Course Outcomes (CO's):
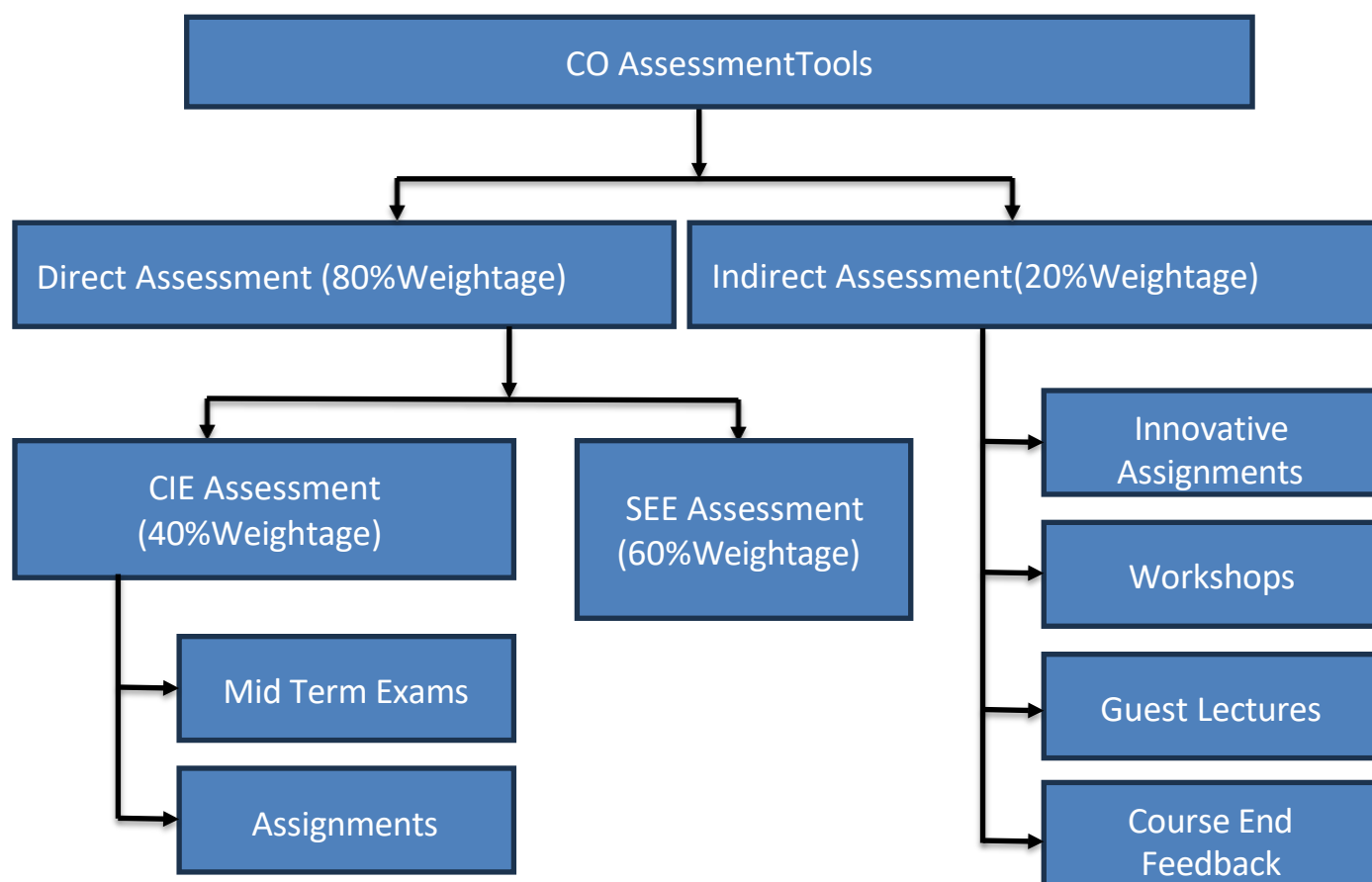
Course Outcome (CO) evaluation is a structured process that measures student performance and learning effectiveness using various assessment tools. The evaluation considers multiple components, including internal assessments, semester-end examinations, course-end feedback, innovative assignments, workshops, and guest lectures. These elements ensure a comprehensive understanding of the student's grasp ofthe subjectmatter andskill development. Toachieve abalanced andeffective assessment, two measurement tools are adopted for CO assessment: direct assessment tools and indirect assessment tools.

<u>CO Assessment Tools</u>

The assessment tools used for assessment of course outcomes are presented below :-

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                        ┌─────────────────────────┐
                        │   CO AssessmentTools     │
                        └─────────────────────────┘
                   ┌──────────────┴───────────────┐
      ┌────────────────────────────┐  ┌────────────────────────────────┐
      │ Direct Assessment          │  │ Indirect Assessment            │
      │ (80%Weightage)             │  │ (20%Weightage)                 │
      └────────────────────────────┘  └────────────────────────────────┘
        ┌──────────┴──────────┐              │
  ┌──────────────┐   ┌──────────────┐   ┌──────────────────────┐
  │ CIE          │   │ SEE          │   │ Innovative           │
  │ Assessment   │   │ Assessment   │   │ Assignments          │
  │ (40%Weightage)│  │ (60%Weightage)│  └──────────────────────┘
  └──────────────┘   └──────────────┘   ┌──────────────────────┐
    ┌─────────────────┐                 │ Workshops            │
    │ Mid Term Exams  │                 └──────────────────────┘
    └─────────────────┘                 ┌──────────────────────┐
    ┌─────────────────┐                 │ Guest Lectures       │
    │ Assignments     │                 └──────────────────────┘
    └─────────────────┘                 ┌──────────────────────┐
                                        │ Course End Feedback  │
                                        └──────────────────────┘
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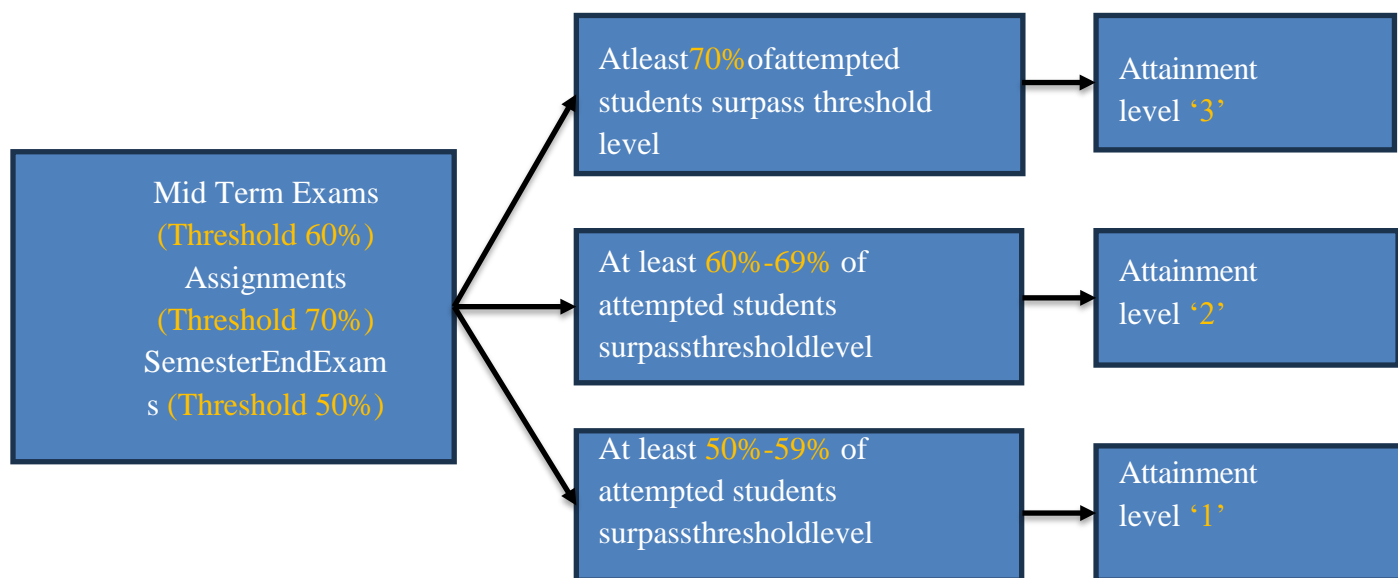
1. **Direct Assessment Tools (80% Weightage):** These include internal assessments and semester-end examinations, which provide measurable performance data. Internal assessments, such as assignments and mid-semester exams, contribute 40% to the total CO attainment, while the semester-end examination contributes 60% to the final CO attainment. This proportion ensures a holistic evaluation of students based on continuous assessment and final examination performance. The various assessment methods used to gather the data for evaluation of course outcomes using direct assessment are as follows.

i. **Internal (Mid) Examinations:** Two Mid Examinations are conducted in each semester as per the university prescribed norms. Mid-1 is conducted from first two and half units of the course syllabus and Mid-2 is conducted from remaining two and half units. Each Mid exam, comprises two parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. It is expected that a student should score at least 1 mark out of total 2 marks for the attainment of that course outcome. Part-B consists of 3 essay questions carrying five marks each with internal choice; the student has to answer all 3 questions. It is expected that a student should score at least 3 marks out of total 5 marks for the attainment of that course outcome.

ii. **Assignment Questions:** 5 questions are given in each assignment. Each question is mapped to one or more course outcomes. Each question carries 1 mark. It is expected that a student should score at least 70% for the attainment of that course outcome. Two assignments are conducted for each course during a semester.

iii. **Semester end examinations:** SEE question paper comprises of Part-A and Part-B with duration of three hours. Part-A is compulsory and consists often questions (two from each unit) of 2 marks each. Part-B consists of five questions (numbered from11 to 15) carrying10 marks each. One question from each unit (may contain sub-questions) with internal choice. Since the answer scripts are retained by the university, the information regarding the attainment evelsof each course outcome cannot be ascertained. However, the marks scored by the students in the end semester examination are used to assess the attainment level of the whole course and the same is transferred to each course outcome attainment level, while calculating the overall attainment level. It is expected that a student should score at least 50% of the maximum marks of the course (i.e. 35 out of 70) for the attainment of course outcomes.

2. **Indirect Assessment Tools (20% Weightage):** These include course-end feedback, innovative assignments, workshops, and guest lectures. These tools gather qualitative insights into student learning experiences and engagement, helping improve teaching methodologies and curriculum effectiveness. Rubrics are developed for assessment of various activities like Innovative assignments, Guest Lectures, Workshops etc. Several activities of the illustrated ones have been prescribedfor all the courses, however the activities for all the courses are not necessarily be the same.

MeasurementofCOAttainments

The attainment of Course Outcomes (COs) is measured by analyzing student performance across various assessment components such as mid-term exams, assignments, and semester-end exams (SEE). Each question in the mid-term exams and assignments is explicitly mapped to specific COs, allowing for a detailed evaluation of student understanding concerning each outcome. However, as question-wise marks distribution in SEE is not available, the entire SEE assessment is considered as a holistic measure contributing equallyto all COsof thecourse. Theformat adoptedfordatacollection is presented in table below.

S.No	Reg.No	MIDTermThreshold60%											ASSIGNMENTThreshold70%					SEE Threshold 50%
		MIQ1 2	MIQ2 2	MIQ3 2	MIQ4 2	MIQ5 2	MIQ6 5	MIQ7 5	MIQ8 5	MIQ9 5	MIQ10 5	MIQ11 15	AIQ1 1	AIQ2 1	AIQ3 1	AIQ4 1	AIQ51	SEE (70M)
1	208R1A0501						4			5	2		1	1	1	1	1	10
2	208R1A0502					2	4			5	5	3	1	1	1	1	1	26
3	208R1A0503	2	2	1	2	2				2	5	4	1	1	1	1	1	13
4	208R1A0504	2	1	0	0	0	4		3	5	5	5	1	1	1	1	1	26
5	208R1A0505	2		1	1		5	4	5	5	1		1	1	1	1	1	25
6	208R1A0506	2	2	1	1	2		5		5	5	5	1	1	1	1	1	50
7	208R1A0507						1	2	0	1	5	3	1	1	1	1	1	9
8	208R1A0508	2	2	1	2	2	5		5	5		4	1	1	1	1	1	26
9	208R1A0509	2	1	2	1	1	5			5			1	1	1	1	1	27
10	208R1A0510	2			2		3	5					1	1	1	1	1	17
	COMAPPING	CO1	CO1	CO2	CO3	CO3	CO1	CO1	CO2	CO2	CO3	CO3	CO1	CO1	CO2	CO2	CO3	AllCOs
	ATTAINMENT LEVELS	3.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0

The attainment levels obtained in above table are categorized into three distinct levels: Level 1 (Low), Level 2 (Medium), and Level 3 (High). These levels are determined based on predefined performance benchmarks/ threshold levels, usually expressed as a percentage of students achieving a minimum required score in each CO-mapped assessment tool as presented in figure below.

```mermaid
graph LR
    A[Mid Term Exams<br>(Threshold 60%)<br>Assignments<br>(Threshold 70%)<br>SemesterEndExams<br>(Threshold 50%)] --> B[Atleast 70% of attempted students surpass threshold level]
    A --> C[At least 60%-69% of attempted students surpassthresholdlevel]
    A --> D[At least 50%-59% of attempted students surpassthresholdlevel]
    B --> E[Attainment level '3']
    C --> F[Attainment level '2']
    D --> G[Attainment level '1']
```

Theattainment of Course Outcomes (COs)from Continuous InternalEvaluation (CIE)is determined by averaging the attainment levels of various CO-mapped assessment methods. Since the Semester End Examination (SEE) does not provide question-wise marks, its attainment level is distributed equally across all CO's. To compute the Direct CO Attainment, a weighted formula is used:

DirectCOAttainment=(40%of COattainmentfromCIE)+
(60%ofCOattainmentfromSEE)

Inadditiontodirectassessment,IndirectCOAttainmentismeasuredusingvariousindirect assessment tools, evaluated through rubrics.

FinalCOAttainment=(80%ofDirectCOattainment)+(20%ofIndirectCOattainment)

This weightedapproach ensuresa comprehensive evaluation ofstudent learning outcomes,integrating both performance-based and perception-based assessments. The process of CO attainment calculation described above is presented in table below.

ASSESSMENTOFCO'sFORTHECOURSE									
CO	**DIRECTASSESSMENT**					**INDIRECTASSESSMENT**			**Final COAttainment**
	Method	**Value**	**CO Attainment CIE**	**CO Attainment SEE**	**CO DirectAttainment**	**Method**	**Value**	**Indirect CO Attainment**	
CO1	MI Q1	3.0	3.00	1.00	1.80	P1	3	3	2.04
	MI Q2	3.0				P2	3		
	MI Q6	3.0				P3	3		
	MI Q7	3.0				P4	3		
	AI Q1	3.0				P5	3		
	AI Q2	3.0				P6	3		
CO2	MI Q3	3.0	2.80	1.00	1.72	P1	3	3	1.98
	MI Q8	3.0				P2	3		
	MI Q9	3.0				P3	3		
	AI Q3	3.0				P4	3		
	AI Q4	3.0				P5	3		

Target for CO Attainment

The target level for Course Outcomes (CO's) attainment of a course is determined based onpercentage of students who scored above the average marks of that course. This benchmark helps in assessing how effectively students have grasped the intended learning outcomes. If the predefined target is met, it indicates satisfactory student performance. However, if the target is not achieved, it highlights gapsin understanding and instructional effectiveness. Based on this analysis, educators can refine their teaching strategies, introduce newmethodologies, and implement corrective actions in the next academic year to enhance student learning, engagement, and overall academic performance.

% of students scored More than average marks in a course → CO Target
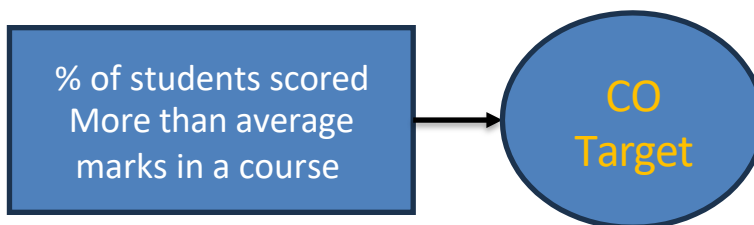
Attainment of Program Outcomes and Program Specific Outcomes

The assessment of Program Outcomes (POs) and Program-Specific Outcomes (PSOs) is carried out using a well-defined set of assessment tools to ensure a comprehensive evaluation of students' knowledge, skills, and competencies. These assessment tools help in measuring the extent to which the desired educational objectives are achieved and identifying areas for improvement.

PO Assessment Tools
The assessment tools used for assessment of Program Outcomes are presented in flowchart below.
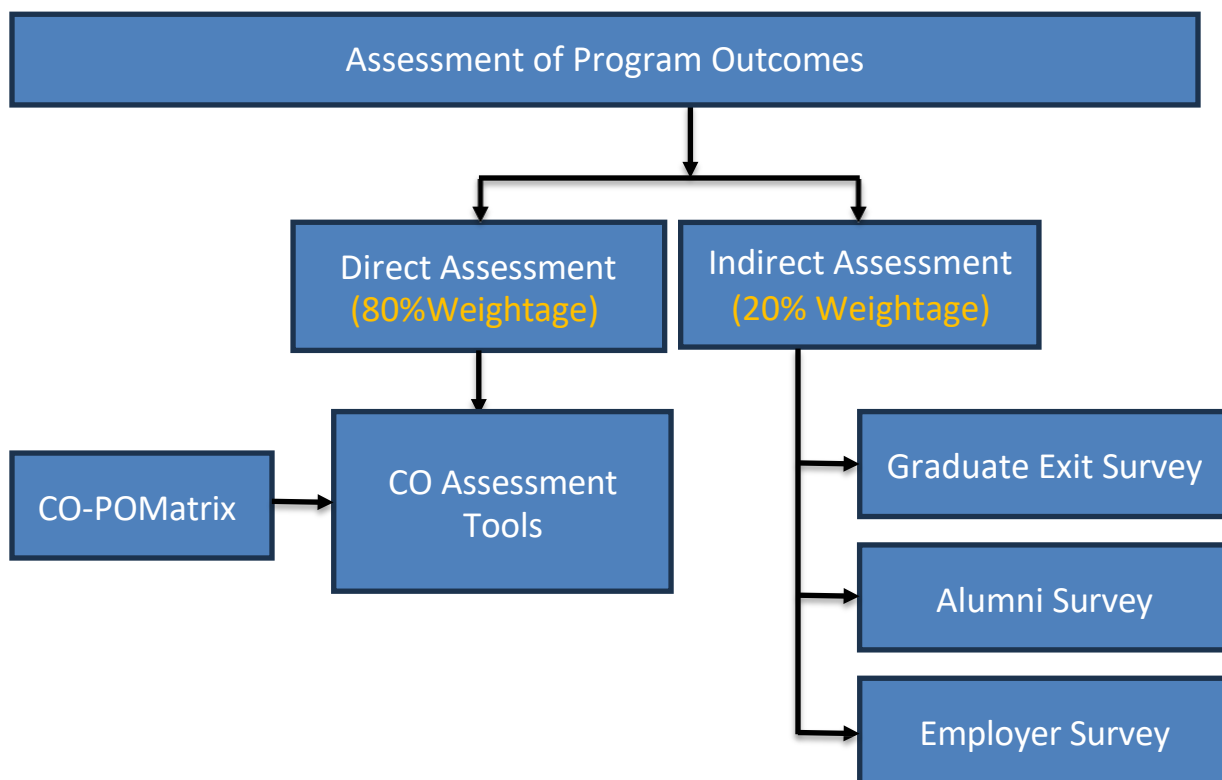
i.   Direct Assessment Tools (80%Weightage)
Direct assessment tools involve objective measures that evaluate students' actual performance based on assessment methods adopted for CO assessment and CO-PO articulation matrix. The reassessments provide concrete evidence of learning and are aligned with predefined criteria.

ii.   Indirect Assessment Tools (20%Weightage)
Indirect assessment tools play crucial role in evaluating the effectiveness of an academic program by gathering qualitative and quantitative feedback from various stakeholders. Unlike direct assessment tools that measure students' actual performance, indirect tools focus on perceptions, experiences, and overall satisfaction with the learning process. These tools provide valuable insights

into how well the curriculum prepares students for real-world challenges and helps in identifying areas for improvement. Following surveys are conducted as a part of indirect PO assessment,

a. **Graduate Exit Survey**, which captures students' reflections on their learning journey at the time of graduation day. It allows students to share feedback on course content and overall satisfaction with the program. This helps institutions assess whether learning objectives have been met from the students' perspective.

b. **Alumni Survey** is another essential tool that evaluates how well the program has prepared graduates for their careers. It gathers feedback at time of alumni meet on employability, skill applicability, industry relevance, and career growth, offering insights into the long-term impact of education.

c. **Employer Survey** collects feedback from industry professionals at the time of campus placement drives regarding graduates' competencies, workplace readiness, and technical and soft skills. This helps institutions align their curriculum with industry needs, ensuring students are better prepared for professional success.

Measurement of PO Attainments

The attainment of Program Outcomes (POs) contributed by course outcome of a course is measured by analyzing student performance across various CO assessment components such as mid-term exams, assignments, and semester-end exams (SEE). Each CO of a course is mapped to one or more PO's based on performance indicators and graduate competencies. This value of direct PO attainment is calculated as average of CO attainment values of CO's mapped to that PO as shown in table below,

Assessment Of PO's & PSO's Through The Course			
PO	CO	CO Attainment	PO Attainment
PO1	CO1	2.04	1.82
	CO2	1.98	
	CO3	1.56	
	CO4	1.98	
	CO5	1.56	
PO2	CO1	2.04	1.84
	CO2	1.98	
	CO3	1.56	
	CO4	2.04	
	CO5	1.56	

From the above table, attainment level of each PO and PSO is determined for a particular course. This way for all the courses under direct assessment, the PO attainment levels are

determined. The overall attainment level of each PO and PSO is obtained by taking the average value of the mapped courses PO's / PSO's attainment levels. The following table illustrates the process.

EachPO/PSOattainmentusingindirectassessmenttoolsistheaverageofallattainmentvalues obtained from survey forms like graduate exit survey, alumni survey and employer survey.

The final PO attainment value of each PO/PSOiscalculatedbygiving80%weightagetodirect PO attained values and 20% weightage to indirect PO attained values.

Final PO Attainment= (80%of Direct PO attainment)+(20%of Indirect PO attainment)
Target for PO Attainment
The process adopted for fixing the target for each of the program outcomes is shown in figure below.
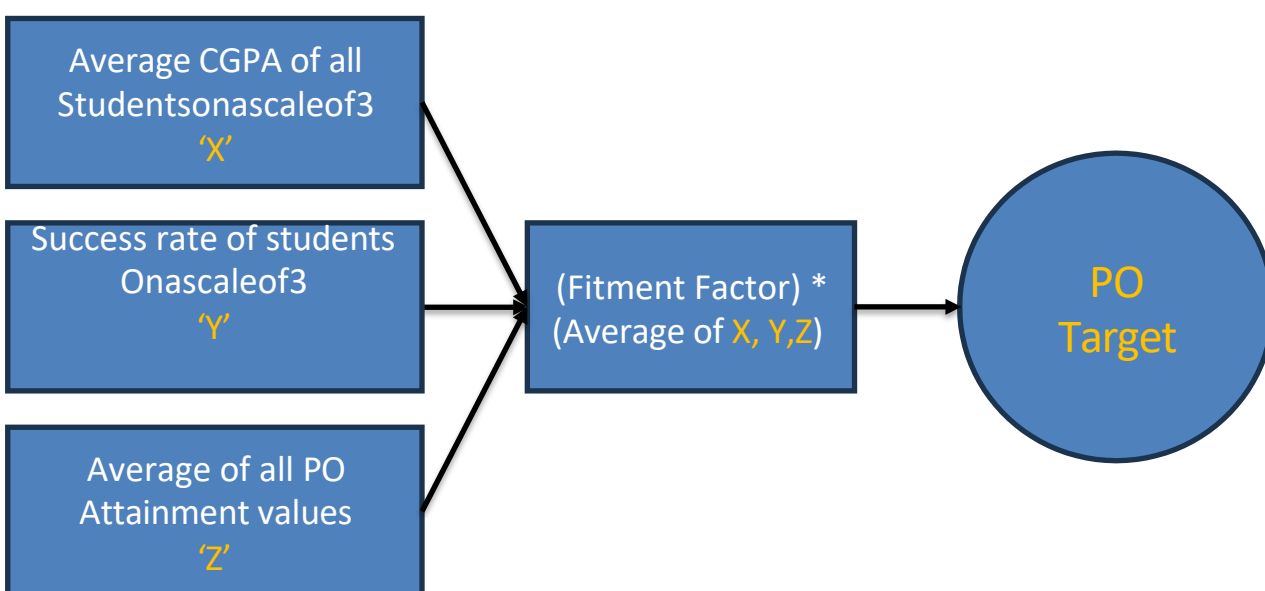
Following tools are adapted in calculating PO target value.
1. Student results of current assessment year
2. Success rate of current assessment year
3. Program Outcome average of current assessment year

1. **Student results of current assessment year:**
   CGPA grade point 'X' is calculated by considering the current assessment year student results as described below.
   i.   Calculate the sum of CGPA scores of all the successful graduates of current assessment year.
   ii.   Divide the above obtained CGPA sum with number of successful graduates, which will be CGPA grade points on a scale of 10.

     iii.   Calculate CGPA grade points on a scale of 3 from CGPA grade points on a scale of10.

     iv.   Consider this grade point as X.

2. **Success rate of current assessment year:**
   CGPA grade point 'Y' is calculated by considering the current assessment year success rate as described below.
   - i.   Consider the successful graduates and total number of students attempted final semester examination of current assessment year.
   - ii.   Success rate =Number of successful graduates /Total number of students attempted final year examination
   - iii.   Grade point Y= Success rate*3

3. **Program Outcome average of current assessment year:**
   CGPA grade point 'Z' is calculated by considering the current assessment year average PO value as described below.
   - i.   Consider the PO attainment values of the current assessment year.
   - ii.   Grade point Z= Average of all the PO attainment values of the current assessment year.

The final PO target value is calculated as,

PO Target=Fitment Factor*(X+Y+Z)/3

Where Fitment Factor is average of scale points (on a scale of 3) takenas feedback from different stake holders like Employers and Alumni.

This benchmark helps in assessing how effectively students have grasped the intended program outcomes. If the predefined target is met, it indicates satisfactory student performance. However, if the target is not achieved, it highlights gaps in assessment methods and instructional effectiveness. Based on this analysis, educators can refine content delivery methods and assessment methods for the next academic year.

Attainment of Program Outcomes of all Courses

PO attainment value using direct assessment tools

PO Attainments for 2023-24 Passed Out Batch(R20)													
Course Code	**COURSE NAME**	**Program Outcomes (PO's) &(PSO'S)**											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
C101	Linear Algebra and Calculus	2.45	2.45										2.45
C102	Applied Physics	1.54	1.54	1.54	1.52	1.54	1.54						1.53
C103	Programming for Problem Solving	1.37	1.37	1.37	1.37	1.37	1.37			1.27			1.27
C418	Project -II	3.00	3.00	3.00	3.00	3.00	2.00	3.00	1.00	3.00	2.00	3.00	3.00
	Sum	175	170	163	155	151	103	17	81	108	108	99	147
	MAPPED COUNT	67	65	63	59	58	40	6	31	41	41	38	56
	Direct PO Attainment (X)	**2.61**	**2.61**	**2.59**	**2.63**	**2.61**	**2.57**	**2.83**	**2.60**	**2.63**	**2.63**	**2.61**	**2.63**
	Indirect PO Attainment (Z)(Through Activities)	**2.50**	**2.26**	**2.25**	**1.90**	**2.23**	**1.50**	**0.80**	**1.40**	**2.20**	**2.30**	**2.50**	**2.50**
	Final PO Attainment (X*80% + Y*10%+Z*10%)	**2.58**	**2.55**	**2.53**	**2.52**	**2.51**	**2.39**	**2.40**	**2.41**	**2.54**	**2.57**	**2.58**	**2.59**
	Target	**2.37**											