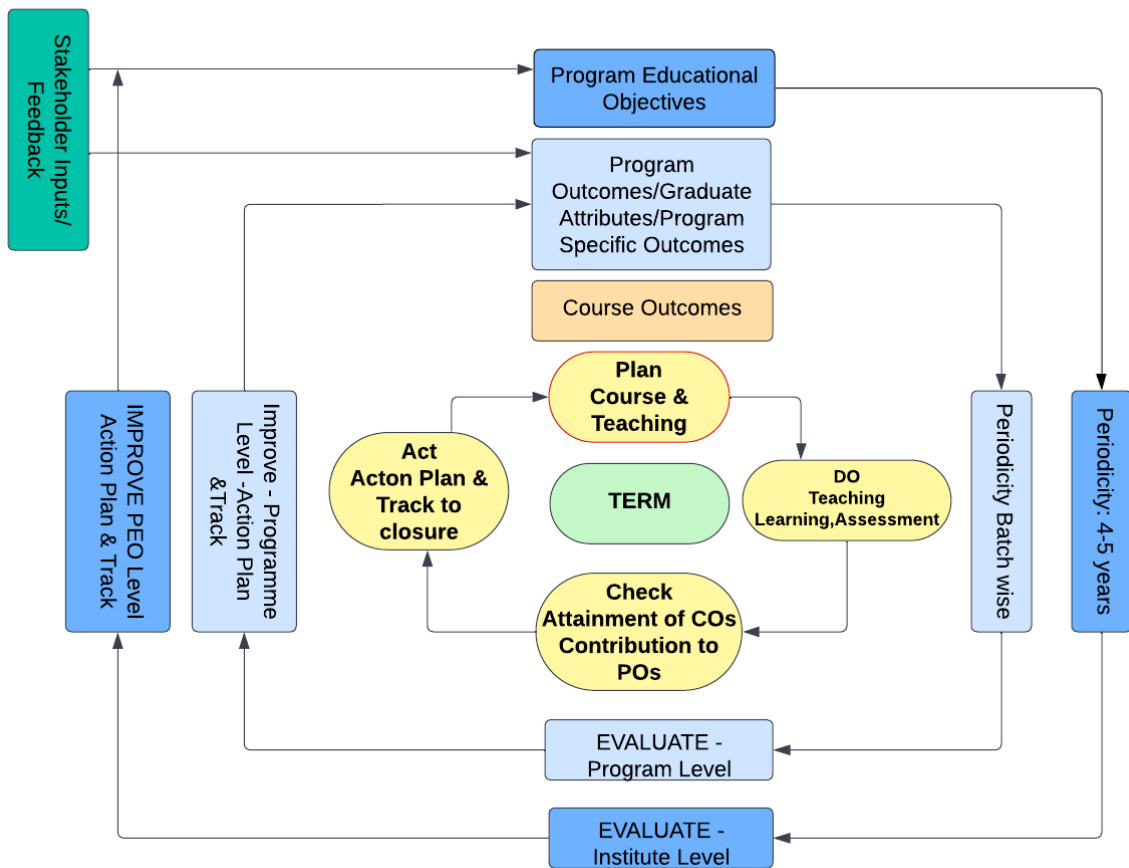
- Any challenges faced during implementation are addressed through collaboration with module coordinator, Program coordinator, and HoD.

**3. Assessment:**

- Comprehensive assessments are conducted to measure student achievement of course learning outcomes (COs).
- Data is analyzed to determine attainment of Program Outcomes (POs) and progress towards PEOs.

**4. Analysis Submission:**

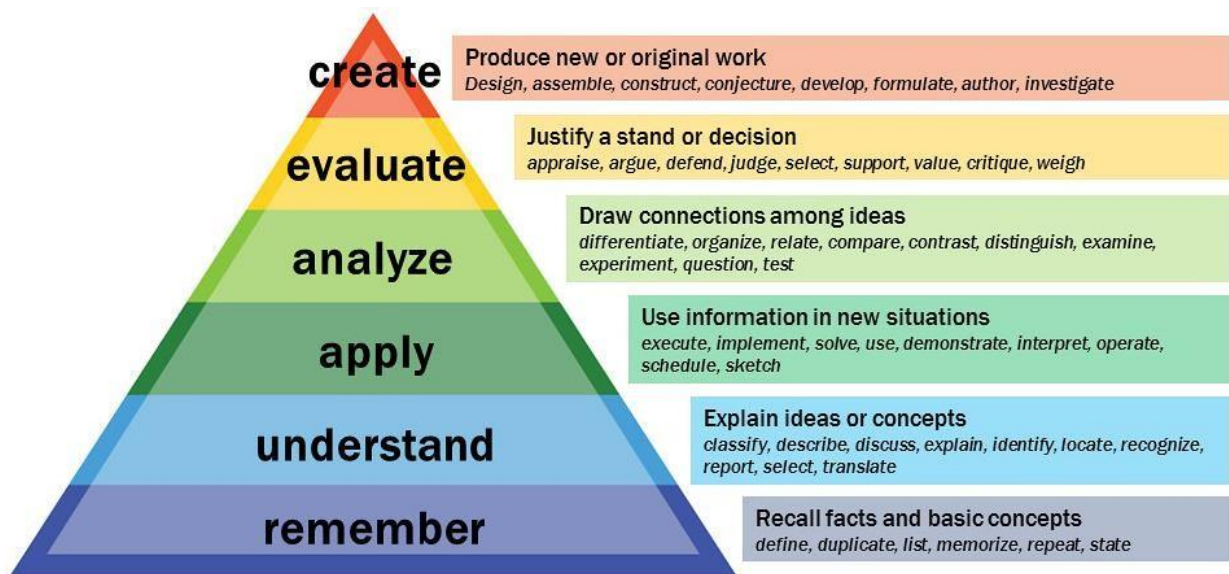
- Faculty submit detailed analysis reports of assessment results and CO-PO attainment levels to the PC and HoD.



**Figure 4.2 OBE Process Cycle**

## 5. REVISED BLOOM'S TAXONOMY

Revised Bloom's taxonomy is considered as the global language for education. Revised Bloom's Taxonomy is frequently used by teachers in writing the course outcomes as it provides a readymade structure and list of action verbs. A summary of Anderson and Krathwohl's revised version of Bloom's taxonomy of critical thinking is provided in below Figure.



**Figure 5.1 Revised version of Bloom's Taxonomy**

**Table 5.1 Action Verbs**

Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyze	Evaluate	Create
Define	Explain	Solve	Analyze	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summarize	Calculate	Distinguish	Recommend	Formulate
Match	Compare	Sketch	Explain	Grade	Invent
Tabulate	Discuss	Prepare	Differentiate	Measure	Develop
Record	Estimate	Chart	Appraise	Test	Organize
Label	Express	Choose	Conclude	Evaluate	Produce
Duplicate	Generalized	Manipulate	Categorize	Assess	Compose
Identify	Give	Use	Determine	Defend	Construct
Outline	Paraphrase	Show	Discriminate	Estimate	Integrate
Recall	Locate	Modify	Investigate	Justify	Generate
Repeat	Select	Interpret	Test	Predict	Combine
Name	Translate	Compute	Specify	Rate	Comply

## 6. GUIDELINES FOR WRITING COURSE OUTCOME (COS) STATEMENTS

Course Outcomes are the statements that help the students to understand the reason for pursuing the course and helps them to identify what they will be able to do at the end of the course. A Course outcome should define the knowledge, skills, the application of the knowledge and the skills the learner has acquired which he/she is able to demonstrate as the result of pursuing the course.

### Course outcomes involve the following parts:

1. Action verbs
2. Subject content
3. Level of achievement as per BTL
4. Modes of performing task

### While writing COs the following questions/points must be addressed properly.

**Table 6.1 Questions/points to be considered for writing COs**

<b>Specific</b>	Is there a description of precise behavior and the situation it will be performed in? Is it concrete, detailed, focused and defined?
<b>Measurable</b>	Can the performance of the outcome be observed and measured?
<b>Achievable</b>	With a reasonable amount of efforts and application can the outcome be achieved? Are you attempting too much?
<b>Relevant</b>	Is the outcome important or worthwhile to the learner or stakeholder? Is it possible to achieve this outcome?
<b>Time-Bound</b>	Is there a time limit, rate, number, percentage or frequency clearly stated? When will this outcome be accomplished?

### Guidelines/Checklist for writing COs:

**Table 6.2 Guidelines/Checklist for writing COs**

<b>Number of COs</b>	5 to 6
<b>CO Essentials</b>	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
<b>Based on BTL</b>	Understand, Remember, Apply, Analyze, Evaluate, Create
<b>Number of BTL Considered in one course</b>	Minimum 3
<b>Technical Content/ Point of curriculum</b>	All curriculum contents are covered

## Hierarchy of faculty involvement in CO Statement and mapping of CO-POs

By using action verbs and learning statements, COs have defined. For each course, course outcomes may vary from 5 to 6 nos. These course outcomes are then mapped with the POs. Then, it is submitted for the approval of the Department Advisory Board and the Board of Studies.

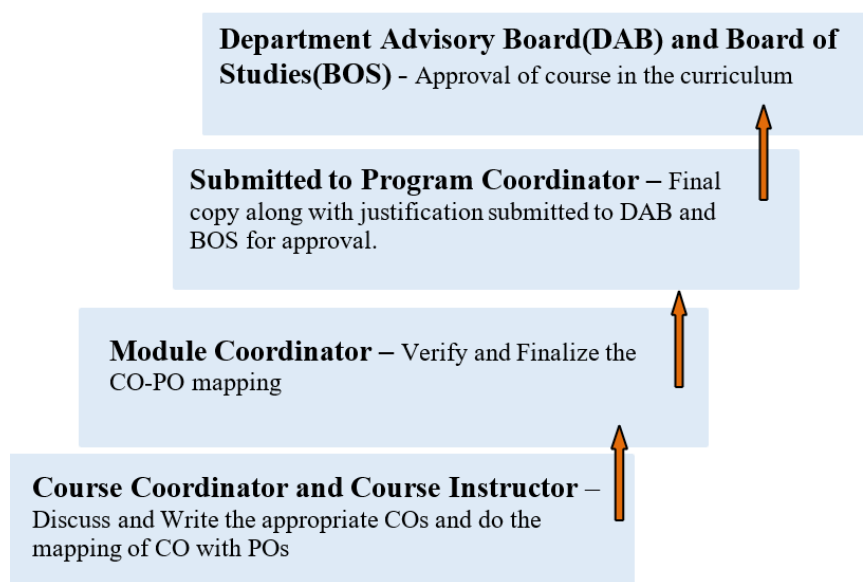


Figure 6.1: Hierarchy of faculty involvement in CO Statement and mapping of COs- POs

## Relation between POs and COs: CO-PO Mapping

Before developing the relationship between the CO and PO, it is necessary to understand the action verbs used in the PO statements. The table 6.3 shows the PO with action verbs and corresponding Blooms Level.

Table 6.3 Blooms levels for PO

PO	Action Verbs (Keyword) in PO	Blooms Level for PO
PO1	Apply	L3
PO2	Identify	L2
	Formulate	L6
	Review	L2
PO3	Design	L6
	Develop	L3,L6
PO4	Analyze	L4
	Interpret	L2,L3
	Design	L6
PO5	Create	L6
	Select	L1, L2,L6
	Apply	L3
PO6-PO12	-	-

## CO-PO Mapping Guidelines

For all the courses mentioned in the programme, the Course outcomes are mapped by the course coordinator and course instructors with the defined twelve POs and two PSOs. The mapping has been done based on the correlation levels defined by Board of Accreditation. The various correlation levels are shown in Table 6.4

**Table 6.4 Correlation levels**

- (Dash)	No Correlation
1	Slight (Low) Correlation
2	Moderate (Medium) Correlation
3	Substantial (High) Correlation

## Quality of CO-PO Mapping:

**Note:** Appropriate keyword is sufficient for mapping.

**Table 6.5 Criteria for CO-PO Mapping**

Action verb/ Keywords Used in Writing COs	Mapping Level
Keywords/action verb of the Course Outcome is not related to the action verb of Program Outcomes	-
Part of PO is reflected through keywords/action verbs of CO	1 (Low)
Major part of PO is reflected through keywords/action verbs and moderate level performance is expected from student to achieve CO	2 (Medium)
Exact action verb of PO and critical performance expected from student to achieve CO	3 (High)

## Illustration:

CO Statement of a Course:

**CO1:** Apply the basic knowledge of BJT and FET devices for designing circuits

**CO2:** Analyse load line concepts for various BJT and FET biasing circuits

**CO3:** Determine the high frequency response for BJT and JFET amplifier circuits using AC Analysis

**CO4:** Compare the effect of feedback topologies in amplifier circuits

**CO5:** Illustrate the working principles of oscillators and power amplifiers

**CO6:** Model the applications of diode, BJT and FET circuits using discrete components and simulation tools

## CO-PO Mapping of a course:

**Table 6.6 Course Articulation Matrix of a course**

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C204.1	3	3	2	-	-	-	-	-	-	-	-	2	-	-
C204.2	3	3	-	-	3	-	-	-	-	-	-	-	3	-
C204.3	3	3	-	-	3	-	-	-	-	-	-	-	3	-
C204.4	3	3	-	-	3	-	-	-	-	-	-	-	3	-
C204.5	3	3	-	-	3	-	-	-	-	-	-	-	3	-
C204.6	3	3	2	2	3	-	-	-	2	2	-	2	3	2
<b>Average</b>	<b>3.00</b>	<b>3.00</b>	<b>2.00</b>	<b>2.00</b>	<b>3.00</b>	-	-	-	<b>2.00</b>	<b>2.00</b>	-	<b>2.00</b>	<b>3.00</b>	<b>2.00</b>

**Table 6.7 Program Articulation Matrix of a course**

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C204</b>	<b>3.00</b>	<b>3.00</b>	<b>2.00</b>	<b>2.00</b>	<b>3.00</b>	-	-	-	<b>2.00</b>	<b>2.00</b>	-	<b>2.00</b>	<b>3.00</b>	<b>2.00</b>

## CO-PO Justification:

**Table 6.8 CO-PO Justification of a course**

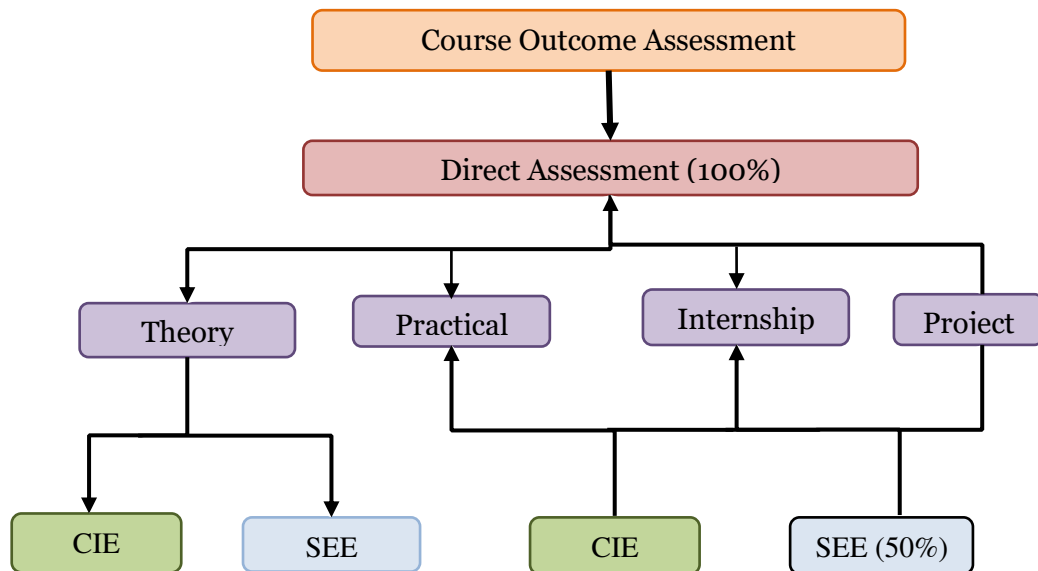
CO	PO	Justifications
CO1	PO1, PO2, PO3, PO12	Working knowledge of BJT and FET (PO1) helps in problem identification and solving design issues (PO2, PO3) and can be useful in life-long electronics engineering practices (PO12)
CO2	PO1, PO2, PO5, PO9, PSO1	Understanding BJT biasing schemes and load lines (PO1) helps in problem identification and solving design issues (PO2). PO5 (Modern tool usage) lends more perspective on understanding the designs. This can either be an individual or a team exercise (PO9). The concept of bias circuits is used in every available electronic circuits and can be useful in designing complex systems (PSO1)
CO3	PO1, PO2, PO5, PSO1	BJT and FET amplifiers and their frequency response (PO1) help in problem identification, analysis and solving design issues (PO2). PO5 (Modern tool usage) lends more perspective on understanding the designs. BJT amplifiers are practically used in every available electronic circuits and can be useful in designing complex systems (PSO1)
CO4	PO1, PO2, PO5, PSO1	Knowledge of Feedback topologies and their characteristics (PO1) helps in problem identification, analysis and solving design issues (PO2). PO5 (Modern tool usage) lends more perspective on understanding the designs. This can be useful in understanding and designing of complex circuits (PSO1).
CO5	PO1, PO2, PO5, PSO1	Working principles of Oscillators and Power amplifiers (PO1) helps in problem identification, analysis and solving design issues

		(PO2).PO5 (Modern tool usage) lends more perspective on understanding the designs. This can be useful in understanding and designing complex circuits (PSO1).
CO6	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO12, PSO1, PSO2	Leveraging the contextual knowledge (PO1, PO2, PO3) of diode, BJT and FET circuits is useful in solving complex problems (PO4). PO5 (Modern tool usage) lends more perspective on understanding the designs. Laboratory sessions help in assessing the students' Individual and Team work (PO9) and Communication (PO9) skills and can be very useful in life-long electronics engineering practices (PO12). Also, this can be useful in understanding and designing complex circuits (PSO1, PSO2).



## 7. Attainment of Course Outcomes

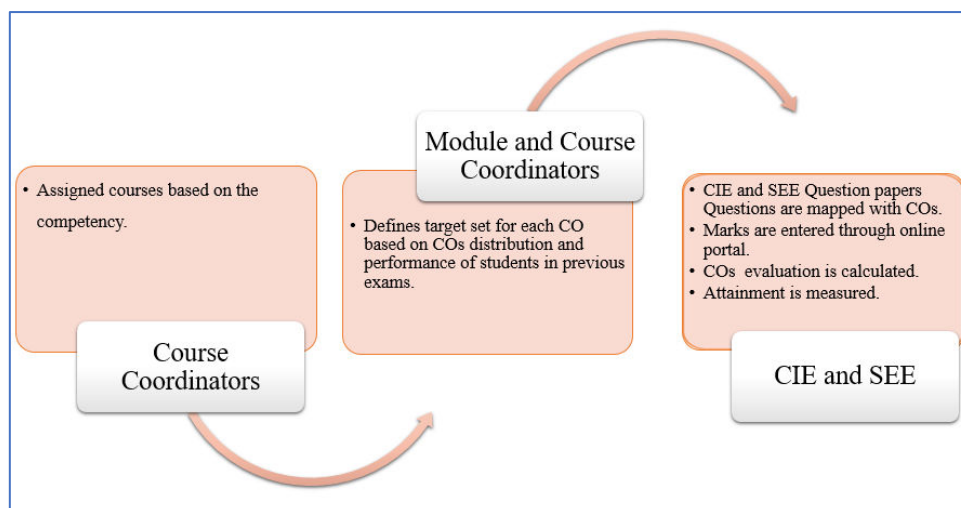
In Outcome Based Education, assessment is carried out by the institution to identify, collect, analyze and evaluate the data towards the achievement of course outcomes. The course outcomes are assessed based on direct assessment tools. The direct method of assessment includes internal test, assignments, quizzes, self-study, laboratory practical examination, internship, project work done etc. Course outcomes are evaluated based on the performance of students in Continuous Internal Evaluation (CIE) and Semester End Examination (SEE). CIE contributes 50% and SEE contributes 50% to the total attainment of a course outcome. Figure 7.1 shows the assessment tools for CO assessment for the theory, practical, internship and project courses in the programme.



**Figure 7.1 CO Assessment Tools**

### **Process of Course Outcome Data Collection:**

Internal Test Question Papers are aligned with Revised Blooms Taxonomy Levels and COs'. . Upon completion of every Internal Assessment (IA) Test, the course instructors enter the marks secured by the student in each IA in the student assessment software through faculty login allotted. Using the similar online portal, marks entry for other direct assessment tools are carried out. They can choose the batch/semester/course and enter the marks question wise for evaluation of the respective course outcomes. The entered marks are maintained in a common server through which COs evaluation is calculated and attainment is measured. Semester End Exam also follows a similar pattern of mapping Question Paper Questions with Revised Blooms Taxonomy Levels and COs' with online entry of Students' marks in the portal and Report generation.



**Figure 7.2 Process – CO Data Collection**

**Direct Assessment Tools:**

For the Theory courses, CIE consists of 2 quizzes, 2 assignments and three internal tests per semester. For the laboratory courses, assessments are done based on the continuous internal evaluation of students in every laboratory, internal test, and Semester End Lab Exams. For internship and Project courses, performance assessment is carried out based on reviews given by the students on the corresponding work done. Each and every review is focused in attaining the program outcomes. The direct assessment based on marks obtained by the individual student is then mapped with POs & PSOs through COs. For Semester End Examination, Controller of Examination will conduct the exam for 100 marks. The questions in SEE paper evenly cover all the COs of a course. The Semester End Exam marks are scaled down to 50 and then summed up with the Continuous Internal Evaluation marks for a total of 100 marks for attainment level calculations of Cos. Table 7.1-7.3 explains various direct assessment Tools and its distribution of marks.

**Table 7.1 Direct Assessment Tools**

Description	Assessment Tools	Frequency
Theory Courses	Internal Assessment (IA) Test (1, 2 and 3)	Once in a semester
	Assignment/Quiz	Twice in a semester
	Semester End Examination	Once in a semester
Lab Courses	Continuous Internal Assessment (Conduction of Experiment, Lab Observation and Record)	During weekly laboratory class
	Internal Test (1 and 2)	Once in a semester
	Semester End Lab Examination	Once in a semester
Internship	CIE	Once in a semester
	Semester End Examination	
Project	CIE	Three reviews in respective semester
	Semester End Examination	Once in a semester

**Table 7.2 Distribution of marks for theory courses evaluation**

Assessment Tool	Maximum Marks	Marks Scaled to	Weightage
Internal Assessment -1	25	25	50%
Internal Assessment -2	25		
Internal Assessment -3	25		
Assignments/Quizzes/Self study	25	25	
Semester End Examination	100	50	50%

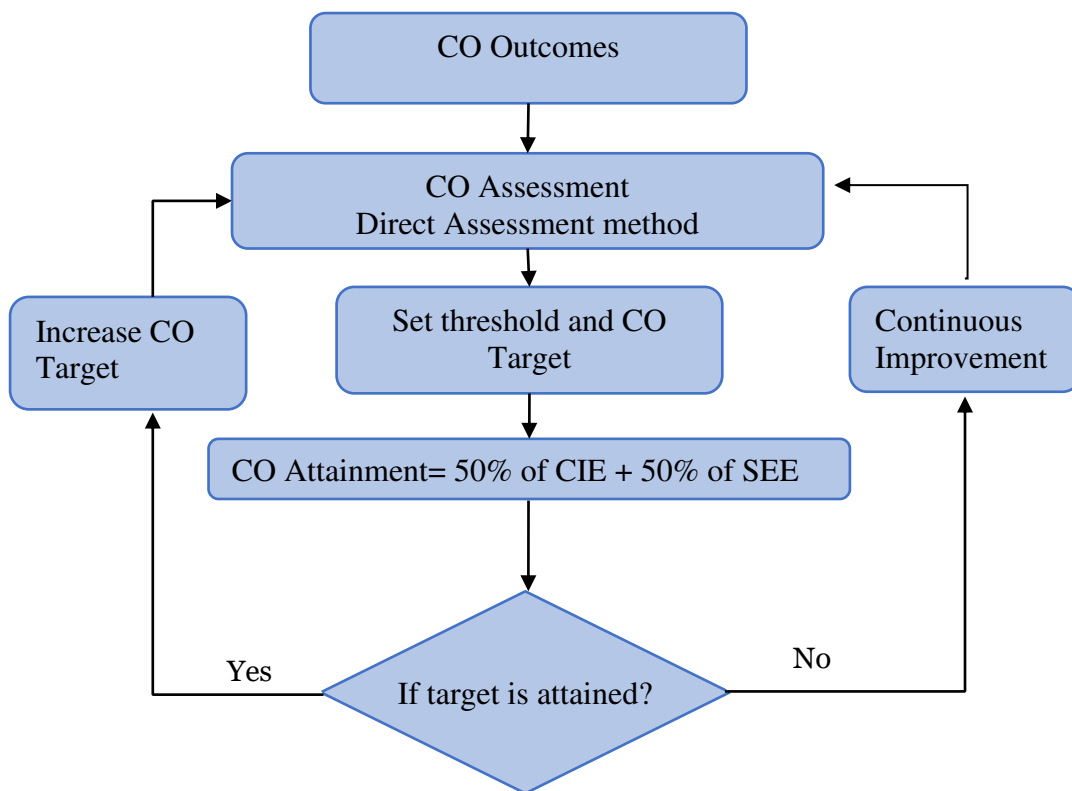
**Table 7.3 Distribution of marks for laboratory courses evaluation**

Examination	Components of evaluation	Marks	Weightage
CIE	Lab Weekly Performance (Conduction, Execution, and Record writing, Result)	30	50%
	Lab Internal Test (Conduction, Results and Viva Voce)	20	
SEE	Procedure & write up	10	50%
	Conducting the practical's, results, Graph etc.	30	
	Viva Voce by External Examiner	10	

**Process on CO Attainment:**

Attainment of CO is directly measured from the performance of students in Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).

Final CO Attainment= 50% of CIE + 50% of SEE.
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**Figure 7.3 Process on CO Assessment**

For assessing the attainment of COs in CIE and SEE, each CO of the course is mapped to individual questions and threshold is fixed for each CO. The individual COs of the courses is mapped with Correlation level and is being evaluated by prescribed assessment tools. Initially, threshold and CO target is set for the courses. After the internal and external assessment, CO attainment is calculated. The attainment of COs is compared with the threshold. If it is met, threshold is revised for the subsequent years. If it is not met, course and module coordinator will plan for further actions to attain the COs. Action may include co-curricular activities and also tutorial classes/extra classes for all students and remedial classes for slow learners of that particular course.

### Identifying Threshold Value for the Courses:

**Table 7.4 Procedure to set threshold (benchmark) of a course**

<b>Assessment Data / Review Previous Thresholds</b>	Previous Year Result [Identify Patterns in Student Performance] Average Scores. [CIE & SEE].  Evaluate Appropriateness of thresholds based on historical data.  <b>Measured using the Result.</b>
---	---

<b>Stakeholder Input</b>	Program Coordinators / Subject Experts / Students Feedback on perception of difficulty of the Course.  <b>Measured using the Ratings and Surveys.</b>
<b>Continuous Improvement</b>	<b>Directly Measurable</b> with an increase in the threshold values.
<b>Grouping of Courses</b>	Compare threshold values with benchmarks or standards from similar courses, programs.
<b>Standard Values</b>	Pass Criteria

**Note:**

1. Threshold level is defined based on three categories:  
Theoretical courses, Numerical courses and Practical oriented courses.
2. If the course is offered for first time:  
Option 1: 60% of the maximum mark is set as Course threshold.  
Option 2: Average of previous three academic year's performance of a particular course is set as course threshold.
3. If the curriculum is revised, then the new threshold value is set by the course coordinator after discussion with Module Coordinator for his/her course.

**Setting CO Target for CO Attainment**

- Target level for attainment of COs can be set initially based on average marks of that course in the last three previous academic years.
- The target level for the CO attainment is set based on the average performance of students in the given course in previous terms, difficulty level of the subject, etc.

**Note:**

**Table 7.5 Procedure to select Co Target of a course**

Same CO Target	<ol style="list-style-type: none"> <li>1. Targets are set for each CO of a course same.</li> <li>2. Very Critical to identify difficulty of specific Cos.</li> <li>3. Does not provide any specific clues to plans for improvement of quality of learning.</li> </ol>
Different CO Target	<ol style="list-style-type: none"> <li>1. Targets are set for each CO of a course separately</li> <li>2. Advantage of finding out the difficulty of specific Cos</li> <li>3. Improvements also can be planned CO-wise</li> </ol>

## Process for calculating CO attainment

Process for calculating CO attainment through Continuous Internal Evaluation and Semester End Examination are described as below.

**Step 1:** CO distributions in assessment tools are identified and planned prior to the starting of the semester.

**Table 7.6 CO Distributions in Assessment Tools**

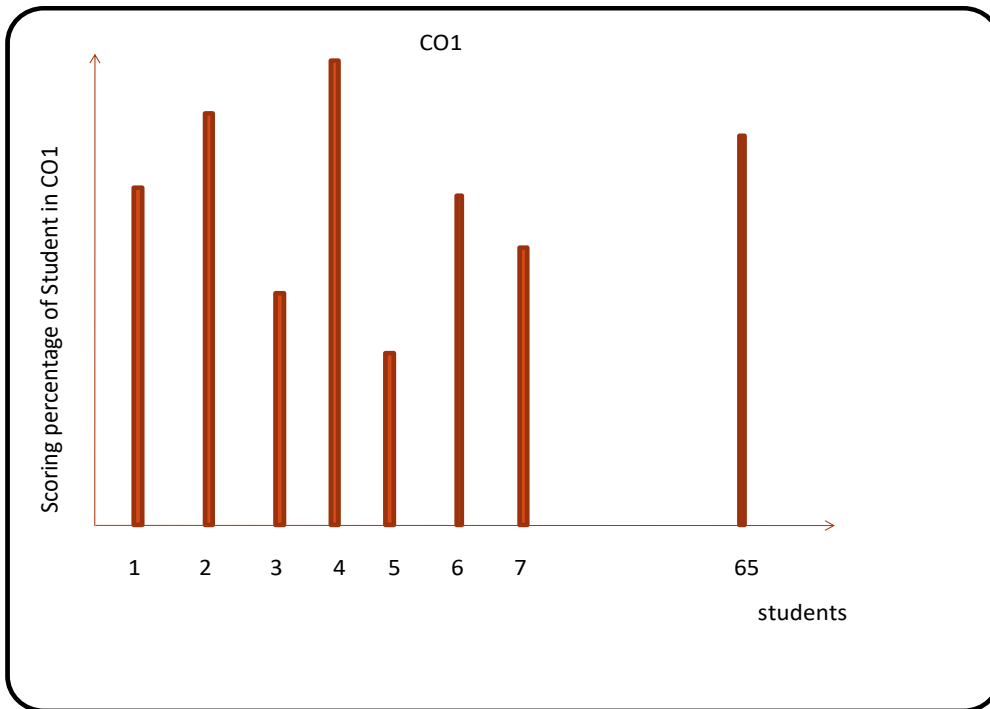
Course Outcomes	Assessment Tools
CO1	Internal Test 1, Assignment 1, Quiz1, SEE
CO2	Internal Test 1, Internal Test 2, Assignment 1, Quiz1, SEE
CO3	Internal Test 2, Assignment 1, Quiz1, SEE
CO4	Internal Test 3, Assignment 2, Quiz 2, SEE
CO5	Internal Test 3, Assignment 2, Quiz 2, SEE
CO6	Internal Test 2, Internal Test 3, Assignment 2, Quiz 2, SEE

**Step 2:** Setting of CO Target for the measurement of course outcomes is decided from the assessment tools. From the above Table, CO1 and CO2 to be assessed in Internal Test 1 while CO2, CO3, CO6 to be assessed in internal Test 2. Also, CO4, CO5, CO6 to be assessed in Internal Test 3. The entire COs is uniformly distributed and assessed among SEE, Assignments and Quiz.

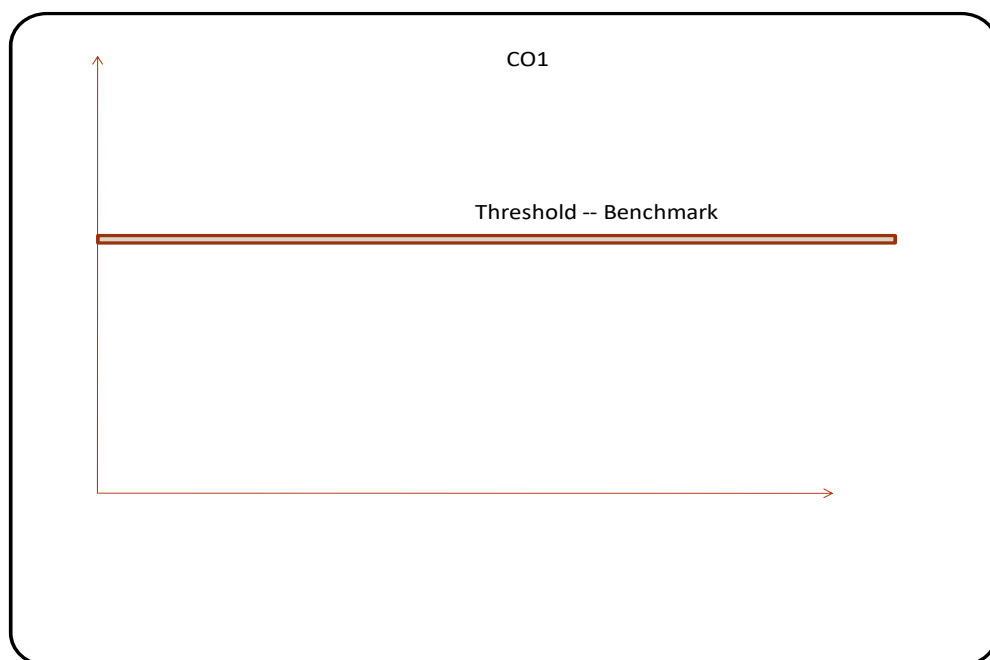
**Step 3:** Set the threshold for the course. Threshold is the minimum percentage of marks that needs to be obtained by the students. This threshold is considered as benchmark for calculating the attainment levels.

**Step 4:** After setting the benchmarks, percentage attainment is calculated by counting the number of students scoring above the benchmark divided by total number of students attempted for the COs. Table 7.7 shows CO attainment calculation.

$$\text{Attainment Percentage} = \frac{\text{Number of students scoring above the threshold value}}{\text{Total Number of students appearing for that particular CO}}$$



**Figure 7.4 Illustration of CO Scoring percentage of students**



**Figure 7.5 Illustration of selection of threshold**

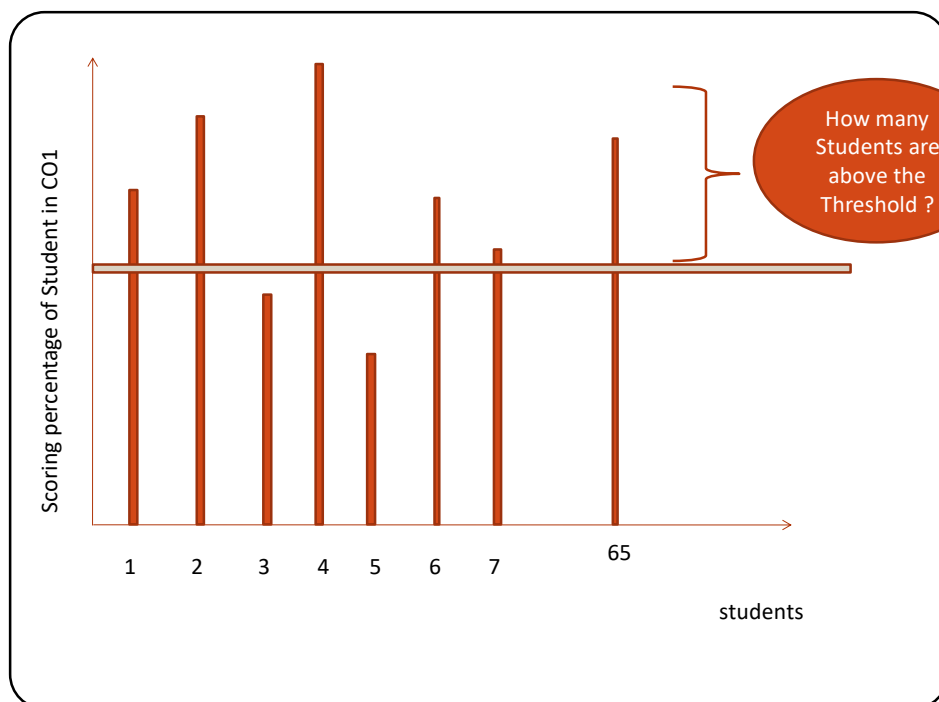


Figure 7.4 Illustration of finding the students above the threshold

Table 7.7 CO Attainment Results

ATTAINMENT RESULTS FOR A COURSE						
COURSE: XXXX COURSE CODE: XX						
CO Attainment=50% of CIE+50% of SEE						
Continuous Internal Evaluation						
Course Outcomes	Threshold Value (marks)	CO Target	Number of Students Scored Above Threshold value	Total number of Students appearing for that particular CO	Attainment Percentage	Attainment Level
CO1	60%	65.00 %	189	208	90.87	3
CO2		65.00 %	187	208	89.9	3
CO3		65.00 %	193	208	92.79	3
CO4		66.00 %	207	208	99.52	3
CO5		66.00 %	205	208	98.56	3
CO6		66.00 %	207	208	99.52	3
Semester End Examination						
CO1	60%	65.00 %	109	195	55.9	2
CO2		65.00 %	139	199	69.85	3
CO3		65.00 %	129	192	67.19	3
CO4		66.00 %	95	197	48.22	1
CO5		66.00 %	100	201	49.75	1
CO6		66.00 %	140	201	69.65	3



**Step 6:** The percentage of students in the class who scored more than threshold percentage of marks in the respective CO is the attainment. Based on the attainment percentage obtained, the attainment level for each of the CO is identified.

**Attainment Levels:**

- If 65% of students scoring more than 60% of marks, then it is considered as **LEVEL 3**
- If 55% of students scoring more than 60% of marks, then it is considered as **LEVEL 2**
- If 45% of students scoring more than 60% of marks, then it is considered as **LEVEL 1**

**Step 7:**

Final CO attainment is calculated as

$$\text{CO Attainment} = \text{CIE} * 0.5 + \text{SEE} * 0.5$$

**Sample calculation**

**Table 7.8 Sample calculation**

Course outcome Target (% of students)	CIE (Benchmarks:60%)			SEE (Benchmarks:60%)		
	Number of students scoring above benchmarks	Total number of students attempted	Attainment %	Number of students scoring above benchmarks	Total number of students attempted	Attainment %
CO1:65%	189	208	$(189/208)*100 = 90.87$ Level 3	109	195	$(109/195)*100 = 55.9$ Level 2
CO2:65%	187	208	$(187/208)*100 = 89.9$ Level 3	139	199	$(139/199)*100 = 69.85\%$ Level 3
CO3:65%	193	208	$(193//208)*100 = 92.79$ Level 3	129	192	$(129/192)*100 = 67.19\%$ Level 3

**CO Attainment calculation**

For CO1\_att= CIE attainment level\* 0.5+ SEE attainment level\*0.5= 3\*0.5+2\*0.5=2.5

For CO2\_att= CIE attainment level\* 0.5+ SEE attainment level\*0.5= 3\*0.5+3\*0.5=3

For CO3\_att= CIE attainment level\* 0.5+ SEE attainment level\*0.5= 3\*0.5+3\*0.5=3

## 8. CO Attainment Gap Analysis

- Based on the attainment levels of each COs, Gap analysis is identified.
- No gap indicates CO target is achieved.
- If the target is achieved, CO Target is enhanced for each batch of that course.
- If gap exists, then CO target is not achieved. Those courses are taken forward for continuous improvement.

### IMPORTANT NOTE:

1. If targets are achieved for that year, higher target can be set (Increase the target by 2% to 5%) for the following academic year.
2. If the target is not attained, CO Target is kept constant as a part of continuous improvement. In such courses, course coordinator along with module coordinator will plan for target improving methodology such as co-curricular activities and also tutorial classes/extra classes for all students and remedial classes for slow learners of that particular course in the subsequent years.

### Illustration:

**Table 8.1 CO Attainment Gap Analysis**

Course Code: XX    Course Name: XXXX					
Course Outcomes	CO Target Level	CO Attainment Level	CO Attainment Gap (point scale of 3)	Attained or Not attained	Action Proposed to bridge the gap
CO1	3	2.5	0.5	Not attained	Tutorial Classes will be planned to improve the attainment levels for next academic year students.
CO2	3	3	0	Attained	CO Target percentage will be revised.
CO3	3	3	0	Attained	CO Target percentage will be revised.
CO4	3	2	1	Not attained	Expert lecturer will be planned.
CO5	3	2	1	Not attained	Implement Target improving Methodology.
CO6	3	3	0	Attained	CO Target percentage will be revised.

## 9. Attainment of Program Outcomes and Program Specific Outcomes

Program Outcomes and Program Specific Outcome are assessed by giving 80% weightage to direct assessment and 20% weightage to indirect assessment. Direct assessment is to evaluate all POs in Continuous Internal Evaluation (CIE) and Semester End Examination, where 50% weightage is given for SEE exam and 50% weightage is given for CIE assessment. Indirect assessment is done through Graduate survey, Alumni survey and Employer Survey. Figure 9.1 represents the evaluation process of PO attainment through course outcome attainment.

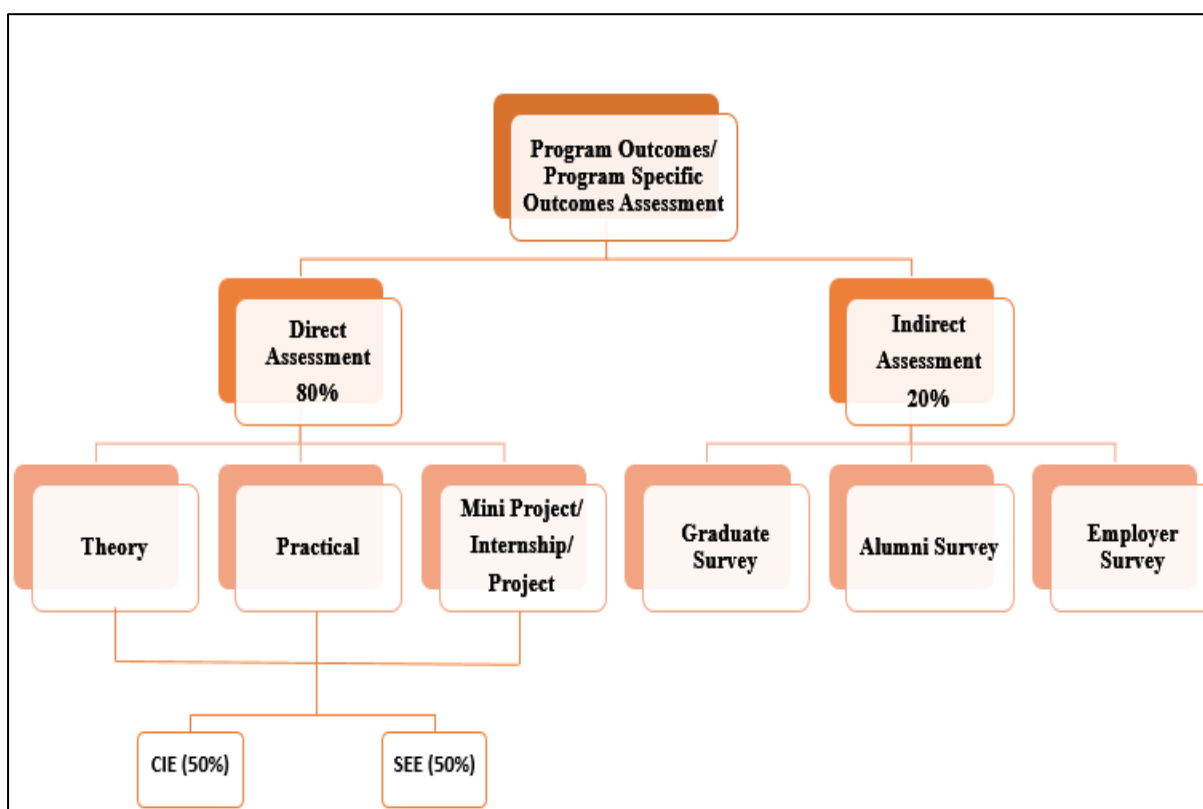


Figure 9.1 PO & PSO Attainment process

### PO and PSO Assessment Tools

At the end of programme, the PO and PSO assessment is done from the CO attainment of all curriculum components. The various direct and indirect assessment tools used to evaluate POs & PSOs and frequency with which the assessment processes are carried out are listed in Table 9.1 & 9.2.

**Table 9.1 Details about Direct Assessment Tools**

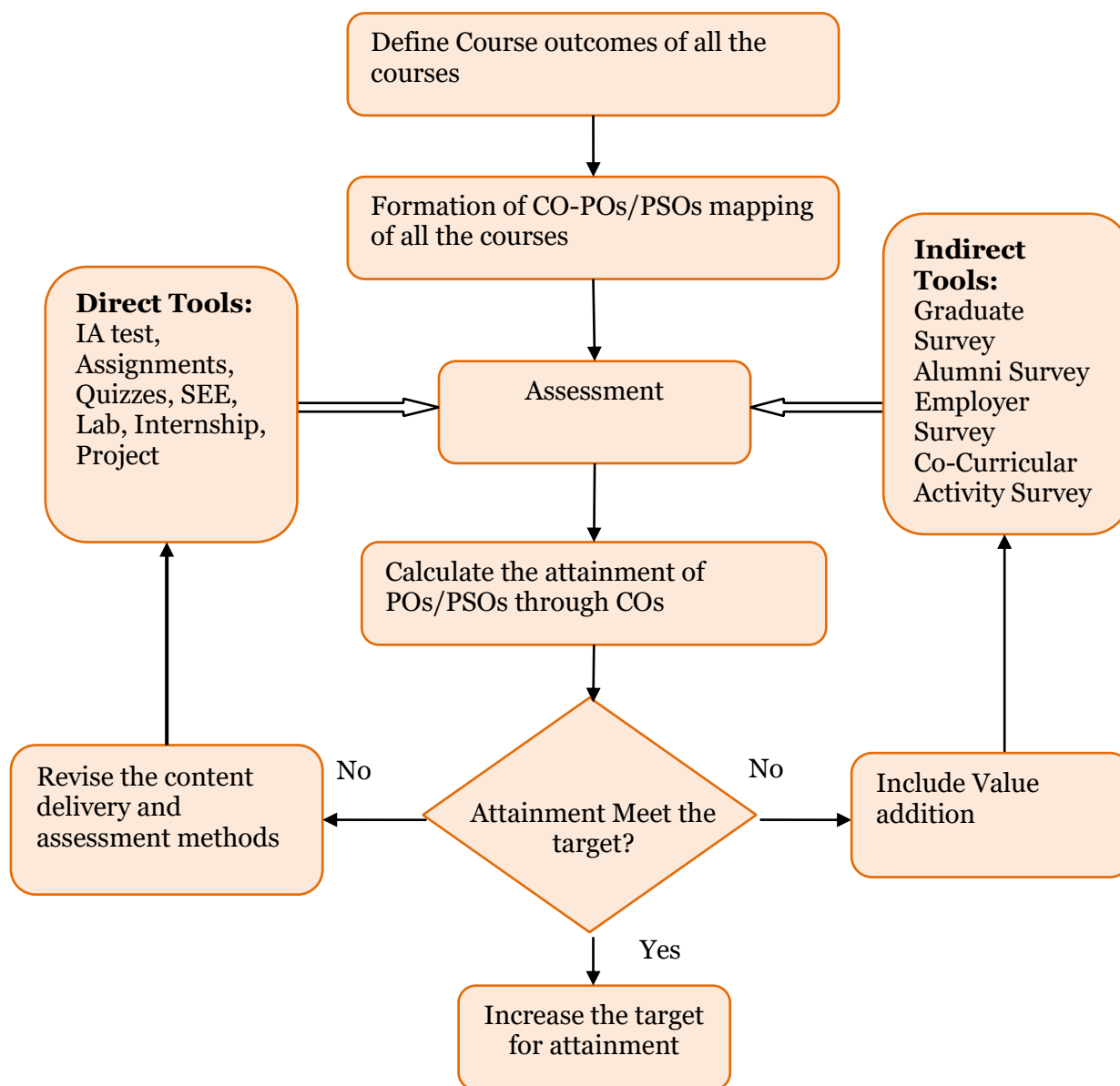
<b>Direct Assessment Tools</b>	<b>Description</b>	<b>Evaluation of COs</b>	<b>Related POs/PSOs</b>
Internal Assessment (IA) Test	Three internal assessment tests are conducted for all the courses and their averages are considered.	The questions in the test are mapped against COs of respective courses. All three IA test questions are framed in such a way to cover all CO's. Entered marks are taken for measuring the CO Attainment.	<b>PO1 to PO4 PSO1, PSO2</b>
Assignment	Two assignments per semester are given by Faculty in charge.	Assignment questions are mapped against COs and marks are taken for measuring the CO attainment.	<b>PO1 to PO12 PSO1, PSO2</b>
Quiz	Two Quizzes per semester are given by faculty in charge.	The questions are prepared for each of the courses and marks are considering for calculating CO attainment.	<b>PO1 to PO4 PSO1, PSO2</b>
Internal Lab Examination	During the semester, two laboratory test conduction and evaluation is done.	In every lab, record, observation and viva are assessed by the faculty in charge through continuous internal Assessment. Experiment wise CO is evaluated and attainment is measured.	<b>PO1 to PO12 PSO1, PSO2</b>
SEE	Conduction of both theory and practical/project examination as per the calendar of events announced.	Final marks are taken for assessing the CO attainment.	<b>PO1 to PO4 PSO1, PSO2</b>
Project/ Mini Project	Project evaluation is done to test the student's independent analysis and design skills. Three project reviews are conducted.	The project guide and project coordinator follow the rubrics which is set by the department for evaluation and then submit to the Head of the Department.	<b>PO1 to PO12 PSO1, PSO2</b>

Internship	Internship evaluation is done during 8 <sup>th</sup> semester. To get the practical exposure from industries, students are encouraged to carry out Internship in reputed industries/public sectors.	The evaluation of the marks based on Presentation and Report of the Internship and the score for every student is calculated.	<b>PO1 to PO12 PSO1, PSO2</b>
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**Table 9.2 Details about Indirect Assessment Tools**

<b>Indirect Assessment Tools</b>	<b>Description</b>	<b>Evaluation Process</b>
Graduate Survey	This survey provides the information about program satisfaction and asks graduates to indicate the level of preparation provided by their graduate program. This type of survey highlights the areas in which the institution should invest more or less resources to enhance a student's learning and development experience.	This survey is conducted for the students who have passed out of the department for that year.
Alumni Survey	This survey provides the information to identify which areas of our academic program that needs to be changed, improved or expanded.	Collect the information from alumni after two years of graduation.
Employer Survey	This survey helps to determine graduates skills, capabilities and Opportunities.	Collect the information from employers who had given jobs to our graduates.
Co-Curricular Activities Survey	This survey helps to collect the opinion of students who have participated in various activities.	Collect the feedback after the completion of the event.

The process for POs/PSOs attainment is described in the flowchart shown in Figure 9.2



**Figure 9.2 PO/PSO Assessment and Attainment Process**

The steps involved in PO Assessment process are as follows:

Step 1. Course outcomes are assessed through Continuous Internal Evaluation and Semester End Examination. The analysis is done to find the level of attainments of COs.

Step 2. The attainment of POs is being calculated based on the COs attainment.

**Attainment of POs/PSOs through a course** is calculated as *Sum of product of CO attainment and CO PO mapping by sum of weight contributed in CO PO mapping.*

**Attainment of POs through all the courses** is calculated by taking the *Average across all Courses Addressing that POs/PSOs*

POs' and PSOs' are calculated as per the below formula:

$$POi = \sum_{j=1}^n COj * (COj \rightarrow POi)$$

$$PSOi = \sum_{j=1}^n COj * (COj \rightarrow PSOi)$$

Where  $POi$  varies from  $i=1$  to  $12$ ,  $PSOi$  varies from  $i=1$  to  $2$ ,  
 $n$  is the number of Cos,  $COj \rightarrow POi$  is the mapping of  $co \rightarrow po$ .

Step 3. The PSOs attainment is calculated by the process similar to that used for POs attainment.

Step 4. For indirect assessments, survey questionnaire is circulated to students, alumni and employer. The surveys are assessed and evaluated to determine the strength of attainment level of POs.

**Attainment of POs based on survey= [(5\*number of students opted for 5-point scale) + (4 \*number of students opted for 4-point scale) + (3\*number of students opted for 3-point scale) + (2\* number of students opted for 2-point scale) + (1\* number of students opted for 1-point scale)]/Total number of responses**

Step 5. Overall attainments of POs are calculated by taking 80% of direct attainment and 20% of indirect attainment.

**PO attainment= Direct Attainment \*0.8+ Indirect Attainment \*0.2**

Step 6. If the POs and PSOs attainment value is below the target, an essential remedial action has been taken.

**Illustration1: To find the PO attainment of a Course**

A course is taken as an example for the calculation of POs and PSOs attainment. And it is explained in below.

**Table 9.3 CO-PO mapping of a course -XXXX**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-				3	
CO2	3	3	-	-	-	-	-	-	-				3	
CO3	3	3	3	3	-	-	-	-	-				3	
CO4	3	-	-	3	-	2	1	-	1	-	-	2	3	2
CO5	3	3	-	-	-	-	-	-	-	-			3	
CO6	3	3	3	3	-	2	-	-	-	-		2	3	2

**Table 9.4 CO Attainment of a course- XXXX**

COs	CIE	SEE	CO Attainment= $0.5 \times \text{CIE} + 0.5 \times \text{SEE}$
CO1	3	2	$3 \times 0.5 + 2 \times 0.5 = 2.5$
CO2	3	3	$3 \times 0.5 + 3 \times 0.5 = 3$
CO3	3	3	$3 \times 0.5 + 3 \times 0.5 = 3$
CO4	3	2	$3 \times 0.5 + 2 \times 0.5 = 2$
CO5	3	2	$3 \times 0.5 + 2 \times 0.5 = 2$
CO6	3	3	$3 \times 0.5 + 3 \times 0.5 = 3$

**Table 9.5 CO Attainment Vs CO PO mapping**

COs	CO Att	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2.5	3	3	3	3	-	-	-	-	-				3	
CO2	3	3	3	-	-	-	-	-	-	-				3	
CO3	3	3	3	3	3	-	-	-	-	-				3	
CO4	2	3	-	-	3	-	2	1	-	1	-	-	2	3	2
CO5	2	3	3	-	-	-	-	-	-	-	-			3	
CO6	3	3	3	3	3	-	2	-	-	-	-		2	3	2



Hence, final contribution of CO attainment in PO attainment can be done using the below formula,

**Attainment of POs/PSOs through a course** is calculated as *Sum of product of CO attainment and CO PO mapping by sum of weight contributed in CO PO mapping.*

**Calculation:**

$$PO1 = \frac{(2.5*3) + (3*3) + (3*3) + (2*3) + (2*3) + (3*3)}{(3+3+3+3+3+3)} = 2.58$$

$$PO2 = \frac{(2.5*3) + (3*3) + (3*3) + (2*3) + (3*3)}{(3+3+3+3+3)} = 2.7$$

$$PO3 = \frac{(2.5*3) + (3*3) + (3*3)}{(3+3+3)} = 2.83$$

**Table 9.6 PO Attainment of a Course**

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
XXXX	2.58	2.7	2.83	2.63	-	2.5	2	-	2	-	-	2.5	2.58	2.5

Similar way all POs are calculated using above formula. For indirect attainment, Survey results from graduates, alumni, employer and Co-curricular are consolidated and the final PO values are calculated through 5 point scale (Excellent, Very Good, Good, Satisfactory, poor). After collection of survey forms, the marks for POs are calculated based on the following formula:

*For each Survey = [(5\*number of students opted for 5-point scale) + (4 \*number of students opted for 4-point scale) + (3\*number of students opted for 3-point scale) + (2\* number of students opted for 2-point scale) + (1\* number of students opted for 1-point scale)]/Total number of responses*

### **Illustration 2 : To find the PO attainment of a Program**

#### **Taken Direct Assessment of PO-3**

Program outcome 3:

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes of Electronics and Communication Engineering that

meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

This outcome is assessed from courses like Analog Electronics circuits, Signals and Systems, Digital Signal Processing , Analog Communication , Embedded systems , project work etc.

Direct PO attainment is calculated from CO attainment of the courses addressing PO-3. Average CO attainment level of all courses addressing this PO is calculated which is mentioned in following Table 9.7 a

**Table 9.7a Direct Assessment of PO3**

Semester	SAR Code	Relevant Courses	PO3_Attainment_Course wise
I SEM	C101	Engineering Mathematics I	3
	C103	Introduction to Programming with C	3
	C104	Computer Aided Engineering Drawing	3
	C105	Basic Electronics	3
II SEM	C107	Engineering Mathematics II	3
	C108	Engineering Physics	3
	C109	Elements of Mechanical Engineering	3
	C110	Elements of Civil Engineering	2.95
	C111	Basic Electrical Engineering	3
III SEM	C201	Engineering Mathematics –III	3
	C202	Life Skills for Engineers	3
	C203	Digital Electronics Circuits	2.72
	C204	Analog Electronics circuits	3
	C206	Signals and Systems	2.9
	C207	Mini Project	3
IV SEM	C208	Engineering Mathematics- IV	3
	C209	Introduction to Economics	2.46
	C210	System design using HDL	2.47
	C211	Digital Signal Processing	2.76

	C212	Control Systems	2.62
	C213	Linear Integrated Circuits	2.84
	C214	Mini Project –II	3
V SEM	C301	Analog Communication	2.56
	C302	Microcontroller	2.77
	C303	CMOS VLSI Design	2.31
	C306	Programming with Data Structure	2
VI SEM	C307	Digital Communication	2.26
	C308	Embedded System Design	2.78
	C309	Microelectronics circuits	2.66
	C310	Microwaves and Radar	2.83
	C311	Object Oriented Programming	3
	C312	Mini Project -3	3
VII SEM	C401	Wireless and mobile Communications	2.85
	C402	Antennas and Wave Propagation	2.47
	C403	Satellite Communications	2.91
	C404	Artificial Intelligence and Cognitive Computing	3
	C405	Low power VLSI Design	2.47
	C406	Renewable Energy	3
	C407	Network Security and Cryptography	2.69
	C408	Python and R Programming	2.8
VIII SEM	C409	Internship	3
	C410	Project Work	3
Average			2.81

### **Indirect Assessment of PO3:**

Indirect PO assessment is done using assessment tools like graduate survey, alumni survey, employer survey and Co-curricular activity survey as described in following Table 9.7b.

**Table 9.7b Indirect Assessment of PO3**

Survey	Attainment level
Graduate Survey	2.81
Alumni Survey	2.6
Employer Survey	2.5
Co-Curricular Activity Survey	2.81
Average	2.68

**Average Attainment of PO3**

Finally, the average of direct and indirect assessment is calculated which is the attainment level for that PO. Table 9.7c shows overall Attainment calculation for PO3.

**Table 9.7c Final Attainment of PO3**

Average Attainment				
PO	Assessment Tool	Attainment Level		Overall Attainment
PO3	Direct Assessment Tool	2.81	80% of 2.81=2.248	2.78
PO3	Indirect Assessment Tool	2.68	20% of 2.68=0.536	

Final PO and PSO attainment level is 80% Direct attainment + 20% Indirect attainment.

Table 9.7d shows final POs and PSOs calculation for LYG (2016-2020 batch)

**Table 9.7d Final POs and PSOs Attainment**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Direct Attainment	2.80	2.77	2.81	2.80	2.76	2.75	2.73	2.82	2.80	2.88	2.73	2.78	2.66	2.72
Indirect Attainment	2.76	2.76	2.68	2.61	2.71	2.56	2.54	2.59	2.83	2.66	2.52	2.58	2.74	2.71
80% Direct Attainment	2.24	2.21	2.25	2.24	2.21	2.20	2.18	2.25	2.24	2.30	2.18	2.22	2.13	2.18
20% Direct Attainment	0.55	0.55	0.54	0.52	0.54	0.51	0.51	0.52	0.57	0.53	0.50	0.52	0.55	0.54

Total PO Attainment	2.79	2.77	2.79	2.76	2.75	2.71	2.69	2.77	2.81	2.84	2.69	2.74	2.68	2.72
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**Comparison of achieved values of POs/PSOs attainment with Target values:**

Set the Target values for technical and non-technical POs and PSOs and are listed in the Table 9.7e. Obtained values of POs /PSOs attainment are compared with target values.

Table 9.7e Set the Target values for technical and non-technical POs and PSOs

Particulars	Target Values	POs/PSOs
Set target for Technical PO	85% (2.55)	PO1, PO2, PO3, PO4, PO5
Set target for Non –Technical PO	85% (2.55)	PO6, PO7, PO8, PO9, PO10, PO11, PO12
Set target for PSO	85% (2.55)	PSO1, PSO2

If the set target is met, improve the target percentage of POs/PSOs for the subsequent batches. If the set target is not met, retain the same target. Root cause analysis for gap to be analyzed and action for improving the PO attainment to be carried out.



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