Outcome Based Education
Assessment Manual

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Course Outcomes Assessment Process

Student learning outcomes articulate what a student should know or can do after completing a course or program. The assessment of student learning outcomes provides information that puts student learning at the forefront of academic planning processes

Target for COs:

Targets for each course outcome is set as the average value of the mapping of all POs corresponding to a course. Sample sheet showing the target value calculation for Engineering Mathematics - I

Course	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Target
Engineering Mathematics-I	C112.1	2	3	-	-	-	-	-	-	-	-	-	-	2.5
	C112.2	2	3	-	-	-	-	-	-	-	-	-	-	2.5
	C112.3	2	3	-	-	-	-	-	-	-	-	-	-	2.5
	C112.4	2	3	-	-	-	-	-	-	-	-	-	-	2.5
	C112.5	2	3	-	-	-	-	-	-	-	-	-	-	2.5
	C112.6	2	3	-	-	-	-	-	-	-	-	-	-	2.5

Assessment tools are categorized into two methods to assess the course outcomes as direct methods and indirect methods.

O **Direct methods** display the student's knowledge and skills from their performance in the continuous internal assessment tests, assignments, semester examinations, seminars, and class room and laboratory tests, etc. These methods provide a sample of what students know and/or can do and provide strong evidence of student learning.

O **Indirect methods** such as surveys and interviews ask the stakeholders to reflect on student's learning. They assess opinions or thoughts about the graduate's knowledge or skills of different stakeholders.

Direct Assessment:

Direct attainment of COs can be determined from the performances of students in all the relevant assessment instruments. Mainly it is divided in to two categories and they are

➢ Internal Assessment
➢ External Assessment.

30% of weightage to internal assessment and 70% weightage to external assessment are assigned.

Internal Assessment:

Internal Assessment methods and their description are given in the following table

Table 1: Internal Assessment Tools

S. No.	Internal Assessment Method	Description
1	Mid Examinations	As per the institute regulations, two mid exams will be conducted for every course in a semester. Each mid exam is conducted after every 2 months and is useful to assess the student performance at the middle and end of the semester. In mid examinations questions are given to cover the respective COs. As the information on performance in mid examination of each student for individual COs is available, the department can determine the attainment of each course outcome separately through mid-examinations.
2	Assignments	The assignment is a qualitative performance assessment tool designed to assess students' knowledge of engineering practices, framework, and problem solving. In this regulation, a total of 2 assignments will be given to the students. Assignments will be given by the faculty members themselves. Hence assignments are given to cover the entire COs. As the information on performance in assignments on each student in individual COs is available, the department can determine the attainment of each course outcome separately through assignments.
3	Online (Quiz) Examinations	Multiple Choice Questions (MCQ) based examination system provides an easy-to-use environment for both test conductors and students appearing for examination. This examination is conducted by the university and department has no provision to set the question paper and the department will have access only to the marks obtained by each student in the course. As the information on performance in online examination on each student in individual COs is not available, the attainment value is taken uniformly for the respective COs.
4	Class Tests	Class tests are to test the performance of the student regularly. Total of two class tests are conducted per semester and the marks obtained are used for assessment. These class tests are useful for assessing the Course Outcomes.

Level of attainment for each CO is determined separately from every assessment tool and the weighted average of all the levels is taken as the final CO attainment level in internal assessment.

30% weightage of internal assessment is subdivided among all the internal assessment tools as follows

<div>

      Mid Examinations - 15%

      Class Tests   - 5%

      Assignments   - 5%

      Quiz Exam   - 5%

</div>

Frequency of Assessment

The frequency of assessment is shown in the following table.

Table 2: Internal Assessment Frequency

S. No.	Internal Assessment Method	Frequency
1	Mid Examinations	Two mid exams are conducted for every course in a semester. Each mid exam is conducted after every two months duration.
2	Assignments	Total of two assignments are given. Assignment 1 is given for the syllabus related to Mid-1 and Assignment 2 is given for the syllabus related to Mid-2.
3	Online (Quiz) Examinations	Two Online exams are conducted per semester along with mid exams.
4	Class Tests	Total of 2 class tests are conducted per semester. Each class test is conducted before the two weeks of Mid Exam Commencement.

External Assessment

External assessment is determined based on the performance of the students in the exams conducted by the institute. External assessment is carried out based on

- ➢ Semester End Examination is conducted and evaluated by the institute.
- ➢ Assessment is done for individual course outcome based on the performance of the student in the semester end examination.

For the detailed assessment division, table 3 indicates the subdivision of assessment tools that are related to the individual CO.

Table 3: Subdivision of assessment components

Course Outcome	Mid 1	Mid 2	Assignments	Class Tests	Quiz	Semester End Exam
CO1	Q1a,Q1b or Q2a,Q2b		A1	C1	Q1	Q2a,Q2b or Q3a,Q3b
CO2	Q3a,Q3b or Q4a,Q4b		A1	C1	Q1	Q4a,Q4b or Q5a,Q5b
CO3	Q5a,Q5b		A1	C1	Q1	Q6a,Q6b or Q7a,Q7b
CO4		Q1a,Q1b	A2	C2	Q2	Q6a,Q6b or Q7a,Q7b
CO5		Q2a,Q2b or Q3a,Q3b	A2	C2	Q2	Q8a,Q8b or Q9a,Q9b
CO6		Q4a,Q4b or Q5a,Q5b	A2	C2	Q2	Q10a,Q10b or Q11a,Q11b
Weightage	15%		5%	5%	5%	70%

As indicated in the Table 3, for Mid-1 there are five questions with subdivision among the questions. Q1a, Q1b or Q2a, Q2b are based on course content related to CO1 & CO2, Q3a, Q3b or Q4a, Q4b are related to CO3 and Q5a, Q5b are related to CO4. Similarly, Questions in Mid-2 are based on course content related to CO4, CO5 & CO6.The marks obtained by the students are used to asses COs.

Similarly, Assignments, Quiz exam and Class test marks are also used for assessing COs as indicated in Table 3.

As indicated in the Table 3 total ten numbers of questions are given, out of which five best answered questions marks are used to assess the individual CO.

Rubrics for CO Assessment
 ➢ Percentage of marks obtained by each student in each assessment tool is calculated.
 ➢ Course Outcome will be achieved by the student if he/she scores more than 45% of marks in the corresponding assessment tool related to that CO.
 ➢ Level is determined for each CO from each tool after measuring the percentage of students scoring more than set target percentage of marks based on rubrics as shown in table 4.

4: Rubrics for CO Attainment level

S.No.	Level	Description
1	3	If more than 80% of the students score above set target level
2	2	If more than 70% of the students score above set target level
3	1	If less than 70% of the students score above set target level

 ➢ The overall CO level is determined by the weighted average of levels of attainment of that CO from all the internal and external assessment tools

Overall CO Level = (0.15* level from Mid exam) +(0.05*level from class test) + (0.05*level from assignment) + (0.05* level from Quiz) +(0.7*level from University End Examination)
The CO attainment levels for all the courses in the program are to be determined using the same procedure as described above.

Assessment Form

An assessment form is developed in excel sheet. The excel sheet contains four sheets and the details of each sheet is given below
 • Sheet 1 contains the details of the maximum marks assigned to each assessment tool
 • Sheet 2 contains the details of the marks obtained by each student for each question/tool in the internal examinations
 • Sheet 3 contains the details of the marks obtained by each student for each question in the external examinations
 • Sheet 4 contains the summary and assessment of course outcomes

Sample Assessment Sheet
Sheet 1

Sheet 1 shows the maximum marks distribution for each question for each tool.

Class	Course	Q1aM1	Q1bM1	Q2a M1	Q2b M1	Q3a M1	Q3b M1	Q4a M1	Q4b M1	Q5a M1	Q5b M1	......	Q1 FE	Q2a FE	Q2b FE	Q11a FE	Q11b FE	CLASS
I ME-B	EC	10	0	10	0	10	0	10	0	10	0		10	4	8	6	6	36
I ME-B	EC	10	0	10	0	10	0	10	0	10	0		10	4	8	6	6	36

Fig. 1 Sheet including the maximum marks

Sheet 2

Sheet 2 shows the consolidated marks obtained by each student in each internal assessment tool.

No.of Students	Course	Name o fthe Faculty	Academic Year	Semester	Class	Program	RegdNo	Name	Q1a M1	Q1b M1	Q1 M1%	>45%	Or	Q2a M1	Q2b M1	Q2 M1 %	>45%	Q1or Q2 M1 %	>45%	....	CT2	CT2 %	>45%
36						Maximum			10	0	100			10	0	100		100			5	100	
36	EC	P.SILPA	2018-2019	ODD	I ME-B	B.Tech. In ME	18K61A0337	I. LALITH RAM PAVAN	6	0	60	Y		0	0	0	N	60	Y		4	80	Y
36	EC	P.SILPA	2018-2019	ODD	I ME-B	B.Tech. In ME	18K61A0371	P. RAMAKRISHNA PRASAD	7	0	70	Y		0	0	0	N	70	Y		3	60	Y
36	EC	P.SILPA	2018-2019	ODD	I ME-B	B.Tech. In ME	18K61A0372	P. VEERA GANGADHAR	9	0	90	Y		0	0	0	N	90	Y		5	100	Y
									31							7		35				18	
									86.11							19.44		97.22				50.00	
							LEVEL		3							1		3				1	
									Q1 M1							Q2M1		Q1or Q2 M1				CT2	

Fig. 2 Sheet including the marks obtained for each question in internal exams

Sheet 3

Sheet 3 shows the consolidated marks obtained by each student in external assessment.

No.of Students	Class	Course	RegdNo	Name	Q1	Q1 %	>45%	Q2a	Q2b	Q2 %	>45%	Q2or Q3 %	>45%	.....	Q11a	Q11b	Q11 %	>45%	Q10or Q11 %	>45%
					10	100		4	8	100		100			6	6	100		100	
36	I ME-B	EC	18K61A0337	I. LALITH RAM PAVAN	2	20	N	3	5	66.66667	Y	66.66667	Y		0	0	0	N	25	N
36	I ME-B	EC	18K61A0371	P. RAMAKRISHNA PRASAD	3	30	N	4	8	100	Y	100	Y		0	0	0	N	66.66667	Y
36	I ME-B	EC	18K61A0372	P. VEERA GANGADHAR	7	70	Y	4	8	100	Y	100	Y		4	5	75	Y	75	Y
					0		N	0	0		N	0	N		0	0		N	0	N
					0		N	0	0		N	0	N		0	0		N	0	N
					0		N	0	0		N	0	N		0	0		N	0	N
					0		N	0	0		N	0	N		0	0		N	0	N
					8					16		20					6		18	
					22.22					44.44		55.56					16.67		50.00	
				LEVEL	1					1		1					1		1	
					Q1					Q2		Q2or Q3					Q11		Q10 or Q11	

Fig. 3 Sheet including the marks obtained for each question in external exams

Overall Assessment Sheet 4

Sheet 4 shows the overall assessment including the internal and external tools both direct and indirect. The sheet includes the following data

- Internal assessment
- External assessment
- Course End Feedback
- Actions taken and Observations

Overall Levels

COs	MID	Assignment	Quiz	ClassTest	Final Exam	Average Level	COAF Level	Ovearall Level
CO1	3	3	1	1	1	1.4	2	1.58
CO2	1	3	1	1	1	1.1	2	1.37
CO3	1	3	1	1	1	1.1	1.8	1.31
CO4	1	3	1	1	1	1.1	1.9	1.34
CO5	2	3	1	1	1	1.25	2	1.475
CO6	2	3	1	1	1	1.25	2	1.475
					Final Average Level	1.20	1.95	1.43

COs	Average Level	Feed Back (COAF)	Overall
CO1	2.65	1.79	2.39
CO2	2.7	1.72	2.41
CO3	2.7	1.71	2.40
CO4	2.5	1.71	2.26
CO5	2.5	1.74	2.27
CO6	2.5	1.74	2.27

Best COs Attained: CO1,CO5,CO6

Least COs Attained: CO3,CO4,CO2

Observations for Least Attainment
1 Basic concepts of factors of corrosion should be revise
2 In tutorials and assignments questions are not equally distributed for thermodynamics and corrosion
3 Better understanding of thermodynamics

Actions to be Taken
1 Lesson plan should be revised i.e. add one class to cover basic concepts of corrosion.
2 In tutorials and assignments questions should be distributed equally for thermodynamics and corrosion
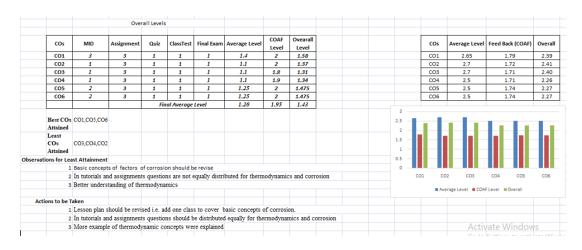3 More example of thermodynamic concepts were explained

Fig. 4 Sheet including overall assessment

Laboratory Assessment

Laboratory assessment is done to assess the student knowledge in performing the experiment. The theoretical knowledge gained through courses is implemented in performing the experiment.

Outcomes for laboratory are considered same as the associated theory course outcomes.

Day to day evaluation is performed for each student during the practical sessions. The assessment for laboratory is done by taking the following tools in consideration

1. Day to day evaluation
   - Observation for 10 marks
   - Viva Voce for 10 marks
   - Record for 10 marks
2. Internal Examination for 20 marks

Internal Assessment

- Marks obtained by each student for each experiment are consolidated in laboratory assessment form.
- He/she attains the outcome only if they score 80% of marks in each assessment tool.
- Percentage of attainment for each tool and for each experiment is calculated by considering the attained students and the total students
- The percentage of attainment for each experiment is mapped with the corresponding laboratory outcomes
- Average of each laboratory outcome including the day to day evaluation and internal exam are calculated

External Assessment

External assessment is performed based on the marks obtained by the student in the end practical examinations. This exam is conducted by the institute under the supervision of the external examiner allotted by the institute. The following procedure is used for external assessment

- The exam is conducted for 50 marks and the student is considered as attained if he/she scores 80% of marks in the exam.
- Percentage of attainment is calculated by considering the attained students and the total students
- The attained percentage is mapped to all the outcomes.

Overall Assessment

The overall laboratory outcome percentage is determined by the weighted average of levels of attainment of that outcome from all the internal and external assessment tools

Overall CO Level = (0.3* Internal Assessment) + (0.7*External Assessment)

Level for each laboratory is determined considering the overall percentage.

Rubrics for determining the level is given in the following table

Table 5: Rubrics for laboratory outcome attainment level

S.No.	Level	Description
1	3	If the overall percentage is more the 80%
2	2	If the overall percentage is in between75% and 80%
3	1	If the overall percentage is less the 75%

S.No.	Regd. No.	Name	Exp-1			Exp-2			......	Internal(20)	Overall Internal(50)	Final Exam(50)	Overall Attainment	
			V(10)	NV(10)	W(10)	V(10)	NV(10)	W(10)						
1	18K61A0373	DOREPALLI HEMANTH	0	0	0	8	9	8		14	39	44		
	'													
	'													
	'													
38	18K61A03B0	YARRA RAVITEJA	8	9	7	8	9	8		12	37	27		
	No. of Students Scored > Target Marks		28	28	23	36	37	36		19	20	19		
	Total No. of Students		38	38	38	38	38	38		38	38	38		
	% of Students Scored > Target Mark		73.68	73.68	60.53	94.74	97.37	94.74		50.00	52.63	50.00		
	C116.1		73.68	73.68	60.53	94.74	97.37	94.74		50.00	77.82	50.00	58.35	1
	C116.2									50.00	90.98	50.00	62.29	1
	C116.3									50.00	87.22	50.00	61.17	1
	C116.4									50.00	69.74	50.00	55.92	1
	C116.5									50.00	80.83	50.00	59.25	1
	C116.6									50.00	76.07	50.00	57.82	1
														1.0

Fig. 5 Sheet including the marks obtained by each student in lab

Course Outcome Assessment Form

Feedback is taken from the students at the end of the semester on each course. Online feedback is taken using Course outcome assessment form and results are analyzed. Sample questionnaire for course end survey is given below.

Fig. 6 Questioner of feedback for Technical English Course

8.4.2 Record the attainment of Course Outcomes of all first year courses (5)

Direct Assessment
Direct Course Attainment Level
The proportional weightage of internal assessment and external assessment is set as 30:70 after having discussions in the department meetings.
Overall Course Level = (0.3*Course Internal Level) + (0.7* Course External Level)

Academic Year - 2018-19   Odd Semester

Table 6: Course Outcome Attainment (Direct Assessment)

Year	Course Code	Course	Course Outcomes						Direct Course Attainment
			CO1	CO2	CO3	CO4	CO5	CO6	
I B. Tech ME – I Semester	C111	Technical English	2.80	2.80	2.50	2.65	2.80	2.80	2.73
	C112	Engineering Mathematics - I	1.35	1.05	1.05	1.10	1.10	1.10	1.13
	C113	Engineering Chemistry	1.30	1.15	1.23	1.23	1.45	1.85	1.37
	C114	Basic Electrical Engineering	1.20	1.20	1.20	1.45	1.15	1.15	1.23
	C115	Constitution of India Professional Ethics & Human Rights	1.20	1.05	1.05	1.25	1.10	1.10	1.13
	L111	English Communication Skills Lab	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	L112	Engineering Chemistry Lab	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	L113	Basic Electrical Engineering Lab	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Indirect Assessment

Table 7: Course Outcome Attainment (Indirect Assessment)

Year	Course Code	Course	Course Outcomes						Indirect Course Attainment
			CO1	CO2	CO3	CO4	CO5	CO6	
I B. Tech ME - I Semester	C111	Technical English	2.48	2.49	2.41	2.52	2.51	2.47	2.48
	C112	Engineering Mathematics - I	2.47	2.44	2.41	2.40	2.36	2.36	2.41
	C113	Engineering Chemistry	2.40	2.40	2.35	2.40	2.29	2.41	2.38
	C114	Basic Electrical Engineering	2.00	2.00	2.00	2.00	2.00	2.00	2.00
	C115	Constitution of India Professional Ethics & Human Rights	2.09	2.15	2.05	2.02	2.01	2.08	2.07
	L111	English Communication Skills Lab	2.47	2.49	2.47	2.47	2.52	2.39	2.47
	L112	Engineering Chemistry Lab	2.47	2.47	2.54	2.52	2.58	2.37	2.49
	L113	Basic Electrical Engineering Lab	1.90	2.00	2.00	2.10	2.10	1.90	2.00

Overall Assessment

Overall Course Attainment Level = (0.3* Indirect Course Attainment) + (0.7* Direct Course Attainment)

Table 8: Overall Course Outcome Attainment

Year	Course Code	Course	Direct Course Attainment	Indirect Course Attainment	Overall Course Attainment	Target	Deviation
I B.Tech ME - I Semester	C111	Technical English	2.73	2.48	**2.65**	**3.00**	*0.35*
	C112	Engineering Mathematics - I	1.13	2.41	**1.51**	**3.00**	*1.49*
	C113	Engineering Chemistry	1.37	2.38	**1.67**	**3.00**	*1.33*
	C114	Basic Electrical Engineering	1.23	2.00	**1.46**	**2.25**	*0.79*
	C115	Constitution of India Professional Ethics & Human Rights	1.13	2.07	**1.41**	**3.00**	*1.59*
	L111	English Communication Skills Lab	1.00	2.47	**1.44**	**3.00**	*1.56*
	L112	Engineering Chemistry Lab	1.00	2.49	**1.45**	**3.00**	*1.55*
	L113	Basic Electrical Engineering Lab	1.00	2.00	**1.30**	**2.83**	*1.53*

Academic Year - 2018-19   Even Semester

Table 9: Course Outcome Attainment (Direct Assessment)

Year	Course Code	Course	Course Outcomes						Direct Course Attainment
			CO1	CO2	CO3	CO4	CO5	CO6	
I B. Tech ME – II Semester	C121	Engineering Mathematics-II	1.10	1.10	1.18	1.45	1.10	1.10	1.17
	C122	Engineering Physics	1.10	1.10	1.33	1.08	1.08	1.08	1.13
	C123	Programming for Problem Solving	1.38	1.08	1.15	1.40	1.40	1.40	1.30
	C124	Engineering Graphics	1.20	1.20	1.55	1.20	1.20	1.20	1.26
	C125	Environmental Science	1.23	1.23	1.26	1.31	1.35	1.35	1.29
	L121	Engineering Physics Lab	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	L122	Programming for Problem Solving Lab	1.00	1.00	1.00	2.20	1.00	1.00	1.20
	L123	Work Shop Lab	2.00	2.00	2.00	2.00	2.00	2.00	2.00

Indirect Assessment

Table 10: Course Outcome Attainment (Indirect Assessment)

Year	Course Code	Course	Course Outcomes						Direct Course Attainment
			CO1	CO2	CO3	CO4	CO5	CO6	
I B. Tech ME – II Semester	C121	Engineering Mathematics-II	2.16	2.15	2.18	2.13	2.07	2.09	2.13
	C122	Engineering Physics	2.24	2.19	2.23	2.21	2.21	2.21	2.22
	C123	Programming for Problem Solving	2.27	2.27	2.31	2.23	2.19	2.21	2.25
	C124	Engineering Graphics	2.60	2.60	2.70	2.60	2.60	2.60	2.62
	C125	Environmental Science	2.20	2.20	2.10	2.10	2.10	2.10	2.13
	L121	Engineering Physics Lab	2.20	2.27	2.23	2.26	2.07	2.21	2.21
	L122	Programming for Problem Solving Lab	2.30	2.40	2.40	2.20	2.30	2.20	2.30
	L123	Work Shop Lab	2.50	2.40	2.40	2.20	2.40	2.30	2.37

Overall Assessment

Overall Course Attainment Level = (0.3* **Indirect Course Attainment**) + (0.7* **Direct Course Attainment**)

Table 11: Overall Course Outcome Attainment

Year	Course Code	Course	Direct Course Attainment	Indirect Course Attainment	Overall Course Attainment	Target	Deviation
I B. Tech - II Semester	C121	Engineering Mathematics-II	1.17	2.13	**1.46**	**3.00**	*1.54*
	C122	Engineering Physics	1.13	2.22	**1.45**	**2.50**	*1.05*
	C123	Programming for Problem Solving	1.30	2.25	**1.58**	**2.75**	*1.17*
	C124	Engineering Graphics	1.26	2.62	**1.67**	**3.00**	*1.33*
	C125	Environmental Science	1.29	2.13	**1.54**	**2.80**	*1.26*
	L121	Engineering Physics Lab	1.00	2.21	**1.36**	**2.80**	*1.44*
	L122	Programming for Problem Solving Lab	1.20	2.30	**1.53**	**3.00**	*1.47*
	L123	Work Shop Lab	2.00	2.37	**2.11**	**2.50**	*0.39*

8.5 Attainment of Program Outcomes from first year courses (20)

8.5.1 Indicate results of evaluation of each relevant PO and/or PSO (15)

Program outcomes assessment refers to the measurement of students' achievement of program-level expected learning outcomes and the use of the results of these assessments to improve the program.

Target for POs:

Targets for each program outcome are set by considering the average value of mapping of all POs corresponding to a course. Sample sheet shows the target value calculation.

	S. No	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average/Target
3	1	Technical English	-	-	-	-	-	-	-	-	-	3	-	-	3.00
4	2	Engineering Mathematics-I	3	3	-	-	-	-	-	-	-	-	-	-	3.00
17	15	PPS Lab	3	3	3		3				3	3			3.00
18	16	Work Shop Lab	3	1							3	3			2.50
19		**PO Target Levels**	3.00	2.75	2.63	2.25	2.50	3.00	2.00	3.00	3.00	3.00		3.00	

Fig. 7 Sheet including Targets for POs

Program Outcomes (POs) Assessment

Program outcome assessment is performed by

- Direct Assessment

Direct Assessment

Direct attainment of POs is carried out by

- Results of Course Outcome Assessment
- Performance of Students in Laboratory tests

PO Attainment from Course Outcome Assessment

There are three steps in getting the PO attainment from the CO attainment. They are

i. CO-PO Mapping
ii. CO Attainment
iii. Attainment of PO from CO attainment using weighted average of CO-PO Mapping and CO Attainment

CO-PO Mapping Strength

- Attainment of a PO/PSO depends both on the attainment levels of associated COs and the strength to which it is mapped
- It is necessary to determine the level (mapping strength) at which a particular PO/PSO is addressed by the course.
- Strength of mapping is defined at three levels: Low (1), Medium (2) and High (3)
- Level of PO is measured with the number of hours devoted to the COs which address the given PO

Table 12: No. of sessions allotted for each PO

COs	Related POs		No. of Sessions for each CO
	PO1	PO2	
CO1	7	12	12
CO2	6	10	10
CO3	7	12	12
CO4	5	8	8
CO5	2	4	4
CO6	3	6	6
Total Classes	30	52	52

The above table describes the relation between POs and COs along with number of sessions allotted to each CO.

Mapping Strength is calculated based on the percentage of class sessions allotted to cover each PO. After calculating, the strength is assigned based on the following scale.

Table 13: Rubrics for PO Attainment Level

Level	Description
3	If ≥65% of classroom sessions addressing a particular PO
2	If 30 to 65% of classroom sessions addressing a particular PO
1	If 5 to 30% of classroom sessions addressing a particular PO
Not Addressed	If <5% of classroom sessions addressing a particular PO

PO1 is addressed by CO1, CO2, CO2, CO3, CO4, CO5 and CO6. Hence total class sessions of PO1 is the sum of the class sessions of all COs addressed by that PO. Similarly Number of class sessions for all the POs is calculated and shown in following table.

Table 14: PO Mapping Strength

PO	No. of Sessions	Percentage	Mapping Strength
PO1	30	58	2
PO2	52	100.00	3
Remaining POs and PSOs	0	0	0

By following the above procedure CO-PO mapping strength is calculated for all the courses by the respective faculty members handling the course. Sample for one subject CO-PO mapping is shown in following table.

Table 15: CO PO Mapping

Course	CO	Pos											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Engineering Mathematics-I	C112.1	2	3	-	-	-	-	-	-	-	-	-	-
	C112.2	2	3	-	-	-	-	-	-	-	-	-	-
	C112.3	2	3	-	-	-	-	-	-	-	-	-	-
	C112.4	2	3	-	-	-	-	-	-	-	-	-	-
	C112.5	2	3	-	-	-	-	-	-	-	-	-	-
	C112.6	2	3	-	-	-	-	-	-	-	-	-	-

➢ Course outcome attainment level is assigned to the POs for which that particular course is mapping

Course outcome attainment levels measured for the courses are used for measuring the attainment of PO through CO.

Attainment of every PO is determined from every CO by considering the strength of the mapping of a particular CO to that PO and the level of attainment of that CO. PO attainment

value is obtained by taking the weighted average of the CO-PO mapping and CO attainment. Same procedure is followed for all the courses to get PO attainment levels. After finding the course wise PO levels, overall PO levels will be obtained by taking the average of the levels of each PO of all the courses that are attaining particular PO.

From CO-PO mapping table sum of the weights of each PO for all COs is calculated and sample is shown in following table.

PO Mapping Table

Course	CO	Pos											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	C112.1	2	3	-	-	-	-	-	-	-	-	-	-
	C112.2	2	3	-	-	-	-	-	-	-	-	-	-
Engineering Mathematics-I	C112.3	2	3	-	-	-	-	-	-	-	-	-	-
	C112.4	2	3	-	-	-	-	-	-	-	-	-	-
	C112.5	2	3	-	-	-	-	-	-	-	-	-	-
	C112.6	2	3	-	-	-	-	-	-	-	-	-	-
		12	**18**										

i. CO Attainment Table

	C112.1	1.30
	C112.2	1.38
Engineering Mathematics-I	C112.3	1.30
	C112.4	1.20
	C112.5	1.30
	C112.6	1.30

ii. PO Attainment from Course Outcomes

Course	CO	Pos											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	C112.1	2.6	3.9										
	C112.2	2.8	4.2										
	C112.3	2.6	3.9										
	C112.4	2.4	3.6										
Engineering Mathematics-I	C112.5	2.6	3.9										
	C112.6	2.6	3.9										
	Total	**15.6**	**23.4**										
	CO Level	**12.0**	**18.0**										
	PO Level	**1.3**	**1.3**										

Sample POs Attainment Sheet

S.No.	Course	CO	POs											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2	Engineering Mathematics-I	C112.1	2	3	-	-	-	-	-	-	-	-	-	-
		C112.2	2	3	-	-	-	-	-	-	-	-	-	-
		C112.3	2	3	-	-	-	-	-	-	-	-	-	-
		C112.4	2	3	-	-	-	-	-	-	-	-	-	-
		C112.5	2	3	-	-	-	-	-	-	-	-	-	-
		C112.6	2	3	-	-	-	-	-	-	-	-	-	-
	Total		12	18										
	Engineering Mathematics-I	C112.1	1.30											
		C112.2	1.38											
		C112.3	1.30											
		C112.4	1.20											
		C112.5	1.30											
		C112.6	1.30											
			1.30											

S.No.	Course	CO	POs											
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
2	Engineering Mathematics-I	C112.1	2.6	3.9										
		C112.2	2.8	4.2										
		C112.3	2.6	3.9										
		C112.4	2.4	3.6										
		C112.5	2.6	3.9										
		C112.6	2.6	3.9										
		Total	15.6	23.4										
		CO Level Total	12.0	18.0										
		PO Level	1.3	1.3										

Fig. 8 Sheet including weighted average procedure

POs Attainment

Table 8.16: POs Attainment through Courses

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C111	-	-	-	-	-	-	-	-	-	2.70	-	-
C112	1.13	1.13		-	-	-	-		-	-	-	-
C113	1.65	1.23	1.23	-	-	-	-		-	-	-	-
C114	1.23	1.23	1.27	1.20	-	-	-		-	-	-	-
C115	-	-	-	-	-	1.13	-	1.10	-	-	-	-
L111	-	-	-	-	-	-	-	-	1.00	1.00	-	-
L112	1.00	1.00		-	-	-	-	-	1.00	1.00	-	-
L113	1.00	1.00	1.00	1.00	-	-	-	-	1.00	1.00	-	-
C121	1.17	1.17	-	-	-	-	-	-	-	-	-	-
C122	1.13	1.13	1.13	1.09	-	-	-	-	-	-	-	-
C123	1.29	1.29	1.28	-	1.31	-	-	-	-	-	-	-
C124	1.26	-	1.26	-	-	-	-	-	-	1.26	-	1.26
C125	1.27	1.32	1.35	-	-	-	1.23	-	-	-	-	-
L121	1.00	1.00	_	1.00	-	-	-	-	1.00	1.00	-	-
L122	1.00	1.00	1.00	-	1.00	-	-	-	1.00	1.00	-	-
L123	2.00	2.00	-	-	-	-	-	-	2.00	2.00	-	-
Average	1.24	1.21	1.19	1.07	1.15	1.13	1.23	1.10	1.17	1.37	-	1.26