VIGNAN's INSTITUTE OF INFORMATION TECHNOLOGY
(AUTONOMOUS)
(Approved by AICTE - New Delhi & Affiliated to JNTUK, Kakinada)
Beside VSEZ, Duvvada, Vadlapudi Post, Gajuwaka, Visakhapatnam - 530 049.

Detailed Process of Attainment of Course Outcomes (COs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

The course outcomes were prepared by using action verbs of Bloom's Taxonomy

Course Outcomes (COs) for Control Systems Course (C222)	
CO1	Derive the transfer function and state space models for electrical, mechanical and electro-mechanical systems
CO2	Analyze the Transient & Steady State Performance of a different system.
CO3	Determine the stability of different Linear Time Invariant systems.
CO4	Design lag, lead and lag-lead compensators for different systems to improve system performance.

CO-PO Mappings for Control Systems Course (C222)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1	2									2	2
CO2	2	2		2						2		1		1	
CO3	3	3		2		2				2		3		3	
CO4	1	2	3	2	2									2	
Avg.	2.25	2.25	3	1.75	2	2				2		3		2	2

- We should prepare in the same manner for the other courses in the program. The CO-PO mapping matrix as shown below

Course Code	Course Name	Program Outcomes												Program Specific Outcomes		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C213	BEDC	2.25	2.67	2.00	2.67	3.00		3.00		2.33	2.33	2.50	1.50	2.50	2.75	3.00
C224	AE	2.50	2.67	2.67	1.50								1.67	2.75		
C315	PE	2.25	2.75	2.75	3.00	3.00	2.00	1.75	2.00	1.33			2.50	2.33	2.25	3.00
C326	IPP	2.50	2.50	2.50	2.50	3.00	2.00			2.00	2.00	1.33	2.00	2.00	2.25	

:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
C423	EDS	2.75	2.25	2.25	1.50	1.50	1.50	2.00	1.50	1.50		1.00	1.50	2.00	3.00	1.25

COURSE-LEVEL ASSESSMENT:

The CO attainment levels are measured based on the direct assessment and indirect assessment. For direct assessment, results of the cumulative internal examinations and semester end examination conducted by the university. This is a form of direct measurement of attainment. The final direct assessment level of a particular course outcome is calculated by giving 20% weightage to internal assessment tools and 80% weightage to end semester university examination. For indirect assessment, course end survey taken as form of feed backs. The Final assessment level of a particular course outcome is calculated by giving 20% weightage to indirect assessment tools and 80% weightage to direct assessment tools.

Process of Course Outcomes

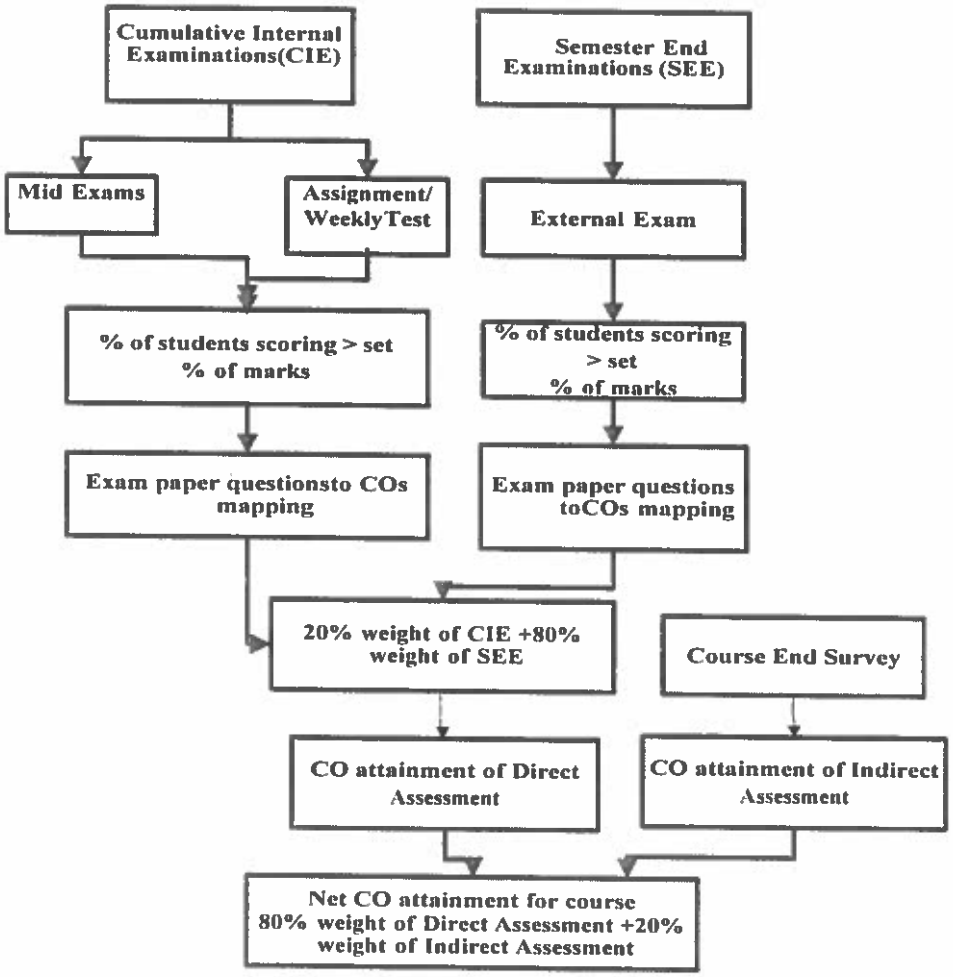

Figure: 1 CO Attainment Process

The data for evaluation of course outcomes for internal examinations are

1. **Week Tests:** Five to six-week test will be conducted on every Monday. The maximum marks will be 10. Each question is a single question carrying ten marks (or) 2 (or) three sub questions with a total of ten marks. It is expected that a student should score at least 6 marks (60%) out of 10 marks for the attainment of that course outcome.

2. **Internal (Mid) Examinations**: Two Mid Examinations are conducted for 2nd, 3rd and 4th year students in each semester as per the university prescribed norms. Mid-1 is conducted from. First, second unit and half of third unit of the course syllabus, Mid-2 is conducted for half of third unit and full third unit of the course syllabus and fourth, fifth units of the course syllabus. The question paper has twenty-Five marks (10 one marks, three five marks), three descriptive questions each carrying 5 marks are given, students haveto answer all questions. It is expected that a student should score at least 60% of marks (for each question) for the attainment of that course outcome.

3. **Internal Lab Examination:** One exam will be conducted when 5 to 6 experiments have been completed. The maximum marks will be of fifty. It is expected that a student should scoreat least 60% of marks for the attainment of that course outcome.

4. **Internal Minor Project:** The minor project is carried out during every semester by conducting two reviews with fifty marks. It is expected that a student should score at least 60%for the attainment of that course outcome.

5. **Internal Project marks:** The project is carried out during final year (seventh or eighth semester) by conducting three reviews. First review is conducted for ten marks and other two reviews are conducted for 20 marks, so cumulatively 50 marks. It is expected that a student should score at least 60% for the attainment of that course outcome.

6. **Internal Internship marks:** The internship is carried out during final year (eighth semester) by conducting two reviews. Each review is conducted for twenty marks. It is expected that a student should score at least 60% for the attainment of that course outcome.

The data for evaluation of course outcomes for external examinations are:

Semester end examination: These end-semester examinations are of 3- hour duration and cover the entire syllabus of the course. It would generally satisfy all course outcomes for a particular course. The question will have a total of 10 questions. The question paper has ten one mark, four either (or) choice of five marks and three either(or) choice of ten marks. The students have to answer the questions with choice. 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 for the attainment of course outcomes.

Semester end lab marks: The end semester lab examination shall be conducted with an external

examiner and the lab handling faculty/internal examiner. The external examiner will be appointed from university exam cell. These end-semester examinations are of 3-hours duration and cover the entire syllabus of the lab experiments. The end exam is evaluated for

a maximum mark of fifty. It is expected that a student should score at least 50% marks for the attainment of that course outcome. The marks scored by the students in the end semester lab 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.

Semester end minor project marks: The end semester minor project examination shall be conducted with an external examiner and the minor project handling faculty/internal examiner. The external examiner will be appointed from university exam cell. These end-semester examinations are of 3-hours duration and the students have to demonstrate and present their projects batch wise. The end exam is evaluated for a maximum mark of fifty. It is expected that a student should score atleast marks 50% for the attainment of that course outcome. The marks scored by the students in the end semester minor project 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.

Semester end Internal Project work/Internship marks: Project work/Internship is conducted during final year (eighth semester). The committee consists of an external examiner and asenior faculty member of the department shall conduct the exam. The external examiner will be appointed from university exam cell. The end-semester Project work/Internship examinations are of 3-hours duration and the students have to demonstrate and present their projects batch wise. The endexam is evaluated for 120 marks. It is expected that a student should score at least 50% for the attainment of that course outcome.

The attainment levels consider for COs attainments are

- **Attainment Level 1**: Students attained score in internal and end semester examination inbetween 60% to 69%.
- **Attainment Level 2**: Students attained score in internal and end semester examination inbetween 70% to 79%.
- **Attainment Level 3**: Students attained score in internal and end semester examination is are greater than or equal to 80%.

The above procedure is followed in R17 regulation in evaluating the attainment of CO using existing data from student marks. Each and every test is focused in attaining the course outcomes. The overall course outcome of a course is computed by considering a weightage of 20% for cumulative internal examinations and 80% for end examination.

<u>Assessment of Course Outcomes:</u>

The final assessment level of a particular course outcome is calculated by giving 20% weightage to internal assessment tools and 80% weightage to end semester university examination. The followingexample illustrates the final attainment level calculation for all course outcomes.

Example:

1. The process of computing assessment tool of a course C222 (1002172202 – Control Systems, 04 Semester EEE) is shown in below table.

CO assessment Based on Internal Examinations

	Internal Marks										
%Target	60.00%										
	Mid-1							Mid-2			
Questions	M1Q1	M1Q2	M1Q3	M1A1	M1A2	M1A3	M1Quiz1	M2Q1		M2A5	M2Quiz2
Max Marks	5	5	5	10	10	10	10	5		10	10
Target Marks	3.00	3.00	3.00	6.00	6.00	6.00	6.00	3.00		6.00	6.00
17L31A0204	5	4	4	6	6	6	0	5	....	6	4
17L31A0205	5	5	5	8	8	8	2	4	....	7	6
17L31A0206	5	5	4	10	4	5	2	2	....	8	9
17L31A0207	5	5	4	10	10	10	2	5	....	10	9
:											:
:											:
:											:
18L35A0250	2	4	5	8	6	6	7	5	....	6	8
18L35A0253	2	4	3	5	4	10	6	5	....	10	10
18L35A0254	5	5	5	9	6	6	8	5	....	6	9
No.of attained students	167	168	173	146	134	166	122	166	....	166	148
No.of attended students	208	208	208	208	208	208	208	208	....	208	208
%No.of attained students	80.29%	80.77%	83.17%	70.06%	64.42%	79.81%	58.65%	79.81%	....	79.81%	71.15%

Course outcomes	CO to Question Mapping	% of CO to Question Mapping	Average of % CO to Question Mapping	Attainment level
CO1	M1Q1	80.29%	72.44%	2
	M1Q2	80.77%		
	M1A1	70.06%		
	M1Quiz1	58.65%		
:	:	:	:	:
:	:	:	:	:
CO4	M2Q2	83.29%	81.29%	3
	M2Q3	90.93%		
	M2A5	79.81%		
	M2Quiz2	71.15%		
CO (Internal Attain)				(2+2+2+3)/4=2.25

CO Assessment Based On End Semester Examinations

External Marks		
%Target	50%	
Max Marks	Grade	GRADE POINTS(10)
Target Marks		6.00
17L31A0204	B	8
17L31A0205	A	9
17L31A0206	B	8
17L31A0207	A	9
:	:	:
:	:	:
:	:	:
18L35A0250	C	7
18L35A0253	B	8
18L35A0254	C	7
No.of attained students		173
No.of attended students		208
%No.of attained students		83.17%
Attainment Level		3

CO Attainment(Direct Assessment)=80% of CO Assessment Based On End Semester Examinations +20% of CO Assessment Based On Internal Examinations

CO Attainment(Direct Assessment) = 0.8* 3 + 0.2 * 2.25 = 2.85.

Based on the course end survey or feed back analysis, we can determine the CO Attainment from Indirect Assessment.

CO Attainment (Indirect Assessment)= 2.25.

CO Final Attainment =0.8* CO Attainment (Direct Assessment)+0.2* CO Attainment (Indirect Assessment)

CO Final Attainment =0.8* 2.65 + 0.2* 2.25 = 2.57.

The above procedure of computing overall CO attainment is to be repeated for each course from first year to final year in an academic year in order to enable computation of PO and PSO attainmentlevels.

CO Attainment Target Value:

Attainment of COs is measured from the performance of students in cumulative internal examinations and from the course marks of the students in semester end examination. The overall pass percentage of the students is considered for CO attainment of that particular course. The attainment is measured in terms of actual percentage of students getting set target marks.

The attainment target of CO is based on **60% cumulative internal examinations** as moderate level and **50% of semester end examination** as substantial level.

Attainment of Course Outcomes: (2017-2021 Batch)

Course Code	Semester	Name of the subject	Attainment (Grading Average on a scale of 3)
C111	1	ENGLISH-I	**2.75**
C114	1	ENGINEERING DRAWING	**2.69**
C123	2	ENGINEERING MATHEMATIC-III	**2.68**
C126	2	ENGINEERING MECHANICS	**2.62**
C212	3	ELECTRICAL MACHINES-I	**2.71**
:	:		:
C425	8	INTERNSHIP	**2.95**
C428	8	PROJECT WORK	**3.00**

b) <u>PROGRAMME LEVEL ASSESSMENT:</u>

The year wise coordinator has to consolidate the CO's of the respective year and maintain the documentation of the CO attainment level of the respective year courses as well as documentation of the individual student extra-curricular and co-curricular activities. These details will hand over to the program coordinator in order to evaluate PO attainment of the individual student as well as individual course at the end of the eighth semester. The Program coordinator has to evaluate the PO attainment through direct and indirect method after the students completing their program. All these works have to be done under the guidance of Department Advisory Committee (DAC). The desired emphasis during the delivery of a programme as prescribed in the course curriculum. PO – PSO Attainment Tools and Process is represented in Fig.2.

Assessment tools for POs and PSOs

- Assessment tools for POs and PSOs are categorized into two namely
  - i) Direct assessment method : 80%
  - ii) Indirect assessment method : 20%

i) Direct assessment method

Direct method helps to increase the student knowledge and skills based on the cumulative internal examinations and semester end examination.

The various assessment processes used to gather the data for evaluation of program outcomes and program specific outcomes are shown in below Table 2.

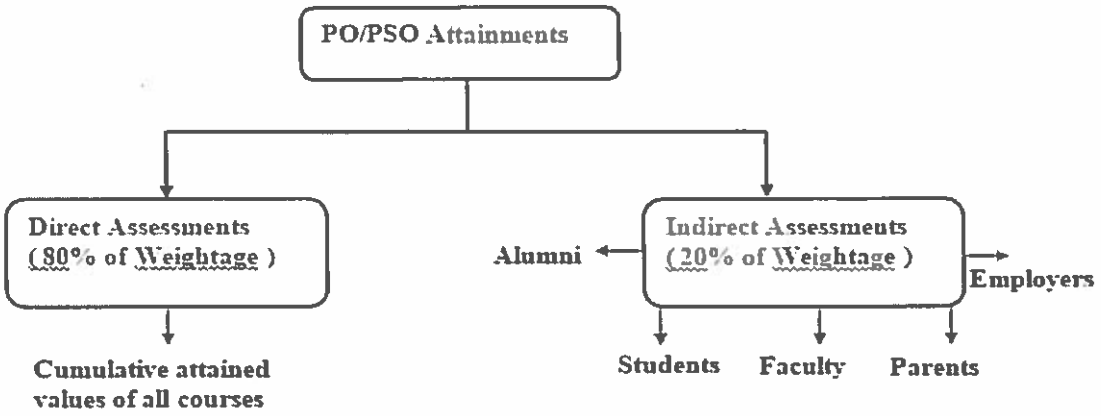

Figure: 2 PO – PSO Attainment Tools

Direct assessment of POs and PSOs is calculated using the following procedure.

- CO-PO mapping table is considered for attainment.
- CO assessment is done by considering cumulative internal examinations and semester endexamination marks. It is used to identify the level of COs attainment.
- The attained COs for a course is multiplied with the values of CO-PO mapping table and dividedby mapped cells multiplied by the substantial correlation value.
- The formula of direct attainment of PO and PSO is

$$PO\ /PSO\ Direct\ attainment\ = \frac{Sum\,(Overall\ CO\ attainment\ \times PO/PSO\ score)}{mapped\ columns\ in\ PO/PSO\ \times 3}$$

Assessment of Program Outcomes:

- The final assessment level of a particular program outcome is calculated from average of CO attainment through 60% of internal assessment and 50% end semester university examination. The following example illustrates the PO's & PSO's calculation for a course.

Step by step process of assessment of POs

Step 1: The program coordinator analyses each outcome into elements (different abilities specifiedin the outcome) and a set of attributes are defined for each element (actions that explicitly demonstrate mastery of the abilities specified), in addition, generate well designed surveys to assess the outcome.

Step 2: For each program outcome define performance indicators (Assessment criteria) and their target levels.

Step 3: Identify/select courses that address the outcome (each course contributes to at least one of the program outcome). Hence, each program outcome is assessed in several courses to ensure that

students acquire an appropriate level in terms of knowledge/skills of an outcome.

Step 4: The program coordinators collect the qualitative and quantitative data and were used for outcome assessment in a continual process.

Step 5: The program monitoring and assessment committee analyse the collected data. If the assessed data meets the performance targets which are specified in step 2, then the programoutcome is attained.

i) Direct attainment method of PO/PSO

The attainment of PO/PSOs process requires the attainment of COs and CO-PO-PSO mapping table (Course articulation matrix) for the course. Based on that, we can calculate following ways

$$\text{PO-1 Direct Attainment} = \frac{(CO-PO_1)_{Map} * (CO)_{Attainment}}{(CO-PO_1)_{Max-Map}}$$

$$\text{PO-2 Direct Attainment} = \frac{(CO-PO_2)_{Map} * (CO)_{Attainment}}{(CO-PO_2)_{Max-Map}}$$

For Example PO1 attainment for the above course is

$$\text{PO-1 Direct Attainment} = \frac{(CO-PO_1)_{Map} * (CO)_{Attainment}}{(CO-PO_1)_{Max-Map}} = \frac{(2.25)*(2.57)}{3} = 1.93$$

C222	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
PO Direct Attainment	1.93	1.93	2.57	1.50	1.72	1.72				1.72		1.72		1.72	1.72

We have to calculate for all the offered courses of the programme with the same procedure

Assessment of Program Outcomes/PSO:

- The final assessment level of a particular program outcome is calculated from average of CO attainment through 60% of internal assessment and 50% end semester university examination. The following example illustrates the PO's & PSO's calculation for a course.

Example for PO attainment:

PO attainment for the course C222 (Control Systems, 04 Semester EEE) is shown in below table

Course Code	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C222	Control Systems	1.93	1.93	2.57	1.50	1.72	1.72				1.72		1.72		1.72	1.72

PO attainment target value:

Levels	Performance quality
PO/PSO < 1	Does Not Meet Expectations
PO or PSO between 1 to 2	Marginal Expectations
PO or PSO >= 2	Meets Expectation

Attainment of Program Outcomes: (Example: 2017-2021 Batch)

Course	Semester	Course Name	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
C112	1	Engineering Mathematic-I	2.73	2.28	2.43	2.73		2.28						2.12			
C114	1	Engineering Drawing	2.69	2.39	1.80									1.57			
C123	2	Engineering Mathematic-III	2.68	2.23	1.79									1.79			
C125	2	Applied Chemistry	2.85	2.37		1.90			2.21	2.21				1.42	2.53		
:		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
C427	8	Comprehensive	2.90	2.42	2.26	2.58	2.42	0.97			2.42			1.93	0.97	2.42	2.42
C428	8	Main Project	2.75	2.50	3.00	2.50	3.00	2.50	2.00	2.00	3.00	3.00	3.00	2.50	2.00	2.33	2.50
Direct Assessment			**2.40**	**2.29**	**2.23**	**2.18**	**2.17**	**1.90**	**1.99**	**1.96**	**2.17**	**2.15**	**1.89**	**1.97**	**1.91**	**2.17**	**2.15**
80% of Direct Assessment			1.92	1.83	1.79	1.75	1.73	1.52	1.59	1.57	1.74	1.72	1.51	1.58	1.53	1.74	1.72

INDIRECT ASSESSMENT METHOD

Indirect Assessment involves the qualitative method of obtaining the reflections of the stakeholders on the achievement of the program outcomes, through feedback mechanism. These methods provide clues about what could be assessed directly easy to administer particularly useful for ascertaining values and beliefs.

The stakeholders include Students, Alumni, Current faculty, Employers offering training (interns), Parents and Experts. An indirect assessment of student learning ascertains the perceived extent or value of learning experiences. They assess opinions or thoughts about student knowledge or skills.

Indirect measures can provide information about student perception of their learning and how this learning is valued by different constituencies. An indirect assessment is useful in that it can be used to measure certain implicit qualities of student learning, such as values, perceptions, and attitudes, from a variety of perspectives.

Assessment tools used for indirect attainment of Pos and PSOs:

a) Graduate Exit Survey: End of the program
b) Parents Survey: End of the program
c) Alumni Survey: After one year of graduation
d) Employer Survey: After one year of graduation
e) Faculty Survey: End of the program

Rubrics: Satisfaction level

>60% and <=70% = 1

>70% and <=80% = 2

>80% =3

Indirect POs/PSOs attainment process:

Indirect POs/PSOs attainment is calculated as follows

Step1: Calculate the average response of each question of the survey

Step2: The average response of the question is mapped to POs/PSOs in the Question-PO/PSO Mapping table.

Step3: Average of the each PO's attainment for the survey is calculated

Indirect Attainment (Example: 2017-21 batch)

Survey	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
Indirect Attainment	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3
20% of Indirect Attainment	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.6	0.6	0.6	0.6	0.6

Overall Attainment of Program Outcomes (Example: 2017-21 batch)

Overall Attainment of PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
80% of Direct Attainment	1.92	1.83	1.79	1.75	1.73	1.52	1.59	1.57	1.74	1.72	1.51	1.58	1.53	1.74	1.72
20% of Indirect Attainment	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.6	0.6	0.6	0.6	0.6
Overall Attainment	2.52	2.43	2.39	2.35	2.33	2.12	2.19	2.17	2.14	2.12	2.11	2.18	2.13	2.34	2.32

Similarly we can calculate for all the other departments (CSE, ECE, ECM, MECH,CE and IT)

PROCEDURE TO VALIDATE THE POs and PSOs:

STEP 1: Outline the Program Specific Outcomes (PSOs).

STEP 2: Outline the Course Outcomes (COs) of Each Courses.

STEP 3: Establish Correlation Between COs-POs-PSOs.

STEP 4: Define the Rubrics to Validate POs and PSOs.

STEP 5: Define the Target Attainment Levels of POs and PSOs.

STEP 6: Estimate the Attainment of POs and PSOs through Direct and Indirect Methods.

STEP 7: Compare the Attainment of POs and PSOs with Target Level.

CONTINUOUS IMPOROVEMENT ASSESSMENT SUMMARY

The PO-PSO attainment values of the CSE department for the 2015, 2016 and 2017 admitted batches are given below for the example. The Department Advisory committee of respective branches gathers with all consolidated tabulated results from the program coordinator. The DAC makes assessment to improve the CO-PO attainment by suggesting plan of action for departmental outcomes improvements based on the assessment data.

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