

**Swami Keshvanand Institute of Technology,  
Management & Gramothan  
Internal Quality Assurance Cell**

SKIT/ IQAC/2022-23/14

May 03, 2023

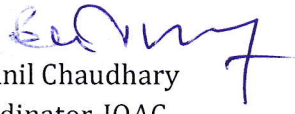
**NOTICE**

A meeting of Internal Quality Assurance Cell (IQAC) is scheduled on May 12, 2023 at 11: 00 AM with following agenda items:

1. Review of previous meeting's action items.
2. Status of preparation of NBA visit of B.Tech program of CSE and EE
3. Status of Institute's application for Autonomous status.
4. Proposed OBE framework
5. Preparation of exam cell for autonomy.
6. Preparation of revised vision and mission statement of Institute
7. Feedback report of odd semester submitted by various offices
8. Report of the FDP for new entrance faculty members
9. The quality audit of the academic activities held since the last IQAC meeting.
10. Assessment of the quality and outcomes of the events concluded since the last IQAC meeting

All the members of IQAC are requested to make it convenient to attend the meeting.

**Venue:** Internal Quality Assurance Cell (Vikram Sarabhai Block).

  
Dr. Anil Chaudhary  
Coordinator-IQAC

**Copy to:**

Director  
Director (Academics)  
Principal  
Registrar  
Dean  
Head-OFA, Head-OSA  
All HoD's  
All the member of IQAC  
IQAC File

**Swami Keshvanand Institute of Technology,  
Management & Gramothan  
Internal Quality Assurance Cell**

SKIT/ IQAC/2022-23/17

May 15, 2023

**Minutes of Meeting**

With reference to SKIT/ IQAC/2022-23/14, A meeting of the Internal Quality Assurance Cell (IQAC) was held on May 12, 2023 2023 at 11: 00 AM in the Internal Quality Assurance Cell (Vikram Sarabhai Block).

The following IQAC members participated:

1. Prof.(Dr.) S. L. Surana, Director (Academics) *S. L. Surana*
2. Prof.(Dr.) Ramesh Kumar Pachar (Chairperson-IQAC)
3. Mrs. Rachna Meel (Registrar)
4. Prof.(Dr.) R. K. Jain, Dean
5. Prof.(Dr.) Anil Choudhary (Coordinator-IQAC)
6. Prof.(Dr.) Praveen Kumar Jain
7. Prof. (Dr.) Rishi Vyas
8. Prof.(Dr.) Mukesh Arora *Mukesh*
9. Prof.(Dr.) Amber Srivastava
10. Prof.(Dr.) Mukesh Kumar Gupta
11. Prof. (Dr.) Sangeeta Vyas *Sangeeta*
12. Prof.(Dr.) Dheeraj Joshi *Dheeraj*
13. Dr. Sarfaraz Nawaz *Sarfaraz*
14. Prof.(Dr.) Rohit Mukherjee *Rohit*
15. Dr. Atul Gupta *Atul*
16. Mr. Kailash Soni
17. Mr. Milind Sharma
18. Mr. Sanket Sharma
19. Mr. Jyoti Prakash Sharma

Members granted leave of absence:

1. Mr. Ronak Singhavi
2. Prof. (Dr.) D. K. Sharma

*Rohit* *Sharma* *Prof. D. K. Sharma* *Surana* *Rachna* *Atul* *Rohit* *Jyoti Prakash Sharma*

Minutes of meetings recorded by: Dr. Rishi Vyas


S. No.	Agenda Items	Highlights/ Observation/Discussion points
1	Review of previous meeting's action items	Previous meetings' action items were discussed and it was resolved to close all the action items at the earliest.
2.	Status of preparation of NBA visit of B.Tech program of CSE and EE	Prof. S.L. Surana shared the preparedness and other details pertaining to the visit of the NBA peer team for accreditation of the B.Tech. program run by Computer Science & Engineering and Electrical Engineering Department.
3.	Status of Institute's application for Autonomous status.	Dean, Prof. R.K. Jain Shared the submission of the Institute's application to RTU Kota and subsequent development in the new online application procedure of UGC. Since the portal is under development hence the submission of application could not be made to UGC.
4.	Proposed OBE framework	Prof. Anil Choudhary presented the findings of the subcommittee and detailed report for the revision in the existing process. The committee approved the revised OBE framework for implementation from the academic session 2023-24.
5	Preparation of exam cell for autonomy.	Dean and Examination Incharge, Prof. R.K. Jain shared the proposed procedure to be adopted post grant of Autonomy. It was decided to implement these procedures from the upcoming academic session.
6.	Preparation of revised vision and mission statement of Institute	Prof. P.K. Jain presented the analysis of feedback received from all stakeholders on the existing vision and mission statement of the Institute. The committee reviewed it and revised statements were proposed for submission to BOG.
7	Feedback report of odd semester submitted by various offices	The head OSA, Prof. Sangeeta Vyas, submitted the report on the feedback received from students during the odd semester. The proposed actions taken are reviewed and approved for submission to AMC.
8.	Report of the FDP for new entrance faculty members	Prof. Anil Chaudhary shared the report of the FDP conducted for newly recruited faculty members.
9.	The quality audit of the academic activities held since the last IQAC meeting.	Head OFA, Prof. Mukesh Arora shared the outcome of the quality audits conducted by OFA. The outlines were discussed and HODs are given instruction to work on lacuna items.
	Assessment of the quality and outcomes of the events concluded since the last IQAC meeting	Head OFA, Prof. Mukesh Arora briefed the members about the quality of the events concluded in the Institute since the last meeting.

The bottom of the page contains several handwritten signatures in blue ink. From left to right, they include: a signature that appears to be 'S. L. Surana', a signature that appears to be 'R. K. Jain', a signature that appears to be 'P. K. Jain', a signature that appears to be 'Sangeeta Vyas', a signature that appears to be 'Anil Chaudhary', a signature that appears to be 'Mukesh Arora', and a signature that appears to be 'Rishi Vyas'. There are also some initials and other marks scattered around.



Dr. Anil Chaudhary  
Coordinator-IQAC

Director  
Director (Academics)  
Principal  
Registrar  
Dean, Head-OFA, Head-OSA  
All HoD's  
All the member of IQAC  
IQAC File  
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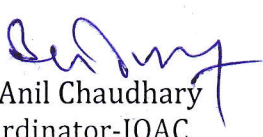

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# Swami Keshvanand Institute of Technology, Management & Gramothan

## Internal Quality Assurance Cell

Attendance: IQAC Meeting held on 12.05.2023

Name	Signature
Prof.(Dr.) S. L. Surana, Director (Academics)	S. L. Surana
Prof.(Dr.) Ramesh Kumar Pachar (Chairperson-IQAC)	R. K. Pachar
Mrs. Rachna Meel (Registrar)	Rachna
Prof.(Dr.) Anil Chaudhary (Coordinator-IQAC)	Anil Chaudhary
Prof.(Dr.) Praveen Kumar Jain	Praveen
Prof. (Dr.) Rishi Vyas	Rishi Vyas
Prof.(Dr.) R. K. Jain	R. K. Jain
Prof.(Dr.) Mukesh Kumar Gupta	Mukesh
Prof.(Dr.) Mukesh Arora	Mukesh
Prof. (Dr.) Sangeeta Vyas	Sangeeta
Prof.(Dr.) Dheeraj Joshi	Dheeraj
Dr. Sarfaraz Nawaz	Sarfaraz
Prof. (Dr.) D.K. Sharma	ABSENT
Prof.(Dr.) Rohit Mukherjee	Rohit
Prof.(Dr.) Amber Srivastava	Amber
Dr. Atul Gupta	Atul
Mr. Kailash Soni	Kailash
Mr. Milind Sharma	Milind
Mr. Sanket Sharma	Sanket
Mr. Ronak Singhavi	ABSENT
Mr. Jyoti Prakash Sharma	Jyoti Prakash

  
Dr. Anil Chaudhary  
Coordinator-IQAC

## **Outcome Based Education: Calculating Attainment of POs/PSOs and PEOs through COs**

For every organization Vision and Mission statements are important. Vision statement leads to Mission statement. For an Institute first vision and mission statements are formulated for the entire institute and then vision & mission statements are formulated for individual department in synchronization with the statements of the institute. Mission statement should naturally progress into PEO statements and then into PO Statements which culminate into CO statements. For undergraduate courses in engineering NBA has specified 12 PO statements which are general. For a particular branch two to three programme specific POs called PSOs are to be defined in the department concerned. For NBA the following method for evaluation of course outcome (CO), programme outcome (PO) and Programme educational objective (PEO) is suggested.

1. Drafting of vision & mission for each department in synchronism with the vision and mission statements of the Institute.
2. Drafting of PEO statements (Programme Educational Objectives) and their Mapping with Mission statements
3. Drafting of PO and PSO statements
4. Drafting Competencies (CA) and Performance Indication (PI) for each PO & PSO
5. Drafting of COs
6. Mapping the relationship between POs-PSOs and COs
7. Determination of curricular gap
8. Steps to bridge the curricular gap
9. Assessment Tools for PO & PSO
10. Direct Attainment of PO & PSO
  - 10.1 Assessment of Theory courses
  - 10.2 Assessment of Practical courses
  - 10.3 Assessment of Seminar
  - 10.4 Assessment of Project
  - 10.5 Assessment of Industrial Training
  - 10.6 Combined Direct Attainment of PO & PSO
11. Indirect Attainment of PO & PSO
12. Overall Assessment of PO & PSO
13. Mapping of PEOs with PO-PSO
14. Tools and Relative weights for Attainments of PEOs

- 14.1 Direct Attainment Tools for PEOs
- 14.2 Indirect Attainment Tools for PEOs
- 14.3 Direct Attainment of PEOs through attainment of PO-PSO
- 14.4 Direct Attainment of PEOs through placement, higher studies and entrepreneurship.
- 14.5 Indirect Attainment of PEOs through graduate exit survey
- 14.6 Indirect Attainment of PEOs through alumni survey
- 14.7 Indirect Attainment of PEOs through employers' survey
- 14.8 Indirect Attainment of PEO through parents Assessment
- 15. Evaluation Process
- 16. Appendix I
- 17. Appendix II
- 18. Appendix III
- 19. Appendix IV

## 1. Drafting of Vision and Mission of each department

The vision and mission of the department should be drafted by DPAQIC in consultation with all stakeholders in such a way that they are consistent-with the vision and mission of the Institute. These should be reviewed every five years and may be modified if required.

## 2. Drafting of PEOs and their Mapping with Vision Statement

Proper Procedure be followed for drafting of PEOs by DPAQIC and mapped with the mission statements of the department. The mapping between the mission statements and PEOs is finalized with the help of various feedback/suggestions received from all the stake holders.

Mapping is defined based on the following levels-  
low (1), medium (2), high (3)

Levels (1/2/3) should be assigned based on the extent to which key words of mission statements are implemented and justified by various stakeholders. (state clearly justification).

**Example:** Three mission statements are mapped with four PEO statements

**Mapping of PEOs with Mission Statements**

PEO statement\ Mission Statement	M1	M2	M3
PEO1 .....	3	1	2
PEO2 .....	2	3	3
PEO3 .....	-	2	1
PEO4 .....	3	3	3

### 3. Drafting PO and PSO Statements

POs and PSOs provide guidance at the programme level for curriculum design, delivery and assessment of student learning. POs represent high level generic goals whereas PSOs represent branch specific goals. There are 12 well defined POs for engineering disciplines by NBA whereas PSOs are to be defined for each specific branch for Engineering which may be 2 to 3 in number. The 12 POs as defined by NBA are as under.

- (i) Engineering knowledge
- (ii) Problem Analysis
- (iii) Design development of solutions
- (iv) Conduct Investigations of Complex problems
- (v) Modern tool usage
- (vi) The engineer and society
- (vii) Environment and sustainability
- (viii) Ethics
- (ix) Individual and team work
- (x) Communication
- (xi) Project management and finance
- (xii) Life-long learning

Formation of PSOs are branch specific. Some examples are given below-

#### Example: Branch Electrical Engineering

<b>PS01:</b>	To train students for professional career in Electrical Engineering such that they are able to solve broadly defined complex electrical engineering problems.
<b>PS02:</b>	To develop proficient Electrical Engineering graduates so that they can apply their knowledge and make decisions.
<b>PS03:</b>	To induct creativity, entrepreneurship and curiosity towards learning new ideas in Electrical Engineering

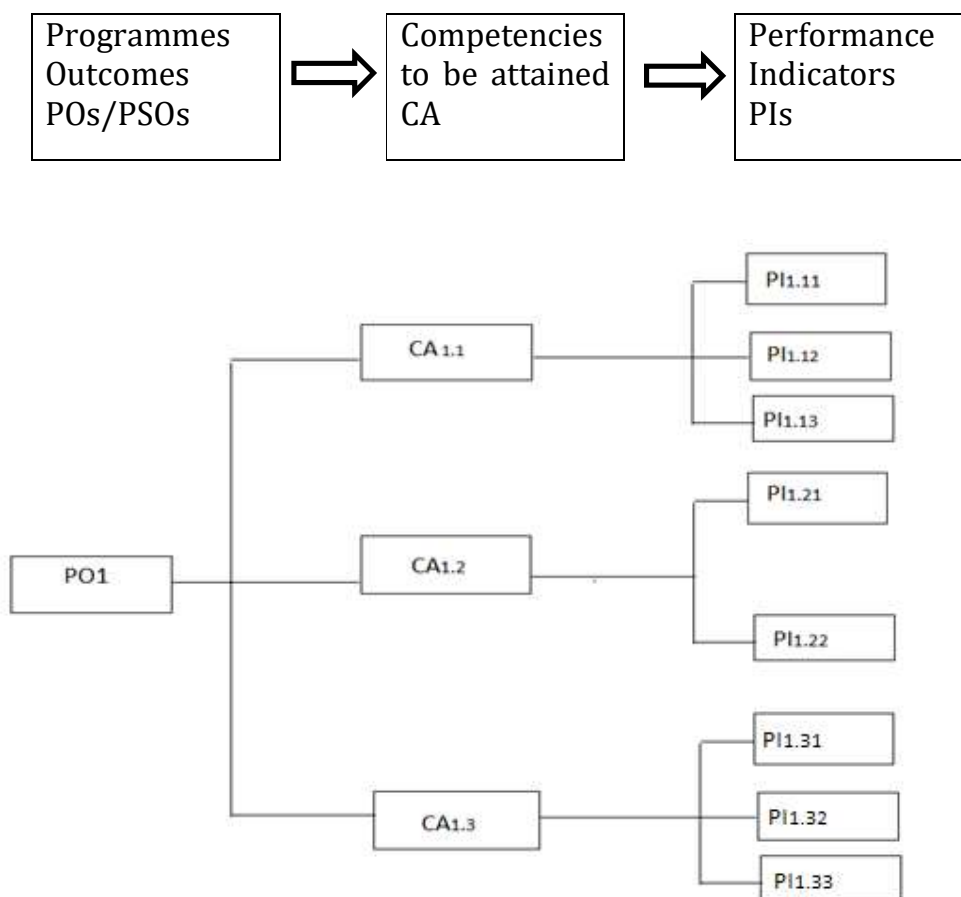
### 4. Defining Competences (CA) and Performance Indicators (PI) for each PO-PSO

POs & PSOs are useful guide at the programme level for curriculum design and represent high level generic goals that are not directly measurable. To map POs & PSOs with COs it is necessary to define the following two terms.

- (i) Competencies (CA) and
- (ii) Performance Indications (PI)



Competencies are the abilities which we wish students to achieve whereas PIs are the breakup statements of POs & PSOs.



**Fig 1: Possible Mapping of CA and PI for PO1**

Competencies (CA) are defined for each PO & PSO and for each competency performance indicators (PI) are defined. As an example three competencies CA<sub>1.1</sub>, CA<sub>1.2</sub> & CA<sub>1.3</sub> are defined for PO<sub>1</sub>. Performance indications 3, 2 & 3 in number are defined for CA<sub>1.1</sub>, CA<sub>1.2</sub> & CA<sub>1.3</sub> respectively. This is shown in Fig. 1.

#### **Examples of Competencies:**

Competency examples may be framed for each PO & PSO in the following format

The student should be able to demonstrate an ability to generate/define/select/model.....etc.

**Examples of PIs:** The student should be able to Identify/Apply/Build/Analyse/Design/Describe/Create.....etc.

## 5. Drafting of COs

As POs & PSOs are for the complete programme, COs are for specific course. They should be drafted in such a way that they are achievable and measurable. Also they should have linkage with POs & PSOs and enhance the learners understanding of the course. While drafting COs, it should be kept in mind that they pushes the learner from first to the final order of Blooms's Taxonomy.

**Example:** The student should be able to understand, apply, analyse, evaluate, create, discuss, explain, develop, classify, compare, design. COs for Project, Seminar and Industrial Training and sample theory and practical course are given in Appendix I

## 6. Mapping the Relationship between POs, PSOs and COs

The correlation value for all PO-PSO with all the courses (theory, practical, Seminar, Project, Industrial training) for all the semesters is determined by considering each course separately. The steps are given below:

**Step 1:** Draft Competencies (CAs) and Performance Indicators (PIs) for all POs-PSOs.

**Step 2:** The correlation value of a particular PO-PSO (say  $PO_j$ ) with CO under consideration (say  $CO_i$ ) is calculated as a number of correlated PIs (say  $PI_{jk}$ ) divided by the total PIs ( $\sum PI_{jk}$ ) of that particular  $PO_j$

The relationship between PO-PSO and CO can be classified as low (1), medium (2), high (3) according to the following rubric as given in Table II

**Table II – Rubric for mapping PO-PSO with CO**

Ratio	Mapping
If $0 < \text{ratio} \leq 0.33$	Low (1)
If $0.33 < \text{ratio} \leq 0.66$	Medium (2)
If $0.66 < \text{ratio} \leq 1.00$	High (3)

**Example:** If  $CO_1$  of a particular course satisfies 2 PIs out of total defined 5 PIs of  $PO_1$ , then the ratio is  $2/5$  i.e 0.4 which lies between 0.33 & 0.66.

Hence mapping of  $CO_1$  with  $PO_1$  is 2

Table III below depicts correlation matrix for all COs for a particular course with POs and PSOs as obtained using step 1 and step 2.

**Table III – Weighted Average Matrix for a Single Course**

POs COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
CO <sub>1</sub>	2	1	-	-		-	2	1
CO <sub>2</sub>	3	-	1	-		3	-	-
CO <sub>3</sub>	1	2	-	-		2	1	3
CO <sub>4</sub>	-	-	2	-		-	2	1
CO <sub>5</sub>	-	2	1	2		1	2	2
Weighted Average	3	2	2	1		3	2	2

In Table III weighted average for the course under consideration is calculated for every PO-PSO by summing relationship number (1, 2 or 3) for all COs of that course and dividing it by the maximum attainable value of the COs that have correlation with that particular PO-PSO.

In the example under consideration PO<sub>1</sub> has correlation with CO<sub>1</sub>, CO<sub>2</sub> and CO<sub>3</sub>. The Course outcome of CO<sub>4</sub> has no correlation with PO<sub>4</sub> and the maximum attainable value of CO<sub>1</sub> is (3x3). Hence the weighted average of PO<sub>1</sub> with CO of this particular course is  $(2+3+1+0+0)/(3 \times 3)$  i.e. 0.67 which lies between 0.66 and 1.00. Hence mapping of CO with PO<sub>1</sub> for this Course is 3.

**Step 3:** As explained in Step 2, obtain relationship as low (1), medium (2) and high (3) for all the courses with all the POs-PSOs.

## 7. Determination of curricular gaps.

According to the procedure described in section 6 correlation weighted average is computed for all courses from semester I to VIII with all POs-PSOs. This is shown in Table IV. In this table curricular sufficiency is calculated by summing up all the weighted average values for a particular PO-PSO and dividing the sum by the number of courses in the programme which have correlation with that particular PO-PSO. The ideal achievement for curricular sufficiency for all courses is 3.0 (high) . Hence curricular gap can be obtained by subtracting curricular sufficiency of each PO-PSO from the ideal achievable value (3.0).

**Table IV – Weighted Average Matrix for all Courses**

All Courses I to VIII Semesters	Weighted Averages of POs/PSOs							
	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
Course 1	*	*	-	-		*	*	*
Course 2	*	-	*	-		-	*	-
Course n	-	-	*	*		*	*	*
sum of Weighted Average	*	*	*	*		*	*	*
No. of correlated courses	*	*	*	*		*	*	*
Curricular sufficiency	*	*	*	*		*	*	*
Curricular Gap	*	*	*	*		*	*	*

## 8. Steps to Bridge the Curricular Gap

In order to bridge the curricular gap extra efforts are needed at the faculty, department and institute level. Some of the suggested activities which may be introduced are listed below.

- (i) Introduction of certain important topics beyond syllabus.
- (ii) Introduction of certain important experiments beyond syllabus.
- (iii) Introduction of one/two open ended experiments in each lab.
- (iv) Introduction of virtual lab
- (v) Group assignment to the students
- (vi) Organization of experts lectures from academia/industry
- (vii) Organization of seminars/conferences/workshops
- (viii) Organization of local visits and industrial tour
- (ix) Organization of Hackathon and other social activities
- (x) Participation in MOOCs
- (xi) Short term certificate courses in emerging technologies related with industry needs.
- (xii) Campus Recruitment Training
- (xiii) Soft Skill Training
- (xiv) Universal Human Values Training
- (xv) Creating students chapters of professional societies

## 9. Assessment Tools for POs and PSOs

These can be classified as

- (i) Direct Assessment Tools
- (ii) Indirect Assessment Tools

## 10. Direct Attainment of POs-PSOs

- Step 1 Obtain attainment of all courses (theory, practical, seminar, project, industrial training) using internal assessment tools.
- Step 2 Obtain attainment of all courses using external assessment tools.
- Step 3 Using correlation matrix (Table III) obtain the combined internal attainment of POs-PSOs.

### 10.1 Assessment of Theory Courses

#### 10.1.1 Direct Internal Assessment Tools and Their Relative Weights

Tools	Weightage
(i) Mid Term Examination (Two)	2 x 0.25
(ii) Unit Test (Two)	2 x 0.1
(iii) Assignment (Two)	2 x 0.1
(iv) Group Assignment (One)	0.1

Step 1: Map the assessment tools with course outcomes for each course.

Example: For a single course it is shown in Table V.

**Table V – Mapping of Direct Internal Assessment Tools with COs**

Direct Internal Assessment Tool	Course Outcome COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Mid Term Examination 1	*	*		*	
Mid Term Examination 2	*	*	*		
Unit Test 1	*	*			
Unit Test 2	*	*			
Assessment 1		*	*	*	
Assessment 2		*	*	*	
Group Assessment			*	*	*

In Table V – Lower order COs on Bloom's Taxonomy such as 'Remember' and 'Understand' can be assessed with the tools such as Unit Tests and to some extent with the help of Assignments. The higher order COs such as Apply and Analyze can be assessed with the help of mid-term examination, assignments and group assignment.



## Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of the students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 50\%$	Low (1)
$50\% < N \leq 70\%$	Medium (2)
$70\% < N \leq 100\%$	High (3)

Example: For single course it is shown in Table VI.

**Table VI – Mapping of Direct Internal Attainment Tools with COs**

Direct Internal Assessment Tool	Weightage	Weighted Course Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Mid Term Examination 1	0.25	2x0.25	3x0.25		2x0.25	
Mid Term Examination 2	0.25	3x0.25	2x0.25	2x0.25		
Unit Test 1	0.10	3x0.1	3x0.1			
Unit Test 2	0.10	3x0.1	3x0.1			
Assessment 1	0.10	3x0.1	3x0.1	3x0.1	2x0.1	
Assessment 2	0.10	3x0.1	3x0.1	3x0.1	3x0.1	
Group Assessment	0.10			2x0.1	2x0.1	2x0.1
Course Outcome Attainment	1.00	2.45	2.45	1.30	0.70	0.20

### 10.1.2: Direct External Assessment and Their Relative Weight

Tool	Weightage
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Semester End Examination	1.0
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Outcome rubric for external assessment of theory courses.

Reference level low (1), medium (2), high (3) are computed as the number (N) in per cent getting target marks 40%.

$0 < N \leq 50\%$	Low (1)
$50\% < N \leq 70\%$	Medium (2)
$70\% < N \leq 100\%$	High (3)

External Attainment in a theory course

1.0 x performance level in semester end examination

Example:  $1.0 \times 2.0 = 2.0$

### 10.1.3: Overall Attainment in Theory Courses

Overall attainment is obtained by combining 20% to 40% weightage of attainment from internal assessment and the remaining 80% to 60% weightage of attainment from external assessment. The distribution of weightage between internal and external assessment depends upon the teaching scheme adopted. In the example considered this ratio between internal and external assessments has been taken as 20:80 for overall assessment.

$$0.2 \times \text{Internal Attainment} + 0.8 \times \text{External Attainment}$$

Example: For theory courses it is shown in Table VII

**Table VII – Overall Direct Attainment of CO in theory courses**

Direct Internal CO Attainment	Course Outcome COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Internal Assessment	2.45	2.45	1.30	0.70	0.20
External Assessment	2.00	2.00	2.00	2.00	2.00
20% of Internal Attainment	0.49	0.49	0.26	0.14	0.04
80% of External Attainment	1.60	1.60	1.60	1.60	1.60
Overall Direct Attainment	2.09	2.09	1.86	1.74	1.64

## 10.2 Assessment of Practical Courses

### 10.2.1 Direct Internal Assessment Tools & Their Relative Weights

Tools	Relative Weightage
(i) Mid Term Examination 1 including conduct of Exp. And viva-voce	0.20 + 0.1
(ii) Mid Term Examination 2 including conduct of Exp. and viva-voce	0.20 + 0.1
(iii) Performance in conduct of Lab experiments during semester	0.20
(iv) Quality of Lab records	0.10
(v) Attendance and punctuality in submission of lab records	0.10

Step 1: Map the assessment tools with outcomes of each practical course.

Example: For a single practical course it is shown in Table VIII.

**Table VIII – Mapping of Direct Internal Assessment tools with practical course.**

Direct Internal Assessment Tool	Practical Course Outcome COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Mid Term Exam 1 + Viva Voce	*	*	*	*	*
Mid Term Exam 2 + Viva Voce	*	*	*	*	*
Lab Performance in Conduct of Exp.		*	*	*	
Quality of Lab records			*	*	
Attendance & Punctuality in submission of lab records					*

In Table VIII lower order COs for well-defined close ended experiments can be assessed through mid-term examinations while higher order COs for design type open ended experiments can be assessed through regular laboratory work.

### Step 2: Setting of Performance Level

The following bench mark may be adopted for assessing the performance of students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 50\%$	Low (1)
$50\% < N \leq 70\%$	Medium (2)
$70\% < N \leq 100\%$	High (3)

Example: For a single lab course it is shown in Table IX.

**Table IX: Mapping of Direct Internal Attainment with CO**

Direct Internal Assessment Tool	Weightage	Weighted Practical Course Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Mid Term Exam 1 + Viva Voce	0.30	3x0.30	2x0.30	2x0.30	3x0.3	3x0.3
Mid Term Exam 2 + Viva Voce	0.30	2x0.30	2x0.30	2x0.30	3x0.3	3x0.3
Lab Performance in conduct of Exp.	0.20		3x0.2	3x0.2	3x0.2	
Quality of Lab Records	0.10			2x0.1	2x0.1	
Attendance & Punctuality in submission of lab records	0.10					3x0.1
Lab Course Outcome Attainment	1.00	1.5	1.8	2.0	2.6	2.1

### 10.2.2 Direct External Assessment Tool and Their Relative Weights

Tools	Weightage
(i) External Examination including conduct of Experiment	0.5
(ii) Quiz	0.2
(iii) Viva voce	0.3

Step 1: Map the assessment tools with Lab course outcomes.

Example : For a single course it is shown in Table X.

**Table X: Mapping of Direct External Assessment Tool with Practical Course**

Direct External Assessment Tool	Lab Course Outcome COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Exam Assessment	*	*	*	*	*
Quiz	*	*	*	*	
Viva Voce	*	*	*	*	*

#### Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of the students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: For a single lab course it is shown in the Table XI.

**Table XI – Mapping of Direct External Attainment of CO**

Direct External Assessment Tool	Weightage	Weighted Lab Course Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Exam Assessment	0.5	2x0.5	3x0.5	2x0.5	2x0.5	3x0.5
Quiz	0.2	2x0.2	2x0.2	2x0.2	3x0.2	
Viva Voce	0.3	2x0.3	2x0.3	2x0.3	2x0.2	
Lab Course Outcome Attainment	1.0	2.0	2.5	2.0	2.0	1.5

### 10.2.3 Overall Attainment in Laboratory Courses

It is obtained by combining 60% weightage of attainment from internal assessment and 40% weightage of external assessment.

$$0.6 \times \text{Internal Attainment} + 0.4 \times \text{External Attainment}$$

**Table XII: Overall Attainment of CO in Practical Course**

CO Attainment of Lab Course	COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Attainment	2.0	2.5	2.0	2.0	1.5
40% of External Attainment	0.8	1.0	0.8	0.8	0.6
Internal Attainment	1.5	1.8	2.0	2.6	2.9
60% of Internal Attainment	0.9	1.08	1.2	1.56	1.26
Overall Attainment	1.7	2.08	2.0	2.36	1.86

## 10.3 Assessment of Seminar

### 10.3.1 Direct Internal assessment Tools and their relative weights

Tools	Weightage
(i) Abstract and References	0.1
(ii) Critical Literature Review add Subject Clarity	0.5 (0.2+0.3)
(iii) PPT and Presentation Skill	0.2
(iv) Question-Answer	0.1
(v) Participation in other seminars	0.1

**Step 1: Map the assessment tools with seminar outcomes.**

Example: It is shown in Table XIII

**Table XIII: Mapping of Internal Assessment Tools with seminar outcomes**

Direct Internal Assessment Tools	Seminar Outcomes				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Abstract and References	*	*			
Critical Literature Reviews & Subject Clarity	*	*	*	*	*
PPT & Presentation Skill			*	*	
Question-Answer	*	*		*	
Participation in other seminars	*				*



## Step 2: Setting of Performance Level

The following bench mark may be adopted for assessing the performance of students through assessments tools. Performance low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XIV

**Table XIV – Mapping of Direct Internal Assessment Tools with seminar outcomes.**

Direct Internal Assessment Tools	Weightage	Weighted Seminar Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Abstract & References	0.1	3x0.1	3x0.1			
Critical Literature Review & Subject Clarity	0.5	2x0.5	3x0.5	2x0.5	1x0.5	1x0.5
PPT & Presentation Skill	0.2			2x0.2	3x0.2	
Question Answer	0.1	2x0.1	2x0.1			
Participation in other seminars	0.1	3x0.1				2x0.1
Seminar Outcome Attainment	1.0	1.8	2.0	1.4	1.1	0.7

### 10.3.2 Direct External Assessment Tools and their relative weights

Tools	Weightage
(i) Report Evaluation	0.6
(ii) Viva voce	0.4

Step 1: Map the assessment tools with seminar outcomes.

Example: It is shown in Table XV

**Table XV: Mapping of Direct External Assessment Tools with Seminar Outcomes**

Direct External Assessment Tool	Seminar Outcomes				
	CO1	CO2	CO3	CO4	CO5
Report Evaluation	*	*	*		
Viva voce	*	*	*	*	*

## Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of the students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as a number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XVI

**Table XVI: Mapping of Direct External Assessment Tools with Seminar Outcomes.**

Direct Internal Assessment Tool	Weightage	Weighted Seminar Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Report Evaluation	0.6	3x0.6	3x0.6	3x0.6		
Viva-voce	0.4	2x0.4	2x0.4	2x0.4	2x0.4	
Seminar Outcome Attainment	1.0	2.6	2.6	2.6	0.8	-

### 10.3.3 Overall Attainment of Seminar.

It is obtained by combining 60% weightage of attainment of internal assessment and 40% weightage of attainment of external assessment.

Example: It is shown in table XVII

**Table XVII: Mapping of overall attainment of seminar**

CO Attainment of Seminars	COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Attainment	2.6	2.6	2.6	0.8	-
40% of External Attainment	1.04	1.04	1.04	0.32	-
Internal Attainment	1.8	2.0	1.4	1.1	0.7
60% of Internal Attainment	1.08	1.2	0.84	0.66	0.42
Overall Attainment	2.12	2.24	1.88	0.98	0.42

## 10.4 Assessment of Project

### 10.4.1 Direct Assessment Tools for Internal Assessment of Project

Tools	Weightage
(i) Objectives, Literature survey & Problem Formulation	0.1
(ii) Project planning and designing	0.2
(iii) Fabrication/Software Development and Testing	0.3
(iv) Weekly progress Report and Timely Completion	0.1
(v) Outcome and future scope	0.1
(vi) Report submission, presentation & Q-A	0.2

Step 1: Map the assessment tools with project outcomes.

Example: It is shown in Table XVIII

**Table XVIII: Mapping of Direct Internal Assessment Tools with Project outcomes**

Direct Internal Assessment Tools	Project Outcomes COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Objectives, Literature survey & Problem Formulation	*				
Project planning and Designing			*	*	
Fabrication/Software Development and Testing			*	*	
Weekly progress Report and Timely Completion		*			
Outcome and Future Score					*
Report submission, presentation & Q-A					*

### Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of students for every assessment tools. Performance level low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XIX

**Table XIX: Mapping of Direct Internal Assessment Tools with Project Outcomes.**

Direct Internal Assessment Tool	Weightage	Weighted Project Outcome CO				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Objective , Literature Survey & Problem Formulation	0.1	3x0.1				
Project planning and Designing	0.2			3x0.2		
Fabrication/Software Development & Testing	0.3			3x0.3	3x0.3	
Weekly progress Report and Timely Completion	0.1		3x0.1			
Outcome & Future Scope	0.1					2x0.1
Report Submission Presentation & Q-A	0.2					2x0.2
Project Outcome Attainment	1.0	0.3	0.3	1.5	0.9	0.6

#### 10.4.2 Direct External Assessment Tools for External Assessment of Project and their Relative Weights.

Tools	Weightage
(i) Achievement of Objectives	0.1
(ii) Functional Demonstration	0.5
(iii) Viva voce	0.3
(iv) Report	0.1

Step 1: Map the assessment tools with project outcomes.

Example: It is shown in Table XX

**Table XX: Mapping of Direct External Assessment Tools with Project outcomes.**

Direct External Assessment Tools	Project Outcomes COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Achievement of Objectives	*	*	*	*	*
Functional Demonstration	*	*	*	*	*
Viva voce	*	*	*	*	*
Report	*	*	*	*	*

## Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as a number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XXI

**Table XXI: Mapping of Direct External Assessment Tools with Project outcomes.**

Direct Internal Assessment Tool	Weightage	Weighted Project Outcome COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Achievement of Objectives	0.1	3x0.1	3x0.1	3x0.1	3x0.1	3x0.1
Functional Demonstration	0.5	3x0.5	3x0.5	3x0.5	3x0.5	3x0.5
Viva voce	0.3	2x0.3	2x0.3	2x0.3	2x0.3	2x0.3
Report	0.1	3x0.1	3x0.1	3x0.1	3x0.1	3x0.1
Project Outcome Attainment	1.0	2.7	2.7	2.7	2.7	2.7

### 10.4.3 Overall Attainment of Project

It is obtained by combining 60% weightage of attainment of internal assessment and 40% weightage of attainment external assessment.

$$0.6 \times \text{Internal Attainment} + 0.4 \times \text{External Attainment}$$

Example: It is shown in Table XXII

**Table XXII: Mapping of Overall Attainment of Project**

CO Attainment of Project	COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Attainment	2.7	2.7	2.7	2.7	2.7
40% of External Attainment	1.08	1.08	1.08	1.08	1.08
Internal Attainment	0.3	0.3	1.5	0.9	0.6
60% of Internal Attainment	0.18	0.18	0.90	0.54	0.36
Overall Attainment	1.26	1.26	1.98	1.62	1.44



## 10.5 Assessment of Industrial Training

### 10.5.1 Direct Internal Assessment Tools and their relative weights for Assessment of Industrial Training

Tools	Weightage
(i) Objectives and their achievements	0.2
(ii) Training Report	0.3
(iii) Preparation of PPTs & Presentation Skill	0.3
(iv) Performance in Q-A Session	0.2

Step 1: Map the assessment tools with outcomes of Industrial Training.

Example: It is shown in Table XXIII

**Table XXIII: Mapping of Direct Internal Assessment Tools with Industrial Training**

Direct Internal Assessment Tools	Industrial Training Outcomes COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Objectives and their achievements	*	*	*	*	*
Training Report				*	
Preparation of PPTs & Presentation Skill				*	
Performance in Q-A Session	*	*	*	*	*

#### Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance through of student for assessment tools. Performance level low (1), medium (2), high (3) may be selected as the number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XXIV

**Table XXIV: Mapping of Direct Internal Assessment Tools with Industrial Training Outcomes.**

Direct Internal Assessment Tool	Weightage	Weighted Industrial Training Outcomes COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Objectives & Their Achievements	0.2	3x0.2	3x0.2	3x0.2	3x0.2	
Training Report	0.5				2x0.5	
Preparation through PPTs	0.1	2x0.1	2x0.1	2x0.1	2x0.1	2x0.1
Performance in Q-A Session	0.2	2x0.2	2x0.2	2x0.2	2x0.2	2x0.2
Industrial Training Attainment	1.0	1.2	1.2	1.2	2.2	0.6

#### 10.5.2 Direct External Assessment Tools and their relative weights for External Assessment of Industrial Training

Tools	Weightage
(i) Report Evaluation	0.4
(ii) Attendance & Regularity in Training	0.2
(iii) Viva voce	0.4

Step 1: Map the assessment tools with Industrial Training Outcomes.

Example: It is shown in Table XXV

**Table XXV: Mapping of Direct External Assessment Tools with Industrial Training Outcomes.**

Direct External Assessment Tools	Industrial Training Outcomes COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Report Evaluation	*	*	*	*	*
Attendance & Regularity in Training (Based on certificate)	*	*			
Viva voce	*	*	*	*	*

## Step 2: Setting of performance level

The following bench mark may be adopted for assessing the performance of the students for every assessment tool. Performance level low (1), medium (2), high (3) may be selected as a number of students (N) in per cent getting target marks 60%.

$0 < N \leq 60\%$	Low (1)
$60\% < N \leq 80\%$	Medium (2)
$80\% < N \leq 100\%$	High (3)

Example: It is shown in Table XXV

**Table XXIV: Mapping of Direct External Assessment Tools with Industrial Training Outcomes.**

Direct Internal Assessment Tool	Weightage	Weighted Industrial Training Outcomes COs				
		CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
Report Evaluation	0.4	3x0.4	3x0.4	3x0.4	3x0.4	3x0.4
Attendance & Regularity in Training	0.2	3x0.2	3x0.2			
Viva voce	0.4	2x0.4	2x0.4	2x0.4	2x0.4	1x0.4
Training Outcome Attainment	1.0	2.6	2.6	2.0	2.0	1.6

### 10.5.3 Overall Attainment of Industrial Training

Overall attainment of Industrial Training is obtained by combining 60% weightage of assessment of internal attainment and 40% weightage of assessment of external attainment.

Example: It is shown in Table XXVII

**Table XXVII: Mapping of Overall Attainment of Industrial Training**

CO Attainment of Industrial Training	COs				
	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>4</sub>	CO <sub>5</sub>
External Attainment	2.6	2.6	2.0	2.0	1.6
40% of External Attainment	1.04	1.04	0.8	0.80	0.64
Internal Attainment	1.2	1.2	1.2	2.2	0.6
60% of Internal Attainment	0.72	0.72	0.72	1.32	0.36
Overall Attainment	1.76	1.76	1.52	2.12	1.00

## 10.6 Combined Direct Attainment of PO & PSO

The weighted average matrix for a single course relating COs and POs-PSOs is depicted in Table III. The direct attainment of COs for same course is shown in Table VII. The combination of these two tables correlating CO attainments with POs-PSOs is shown in Table XXVIII.

**Table XXVIII: Depicts correlation between COs and POs & PSOs and attainment values of COs.**

Courses		Weighted Average of PO-PSO							
CO	Attainment	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
CO <sub>1</sub>	2.09	2	1	-	-		-	2	1
CO <sub>2</sub>	2.09	3	-	1	-		3	-	-
CO <sub>3</sub>	1.86	1	2	-	-		2	1	3
CO <sub>4</sub>	1.74	-	-	2	-		-	2	1
CO <sub>5</sub>	1.64	-	2	1	2		1	2	2

In the Table XXIX the formula for the corresponding cells is presented. It is the product of COs and POs – PSOs.

Example: For a single course it is shown in the Table XXIX.

**Table XXIX: Product of COs and POs-PSOs**

COs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
CO <sub>1</sub>	2.09x2	2.09x1	-		-	2.09x2	2.09x1
CO <sub>2</sub>	2.09x3	-	2.09x1		2.09x3	-	-
CO <sub>3</sub>	1.86x1	1.86x2	-		1.86x2	1.86x1	1.86x3
CO <sub>4</sub>	-	-	1.74x2		-	1.74x2	1.74x1
CO <sub>5</sub>	-	1.64x2	1.64x1		1.6x1	1.64x2	1.64x2
Average	4.10	3.03	2.40		3.88	3.20	3.17

PO can attain the maximum value 3 and CO also can attain the maximum value 3. Hence the maximum value their product can attain is 9. Hence the average value of CO & PO in the above table is divided by 9.

Example: Attainment values for a single course is shown below

Attainment in	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
P.U.	0.45	0.34	0.27		0.43	0.35	0.34

In this manner direct attainment for PO-PSO for all courses from I to VIII semesters with PO & PSO is calculated. This is tabulated in Table XXIX A.

**Table XXIX A : Course PO Matrix for the entire course**

<b>Course Number</b>	<b>PO<sub>1</sub></b>	<b>PO<sub>2</sub></b>	<b>PO<sub>3</sub></b>	<b>PO<sub>4</sub></b>	<b>.....</b>	<b>PO<sub>12</sub></b>	<b>PSO<sub>1</sub></b>	<b>PSO<sub>2</sub></b>
101								
102								
⋮								
201								
202								
⋮								
301								
302								
⋮								
401								
402								
⋮								
801								
802								
⋮								
<b>Average Direct Attainment</b>								

Direct average attainment for each PO-PSO is calculated by summing up each column in the above matrix and dividing the sum by the number of courses which contribute that particular PO-PSO.

Example : Let the sum of direct attainment of PO<sub>1</sub> due to all the courses is  $\sum PO_1$  and it is contributed by x number of courses then average direct attainment of PO<sub>1</sub> is  $\sum PO_1/x$ .

These final values of attainment of PO-PSO which includes attainment due to both direct and indirect tools is compared with the target values which may be set as certain percentage of maximum target value which is 3. If the target values are achieved then the target value for the next academic year may be increased by 10 percent otherwise reforms may be done in the teaching learning process so that the set target values are achieved.



Usually the attainment is denoted as low (1), medium (2), high (3). Here the final value is multiplied by 3 to get the value between 1 and 3. Therefore the direct attainment for POs-PSOs with respect to a single course is as under-

Attainment	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
Course 1	1.35	0.96			2.10	1.23	1.05

In this manner direct attainment for PO-PSO for the entire programme can be calculated.

These final values of attainment of POs-PSOs from COs are compared with the target values which may be set as certain percentage of maximum target value which is 3. If the target values are achieved then the target value for the next academic year may be increased by 10 per cent otherwise reforms may be done in the teaching learning process so that the set target values are achieved.

## 11. Indirect Attainment of PO & PSO

Indirect Attainment of PO-PSO can be calculated using the following tools.

	<b>Tools</b>	<b>Weightage</b>
(i)	Graduate Exit Survey	0.6
(ii)	SODECA	0.2
(iii)	Faculty (Batch Counsellor) Perception	0.2

- (i) An exit survey is conducted for all the students of particular programmes at the end of the final year. It encourages the students to be proactive and become more responsible for their own learning and help the department to identify all those domains that require improvement. For exit survey relevant questionnaire related with PO-PSO is circulated to all the outgoing students and the feedback collected. The questionnaire is enclosed in Appendix II.
- (ii) SODECA (Student Discipline and Extra and Co-curricular Activities) takes care of participation of students in some of the co-curricular and extra-curricular activities. It may be assumed same for attainment of all PO-PSO.
- (iii) Faculty (batch Counsellor) perception about the student growth is important because batch counsellor observes a batch of 25 to 30 students for all the four years of their stay in the institute. It may also be assumed same for attainment of all PO-PSO.

## 11.1 Evaluation Process

- (i) The questionnaire for graduate survey consists of one question for each PO/PSO. Each question has three options namely low (1), medium (2), high (3). Average for each PO-PSO is calculated.
- (ii) The following rubric may be adopted for classifying students based on their participation in co-curricular or extra-curricular activity during their four year of stay in the institute.

No Participation in any activity	Low (1)
Participation in at least three activities	Medium (2)
Participation in two or more activities and won award in any one activity	High (3)

Average mapping for all the students may be obtained which may be assumed same for all PO-PSO.

- (iii) The following rubric may be adopted for classifying students based on their participation in class room activities, class attendance, certifications in MOOCs.

Low attendance, NO certification in MOOCs	Low (1)
Average attendance, At least two certification in MOOCs	Medium (2)
Good attendance, More than two certifications	High (3)

Average mapping for all the students may be obtained which may be assumed same for all PO-PSO.

**Table XXX: Indirect Attainment of PO-PSO.**

PO-PSO	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
Response of graduate exit survey								
60% of response of graduate exit survey								
Response of SODCA	Attainment values of SODECA same for all PO-PSO							
20% Response of SODECA								
Response of faculty perception	Attainment values of faculty perception same for all PO-PSO							
20% Response of faculty perception								
Overall indirect response								

## 12. Overall attainment of PO/PSO

Overall attainment of PO/PSO is calculated by the following formula.

Overall Attainment = 0.8 x Direct Attainment + 0.2 x Indirect attainment

**Table XXXI: Calculation of overall attainment**

<b>POs PSOs Attainment</b>	<b>PO<sub>1</sub></b>	<b>PO<sub>2</sub></b>	<b>PO<sub>3</sub></b>	<b>PO<sub>4</sub></b>	<b>PO<sub>5</sub></b>	<b>.....</b>	<b>PO<sub>12</sub></b>	<b>PSO<sub>1</sub></b>	<b>PSO<sub>2</sub></b>
Direct Attainment									
Indirect Attainment									
80% of Direct Attainment									
20% of Indirect Attainment									
Overall Attainment									

## 13. Mapping of PEOs with PO-PSO

**13.1 Step 1 :** Programme educational objectives are framed for each programme according to the Mission statements of the department as discussed in Sec. 2.

**Step 2:** The PEOs so framed under step 1 are mapped with POs/PSOs. A sample matrix for some POs/PSOs is shown in Table XXXIII.

**Table XXXIII: Mapping of PEOs with PO-PSO.**

<b>POs PSOs Attainment</b>	<b>PO<sub>1</sub></b>	<b>PO<sub>2</sub></b>	<b>PO<sub>3</sub></b>	<b>PO<sub>4</sub></b>			<b>PO<sub>1</sub> 2</b>	<b>PSO<sub>1</sub></b>	<b>PSO<sub>2</sub></b>
PEO1	*	*	*					*	
PEO2	*			*				*	*
PEO3		*			*		*		*
PEO4	*						*	*	

## 14. Tools and Relative weights for attainments of PEOs classified as

### 14.1 Direct attainment tools for PEOs

Tools	Relative Weight
(i) Through attainment of PO/PSO	0.8
(ii) Trough placement, higher studies and entrepreneurship	0.2

### 14.2 Indirect attainment tools for PEOs

Tools	Relative Weight
(i) Graduate Exit Survey	0.3
(ii) Alumni Survey	0.3
(iii) Employers survey	0.2
(iv) Parents survey	0.2

### 14.3 Direct Attainment of PEOs through attainment of POs-PSOs.

Target level and actual attainment of each PO-PSO as calculated through direct and indirect tools and the percentage attainment is shown in table XXXIV.

**Table XXXIV: Percentage attainment of PO-PSO**

	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>	.....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
Target Level (x)	*	*	*	*	*		*	*	*
Actual Attainment (y)	*	*	*	*	*		*	*	*
% Attainment $Z=(y/x) \times 100$	*	*	*	*	*		*	*	*
80% of z	*	*	*	*	*		*	*	*

### 14.4 Direct Attainment of PEOs through Placement, Higher Studies and Entrepreneurship.

Number of students placed + opted for higher studies

+ became entrepreneur during the last 3 years = P

Number of final year students during the last 3 years = Q

$$\% (\text{Placed} + \text{higher studies} + \text{entrepreneurship}) = \frac{P}{Q} \times 100 = R$$

The following rubric may be adopted

If	$0 < R \leq 30\%$	Low (1)
	$30\% < R \leq 40\%$	Medium (2)
	$40\% < R \leq 100\%$	High (3)

$$20\% \text{ of it} = (1/2/3) \times 0.2$$

#### 14.5 Indirect Attainment through graduate exit survey

Indirect attainment of PO-PSO through exit survey is explained in Sec. 11.1

#### 14.6 Indirect Attainment through alumni survey

An alumni survey is conducted at least once a year during alumni meet. This survey help and enable the departments to revise and modify the course contents as per the future needs of industries. For alumni survey relevant questionnaire related with PO-PSO is circulated to all alumni attending the meet and feedback collected. The questionnaire is given in Appendix III.

#### 14.7 Indirect Attainment through Employers Survey

Employers survey is conducted by the placement cell by sending e-mail to employers who visit the institute for campus recruitment. Feedback is also obtained from the recruiters when they come for placement of the students.

#### Total number of participants E

Response	Value	Response Value
Good	2	$2 \times E_1$
Excellent	3	$3 \times E_2$

$$\text{Average Response} = (2E_1 + 3E_2)/E$$

$$\text{Contribution to each PO-PSO} = 0.2 \times \text{Average Response}$$

#### 14.8 Parents Assessment

Parents Assessment is based on the basis of fulfilment of their expectations from the Institute in grooming their wards into successful engineers. It is done every year by the department from the parents of the graduating students.

#### Total number of participants P

Response	Value	Response Value
Low	1	$1 \times P_1$
Medium	2	$2 \times P_2$
High	3	$3 \times P_3$

$$\text{Average Response} = (1 \times P_1 + 2 \times P_2 + 3 \times P_3)/P$$

$$\text{Contribution to each PO/PSO} = 0.2 \times \text{Average Response}$$

## 15 Evaluation Process

The questionnaire for exit survey and alumni survey consists of one question for each PO/PSO. Each question has three options namely low (1), medium (2) and high (3).

Indirect attainment of PEOs through indirect attainment of PO/PSO is given in Table XXXV

**Table XXXV: Indirect attainment of PEOs**

POs/PSOs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
30% Response of Graduate Exit Survey	Attainment values of Graduate Exit Survey							
30% Response of Alumni Survey	Attainment values of Alumni Survey							
20% Response of Employers Survey	Attainment values of Employers Survey Same for all PO/PSO							
20% Response of Parents Assessment	Attainment values of Parents Survey Same for all PO/PSO							
Overall Indirect Response								

**Table XXXVI: Direct Attainment of PEOs through indirect attainment of PO-PSO**

POs/PSOs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
80% of Direct Attainment through PO/PSO								
20% of Direct Attainment through Placement etc.	Attainment values through of Placement + Higher Students + Entrepreneurship Same for all PO/PSO							
Overall Indirect Response								

Overall Attainment of PEOs through PO-PSO is given in Table XXXVII.

**Table XXXVII: Overall Attainment of PEOs thorough PO-PSO.**

POs/PSOs	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	....	PO <sub>12</sub>	PSO <sub>1</sub>	PSO <sub>2</sub>
80% of Direct Attainment								
20% of Indirect Attainment								
Overall Attainment								

The attainment of PEOs can be obtained using the relationship between PEOs and PO-PSO as given in Table XXXIII. The elements of matrix given in Table XXXVIII can be filled using Table XXXVII.

**Table XXXVIII – Attainment of PEOs through overall attainment of PO-PSO**

<b>PO/PSO</b>	<b>PEO<sub>1</sub></b>	<b>PEO<sub>2</sub></b>	<b>PEO<sub>3</sub></b>	<b>PEO<sub>4</sub></b>
<b>PO<sub>1</sub></b>				
<b>PO<sub>2</sub></b>				
<b>PO<sub>3</sub></b>				
<b>PO<sub>4</sub></b>				
<b>PO<sub>12</sub></b>				
<b>PSO1</b>				
<b>PSO2</b>				
<b>Average PEOs</b>				

## **16. Appendix-I**

### **Course Outcomes of Project**

**After the completion of project the student should be able to**

- (1) articulate the complex engineering problem statement, understand the existing literature, identify the objectives and analyse it.
- (2) develop professionalism and team work ability in project planning and implementation to ensure timely completion.
- (3) design and develop appropriate skills for fabrication/software development
- (4) demonstrate project functionality and trouble shooting ability
- (5) write effective report & design documentation and make impressive presentation, reply queries and point out the future extension of the project.

### **Course Outcomes of Seminar**

After the completion of seminar the student should be able to

- (1) learn to select topic in emerging area of the branch chosen and understand the background literature.
- (2) analyse critically the existing literature, and point out the future scope.
- (3) develop oral as well as written presentation skill
- (4) answer questions raised during presentation
- (5) participation in seminars other than his/her own

### **Course Outcome of Industrial Training**

Having completed the industrial training the student should be able to-

- (1) make comprehensive use of acquired technical knowledge to understand industrial processes
- (2) acquire project management and problem solving skills
- (3) learn operation, maintenance aspects of industrial processes.
- (4) acquire oral and written communication and human resource management skills.
- (5) demonstrate professional and ethical responsibilities of an engineer



## **Course Outcome of Practical Courses**

Having completed the practical course work the student should be able to-

- (1) understand the background theory involved in the design and performance of the experiments.
- (2) Understand and apply approximate procedure, select suitable device/instruments/tools to perform experiment and collect data.
- (3) State inherent assumptions involved in the development of the experiments and discuss their justifications.
- (4) establish relationship between measured data and underlying physical principles by analysing the observed experimental data and interpret results.
- (5) Function effectively as an individual and a member/leader in a group while performing experiment and show regularity and punctuality in submitting laboratory records.

## 17. Appendix II

### Graduate Exit Survey Questionnaire

- |  |      |
|--|------|
| 1. I have acquired enough knowledge of Mathematics, Basic Sciences and Engineering to articulate problem statement, identify, Objectives and develop mathematical model to analyse it. | P01  |
| 2. I am able to identify, search relevant literature and solve engineering problem.  | P02  |
| 3. I am able to extract requirements from relevant engineering codes and standards and design appropriate system.  | P03  |
| 4. I am able to build models/ prototypes based on the design.  | P04  |
| 5. I am able to make use of relevant engineering tools and techniques to design appropriate experiments to test the products/prototypes and analyse the experimental data collected.   | P05  |
| 6. I am able to apply appropriate instrumentation and or software tools to make measurements of physical quantities.   | P06  |
| 7. I have developed an understanding of the Impact of technology on social, environmental and economic aspects of the society.   | P07  |
| 8. I am able to apply ethical principles, responsibility and norms of the engineering practice.  | P08  |
| 9. I have developed sufficient understanding to apply management principles to work as a member and leader in a team to manage projects in multi-cultural environment.                 | P011 |
| 10. I am able to communicate effectively on complex engineering problems with the engineering community and with Society at large  | P09  |
| 11. I am able to analyse and evaluate the projects on economic, environmental and sustainability aspects.  | P012 |
| 12. I am able to maintain composure in different situation and lead the team effectively.  | P010 |
| 13. I am able to analyse, design and implement application specific Electrical/Electronics/Civil/Mechanical/Information Technology/AI/IOT/Data Science system effectively.             | PS01 |
| 14. I am able to adapt to changing need of the society and to the rapid changes in the technology.   | PS02 |

## 18. Appendix-III

### Alumni Feedback Survey Questionnaire

- |  |      |
|--|------|
| 1. Do you think the knowledge of Mathematics, Science and Engineering fundamentals acquired during the Course period empowered you to solve complex engineering problems.              | P01  |
| 2. Do you think that the course curriculum provided enough training to analyse problems you encounter during your professional work  | P02  |
| 3. Do you think the course curriculum help you design system components or processes that are appropriate from the consideration of social and environmental needs.                    | P03  |
| 4. Have you been trained enough during the course, to handle appropriate hardware/software tools to carry out project during your professional career.                                 | P04  |
| 5. Do you think that the experience of conducting experiments in various laboratories helped you in your professional carrier in analysing and Interpreting data.                      | P05  |
| 6. Do you think your training in the use of IT technologies, modern software tools during the course was adequate for your profession.   | P06  |
| 7. Do you think that the course curriculum facilitates you in cognitive, social, ethical and environmental growth.   | P07  |
| 8. To what extent conduct of soft skill training, seminars, workshops and student development programmes have enabled you to improve oral, written communication and technical skills. | P08  |
| 9. Effort of the Institute in promoting internship, local field visits and industrial tour for students helped in broaden their outlook  | P09  |
| 10. Do think your roll in performing group activities in laboratories, project work, extra and co-curricular activities helped in your development as a leader.                        | P010 |
| 11. How far this programme helped to prepare yourself for life-long learning.  | P011 |
| 12. How far in your opinion the Institute has achieved its mission to promote quality education, training and research in the field of engineering.                                    | P012 |
| 13. To what extent the course curriculum helped in enhancing technical knowledge in the chosen programme and your future prospective.  | PS01 |
| 14. To what extent the course curriculum is helpful in tackling challenges of 21 <sup>st</sup> century such as climate change, financial crisis, rapid developments in technology etc. | PS02 |

## **19. Appendix IV**

### **Sample PEOs**

#### **PEOs**

- PEO1: To empower students with strong fundamental Concepts, analytical capability and problem-solving skills.
- PEO2: To motivate students to pursue higher studies, Carryout industry sponsored innovative projects and undertake research.
- PEO3: To prepare students to embrace professional career growth in the chosen branch of engineering with values, ethics and urge for life long learning.

## **Sample Course outcomes for a theory course**

### **Course Name: Theory of Computation**

On successful completion of the course, the student should be able to:

- CO<sub>1</sub> define and discuss the concept of formal grammar, formal language, regular expression and automata machine.
- CO<sub>2</sub> design finite automata and push down automata machines for given formal language.
- CO<sub>3</sub> visualize the capability of Turing machine and its design for context sensitive languages
- CO<sub>4</sub> choose and design appropriate automata for modelling the solution for various computational engineering problems.
- CO<sub>5</sub> understand the concept of tractable and untractable problems and capable of deciding if a given problem is tractable.

## **Sample Course outcomes for a practical course**

### **Course Name: Computer Networks and Web Technologies**

On successful completion of the lab course, the student should be able to:

- CO<sub>1</sub> implement data link layer framing methods.
- CO<sub>2</sub> analyze error detection and error correction codes.
- CO<sub>3</sub> implement and analyze routing and congestion issues in network design.
- CO<sub>4</sub> implement encoding and decoding techniques used in presentation layer.
- CO<sub>5</sub> work with different network tools.