

## Institute of Engineering & Management (Autonomous)

### CO-PO Attainment Calculation Process

#### 1.1 Establishing relation between Program Educational Objectives (PEOs) and Program Outcomes (POs) to setup target level of PO attainment

In this step the PEOs are mapped with POs as

POs and PEOs		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
		Engineering knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and teamwork	Communication	Project management and finance	Life-long learning
PEO 1	Core Strength	3	3	3	3	1	2	1	1	1	1	1	1
	Provide solutions for the benefit of society	3	3	3	3	1	2	1	1	1	1	1	1
PEO 2	Design and Innovation	3	3	3	3	3	1	1	1	1	1	1	1
	Provide technically and commercially feasible solutions	3	3	3	3	3	1	1	1	1	1	1	1
PEO 3	Personal development and social responsibilities	1	1	1	1	1	2	3	3	2	3	2	2
	Energy security awareness, communication skill, professionalism	1	1	1	1	1	2	3	3	2	3	2	2
<b>Target level of outcomes</b>		<b>2.33</b>	<b>2.33</b>	<b>2.33</b>	<b>2.33</b>	<b>1.66</b>	<b>1.66</b>	<b>1.66</b>	<b>1.66</b>	<b>1.33</b>	<b>1.66</b>	<b>1.33</b>	<b>1.33</b>

Table 3.10.1.1



**High**



**Moderate**



**Low**



**No  
Relevance**

#### 1.2 Defining relation between Course Outcomes (COs) and POs for each course to obtain overall CO mapping with each POs

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In this step, COs of each course are mapped with POs. The CO levels corresponding to each PO are averaged to obtain overall CO level for each PO and this is repeated for all courses.

*Example: Obtaining overall CO level with each PO for the course PCCCS501.*

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	2	2	1					1
CO2	3	2	2	2	1	1	1	1	1	1		2
CO3	3	3	3	3	2	3	2		1		1	1
CO4	3	3	3	3	2	2	2	1	1	1		2
CO5	3	3	2	3	1	2	2					2
CO6	3	3	2	3	2	2	2					2
<b>PCCCS501</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>

*Table 1.2.1*

The last row of above table is showing the corresponding overall CO levels with each PO for PCCCS501.

### 1.3 Development of overall CO-PO mapping matrix for all courses

The overall CO levels will be obtained for all courses from CO-PO mapping table of each course (Table 1.2.1) and can be expressed in matrix form. Each element of the matrix can be expressed as  $COPO_i$ , where  $i$  denotes serial number of a course and  $j$  corresponds  $j$ th PO.

*Example: A part of the COPO mapping matrix is given below*

Course	Sl. No	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PCCCS501	1	3	3	2	3	2	2	2	1	1	1	1	2
Courses 2	2	1	1	2	3	2	1	1	1	1	2	1	2
Courses 3	3	1	2	2	3	2	2	2	1	1	2	1	2
Courses 4	4	1	2	2	3	2	2	2	1	1	2	1	2
Courses 5	5	3	2	1	3	2	1	1	1	1	1	1	2

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<b>Courses 6</b>	6	3	3	1	3	2	1	1	1	1	1	1	1
.....	.....	3	3	2	3	2	1	1	1	2	1	1	2
<b>Courses N</b>	<b>N<sub>th</sub></b>	3	3	2	3	2	2	2	1	1	1	1	2

*Table 1.3.1*

From the above matrix, the bottom right element can be written as  $COPO_{Nth,12}$ .

#### 1.4 Course Outcome (CO) Attainment Process

The attainment of COs are evaluated using the existing student data from the examination results, quizzes and laboratory sessions for a course.

CO Attainment value is evaluated using the formula given below.

$$CO_i \text{ in } \% = \frac{\text{sum of marks scored in exam for } CO_i \text{ questions}}{\text{sum of marks allotted in exam for } CO_i \text{ questions}} \times 100$$

$$\text{Attainment \% of } CO_i = \frac{\text{Number of Students Scored } \geq \text{Threshold Marks}}{\text{Number of Students attempt the } CO_i \text{ questions}} \times 100$$

( where  $i$  is the serial number of CO )

According to the formula those students are considered only who have scored greater than/equal to the 60 % of marks assigned for a particular question.

#### 1.5 Computation and construction of overall CO attainment matrix for each course using course assessment tools

The assessment tools for CO attainment of the courses are minor exams, major exam and continuous assessment. The CO attainment levels for each method of assessment are defined below

Definition of CO attainment levels for each method of assessment		
Assessment method	Level	Attainment
<b>End Semester Examination (ESE)</b>	1	60% of students scoring more than 60% marks
	2	70% of students scoring more than 60% marks

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	3	80% of students scoring more than 60% marks
<b>Mid Semester Examination(MSE)</b>	1	60% of students scoring more than 60% marks
	2	70% of students scoring more than 60% marks
	3	80% of students scoring more than 60% marks
<b>Continuous Assessment(CA) based on class attendance &amp; assignment</b>	1	60% of students scoring more than 60% marks
	2	70% of students scoring more than 60% marks
	3	80% of students scoring more than 60% marks

*Table 1.5.1*

Course attainment levels through End Semester Examination ( $E_i$ ), Mid Semester Examination ( $M_i$ ) and Continuous Assessment( $CA_i$ ) assessment method for  $i$ th course are obtained using the above table and method-wise marks obtained by students in a course.

**1.6 Overall Course Outcome (OCO) attainment level for each course is given by**

$$OCO_i = 0.7 \times E_i + 0.2 \times M_i + 0.1 \times CA_i \quad (i \text{ is the serial number of a course.})$$

Where  $E_i$  and  $M_i$  represent CO attainment levels using End Semester, Mid Semester assessment methods respectively.

*Example: Overall CO attainment level for a course*

Assessment Tool	Course PCCCS 501
ESE	3
MSE	2
CA	3
<b>Overall CO</b>	<b>2.80</b>

*Table 1.6.1*



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Overall CO attainment level of PCCCS 501

$$OCO_1 = 0.7 \times 3 + 0.2 \times 2 + 0.1 \times 3 = 2.80 \quad (1 \text{ is the serial number of the course. PCCCS501})$$

#### 1.7 Attainment of PO through CO-PO mapping

Attainment of each PO is calculated using the mapping of respective CO to PO/s and the attainment of each CO using the following equation.

$$PO_i = \frac{\text{Attainment of CO1} \times \text{level of CO1 to PO}_i + \text{Attainment of CO2} \times \text{level of CO2 to PO}_i + \dots + \text{Attainment of CO}_4 \times \text{level of CO}_4 \text{ to PO}_i}{\text{Sum of Levels of all COs to PO}_i} \times 100$$

100

(Where  $i$  is the serial number of PO ranges from 1 to 12)

#### 1.8 Calculation and construction of Direct PO attainment matrix using overall CO-PO mapping matrix and overall CO attainment matrix

The direct PO attainment of a course is given by

$$DCPO_{i,k} = COPO_{i,k} \times 1/3 \times OCO_i$$

Where  $i$  is the serial number of a course,  $k$  corresponds to  $k$ th PO.  $COPO_{i,k}$ , and  $OCO_i$  can be obtained from **Table 1.3.1** and **Table 1.5.1** with formulae respectively for each course.

1. Calculation of overall Direct PO attainment. 
$$DPO_j = \frac{1}{P} \sum_{k=1}^P DCPO_{j,k}$$

2. **Calculation of Indirect PO attainment.** Indirect assessment is done through program student survey, alumni survey and employer survey. Program student's survey is given a weight age of 40%, employer and alumni survey are given a weight age of 30% each. Survey forms were prepared (hard copy and Google form) and distributed among current students, graduating students, alumni and employers. Feedback forms were designed with questions corresponding to POs and PSOs relevant to the program. All the feedback forms are collected and data are tabulated in an excel sheet. Average level for each PO has been calculated using the formula

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$$IPO_j = \frac{0.4}{p} \sum_{k=1}^p QPO_{j,k} + \frac{0.3}{q} \sum_{k=1}^q QPO_{j,k} + \frac{0.3}{r} \sum_{k=1}^r QPO_{j,k}$$

Where  $p$  is the number of current student participants,  $q$  is the number of alumni participants,  $r$  is the number of employer participants,  $j$  is the number of PO related questions and  $QPO_j$ , is the level given by  $p$ th participant for  $j$ th question.  $IPO_j$  is the indirect attainment of  $j$ th PO.

#### 3. Computation of overall PO attainment

The formula for calculating overall PO attainment is given by  
 $OPO_j = 0.8 \times DPO_j + 0.2 \times IPO_j$ ,  
 where  $j=1 \dots 12$  (12 POs).

#### 4. Comparison of target level and obtained PO attainment

In this step the target levels of PO attainment which were obtained are compared with the attainment computed.

#### Example:

Sl. No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Target level	2.33	2.33	2.33	2.33	1.66	1.66	1.66	1.66	1.33	1.66	1.33	1.33
Actual Attainment $OPO_j$	2.46	2.33	2.05	2.37	1.95	1.62	1.65	1.31	1.42	1.53	1.22	1.75
Remarks	Y	Y	N	Y	Y	N	N	N	Y	N	N	Y

Y: Target Achieved, N: Target Not Achieved

Table 1.8.1



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## Instructions of USE

**1. The template should be copied before any editing is done. The same template shall be used per subject.**

- a. Either use copies of the template for each subject, thus creating one file per subject.
- b. Alternatively copy the subject tab in the excel files and create a copy of the tab. In such case, ensure that each subject tab is properly named.

**2. Mention the Subject Details (Subject Name & Subject Code) at the top of each sheet, along with the Academic Year for which the analysis is been done.**

**3. Fillup the COs corresponding to the Mid Sem Examinations, Continuous Assessment, End Semester Examination as and when they are done. Keep the whatever assessment is yet to be completed as blank.**

- a. COs must be written as CO1, CO2, CO3, CO4, CO5, CO6
- b. Only one CO is assigned to one question or its alternative
- c. The assigned COs should be taken from the question papers, printed during examination. Please ensure to keep a copy of the printed questions paper.

**4. The Bloom's Levels will reflect automatically, hence there is no need to fill them up.**

**5. Fillup the marks attained by the student for each question**

- a. If a student has not attempted a particular question or has scored a "zero" in a particular question, please fillup with 0 in numeric format.
- b. The sample template contains random data to facilitate understanding, it should not be regarded as guidelines for marks entry
- c. **New rows for student should be added between row 16 to row 23. This should be strictly followed, else the formulae shall not be applied properly to all students.**

**6. Fillup the "Maximum Weightage of Marks" with the full marks per question or assessment as per the available source of information.**

**7. "Marks Score", "Participation", "60% of actual marks", "Student getting more than 60% marks", "Student participation" shall reflect automatically, hence there is no need to fill them up.**

**8. CO-PO mapping table of the respective subject should be filled up as per available source of information**

- a. Attainment of CO-PO shall be reflected automatically.
- b. Graphs and other tables shall be reflected automatically once data is entered in the appropriate tables.





