2.6.2 Attainment of POs and COs are evaluated

PROCESS OF COURSE OUTCOMES AND PROGRAM OUTCOMES ASSESSMENT AND ATTAINMENT

A. Attainment of Course Outcomes

Description of the assessment processes used to gather the data upon which the evaluation of Course Outcome is based

Assessment of Course Outcome

Assessing course outcomes is an important part of evaluating the effectiveness of a course and determining whether it has achieved its intended goals. This process is carried out using following steps:

1. Define the Course outcomes: The first step is to clearly define the course outcomes of the course using Bloom's Taxonomy. This includes identifying the specific knowledge, skills, and abilities that students are expected to gain by the end of the course. For each course six Course Outcome statements are defined.

2. Develop assessment tools: Once the course outcomes have been defined, the next step is to develop assessment tools that measure whether students have achieved those outcomes.

3. Collect data: Collect data from students' performance on the assessment tools. This is done by grading exams, projects, through surveys.

4. Analyze data: Once data has been collected, it is analyzed to determine how well students have achieved the course outcomes.

5. Use data to improve the course: Finally, the data collected is used to identify areas where the course could be improved.

Assessing course outcomes is an iterative process that involves continuous refinement and improvement. By carefully defining course outcomes, developing appropriate assessment tools, and analysing data, course teacher ensure that their courses are effective in achieving their intended goals.

Assessment Tools

Assessment tools are designed to evaluate the attainment of the course outcomes (COs). It is important to select assessment tools that align with the specific COs of the course and to use multiple assessment tools to provide a comprehensive evaluation of student learning. The assessment tools are chosen based on the specific course outcomes being assessed and the teaching methods being used in the course.

The evaluation of the Course Outcome (CO) involves the use of both direct and indirect assessment tools, with greater weightage assigned to the former. Specifically, 80% weightage is given to direct assessment tools, which include both internal assessments (20%) and external assessments (80%). Meanwhile, indirect assessment tools are assigned a weightage of 20%. The CO is assessed through a combination of direct and indirect methods, with greater emphasis placed on the former. The performance of students in both internal and external assessments is taken into account, with appropriate weightage assigned to each.
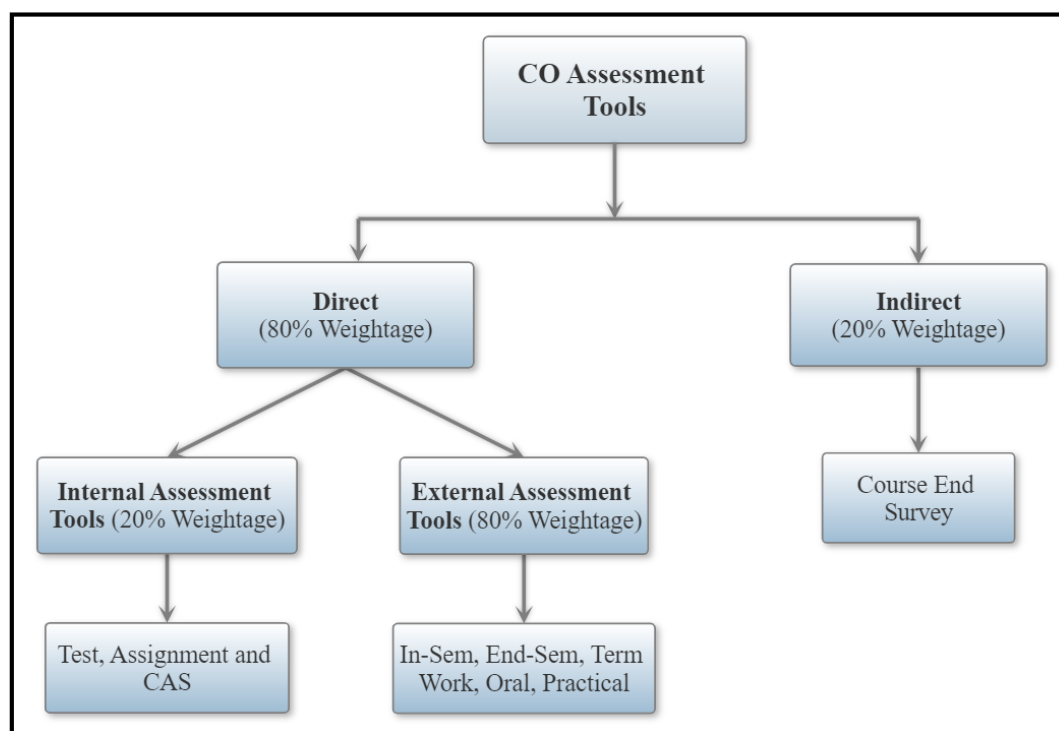

Figure 1: Assessment tools and its weightage

Direct Assessment Tools:

The assessment of Course Outcomes (COs) is evaluated using direct assessment tools, which include internal and external assessments. Internal assessments contribute 20% and external assessment contributes 80% to the overall assessment of COs.

Theory:

Internal Tests and Assignments: In order to ensure that students are keeping up with the course content, internal tests and assignments are used as effective measures of their progress. The course is divided into six units, each of which is evaluated through a corresponding test. Additionally, three assignments are given, each based on two units of the course. The questions in these assessments are designed in accordance with Bloom's Taxonomy and are mapped to

the specific Course Outcomes (COs) of the course. The department sets target level for COs, against which the students' performance is evaluated.

External Assessment:

University Examination: The university conducts both in-semester and end-semester examinations to evaluate students' understanding of the course contents. The in-semester examination covers three units of the course and assesses three specific Course Outcomes (COs), while the end-semester examination covers the entire syllabus and evaluates all of the COs. These examinations are designed to test students' knowledge and comprehension of the course contents, as well as their ability to apply that knowledge to real-world situations.

Practical

Internal Assessment: Lab courses offer students a valuable opportunity to gain hands-on experience in applying the concepts they learn in class and to develop the skills necessary for success in their field of study. To assess students' performance in these practical aspects of the course, a Continuous Assessment Sheet (CAS) is used. This sheet evaluates several parameters, including regularity, quality of experiment write-ups, and overall performance during each experiment. By using the CAS, teachers are able to track students' progress and provide constructive feedback to help them improve their skills and understanding of the lab work.

External Assessment:

Practical courses conclude in an end-semester examination, which may take the form of a term work, oral examination, or practical examination. This evaluation is conducted by both an external examiner and an internal examiner to ensure that the assessment is fair and objective. Through this examination, students are tested on their ability to apply the knowledge and skills they have acquired throughout the course to practical scenarios. By employing a variety of assessment formats, instructors are able to evaluate students' abilities from multiple perspectives

To assess the achievement of Course Outcomes (COs), Program Outcomes (POs), and Program Specific Outcomes (PSOs), a range of assessment tools are used at different intervals throughout the course. Table **1** presents a comprehensive overview of these assessment tools, including the frequency at which they are administered. By utilizing a variety of methods to evaluate learning outcomes, course teachers are able to gain a more complete understanding of students' knowledge and skills, and ensure that the curriculum is meeting the desired standards.

Sr. No.	Assessment Tool	Description	Evaluation of Course Outcomes	Related POs/PSOs	Frequency of

					assessment per term
Internal Assessment Tools					
1.	Test	Written examination	Questions in the test are mapped against CO of respective course.	Corresponding mapped POs/PSOs with the CO	Six (One for each CO)
2.	Assignment	Set of question to solve to home. (Open Book)	Questions in the assignment are mapped against two CO of respective course.	Corresponding mapped POs/PSOs with the COs	Three (one for Two COs)
3	Continues Assessment Sheet (CAS)	Assessment of students during practical	Based on the COs mapped with the experiments / assignments	Corresponding mapped POs/PSOs with the COs	For each experiment/ assignment during practical.
External Assessment Tools					
4	In-Sem Exam	Written examination	Questions in the exam are mapped against COs corresponds to first three units of respective course.	Corresponding mapped POs/PSOs with the COs	One (Mid of the Term)
5	End-Sem Exam	Written examination	Questions in the exam are mapped against COs corresponds to complete syllabus of respective course.	Corresponding mapped POs/PSOs with all COs	One (End of the Term)
6	Term Work	Based on the continues assessment during practical sessions –CAS is used	Based on the COs mapped with the experiments / Assignments	Corresponding mapped POs/PSOs with the COs	One (End of the Term)

7	Oral/Practical	Based on the experiments / assignment performed during practical session	Based on the COs mapped with the experiments / Assignments	Corresponding mapped POs/PSOs with the COs	One (End of the Term)
8	Seminar	Based on the continues assessment during practical sessions – CAS is used	Based on the COs mapped	Corresponding mapped POs/PSOs with the COs	One (End of the Term)
9	Project	Based on the continues assessment during internal review and university exams, CAS and rubrics are used	Based on the COs mapped	Corresponding mapped POs/PSOs with the COs	External – One (End of the Term) and Internal Review – Two in Term

Table – 1: Mapping of assessment tools to COs, POs/PSOs with frequency

Indirect assessment tool – Course End Survey

A course end survey is a feedback tool used to gather information from students at the conclusion of a course. Its purpose is to assess the effectiveness of the course. Typically administered in the final week of the course, the survey covers course content in the form of CO statements.

To be effective, course end surveys are well-designed and focused on relevant and meaningful questions. Course teacher carefully analyse the results of the survey and make necessary changes to their course design and teaching methods based on the feedback received.

The weightage assigned to the indirect assessment tool in CO attainment highlights its importance in evaluating the effectiveness of the course design and teaching methods. By using this feedback to make informed decisions about course improvements, Course teacher ensure that future iterations of the course are even more effective in helping students achieve their learning goals.

Evaluation of CO Attainment by Direct Assessment Tool

The evaluation of course outcome (CO) attainment by assessment tool involves a systematic process of collecting and analysing data to determine the extent to which the course objectives have been met. The following steps are taken for this evaluation:

a) Choose an appropriate assessment tool: There are various internal and external assessment tools that are used. The choice of tool is aligning with the objectives and course outcomes of the course.

b) Determine assessment criteria: The assessment criteria are clearly defined and communicated to students. This will help to ensure that students understand what is expected of them and how their performance will be evaluated.

c) Administer assessment: The assessment tools are administered in a fair and consistent manner.

d) Analyse results: The results of the assessment should be analysed to determine the extent to which the course objectives have been met. This analysis should take into account the strengths and weaknesses of the students and the course. This analysis can be used to inform future instructional strategies and to improve the course content.

e) Evaluate the effectiveness of the assessment: It is important to evaluate the effectiveness of the assessment to determine if it has been successful in achieving its intended purpose. This evaluation may involve soliciting feedback from students or conducting a review of the assessment process.

Internal assessment tools consist of Test, Assignment, Continuous Assessment Sheet for Practical (CAS) to evaluate CO attainment level.
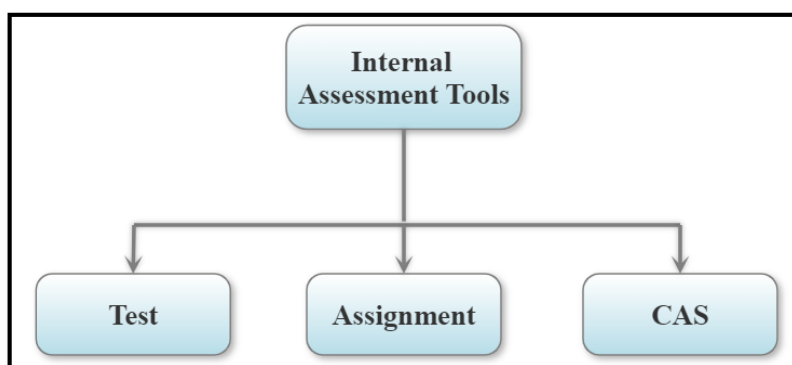

Figure 2: Internal assessment tools

External assessment tools consist of university examination such as In-Sem Exam, End Semester Exam, Oral, Practical, Seminar and Project examinations.
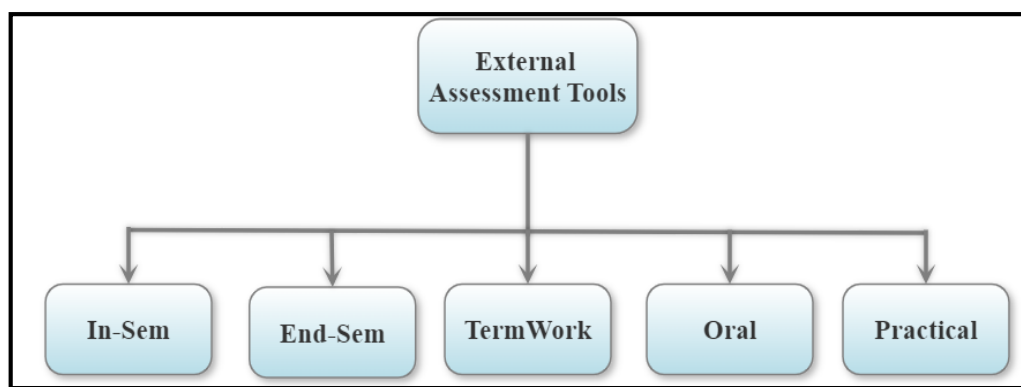
Figure 3: External assessment tools

Attainment Levels

Attainment levels for Course Outcomes (COs) are a measure of students' achievement in meeting the course objectives. These levels are assessed using a variety of tools, and the attainment level may be stated as a percentage of students expected to achieve a certain threshold of marks. The attainment level is then measured as the actual percentage of students who meet or exceed the set threshold.

The defined attainment levels are;

Attainment Level 1: **40% to less than 60%** students scoring more than **60%** marks out of the relevant maximum marks.

Attainment Level 2: **60% to less than 70%** students scoring more than **60%** marks out of the relevant maximum marks.

Attainment Level 3: More than **70%** students scoring more than **60%** marks out of the relevant maximum marks.

Mapping of Assessment Tools and COs

Mapping assessment tools and COs is an important part of the assessment process and can help to ensure that student performance is evaluated consistently and effectively.

Mapping of assessment tools and course outcomes (COs) involves identifying which assessment tools are appropriate for evaluating specific COs. This process ensures that the assessment tools align with the intended learning outcomes and measure the desired knowledge, skills, and abilities. This process also helps to ensure that the assessment methods are valid and reliable, and that they provide accurate and meaningful information about student learning.

Weighted average method

The weighted average method is a technique used to calculate the CO attainment from attainment values by tools. To use the weighted average method, weights are assigned to each tool based on maximum marks assigned to it, its relative importance, contribution to the overall attainment.

The steps involved in using the weighted average method to calculate CO attainment are as follows:

i.   Decide on the assessment tools to be employed in calculating CO attainment.

ii. Establish the level of attainment for each tool used in the process, which will be measured on a scale of 1 to 3.

iii. Assign weights to each tool based on its Maximum Marks. The weight for each tool will be calculated as the ratio of its Maximum Marks to the total marks assigned to all selected tools for calculating CO attainment.

iv. Multiply each tool's level of attainment by its corresponding weight

v.   Sum up the weighted attainment values for all the tools to get CO attainment.

For example, if three tools are used with maximum marks assigned as 20, 30, 40 (Total Maximum Marks = 90), and the CO attainment values for the tools are 2, 1, and 3, weights assigned as (20/90), (30/90) and (40/90), respectively, based on the maximum marks for each tool in measuring the CO attainment.

To calculate the weighted average CO attainment, following formula is used:

Weighted average CO attainment = (Tool 1 attainment * Weight 1) + (Tool 2 attainment * Weight 2) + (Tool 3 attainment * Weight 3) + ...

In the example above, the weighted average CO attainment would be:

Weighted average CO attainment = (2 * 20/90) + (1 * 30/90) + (3 * 40/90) = 2.11

Therefore, the weighted average CO attainment for the three tools is 2.11.

Let's take an another example of a course that has six Course Outcomes (CO.1 to CO.6), and for each CO, specific assessment tools are used along with their corresponding maximum marks (M_i), as shown in the table below. Based on the performance of students and target values, CO attainment levels can be determined for each assessment tool as A_i.

Assessment Tool	Internal				External		
	Test-1	Test-2	Assignment	CAS	In-Sem	End Sem	Term Work
COs Mapped	*CO.1*	*CO.2*	*CO.1 & 2*	*All COs*	*CO.1 & 2*	*All COs*	*All COs*
Maximum Marks	*M1*	*M2*	*M3*	*M4*	*M5*	*M6*	*M7*
CO Attainment Level	*A1*	*A2*	*A3*	*A4*	*A5*	*A6*	*A7*

Table 2: Mapping of Cos with Assessment Tools

Since different assessment tools are used to evaluate each Course Outcome, the average attainment of each CO will depend on the attainment level obtained from each tool. For instance, the average attainment level of CO.1 will depend on the attainment levels obtained through various internal assessment tools, such as Test 1, Assignment 1, and CAS, as well as external assessment tools, such as In-Sem, End Sem, and Term work. If an assessment tool is used for multiple COs, the maximum marks can be distributed equally among those COs.

For example, if Assignment 1 is used as an assessment tool for CO.1 and CO.2, the maximum mark can be distributed equally between both COs, i.e., M3/2 for each CO. When calculating the attainment levels for external tools, such as End Sem Exam, CO-wise mark distribution should be considered. Additionally, the average CO attainment for internal tools and external tools should be calculated separately.

Average CO Attainment for particular CO using multiple assessment tools can be calculated as

$$\Sigma \text{ weightage} * \text{CO attainment}$$

Average CO Attainment by Internal Assessment Tools				
CO	**Assessment Tool, Weightage and Attainment Level**			**Total**
CO.1	Test-1	Assig.-1	CAS	
Marks for CO.1	M1/1	M1/2	M4/6	**Mint1**
Weightage	WT1 = M1 / (1*Mint1)	WA1 = M1 / (2*Mint1)	WCS = M4 / (6*Mint1)	**1**
CO Attainment	A1	A3	A4	
Average CO Attainment (Aint)	**= WT1*A1 + WA1*A3 + WCS*A4**			

Table 3: CO Attainment calculations for Internal Assessment Tools

Average CO Attainment by External Assessment Tools				
CO	**Assessment Tool, Weightage and Attainment Level**			**Total**
CO.1	In-Sem	End Sem	Term Work	
Marks for CO.1	M5/2	M6/6	M7/6	**Mext1**
Weightage	WI1 = M5 / (2*Mext1)	WE1 = M6 / (6*Mext1)	WTW = M7 / (6*Mext1)	**1**
CO Attainment	A5	A6	A7	
Average CO Attainment (Aext)	**= WI1*A5 + WE1*A6 + WTW*A7**			

Table 4: CO Attainment calculations for External Assessment Tools

The CO attainment level by direct tools is calculated by giving 20% weightage to the average CO attainment level obtained from internal assessment tools and 80% weightage to the average CO attainment level obtained from external assessment tools.

CO attainment for CO1 = 0.2 X Aint + 0.8 X Aext

CO Attainment Level by Indirect Assessment Tool

Mapping the survey questions to the COs enables course teacher to better understand the degree to which students have achieved the desired course outcomes. Standardizing the survey form ensures consistency across different courses, while a rating scale allows for a more nuanced and detailed assessment of student performance.

At the end of each course, a customized survey form is created with questions directly linked to the Course Outcomes (COs). Responses to these questions are collected through forms that typically use a 1-3 scale (with low to high ratings). Average of all the responses to respective CO is consider as CO attainment. The data is then used to compute the indirect CO attainment, which is given a weightage of 20% in the overall CO attainment assessment.

Overall CO Attainment Level for Course

To evaluate and assess COs, multiple tools are used, including direct assessment tools such as internal assessment and external assessment tools (university exams). When calculating CO attainment using direct assessment tools, 20% weightage is given to internal assessment tools, and 80% weightage is given to external assessment tools.

The weightage for CO attainment by direct assessment tools is 80%, while the weightage for the indirect assessment tool (Course End Survey) is 20%.

Thus, CO attainment using all the tools is

Target for CO attainment

Target for CO attainment refers to the desired level of achievement or proficiency that a student is expected to reach for a particular course outcome (CO). It is should be set by the department offering the course, and it serves as a benchmark for evaluating the effectiveness of the course in achieving its intended learning outcomes.

By setting clear targets for CO attainment, course teacher and institutions can monitor student progress and make adjustments to the course as needed to ensure that students are meeting the desired learning outcomes.

Action upon CO attainment values

• **All of CO targets are not attained**

Corrective actions are taken based on the CO attainment values in order to improve the quality of education provided. If the attainment value for all COs is consistently low, it indicates that students are not achieving the expected learning outcomes for COs. In this case, the following corrective actions can be taken:

a) Teaching methodology: Teaching methodology can be evaluated and revised to ensure that it is effective and aligns with the COs. This could involve adopting new instructional methods or revising existing ones to better support student learning.

b) Assessment tools: Assessment tools can be reviewed and revised to ensure they accurately measure student learning and achievement of the COs. This could involve creating new assessment tools or revising existing ones to better align with the COs.

c) Faculty development: Faculty can be provided with professional development opportunities to enhance their teaching skills and keep up with the latest pedagogical techniques and strategies.

d) Learning resources: The availability and accessibility of learning resources can be improved to better support student learning and achievement of the COs.

e) Student support services: Student support services can be improved to provide additional assistance to students who may be struggling to achieve the COs.

By taking these corrective actions, the attainment of COs is improved, and the overall quality of education provided can be enhanced. In this case maintain the same CO targets.

- **Some of CO targets are not attained**

When deciding whether to change CO targets for the next academic year based on the attainment values, it is important to consider multiple factors. Here are some suggestions for improving this approach:

a) Analyze the distribution of CO attainment values: It's important to analyze the distribution of CO attainment values to identify any gaps or areas of improvement. For example, if some COs are consistently below the target value while others are above it, it may be more effective to focus on improving the performance in the weaker areas before changing the target value for COs.

b) Consider the difficulty level of COs: The difficulty level of COs can vary, and some COs may be more challenging than others. Therefore, it's important to consider the difficulty level of COs when deciding whether to increase the target value. COs that are already at a high level of attainment may not require an increase in the target level, whereas those that are below the target level and have higher difficulty levels may require more attention.

c) Align CO targets with program and industry standards: CO targets should be aligned with the program and industry standards to ensure that students are adequately prepared for their future careers.

By taking these factors into consideration, course teacher can make informed decisions about whether to increase the CO target values based on attainment values, and if so, how much to increase them. This approach can help ensure that CO targets are tailored to the needs of the learners and the demands of the industry, while also providing students with the necessary skills and competencies.

- **All of CO targets are attained**

When all CO targets are attained, it is important to reassess the CO targets and set new targets for the next academic year. Here are some suggestions to improve this process:

a) Analyze the CO attainment values: Before setting new CO targets, it is important to analyze the CO attainment values to identify areas of strength and areas for improvement. This analysis can help inform the setting of new targets that are challenging and realistic.

b) Consider industry and program standards: CO targets should be aligned with industry and program standards to ensure that students are well-prepared for their future careers. Therefore, it is important to consider these standards when setting new CO targets.

d) Use a data-driven approach: Setting new CO targets based on the average of all CO attainment values may be the one of the approaches. Instead, a data-driven approach that takes into account the distribution of CO attainment values and the difficulty level of each CO can help ensure that new targets are appropriately challenging and achievable.

By following these suggestions, educators can set new CO targets that are tailored to the needs of the learners and the demands of the industry. This can help ensure that students are well-prepared for their future careers and have the necessary skills and competencies to succeed.

- **CO attainment values at Maximum Level (nearly equal to 3.00)**

When CO attainment values are already at the maximum level, further improvements can still be made to the course outcomes by adopting the following strategies:

a) Increase the level of challenge: When the attainment level is already at the maximum, one way to improve the COs is to increase the level of challenge for the students. This can be achieved by adding more complex and advanced course content, assessments, and/or projects. By doing this, students can continue to learn and grow even if they have already reached the maximum attainment level.

b) Update the criteria for attainment level: When the attainment level is already at the maximum, it may be necessary to update the criteria for the attainment level to ensure that it remains challenging and relevant.

For example, new target value and criteria can be,

Attainment Level 1: 40% to 60% students scoring more than **65% marks** out of the relevant maximum marks.

Attainment Level 1: **50% to 70%** students scoring more than 60% marks out of the relevant maximum marks.

By adopting these strategies, course teacher continues to improve the course outcomes even when the attainment level is already at the maximum. It is important to remember that course outcomes should be designed to provide students with the knowledge, skills, and competencies.

B. Attainment of Program Outcomes and Program Specific Outcomes

Assessment of program outcomes (POs) and program-specific outcomes (PSOs) is an essential part of the evaluation and improvement of academic programs.

In outcome-based education, program outcomes (POs) serve as a guide for curriculum design, delivery, and assessment of student learning. To ensure alignment, a "design down" process is employed, where outcomes are cascaded from POs to Course Outcomes (COs) and outcomes for individual learning experiences.

To connect high-level learning outcomes (POs) with course content, course outcomes, and assessment, there is a need to bring further clarity and specificity to the program outcomes. This can be achieved through a two-step process of identifying competencies and defining performance indicators (PIs). Competencies are different abilities implied by program outcome statements, while PIs are explicit statements of expectations of student learning.

Once the competencies and PIs are identified, the assessment of COs for all courses is designed by connecting assessment questions to the PIs. By following this process, where examination questions map with PIs, there is better resolution for the assessment of COs and POs. Ultimately, the achievement of POs is crucial for the effectiveness of the program and needs to be proven through accurate and reliable assessments.

Assessing POs and PSOs typically involves gathering evidence of student learning, analysing that evidence, and using it to improve teaching and learning. The key steps involved in the assessment process:

1. Develop assessment criteria: Develop criteria for assessing program outcomes and PSOs. The criteria are measurable, observable, and achievable. This includes developing rubrics or other assessment tools that allow for objective and consistent evaluation.

2. Collect data: Collect data on student performance related to program outcomes and PSOs. This includes assessments of student work, surveys of student.

3. Analyse data: Analyse the data to assess how well the program is meeting its outcomes and PSOs. This include comparing student performance to the established criteria and identifying areas of strength and weakness.

4. Use results for improvement: Use the results of the assessment to identify areas where improvement is needed and develop strategies to address these areas. This involves changes teaching methods, or assessment methods or providing additional resources to students to help them meet the Program Outcomes and PSOs.

PO and PSO Assessment tools

PO (Program Outcomes) and PSO (Program Specific Outcomes) assessment tools are used to evaluate the overall effectiveness of a program and to ensure that it meets the required standards.

There are various tools and techniques that can be used to assess POs and PSOs, some of which include:

a) Direct assessment tools: These tools assess the students' achievement of POs/PSOs through internal and external assessment. Internal assessment tools include assignments, test, CAS, etc. whereas external assessment tools include university theory exams, Oral, Term work, Practical, Seminar, Project etc. Direct assessment tools are used to measure students' performance against the pre-defined performance indicators.

b) Indirect assessment tools: These tools evaluate the effectiveness of the program in terms of student satisfaction, feedback, and perception. Indirect assessment tools include surveys. Exit surveys are conducted with graduating students to evaluate the overall effectiveness of the program. Exit surveys can provide feedback on areas of strength and areas for improvement.

The tools used for assessment of POs/PSOs are same which are used for assessment of COs. These tools are defined in **Table – 1**.
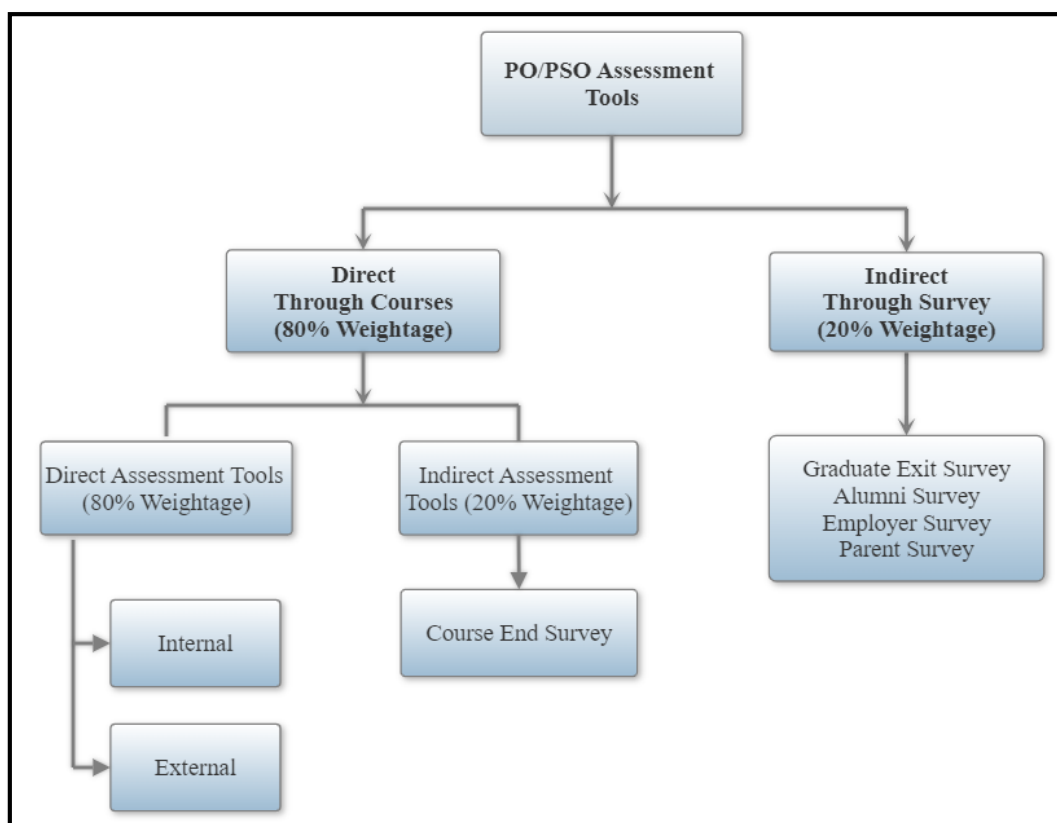
Figure 4: PO/PSO assessment tools

The steps taken are

a. Weightage Distribution: A balanced distribution of weightage is used for direct and indirect assessment methods. A suggested distribution is 80% weightage for direct assessment and 20% weightage for indirect assessment, as both methods have their own strengths and limitations.

b. Direct Assessment: Direct assessment of POs and PSOs is based on the attainment of COs, where COs are mapped to POs and PSOs.

c. Indirect Assessment: Indirect assessment of POs and PSOs is conducted through surveys targeting different stakeholders. These surveys include graduate exit survey, employer survey, parent survey, and alumni survey. The weightage for each survey is equal.

Attainment Levels of POs/PSOs

The various direct assessment tools used to evaluate COs, PO/PSOs and the frequency with which the assessment processes are carried out are listed in **Table 1**.

Tools used to evaluate PO/PSO attainment are same as that of CO attainment. Attainment Levels for internal as well as external assessment tools are also same for PO/PSO attainment and defined as;

Attainment Level 1: 20% to 60 % students scoring more than **60%** marks out of the relevant maximum marks.

Attainment Level 2: 60% to 70 % students scoring more than **60%** marks out of the relevant maximum marks.

Attainment Level 3: More than **70%** students scoring more than **60%** marks out of the relevant maximum marks.

In order to assess attainment levels of program outcomes (POs) and program-specific outcomes (PSOs), the same tools and criteria used to define course outcomes (COs) attainment levels are applied. As a result, the attainment levels of COs are used to calculate the attainment levels of PSOs and POs. Direct assessment of PSOs and POs is based on the attainment levels of COs and the degree of correlation between them.

Sample calculation for PO/PSO attainment is described in following three steps:

Step – 1

CO Attainment and CO – PO/PSO mapping is defined for course by correlation level low to high (1 to 3).

Course Outcomes	CO Attainment	Program Outcomes			
		PO1	PO2	PO3	PSO1
CO207002.1	2.5	3	1		
CO207002.2	2.8	3	2	1	1
CO207002.3	2.3	2	2		2
CO207002.4	1.5	2	1	1	1
CO207002.5	2.0	1	1		
CO207002.6	3.0	3	3		

Table 5: CO - PO Mapping

Step – 2

The program-specific outcome (PSO) or program outcome (PO) attainment is based on the level of mapping between the POs and course outcomes (COs) and the CO attainment level.

Direct PO/PSO attainment is calculated using following formula:

PO/PSO attainment = (Level of Mapping of PO with CO X CO attainment Level) / 3

Course Outcomes	CO Attainment	Program Outcomes			
		PO1	PO2	PO3	PSO1
CO207002.1	2.5	=2.5x3/3	=2.5x1/3		
CO207002.2	2.8	=2.8x3/3	=2.8x2/3	=2.8x1/3	=2.8x1/3
CO207002.3	2.3	=2.3x2/3	=2.3x2/3		=2.3x2/3
CO207002.4	1.5	=1.5x2/3	=1.5x1/3	=1.5x1/3	=1.5x1/3
CO207002.5	2.0	=2.0x1/3	=2.0x1/3		
CO207002.6	3.0	=3.0x3/3	=3.0x3/3		

Table 6: PO/PSO Attainment Calculations

Step – 3

Direct PO/PSO attainment is evaluate by taking average of PO/PSO attainment by each CO attainment.

Course Outcomes	CO Attainment	Program Outcomes			
		PO1	PO2	PO3	PSO1
CO207002.1	2.5	2.50	0.83		
CO207002.2	2.8	2.80	1.87	0.93	0.93
CO207002.3	2.3	1.53	1.53		1.53
CO207002.4	1.5	1.00	0.50	0.50	0.50
CO207002.5	2.0	0.67	0.67		
CO207002.6	3.0	3.00	3.00		
Average PO/PSO Attainment		1.92	1.40	0.72	0.99

Table 7: Average PO/PSO Attainment by Course

Using direct tools to assess PO/PSO attainment provides objective evidence of students' learning outcomes and helps department to identify areas for improvement in the program. Additionally, it allows for a more accurate evaluation of the effectiveness of the program's curriculum, instructional methods, and teaching strategies.

Attainment of POs/PSOs through Indirect Tools

Indirect tools provide valuable information about students' perceptions of their learning experiences and the extent to which they perceive that they have achieved program outcomes. While indirect tools have limitations, they can provide valuable insights into students' experiences and perceptions of the program, as well as how well it aligns with the needs of employers and the community.

By combining direct and indirect tools, department gain a more comprehensive understanding of the program's effectiveness in achieving its intended learning outcomes.

Graduate Exit Survey, Employer Survey, Parents Feedback and Alumni Survey are conducted at the end of program and equal weightage is given each.

The department conducts surveys using a relevant questionnaire in order to assess the attainment of Program Outcomes (POs) and Program Specific Outcomes (PSOs). The questionnaire provides 5 response options, namely Excellent, Very Good, Good, Average, and Poor, which are assigned scores of 5, 4, 3, 2, and 1, respectively. The survey results are then tabulated, and the average scores for each PO and PSO are calculated. To determine the attainment level for each PO and PSO, the average score is converted to a scale of 0 to 3.

For indirect PO/PSO attainment 20% weightage is given.

Total PO/PSO attainment is calculated as:

Direct Attainment by all courses X 0.8 + Indirect Attainment X 0.2

The templets used to execute different surveys are as follows.

Graduate Exit Survey: Relevant questionnaire in graduate Exit survey form to evaluate attainment of POs and PSOs is given in section (i) and relation of POs & PSOs with questionnaire is given in section (ii).

i. Questionnaire Format:

Kindly rate the following criteria on a scale of 1-5. Your genuine response will be helpful for the continuous quality improvement of our UG programme.

5. Excellent 4. Very Good 3. Good 2. Average 1. Poor

Q No.	Question
Q1	Ability acquired by you to apply knowledge of Mathematics, Science and Engineering in real time from value added certifications, workshops and training programs conducted during your stay in college.
Q2	Ability acquired to apply engineering knowledge to design experiments, analyze and interpret data to obtain valid conclusions.
Q3	Ability to identify and design a solution for mechanical engineering problem with an appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.
Q4	Ability acquired to conveniently investigate complex problems using research-oriented knowledge and methods to provide appropriate solution through design-oriented courses and project.
Q5	Ability to use techniques, skills and modern engineering and IT tools necessary for engineering practice through internship, state of art labs.
Q6	Ability to grasp the impact of professional engineering solutions in the context of society and environment and apply it for sustainable development.

Q7	Ability to understand that you have about the available resources and ensure judicious use of them without affecting the environment for sustainable progress.
Q8	Ability to apply ethical principles and commitment to professional ethics and responsibilities acquired through courses, project, seminar and Gymkhana activities.
Q9	Ability acquired to lead team / work in team / work as an individual gained from the co-curricular and extracurricular activities.
Q10	Ability developed to communicate effectively, write precise reports, design documentation applying the engineering knowledge, speaking in a large group which you have acquired.
Q11	Ability to do interdisciplinary projects and carry them out in time and utilize fund in a meaningful way with the training provided by the department, through various activities of student chapter such as BAJA, SUPRA, ET.
Q12	Ability to work as a successful self-reliant engineer with the training provided by department, entrepreneurship development cell, Innovation cell and Audit courses etc.
Q13	Competencies acquired in design and develop mechanical elements and systems.
Q14	Skills developed to specify and select materials, processes to manufacture and inspect quality of industrial product.
Q15	Ability acquired to analyze and evaluate performance of thermal system.

ii. Relation of POs and PSOs with questionnaire

Question	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Question	Q9	Q10	Q11	Q12	Q13	Q14	Q15	
PO/PSO	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO	

Alumni Survey: Feedback is taken from alumni. Relevant questionnaire in alumni survey form to evaluate attainment of POs and PSOs is given in section (i) and relation of POs & PSOs with questionnaire is given in section (ii).

i. Questionnaire Format:

Kindly rate the following criteria on a scale of 1-5. Your genuine response will be helpful for the continuous quality improvement of our UG programme

5. Excellent 4. Very Good 3. Good 2. Average 1. Poor

Q. No.	Question
Q1	Your ability to apply knowledge and design and analyse Mechanical system or process to meet desired specifications and needs.

Q2	Benefit from value added certifications, workshops and training programmes conducted during your course.
Q3	Your ability to use techniques, skills and modern engineering tools necessary for engineering practice.
Q4	Benefit from communication skills, presentation skills and leadership qualities gained from the co-curricular and extracurricular activities.
Q5	Your ability to engage in, to resolve contemporary issues and acquire lifelong learning.
Q6	Skills attained to create, select and apply appropriate techniques, resources and modern engineering and IT tools.
Q7	Extent of Ethical, social and environmental values inculcated, helping you to relate Mechanical engineering issues with societal needs.
Q8	Ability acquires to meet the industry needs.

ii. Relation of POs and PSOs with questionnaire

Question	Q1	Q2	Q3	Q4
PO/PSO	PO1, PO3	PO1, PO5	PO5, PO11	PO9, PO10
Question	Q5	Q6	Q7	Q8
PO/PSO	PO12	PO2, PO4	PO6, PO7, PO8	PSO1, PSO2, PSO3

Employer Survey: Feedback is taken from employer. Relevant questionnaire in employer survey form to evaluate attainment of POs and PSOs is given in section (i) and relation of POs & PSOs with questionnaire is given in section (ii).

i. Questionnaire Format:

Kindly rate the following criteria on a scale of 1-5. Your genuine response will be helpful for the continuous quality improvement of our UG programme

5: Strongly Agree, 4: Agree, 3: Moderate, 2: Disagree, 1: Strongly Disagree

Q No.	Parameters
Q1	AISSMS COE *Mechanical* Engineering graduate exhibits an ability to apply engineering knowledge to design and develop the product.
Q2	AISSMS COE *Mechanical* Engineering graduate has the ability to communicate effectively both written and verbal communication
Q3	AISSMS COE *Mechanical* Engineering graduate is well aware of Modern Engineering Tools(PO5)
Q4	AISSMS COE *Mechanical* Engineering graduate has an understanding of ethical and social responsibility

Q5	AISSMS COE *Mechanical* Engineering graduate has desire for learning new areas, engaging in professional development, and adapting to technological changes to solve complex engineering problems
Q6	AISSMS COE *Mechanical* Engineering graduate has an ability to function as a member or leader in multi-disciplinary teams
Q7	AISSMS COE *Mechanical* Engineering graduate has an ability to manage multidisciplinary projects
Q8	AISSMS COE *Mechanical* Engineering graduate is able to provide solutions to societal problems for sustainable development.
Q9	*AISSMS COE Mechanical Engineering graduate* have competencies in usage of modern tools to optimally design, develop and manufacture product and/or process
Q10	*AISSMS COE Mechanical Engineering graduate* have skills to enhance employability in the automotive and thermal engineering fields.

i. Relation of POs and PSOs with questionnaire

Question	Q1	Q2	Q3	Q4	Q5
PO	PO1, PO2, PO3, PO4	PO 10	PO 5	PO 8, PO6	PO 12
Question	Q6	Q7	Q8	Q9	Q10
PSO	PO 9	PO 11	PO 7	PSO 1	PSO 2

Parent Feedback: Parent feedback is taken to signify holistic development of their ward through a conducive teaching-learning environment. Relevant questionnaire in parent feedback form to evaluate attainment of POs is given in section (i) and relation of POs with questionnaire is given in section (ii).

i. Questionnaire Format:

Kindly rate the following criteria on a scale of 1-5. Your genuine response will be helpful for the continuous quality improvement of our UG programme

5: Strongly Agree, 4: Agree, 3: Moderate, 2: Disagree, 1: Strongly Disagree

Q. No.	Parameter
Q1	My ward has gained Engineering knowledge through teaching learning process at the institute.
Q2	My ward will be able to pursue research and higher studies.
Q3	Co-curricular and Extra-curricular activities conducted in institute helped to develop my wards communication, leadership and team work skills.
Q4	My ward is aware of social, cultural, environmental, global, public health and safety related issues and tries to resolve them.
Q5	My ward has ability to manage activities and financial issues.

Q6	My ward follows professional ethics.
Q7	My ward is able to use modern tools and techniques.
Q8	My ward converted into a lifelong learner.
Q9	My ward has professional abilities to meet industrial needs

ii. Relation of POs and PSOs with questionnaire

Question	Q1	Q2	Q3	Q4	Q5
PO	PO 1	PO 2, PO 3, PO 4	PO 9, PO10	PO 6, PO7	PO11
Question	Q6	Q7	Q 8	Q9	
PO	PO8	PO 5	PO 12	PSO1, PSO2	