INSTITUTE OF ENGINEERING & MANAGEMENT
Good Education, Good Jobs

Institute of Engineering & Management (Autonomous)

CO-PO Attainment Calculation Process

1.1 Establishing relation between Program Educational Objectives (PEO)s and Program Outcomes (PO)s 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 team work	Communication	Project management and finance	Life-long learning
	Core Strength	3	3	3	3	1	2	1	1	1	1	1	1
PEO 1	Provide solutions for the benefit of society	3	3	3	3	1	2	1	1	1	1	1	1
	Design and Innovation	3	3	3	3	3	1	1	1	1	1	1	1
PEO 2	Provide technically and commercially feasible solutions	3	3	3	3	3	1	1	1	1	1	1	1
	Personal development and social responsibilities	1	1	1	1	1	2	3	3	2	3	2	2
PEO 3	Energy security awareness, communication skill, professionalism	1	1	1	1	1	2	3	3	2	3	2	2
Target level of outcomes		2.33	2.33	2.33	2.33	1.66	1.66	1.66	1.66	1.33	1.66	1.33	1.33

Table 3.10.1.1

3	High	2	Moderate	1	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
PCCCS501	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**

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 $COPOi$, where i denotes serial number of a course and j corresponds jth 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
Courses 6	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

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Courses N	Nth	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 bellow.

$$COi\ in\ \% = \frac{sum\ of\ marks\ scored\ in\ exam\ for\ COi\ questions}{sum\ of\ marks\ alloted\ in\ exam\ for\ COi\ questions} \times 100$$

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

(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**
End Semester Examination (ESE)	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
Mid Semester Examination(MSE)	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
Continuous Assessment(CA) based on class attendance & assignment	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 (Ei) , Mid Semester Examination (Mi) and Continuous Assessment(CAi) assessment method for ith 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

$OCOi = 0.7 \times Ei + 0.2 \times Mi \; + + \; 0.1 \times CAi$ (i is the serial number of a course.)

Where Ei and Mi 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
Overall CO	**2.80**

Table 1.6.1

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Overall CO attainment level of PCCCS 501

$OCO_1 = \mathbf{0}.7\times\mathbf{3} + \mathbf{0}.2\times\mathbf{2} + \mathbf{0}.1\times 3 = 2.80$ *(1 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.

$$POi = \frac{Attnmnt\ of\ CO1 \times level\ of\ CO1\ to\ POi + Attnmnt\ of\ CO2 \times level\ of\ CO2\ to\ POi + \cdots\ldots + Attnmnt\ of\ CO4 \times level\ of\ CO4\ to\ POi)}{Sum\ of\ Levels\ of\ all\ COs\ to\ POi} \times 100$$

(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

$$DCPOi,=COPOi,k\times 1/3\ OCOi$$

Where i is the serial number of a course, k corresponds to kth PO. $\boldsymbol{COPOi,}$ and $\boldsymbol{OCOi}$ 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. $\boldsymbol{DPO_j = \frac{1}{p}\sum_{k=1}^{p} DCPO_{j,k}}$

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 $QPOj$, is the level given by pth participant for jth question. $IPOj$ is the indirect attainment of jth PO.

3. **Computation of overall PO attainment**
   The formula for calculating overall PO attainment is given by
   $OPOj=0.8\times DPOj+0.2\times IPOj$,
   where j=1...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 $OPOj$	**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

Prof. Dr. Debika Bhattacharyya,
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