

Sarvajanik Education Society  
**SARVAJANIK COLLEGE OF ENGINEERING &  
TECHNOLOGY**  
(Constituent Institute of Sarvajanik University)



**OUTCOME BASED  
EDUCATION (OBE)  
MANUAL**

**2024-25**

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## **UNIT 01: Vision, Mission and Quality Policy of the Institute**

### **Vision statement of the institute**

To evolve into a center of excellence by providing value based technical education, transformative research and innovations for creating a sustainable and advanced society.

### **Mission statement of the institute**

To develop, train and nurture intellectually capable, innovative and entrepreneurial professionals to contribute to the growth of science and technology through education, research, global consultancy and industry-academia collaboration.

### **Quality Policy of the Institute**

Quality policy of SCET primarily aims to:

- Develop a mechanism to promote conscious, consistent, and catalytic action plans to improve the academic performance of the institution.
- Promote institutional quality enhancement and sustenance through the internalization of quality culture and the institutionalization of best practices.

### **Inclusiveness and Access of Higher Education**

- Access to all the classes of the community is allowed.
- Tuition fee waiver seats, Reservation for SC/ST/SEBC, Students under EWS (Economically Weaker Sections), and admissions to Foreign and J&K students are available in each course as per government guidelines.
- Scholarships offered to needy students for allowing access to the quality education, and capacity building
- Recruitment of well-qualified teachers
- Teachers are undergoing training at various industries to keep themselves updated
- Teachers are attending Faculty development programs (FDP), Short-term training programme (STTP), Workshops, Webinars etc. organized by AICTE, and other academic institutions. Necessary financial assistance and support are provided.
- Teachers are also encouraged to take courses through MOOC platforms like SWAYAM NPTEL/Coursera etc.
- Joint study programs conduction on a regular basis with various universities/organizations
- International experience program (IEP) with foreign Universities for faculty/students upgrading.

### **NBA Accreditation**

Accreditation is a process of quality assurance and improvement, whereby a programme in an approved Institution is critically appraised to verify that the programme continues to meet and/or exceed the Norms and Standards prescribed by the regulator from time to time. It is a kind of recognition which indicates that a programme fulfills certain standards.

### **Accreditation Reforms (sequence)**

- SCET is regularly participating in NIRF /GSIRF rankings and achieving good ranks.
- NBA accreditation for above 50% of the courses have also been obtained since year 2016.

## NBA Accreditation @ SCET

Sr. No.	Program	Level	Accreditation Current status	Accreditation Current Duration	Accreditation history
01	ELECTRONICS AND COMMUNICATION ENGINEERING	UG	ACCREDITED	Academic Year 2022-23, 2023-24 and 2024-25, i.e., up to 30/06/2025	Academic Year 2016-17, 2017-18 and 2018-19, i.e., up to 30-06-2019; Further accredited from Academic Year 2019-20, 2020-21 and 2021-22, i.e., up to 30-06-2022
02	ELECTRICAL ENGINEERING	UG	ACCREDITED	Academic Year 2022-23, 2023-24 and 2024-25, i.e., up to 30/06/2025	Academic Year 2016-17, 2017-18 and 2018-19, i.e., up to 30-06-2019; Further accredited from Academic Year 2019-20, 2020-21 and 2021-22, i.e., up to 30-06-2022
03	INSTRUMENTATION AND CONTROL ENGINEERING	UG	ACCREDITED	Academic Year 2022-23, 2023-24 and 2024-25, i.e., up to 30/06/2025	Academic Year 2016-17, 2017-18 and 2018-19, i.e., up to 30-06-2019; Further accredited from Academic Year 2019-20, 2020-21 and 2021-22, i.e., up to 30-06-2022
04	COMPUTER ENGINEERING	UG	ACCREDITED	Academic Year 2023-24, 2024-25 and 2025-26, i.e., up to 30/06/2026	-
05	CIVIL ENGINEERING	UG	ACCREDITED	Academic Year 2023-24, 2024-25 and 2025-26, i.e., up to 30/06/2026	-
06	TEXTILE ENGINEERING	UG	-	-	Academic Year 2016-17, 2017-18 and 2018-19, i.e., up to 30-06-2019; Further accredited from Academic Year 2019-20, 2020-21 and 2021-22, i.e., up to 30-06-2022
07	CHEMICAL ENGINEERING	UG	-	-	Academic Year 2006-07, 2007-08 and 2008-09, i.e., up to 30-06-2009;

## **Multi-entry and Multi-exit**

Provisions are made various Program wide /courses wide in rules and regulations.

## **Multidisciplinary**

In university curriculum, actual implementations are executed for Trans-disciplinary open elective (ToEs). Students from one stream i.e engineering are studying ToEs CREDIT courses from other streams like management, architecture, science, performing arts etc.

## **Research and Innovation**

- Provisions are made to utilize research funds available with SCET to purchase research related equipment
- MoUs are done with various premier Institutes /Industries
- Faculties and students are provided financial support to publish research papers.
- SSIP- Phase 1 implemented successfully. SSIP- Phase 2 is going on.

## **Integration of Vocational and Academic Education**

2 credits' Skill development compulsory course in the curriculum.

## **Promotion of Indian Knowledge Systems (IKS)**

Sarvajanik University has tied up with Swami Narayan Vidhyapith and SAYONA for course on Indian Ethos.

## **Internationalization**

Well accepted and implemented as policy having:

- Association with Foreign universities
- Expert lectures from Professors from foreign universities are often conducted.
- Participation of students in IEP

## **Academic Bank of Credit**

Accepted in principle and will be implemented soon with the help of Enterprise Resource Planning (ERP) (in process).

## **ICT enabled Education**

- Power point presentations, video lectures, use of Integrated Development Environment (IDE) etc. for programming concepts demonstration are used in teaching.
- Simulation tools are employed and integrated with the courses

- MOOCs courses are embedded with the curriculum
- Lectures in blended mode
- Live interaction with the students, professors and professionals of various universities across the state/country/globe
- Participation in online training and competitions using ICT.

### **Student Assistance and Support**

- Augmentation of financial assistance from within college welfare funds
- Channelizing Scholarships and Financial Assistance through NGOs and Individuals
- Student centric approach is followed in academics
- Assistance and counseling provided for various activities like curricular, co-curricular, extra-curricular, research, entrepreneurship or startup related, social, grooming and enough opportunity for the all-round development of students
- Mentors and class teachers are appointed for assisting students
- Dedicated mentors for foreign students and other state students
- Financial support for participation in competitions, conferences, research publication etc. are also provided.

### **Governance Reforms**

- Decentralization done for Academic Governance as well as Research Governance.
- Formation of various committees and subcommittees.

### **Examination Reforms**

- Adaption of more weight-age on Continuous and Comprehensive Evaluation (CCE) system
- Exam papers are drawn based on the concept suggested as per ABET/ Bloom's taxonomy
- Make up exams are conducted after the regular exams
- Makeup/revision classes are conducted before these make-up exams.

### **Academic Autonomy**

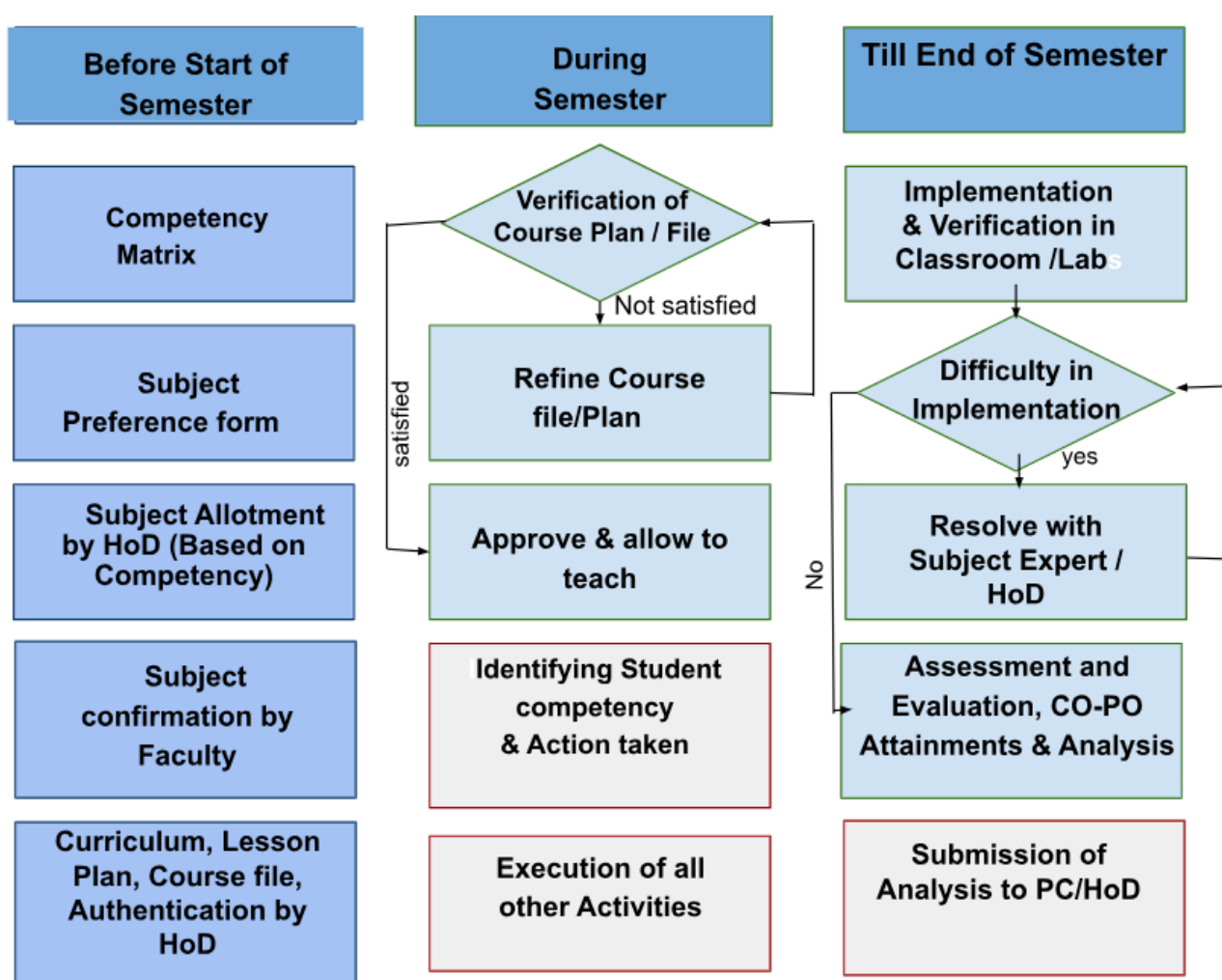
- Curriculum is framed by the faculties of the constituent colleges in association with subject experts from industries and other academic institutes of repute.
- Large number of Honors/Minor programs are offered. Departments have autonomy to design and float such programs and students have the flexibility to select any of them
- Faculties are having autonomy in curriculum design and execution of classes and pedagogy
- Students are having the partial autonomy/freedom to select the MOOCs courses and the credits are awarded for the same.

### **Apprentice/Internship and Placement**

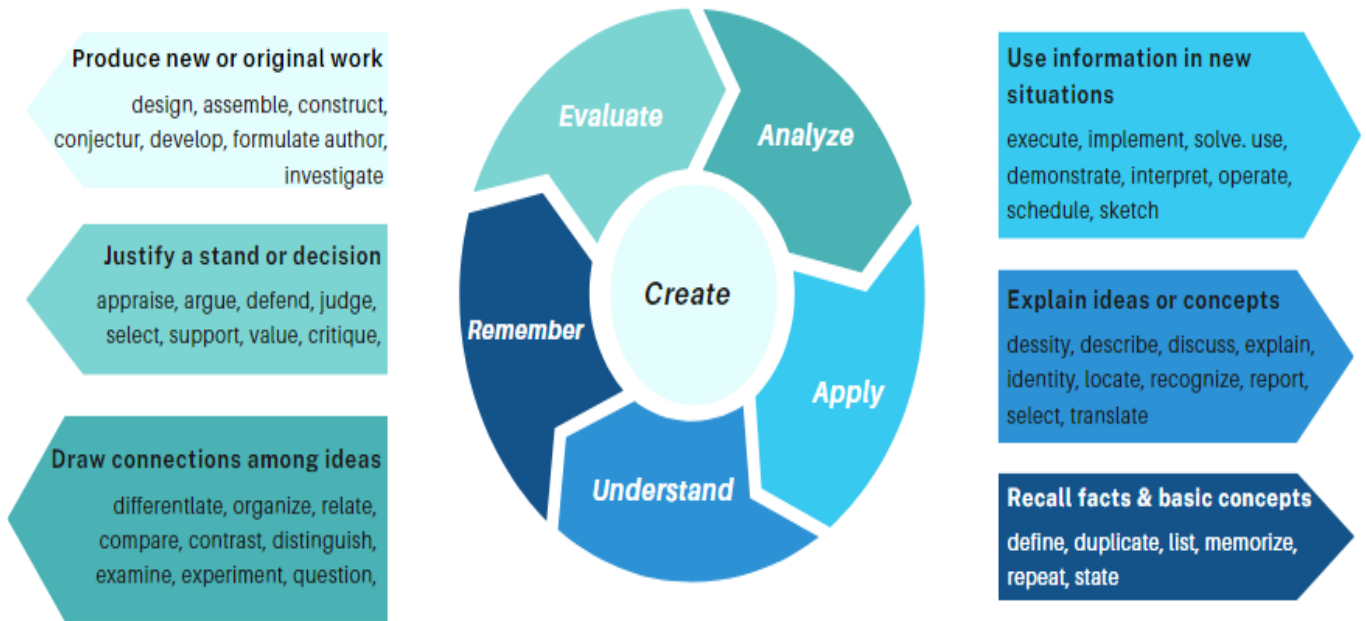
- Mandatory Internship in final semester for all the undergraduate engineering, architecture and MCA students
- Internship/Training of at least 15 days for all the undergraduate students in summer break after 4<sup>th</sup> and 6<sup>th</sup> semester.



## UNIT 02: OBE Framework of the Institute



## UNIT 03: Revised Blooms' Taxonomy (BT)



The Cognitive Process Dimensions- Categories					
Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyse	Evaluate	Create
Recognizing (Identifying) Recalling (Retrieving)	Interpreting Illustrating Classifying Summarizing Inferring (Concluding) Comparing Explaining	Executing Implementing	Differentiating Organizing Attributing	Checking (Coordinating, Detecting, Testing, Monitoring) Critiquing (Judging)	Planning Generating Producing (Constructing)

The Knowledge Dimension			
Concrete Knowledge		→	Abstract knowledge
Factual	Conceptual	Procedural	Metacognitive
<ul style="list-style-type: none"> <li>• Knowledge of terminologies</li> <li>• Knowledge of specific details &amp; elements</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of classifications and categories</li> <li>• Knowledge of principles &amp; generalizations</li> <li>• Knowledge of theories, models &amp; structures</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of subject specific skills and algorithms</li> <li>• Knowledge of subject specific techniques and methods</li> <li>• Knowledge of criteria for determining when to use appropriate procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Strategic Knowledge</li> <li>• Knowledge about cognitive task, including appropriate contextual and conditional Knowledge</li> <li>• Self- Knowledge</li> </ul>

## UNIT 04: Action Verbs for Course Outcome

### Action Verbs for Course Outcomes

Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyse	Evaluate	Create
Define	Explain	Solve	Analyse	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summarise	Calculate	Distinguish	Recommend	Formulate
Match	Compare	Sketch	Explain	Grade	Invent
Tabulate	Discuss	Prepare	Differentiate	Measure	Develop
Record	Estimate	Chart	Appraise	Test	Organize
Label	Express	Choose	Conclude	Evaluate	Produce

### Illustrations (use of action verb w.r.t knowledge dimension and order of thinking)

Use of action verbs	Factual	Conceptual	Procedural	Metacognitive
<b>Remember</b>	List properties of soil	Recognize the characteristic of material	Explain working of pump	Identify strategies for report writing
<b>Understand</b>	Summarize features of a new product.	Classify adhesives by toxicity	Explain assembly instructions	Predict the behavior of member
<b>Apply</b>	Respond to frequently asked questions	Provide advice to team members	Carry out pH tests of water samples	Use modern techniques to get solution
<b>Analyse</b>	Explain the selection of tool/ activity	Differentiate LOT and HOT	Integrate compliance with regulations	Assess the project work
<b>Evaluate</b>	Select the appropriate tool	Determine relevance of results	Judge efficiency of sampling techniques	Reflect on one's progress
<b>Create</b>	Generate a log of daily activities	Assemble a team of experts	Design efficient project workflow	Create a learning portfolio

## UNIT 05: Guidelines for Writing Course Outcome Statements

**Well-written course outcomes involve the following parts:**

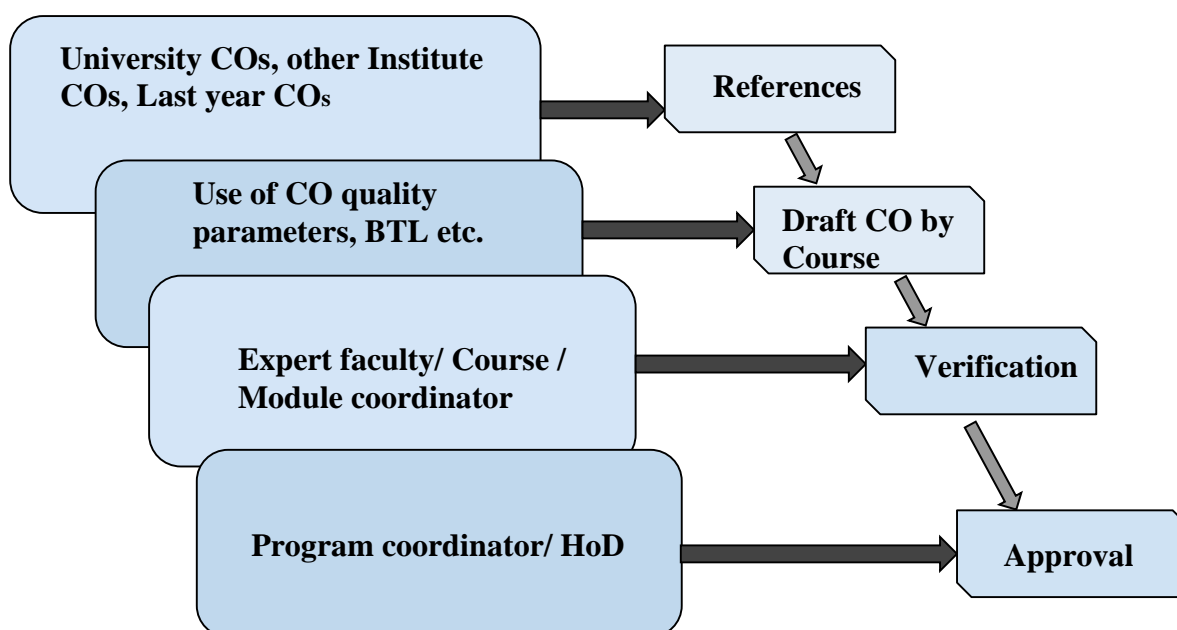
- 1. Action verb:** Students are able to Design column splices and bases
- 2. Subject content:** Students are able to Determine the losses in a flow system.
- 3. Level of achievement as per BTL:** Students are able to Use structural analysis software to a competent Level
- 4. Modes of performing tasks (if applicable):** Students are able to Present seminar on real life problems.

**While writing COs the following questions/points must be addressed properly.**

<b>Specific</b>	Is there a description of precise behavior and the situation it will be performed in? Is it concrete, detailed, focused, and defined?
<b>Measurable</b>	Can the performance of the outcome be observed and measured?
<b>Achievable</b>	With a reasonable amount of effort and application, can the outcome be achieved? Are you attempting too much?
<b>Relevant</b>	Is the outcome important or worthwhile to the learner or stakeholder? Is it possible to achieve this outcome?
<b>Time-Bound</b>	Is there a time limit, rate, number, percentage, or frequency clearly stated? When will this outcome be accomplished?

**Note: If the Laboratory is given as a separate course (with course code) then there should be separate course outcomes for the Laboratory.**

## UNIT 06: Quality of Course Outcome: Creation of COs



### Guidelines/Checklist for COs

<b>Number of COs</b>	4 to 6
<b>CO essentials</b>	Action Verb, Subject Content, Level of Achievement, Modes of Performing task (If Applicable)
<b>Based on BTL</b>	Understand, Remember, Apply, Analyse, Evaluate, Create
<b>Number of BTL Considered in one course</b>	Minimum 3
<b>Technical Content/ point of curriculum</b>	All curriculum contents are covered
<b>Curriculum gap</b>	Additional CO for gap identified/filling. Adds more weight-age

## UNIT 07: CO-PO Mapping Guidelines

Consider any two minimum criteria for Co-Po mapping justification

### A) Contact Hours: Lecture, Tutorial and Practical

Level	Contact Hours in Percentage (including Lecture, Tutorial & Practical)
No mapping (-)	< 5%
Low (1)	5- 15%
Medium (2)	15- 25%
High (3)	>25%

#### Description

- Number of Lectures = 3 per week x 15 weeks = 45 Hours
- Tutorial = 1 Hr x 15 Weeks = 15 Hours
- Practical = 2 Hr x 15 Week = 30 Hours
- Total Hrs = 45+15+30 = 90 Hours

Example: Let, CO1 related points are engaged in 10 lectures + 1 Tutorial and 2 practical Hours

Then contact hours =  $10+1+2 \times 2 = 15$  hours

Therefore, contact hours in percentage =  $(15/90) \times 100 = 16.67\%$ . Medium mapping (2)

### B) Number of Assessment Tools Used

Level	Number of assessment tools used to assess the CO
No mapping (-)	0
Low (1)	1 or 2
Medium (2)	3
High (3)	4 or more

#### Description

**CO assessment tools:** Mid-term test, end term test, class test, surprise test, oral, continuous internal assessment (Assignment, Lab practical assessment), course exit survey, University theory exam, oral exam/ practical oral exam, external feedback, Activities (Survey, guest lecture, workshop, seminar, case studies, mini/minor projects etc.) Every CO must be correlated with each PO and appropriate mapping may be selected.

### C) Keywords

Most of the time, the appropriate keyword is sufficient for mapping.

Level	Keywords Used in writing COs
No mapping (-)	Key words related with LOT and not related with course or any outcomes
Low (1)	Part of PO is reflected through keywords/action verbs
Medium (2)	Major part of PO is reflected through keywords/action verbs. + moderate level performance is expected from student to achieve PO
High (3)	Exact action verb of PO + critical performance expected from student to achieve PO

### D) Critical Assessment Record for PO5 to PO12

Level	Assessment Depth
No mapping (-)	No rubric used for assessment
Low (1)	Single rubric category used for assessment
Medium (2)	Two rubrics category used for assessment
High (3)	Three or more rubrics category used for assessment

#### Illustration:

Category No.	Rubric Category	Level of Performance			
		4	3	2	1
1	Group Leader	Seeks opportunities to lead; while leading is attentive to each member	Will take lead if group insists; not good at being attentive to each member	Resists taking on leadership role; while leading allows uneven contributions	Never shows up
2	Contribution	Always contributes; quality of contributions is exceptional	Sometimes contributes; quality of contributions is fair	Rarely contributes; contributions are often peripheral or irrelevant; frequently misses team sessions	Never shows up and never contributes.
3	Cooperation	Always cooperative with all members, support good initiatives	Cooperative with members, but sometimes argue	Cooperative with few members, and argue most of time	Non-cooperative



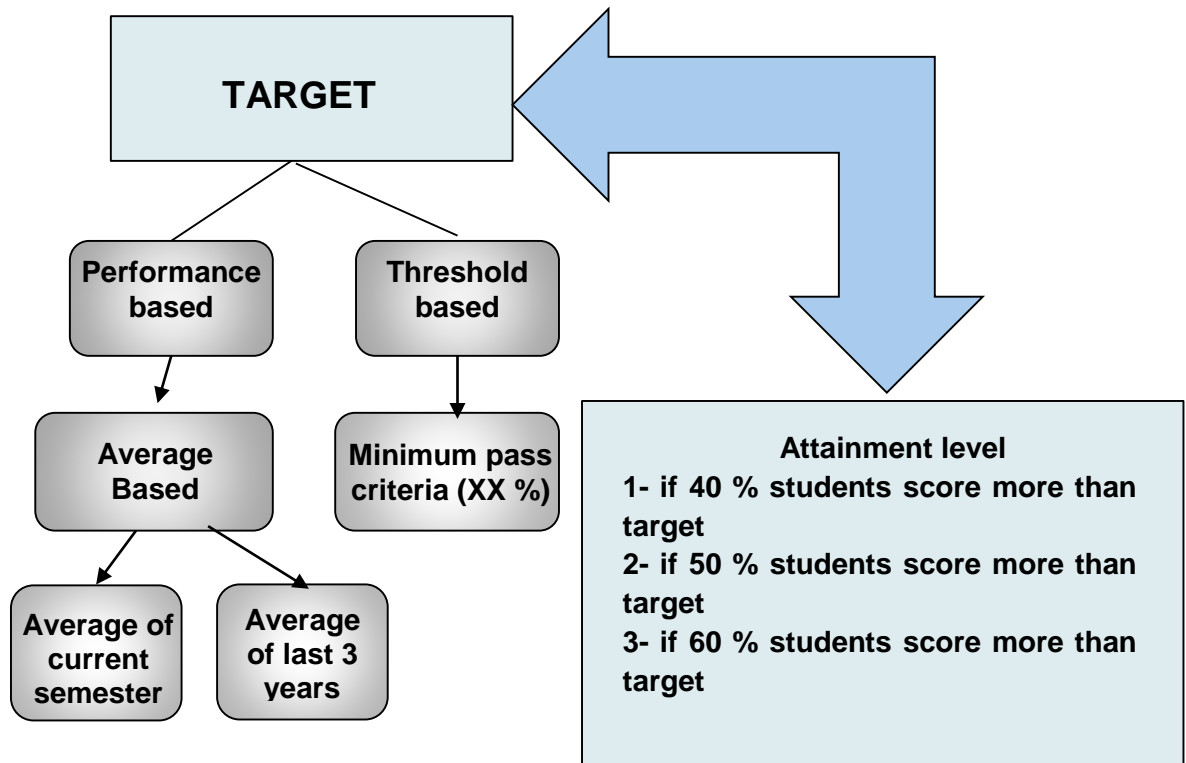
## E) Assessment Type

Level	Assessment Depth
No mapping (-)	Test items (1) OR Nil
Low (1)	Test items (2) OR Assessment item (1)
Medium (2)	Test items (2) + Assessment item (1) OR Assessment item (2)
High (3)	Test items (2) + Assessment item (2) and More

**Test Item:** Mid-term, End term, class test, surprise test, University theory exam (Questions + additional information)

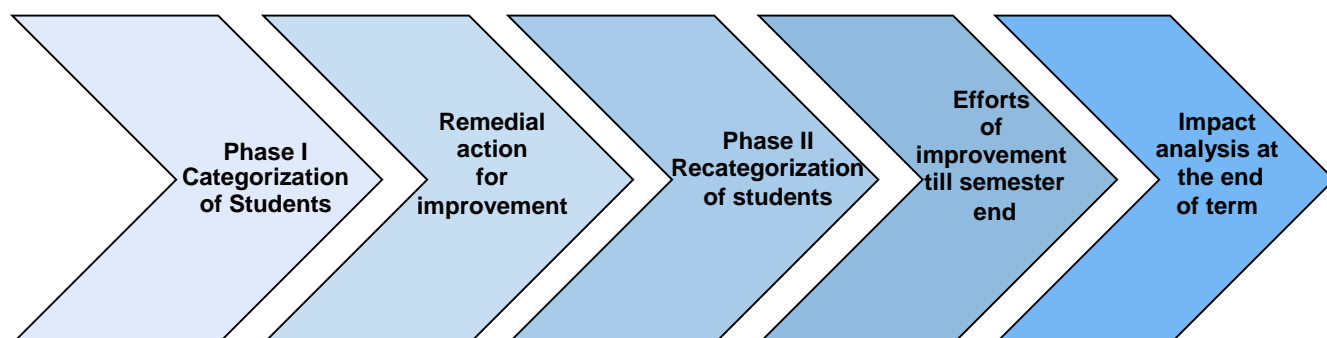
**Assessment items:** Quizzes, Assignment problems, simulation, laboratory experiments, project, field work, report presentation, tutorials, activities, etc.

## UNIT 08: Targets / Attainment Levels



## UNIT 09: Students' Competency

### Chart of Action Plan



### Guidelines for First Year

Phase I- Categorization (After 15 days of start of semester)	Phase II- Re-categorization (After Mid-term Result)
12th Marks	Mid Term Result
Prerequisite Test	Timely Completion of work
Surprise Test after 15 days	Lab Performance
Attendance & Behaviour	Attendance & Behaviour
	Previous Semester University Result (Applicable for Sem-II)

### Guidelines for Higher Classes [Second Year, Third Year and Fourth Year]

Phase I- Categorization (After 15 Days of start of semester)	Phase II- Re-categorization (After Mid-term Result)
Previous semester University Result whichever is available	Mid Term Result
Prerequisite Test	Timely Completion of work
Surprise Test after 15 days	Lab Performance
Attendance & Behaviour	Attendance & Behaviour
	Previous semester University Result

### Base Score for student category

- <50% - Slow Learner
- 50% to 65% - Average Learner
- >65% - Advanced Learner

## **Strategies for Slow, Average and Advanced Learners**

### **For Slow learners**

- Document/record of remedial classes with timetable & attendance
- Specially designed assignment/ task
- Student study group for peer-to-peer learning
- Individual counseling
- Student help desk

Note: Remedial sessions should be conducted once every week.

### **For Average Learners**

- Additional assignment/ task
- Encouraging for timely and effective completion of work
- Conduction of quiz, orals etc.
- Solving previous year University question papers and test papers
- Presentation on technical topics/ case studies/mini projects

Note: Activities should be on a continuous basis.

### **For Advanced Learners**

- Encouraging to present & publish papers in journals/conferences/competitions
- Guidance for GATE/Competitive Examination
- Encouraging to participate in professional activities.
- Specially designed activities to improve the portfolio of students.
- Individual guidance for career building

Note: Activities should be on a continuous basis.

## UNIT 10: Rubrics for Assessment

### Structure of Rubrics

A **rubric for evaluation** is a scoring guide used to assess and grade the quality of student work or performance, based on the expectation of quality around a task. A rubric includes three components:

1. the **criteria** to which evaluation to be made
2. the **scale** of assessment of the criteria
3. the qualitative statements corresponding to each criterion (**descriptors**).

Task Descriptions				
	Unsatisfactory	Satisfactory	Good	Exemplary
Performance Criteria 1				
Performance Criteria 2				
Performance Criteria 3				

Dimensions

Scales

Descriptors

Rubrics are used for an objective estimation of student's performance using assessments tools like assignments, projects, seminars, portfolios, exams etc. it would be ideal to prepare evaluation Rubrics, based on the criteria that are significant.

### Types of Rubrics

Based on the type of scales adopted in the rubrics we could classify the rubrics as Checklist - dichotomous scale like "yes or no", "criteria met or not met" Holistic rubrics - Likert rating scale is used but without criteria so a single score based on an overall assessment of the students work. Analytic Rubrics - Likert rating scale is used to mark the level of performance of the students to project the criteria wise judgement of the student's work.

If we adopt a dichotomous scale like "yes or no", "criteria met or not met" we call it as a Check List. This type of rubrics is easy to use and it will only ensure the presence of the trait or criteria. It does not give any information about the level of performance related to the criteria.

In both holistic rubrics and analytic rubrics, Likert rating scale is used to mark the level of performance of the students. The holistic rubrics is modelled in such a way that it does not differentiate the various criteria of performance, instead assigns a single score based on an overall assessment of the students work. Analytic rubric digs deep into criteria-level to project the criteria wise judgement of the student's work. However, the score assigned to each level of performance is an ordinal scale of measurement.

## Preparation of Rubrics

The development of rubrics requires a deep insight into the curricular structure and the nature of activity or tools for which rubrics are developed. The sequential steps in the construction of a rubrics are detailed here.

1. The first stage is the review of the learning outcomes by breaking down the outcomes into component outcomes and connect it to the activities or tools for which the evaluation rubrics are developed.
2. The next stage is to identify the set of criteria related to the activity that addresses the component outcome under consideration.
3. The third stage is to develop quality statements for each criterion. These statements should be specific, observable and measurable descriptors which characteristics the expectation at each level of performance.
4. The fourth stage is to arrange the criteria and scale of measurement with the appropriate qualifying statement in a tabular grid.
5. The fifth stage will be to assign a numerical score to each level of performance.
6. The next phase is to ensure the fairness of the rubrics with expert opinion from resource persons and by using it to evaluate the previous students' performance. It is also a good practice to share the rubrics to the students before they involve in the assigned activity that will be assessed.

### Task Descriptions: Effective presentation on project work (written and oral communication)

	Proficient/Good	Satisfactory	Unsatisfactory
<b>Written Communication</b>	Report is well organized and clearly written	Report is organized and most parts adequately written	Report has no clarity of concept and not organized
<b>Presentation Visual aids</b>	Slides are error free and logically present the main components of the process	 <b>Quality Statements</b>	
<b>Oral Presentation</b>	Speakers are audible and fluent in their topic		
<b>Body Language</b>	Body language is indicated by appropriate and meaningful gestures		

In an OBE enabled evaluation plan, the evaluation rubrics must be integrated with the outcomes – at both course level and the program level with which the activities correlate. For this, each criterion must be mapped onto the corresponding outcomes that each criterion addresses. Also, the mapping strength should be recorded in terms of high, moderate or low. This should be mentioned in a score pattern which ranges from 3 to 1. It should be presented as a matrix extension grid of various criteria to outcomes at the course level and program level as shown in the figure.

### Task Descriptions: Project

	Proficient/ Good	Satisfactory	Unsatisfactory	CO1	CO2	CO3
	Assessment Rating			CO Weightage		
Performance Criteria 1				2		1
Performance Criteria 2					2	2
Performance Criteria 3				2		1
Performance Criteria 4				1	2	

The weighted average of the attainment scores converted into a three-point scale will contribute to the score of outcome attainment with respect to the activity. These attainments could be cumulated to the Program matrix table or the course matrix table for computation of the respective course outcome or program outcome.

Development of an appropriate analytic rubrics is a skill which needs a certain level of expertise. However, there are few customizable templates available online, for easier creation of rubrics. Beginners who are not familiar with rubrics-making can work with such templates to enhance the competency level so that in further stages they could build better rubrics independently as per the requirements.

### Conclusion

In the milieu of the new educational policy 2020, revolutionary changes are happening in the higher education system towards enhancement of quality and transformation of India to a knowledge superpower. One major focus of the transformation is the change of the education system from input-based to output-based. Consequently, there is a change in the curricular level activities from a lower-order learning process to a higher-order learning process.

In such a situation, for assessments of Higher Order Thinking Skills (HOTS), we cannot completely rely on a paper-pencil summative test. To ensure authenticity in student-level assessment, we must incorporate multi-level performance-based activities and projects. Obviously, the usage of evaluation rubrics will become mandatory in the education system. Clearly, a rubric enabled assessment scheme will safeguard objectivity and validity of the evaluation process, based on set criteria and outcomes.

## Evaluation of any subject has two parts: Theory and Practical Evaluation

Theory evaluation is in two parts:

1. Theory Exam (TEE) 60%
2. Internal evaluation (CA1+CA2) 40%

CA1: Midterm exam

CA2: Internal Evaluation can have 2/3/4 different components

- Assignments linked with different COs (based on Numerical/Theory questions) 40% weight-age
- Quiz linked with COs (online/Offline MCQ based quiz/Class Test) (10% weight-age)
- Mini Project (40% weight-age)
- Activity based Learning (Seminar/Presentation) (10% weight-age)

## Rubrics for Numerical Assignment Evaluation

Assignment Topic: XYZ

Assignment Linkage with COx

Criteria for Evaluation:

- a) Submission of the assignments within the stipulated time
- b) Method of solving the given problem
- c) Accuracy of all the answers with references
- d) Presentation should be legible and neat.

Criteria	Excellent	Good	Fair	Unsatisfactory
Range for 10 marks for each point	(10-9) marks	(8.5-7) marks	(6.5-5) marks	(4 marks)
<b>Submission in Stipulated Time (10)</b>	Submitted before stipulated time	Submitted before deadline	Submitted after deadline and one Reminder	submitted after many Reminders
<b>Formula used and Steps of Calculation (10)</b>	All steps presented in sequence and Answer supported with Graph /diagram or written conclusion	All steps presented in sequence with correct answer with few diagram/graph/written statements	Partial Sequence and incorrect answer with very few diagram/graph/written statements	Partial Sequence and incorrect answer with no diagram/graph/written statements
<b>Presentation (Tidiness, legible writing etc. (10)</b>	Excellent representation with high quality	Representation with good quality	Presentation with satisfactory quality	Presentation with bad quality
<b>Total point (30)</b>	<b>(30-27) marks</b>	<b>(26-21) marks</b>	<b>(20-15) marks</b>	<b>(12) marks</b>



Rubric maximum score = 10+10+10 (high marks) = 30 (100%)  
 Rubric minimum score = 4+4+4 (low marks) = 12 (40%)

## Rubrics for Theoretical Assignment Evaluation

Assignment Topic: XYZ  
 Assignment Linkage with COx

Criteria for Evaluation:

- Submission of the assignments within the stipulated time
- Way of writing answers backed with quality of examples and diagrams.
- Presentation should be legible and neat.

Criterion	Excellent	Good	Fair	Unsatisfactory
Range for 10 marks for each point	(10-9) marks	(8.5-7) marks	(6.5-5) marks	(4 marks)
<b>Submission in Stipulated Time (10)</b>	Submitted within stipulated time	Submitted after the deadline with one reminder. before the next turn/week.	Submitted after deadline with two Reminders after a week of reminder	submitted after many Reminders or submitted at the end.
<b>Explanation of Topic (10)</b>	All questions written with Complete Explanation with Examples /illustrations and figures supporting answers.	Answers written with Complete Explanation using Examples /illustrations and / figures of in few questions only.	Few questions written with Partial Explanation without example or diagram	Very few questions but with No clear Explanation without diagram/example
<b>Presentation (Tidiness, legible writing etc. (10)</b>	Excellent representation with high quality	Representation with good quality	Presentation with satisfactory quality	Presentation with bad quality
<b>Total point (30)</b>	<b>(30-27) marks</b>	<b>(26-21) marks</b>	<b>(20-15) marks</b>	<b>(12) marks</b>

Rubric maximum score = 10+10+10 (high marks) = 30 (100%)  
 Rubric minimum score = 4+4+4 (low marks) = 12 (40%)

## Rubrics for Laboratory Internal Evaluation (30 marks)

**Note: According to the subject, one can choose any of the following parameters for performance evaluation.**

<b>Criterion</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Unsatisfactory</b>
Range for 5 marks for each point	(5-4.5) marks	(4.5/4-3.5) marks	(3-2.5) marks	(2) mark
<b>Performance in Lab (5 marks)</b>	Able to implement circuit/connections in kit etc. for an experiment independently within prescribed time	Able to implement circuit/connections in kit etc. for with guidance of teacher/friend within prescribed time. The result is close or to standard value.	Able to implement circuit/connections in kit etc. for with guidance of teacher/friend within prescribed time. Large deviation of result from standard value	Not able to perform experiment with guidance of teacher/friend within prescribed time. Large deviation of result from standard value
<b>Program Execution (5 marks)</b>	Program executes correctly with no syntax or runtime error	Program executes correctly with no syntax or runtime error (	Program executes with a minor (easily fixed error)	Program does not execute
<b>Correct output (5 marks)</b>	Program displays correct output with no error.	Output has minor errors	Output has multiple errors	Output is incorrect
<b>Quality of documentation (5 marks)</b>	Complete report written with all figures and tables, conclusions and index signed and comments and output in case of program, Graphs, table, contents are well constructed.	Complete report written with few figures/tables, conclusions and comments in case of programs and index signed. Graphs, table, contents are constructed with	Partial report written with few figures, tables and partial right conclusions and without comments in case of programs and index signed.	Partial report written with no figures, tables and no conclusions and without comments in case of programs and index signed, presented graph, tables in incorrect manner
<b>Submission in Stipulated Time (5 marks)</b>	Submitted within stipulated time	Submitted after the deadline with one reminder. before the next turn/week.	Submitted after deadline with two Reminders after a week of reminder	Submitted after many Reminders or submitted at the end.
<b>Standards (5 marks)</b>	Program is stylistically well designed	Few inappropriate design choices (i.e. poor variable names, improper indentation	Several inappropriate design choices (i.e. poor variable names, improper indentation)	Program is poorly written
<b>Total point (30)</b>	<b>(30-27) marks</b>	<b>(26-21) marks</b>	<b>(20-15) marks</b>	<b>(12) marks</b>

	Attendance	Practical performance	Timely report submission	interaction with group member	Total marks obtained in each week
week1					
week 2					
week 3					
week 4					

### Rubrics for Minor Project / Mini Project Evaluation (50 marks)

**Note: According to the Marks of project, one can choose any of the following parameters for performance evaluation.**

Criterion	Excellent	Good	Fair	Unsatisfactory
Range for 5 marks for each point	(5-4.5) marks	(4.5-3.5) marks	(3.5-2.5) marks	(2) mark
<b>Problem Identification (5 marks)</b>	Detailed explanation n of the Purpose and need of the project	Good explanation of the purpose and need of the project	Average explanation of the purpose and need of the project.	Unable to explain the concept
<b>Literature Survey (5 marks)</b>	Detailed explanation of the specification and the limitations of the existing system collection of information is very good	Good study of specifications and the limitations of the existing systems, collection of information is good	Average study of specifications and the limitation of the existing system. Collection of information is basic.	Unable to explain the specifications of the existing system; incomplete information
<b>Objective and Methodology of Proposed Work (5 marks)</b>	Objective of the proposed work is clear, each module clearly specified.	Good justification of the objective; methodology to be followed is specified but not explained in detail.	Information justification of the proposed objectives; steps are mentioned but under	Objective of the proposed work are not identified and not well defined, incomplete and improper specification
<b>Technical Knowledge and</b>	Very good awareness	Awareness related to work	Awareness related to the	Lack of sufficient

<b>Awareness Related to Project (5 marks)</b>	related to work having technical knowledge in depth.	and technical knowledge is good	work is fair and technical knowledge is basics	knowledge.
<b>Individual Contribution (5 marks)</b>	Contribution in overall work	Contribution in documentation, presentation, requirements.	Contribution only documentation and presentation.	Lack of contribution in documentation as well as presentation.
<b>Team Work (5 marks)</b>	Collaborates and communicates in a group situation and exchange the views with each other's very good	Collaborating and communicating in a group situation and exchanging views is good.	Exchange some views but requires guidance to collaborate with others	Make little or no attempt to collaborate in group situation
<b>Ppt Presentation (5 marks)</b>	Contents of the presentation are appropriate and well delivered. Clear audible voice and good spoken language.	Contents of the presentation are appropriate and well delivered. Clear audible voice but not good spoken language	Contents of presentation appropriate and well delivered. Clear audible voice but not good spoken language.	Contents of the presentation are appropriate and well delivered. Poor delivery of presentation.
<b>Project Report (5 marks)</b>	Project report is according to the specified format; data and references are appropriate and mention clearly.	Project report is according to the specified format, data and reference are appropriate but not mentioned clearly	Project report is according to the specified formant but some mistakes. Insufficient data and references.	Project reports not prepared according to the specification format data and references are not appropriate.
<b>Timely Submission /Regularity (5 marks)</b>	Reports to the guide is regularly and consistent in the work.  Both Report and Project submitted timely	Not very regular but consistent in the work Report /Project is submitted next day of due.	Report to guide and lack of consistent in the work Report/project is submitted a week late.	Irregular and inconsistent in the work. Report and Project is submitted after many reminders.
<b>Incorporation of Suggestions and Viva-Voice (5 marks)</b>	Changes are made as per the suggestions given by the reviewers in the review-1 evaluation and detailed explanation	Changes are made as per the suggestions given by the reviewers in the reviews in the evaluation and good justification	All manger Changes are made as per the suggestions given by the reviewers in the reviews in the evaluation and	Changes are not incorporated as per the suggestions given by the reviewers in the review-1 evaluation. Unable to

	given; able to answer all the questions with clear explanation.	given; able to answer all the questions without clear explanation.	justification not given; able to answer few questions with clear explanation.	answer all the questions.
<b>Total point (50)</b>	<b>(50-45) marks</b>	<b>(44-35) marks</b>	<b>(34-25) marks</b>	<b>(20) marks</b>

### Rubrics for Internship Evaluation (Summer Internship Evaluation) (50 marks)

Criterion	Excellent	Good	Fair	Unsatisfactory
Range for 5 marks for each point	(5-4.5) marks	(4-3.5) marks	(3.5-2.5) marks	(2.5) mark
<b>Attendance</b>	All days attended 90-100% days	70% days attended	60% attendance	50% or less attendance
Range for 10 marks for each point	(10-9) marks	(9-7.5) marks	(7-5.5) marks	(4 marks)
<b>Real world Problem Addressed (10)</b>	(Any specific problem solved and implemented (written feedback by industrial guide)	Solution of problem suggested( written feedback by industrial guide)	No specific problem found or solved	
<b>Knowledge gained in training and used advanced tools (viva) (10)</b>	Give a complete and logical reply to the questions asked by examiner(s).	Give a complete and logical reply to the questions asked by examiner(s) with few errors.	Give incomplete and illogical reply to the questions asked by examiner(s).	Given no reply to the questions asked by examiner(s).
<b>Presentation of ppt (10)</b>	Full understanding and demonstration of the work done in the industry with complete fulfillment of objectives reflected in content of presentation Proper eye contact, clear loud speech, proper dress code and body language	Full understanding and demonstration of work done in the industry with partial fulfillment of objectives which is reflected in content of presentation proper eye contact, low voice, inappropriate body language, proper dress	Partial understanding and demonstration of work done in the industry with very few of objectives and does not make connections among ideas. occasional eye contact, no clear voice , proper dress code, inappropriate, adequate body language	No demonstration of work done in the industry and no understanding of project objectives. Reads, no eye contact, low voice, no dress code, inappropriate body language.
Range for 15 marks	(15-13.5) marks	(13-9) marks	(9-5.5) marks	(5.5) marks
<b>Project Report (15)</b>	Report prepared according to format given. all contents	Report prepared according to format (75%). Information	Report prepared according to format (60%).	Report not prepared according to

	are described well. students has taken pain in formatting the report properly with all Sketches, calculations, observations,figure ,tables numbered properly etc.	presented in sequence and at ease but failed to elaborate .		format suggested.
<b>Total point (50)</b>	<b>(50-45) marks</b>	<b>(44-35) marks</b>	<b>(34-25) marks</b>	<b>(20) marks</b>

### Rubrics for Seminar (30 marks)

<b>Criterion</b>	<b>Excellent</b>	<b>Good</b>	<b>Fair</b>	<b>Unsatisfactory</b>
Range for 10 marks for each point	(10-9) marks	(8.5-7) marks	(6.5-5) marks	(4 marks)
<b>Concept Explanation (10 marks)</b>	Detailed explanation n of the concept	Good explanation of the concept	Average explanation of the concept	Unable to explain the concept
<b>Ppt Presentation (10 marks)</b>	Contents of presentation are appropriate and well delivered clear audible voice and good spoken language	Contents of presentation are appropriate and well delivered. Not clear voice but good spoken language	Contents of presentation are appropriate and well delivered. Clear audible voice but not good spoken language.	Contents of presentation are appropriate and well delivered. Poor delivery of presentation
<b>Viva Voice (10 marks)</b>	Able to answer all the questions with clear explanations	Able answer all the questions without clear explanation	Contents of presentation are appropriate and well delivered. Clear audible voice but not good spoken language.	Unable to answer all the questions.
<b>Total point (30)</b>	<b>(30-27) marks</b>	<b>(26-21) marks</b>	<b>(20-15) marks</b>	<b>(12) marks</b>

## Case Study: Evaluation Procedure for Chemistry Lab

**Note:** According to the subject, one can choose any of the following parameters for performance evaluation.

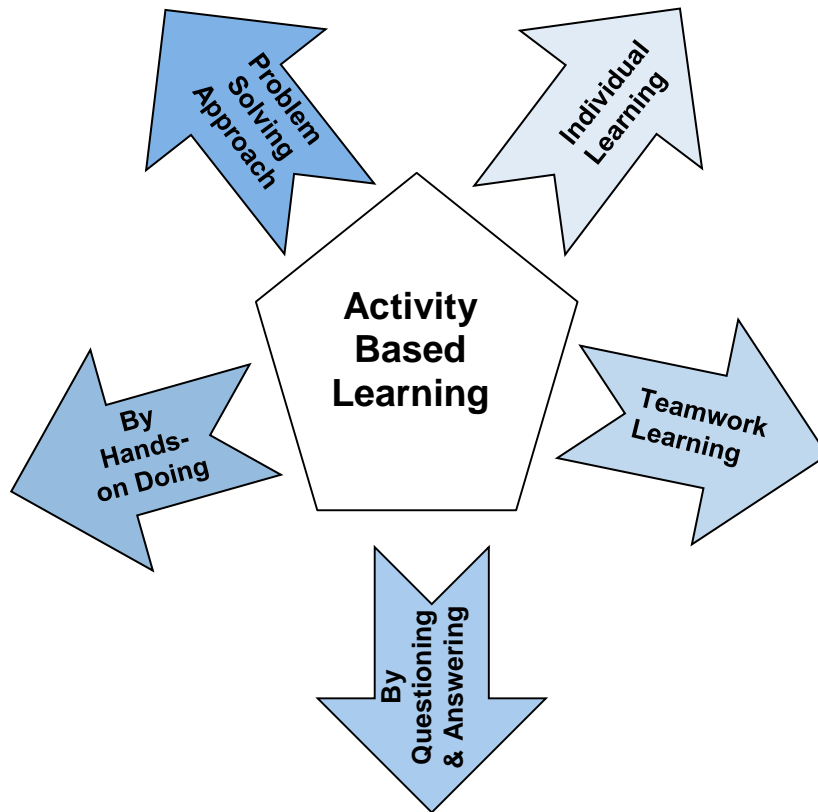
<b>Criteria/ Recommended Scores</b>	<b>Excellent:</b>	<b>Good:</b>	<b>Average</b>	<b>Unsatisfactory</b>
Range for 10 marks for each point	(10-9) marks	(8-7) marks	(5-6) marks	(4) marks
<b>Attendance</b>	Punctual in the lab and experiment is completed within the specific time.	Late in the lab but experiment is completed within the specific time.	Late in the lab but experiment is not completed within the specific time.	Experiment is done in extra class due to absence on assigned days.
<b>Lab Performances</b>	Demonstrates very good knowledge of both theory and experimental procedure.	Demonstrates good knowledge of both theory and experimental procedure.	Demonstrates average knowledge of both theory and experimental procedure.	Demonstrates poor idea of theory and experimental procedure.
<b>Data Accumulation</b>	Measurements, skills or techniques are very good and accurate.	Measurements, skills or techniques are good and fairly accurate.	Measurements, skills or techniques are average and fairly accurate.	Measurements, skills or techniques are poor and inaccurate.
<b>Data Analysis &amp; Calculation</b>	Data is clearly represented and step wise calculations are presented. If necessary, graph is plotted with proper labelling along with units.	Data is clearly represented but step wise necessary calculations are missing. If necessary, graph is plotted with proper labelling.	Data is clearly represented and step wise necessary calculations are missing. If necessary, graph is plotted without proper labelling.	Either data are incomplete or step wise calculations are missing or necessary graph is not correctly scaled and labeled.
<b>Interaction with Group</b>	Excellent team work with proper attitude	Very good team work with proper attitude	Good team work with proper attitude	Minimum team work with lack of proper attitude
<b>Timely Submission</b>	Writing Fair Lab copy properly and submit before performing the next practical.	Writing fair Lab copy properly and late submission.	Writing fair Lab copy partially and submit before performing the next practical.	Writing fair Lab copy partially and late submission.

Evaluation Criterion		Attendance	Lab Sheet	Procedure Knowledge	Technique	Overall Knowledge Gathered About The Topic (Viva)	Details Of Assignments	Signature & Date (Teacher In Charge)
CO 1	Assignment:1 (Date: )							
	Assignment:2 (Date: )							
	Assignment:3 (Date: )							
	Assignment:4 (Date: )							
	Assignment:5 (Date: )							
	TOTAL							
	TOTAL (SCALE of 5)							
CO 2	Assignment:1 (Date: )							
	Assignment:2 (Date: )							
	Assignment:3 (Date: )							
	Assignment:4 (Date: )							
	Assignment:5 (Date: )							
	Assignment:1 (Date: )							
	Assignment:2 (Date: )							
	Assignment:3 (Date: )							
	Assignment:4 (Date: )							
	Assignment:5 (Date: )							
	TOTAL							
	TOTAL (SCALE of 5)							



EVALUATION SHEET FOR CHEMISTRY												
Student Name:		Roll No:					Sem:			Year:		
CATEGORIES		Expt: 1	Expt: 2	Expt: 3	Expt: 4	Expt: 5	Expt: 6	Expt: 7	Expt: 8	Expt: 9	Expt: 10	TOTAL
Lab Technique	Attendance											
	Lab performances											
	Data accumulation											
	Data analysis & Calculation											
	Interaction with Group											
Lab Report	Timely submission											
TOTAL												
REMARKS												
SIGNATURE OF TECHNICAL ASSISTANTS / LAB INSTRUCTOR WITH DATE												

## UNIT 11: Activity Based Learning



### Examples:

MOOC, Flipped Classroom, Think Pair Share, Think Pair Solo, Four Corners, Round Robin, Collaborative Learning, Jig-Saw Puzzle, Matrix Method, Peer Learning, Work-Based Learning, Problem-Based Learning, Personalized Learning, Group Discussion, Debate, Case Studies, Fish Bowl, Reciprocal Teaching, etc.

## UNIT 12: List of Assessment Tools

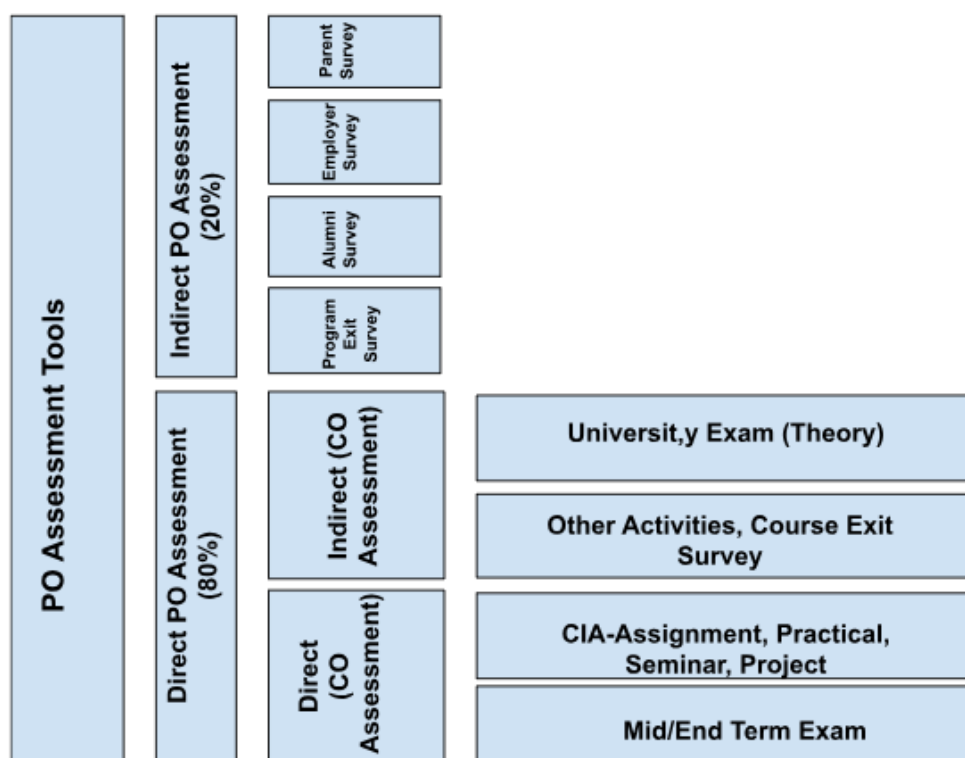
**All (Direct + Indirect) CO Assessment Tools = PO Direct Assessment Tools Sample**

### CO Assessment Tools

- Mid Term Test
- End Term Test
- Quiz
- Assignment
- Practical/ Lab work
- Industrial Visit, Workshop
- Other Task/Activity
- University Exam
- Oral
- Course Exit Survey
- External Feedback (External Examiner/Trainer, Campus Placement Technical Expert)

**Direct Tools:** (Measurable in terms of marks and w.r.t. CO) Assessment done by faculty at the Institute level

**Indirect Tools:** (Non-measurable in terms of marks and w.r.t. CO) Assessment done at University Level



### Sample Indirect PO assessment Tools

- Program Exit Survey
- Alumni Survey
- Employer Survey of Alumni
- Parent Feedback

## UNIT 13: CO Attainment Calculations

### Attainment Weightage:

Consider the following weightage for PO Assessment Tools

PO Assessment Tools	
Direct PO Assessment (80%)	Indirect PO Assessment (20%)

Consider following weightage for CO Assessment Tools

PO Direct Assessment Tools = CO Assessment Tools		
Direct CO Assessment	Indirect CO Assessment	
80	20	University B.Tech Curriculum

### Illustration of Internal Test Examination Attainment:

Course	Engg. Mathematics
Maximum Marks	25
Number of Students Appeared	60
Passing Level (Threshold-Based Target)	10 (40% here)

Now, we need the target (mentioned above in the table) and the marks of all students to calculate attainment. The table below shows the marks of all students.

### Sample Internal Marks of Total 60 students in a given subject

5	23	5	11	21	0
0	12	5	2	7	4
0	22	3	3	10	7
5	18	9	20	17	24
23	8	25	16	9	10
12	2	8	11	22	4
25	13	2	1	25	19
24	22	16	10	1	2
12	21	8	25	11	4
24	9	22	20	20	17

Now

Number of student achieving 12 or more marks	28
% of students achieving 12 or more marks	$(28/60)*100 = 46.6\%$

- 1 – if 40 % students score more than target
- 2 – if 50 % students score more than target
- 3 – if 60 % students score more than target

**Then attainment = 1 (from 46.6%)**

### **Illustration of Feedback/Rubric based Assessment & Attainment**

Course	SOM
Maximum Marks	5
Number of Students Appeared	60
Passing Level (Threshold Based Target)	3 (>50% here)

Now, we need target (mentioned above in table) and response/feedback of all students to calculate attainment. The table below shows score/response of all students.

#### **Sample Assignment Marks of Total 60 students in a given subject**

4	3	3	1	2	5
3	3	2	1	2	4
4	2	5	5	1	5
1	1	5	2	2	4
2	2	5	3	5	1
2	4	2	5	2	1
3	4	4	2	4	3
5	2	4	3	2	5
5	5	4	4	4	2
5	4	4	2	3	5

Now

Number of students achieving 3 or more marks	37
% of students with 3 or more marks	$(37/60) \times 100 = 61.7\%$

- 1 – if 40 % students score more than target
- 2 – if 50 % students score more than target
- 3 – if 60 % students score more than target

**Then attainment = 3 (from 61.7%)**

### **Overall Attainment of CO**

Let's assume CO1 is assessed using any 2 direct + 2 Indirect CO assessment tools, then

1. **Overall CO Attainment = (Weightage x Direct CO attainment) + (Weightage x Indirect CO attainment)**

For University Regular B.Tech Curriculum

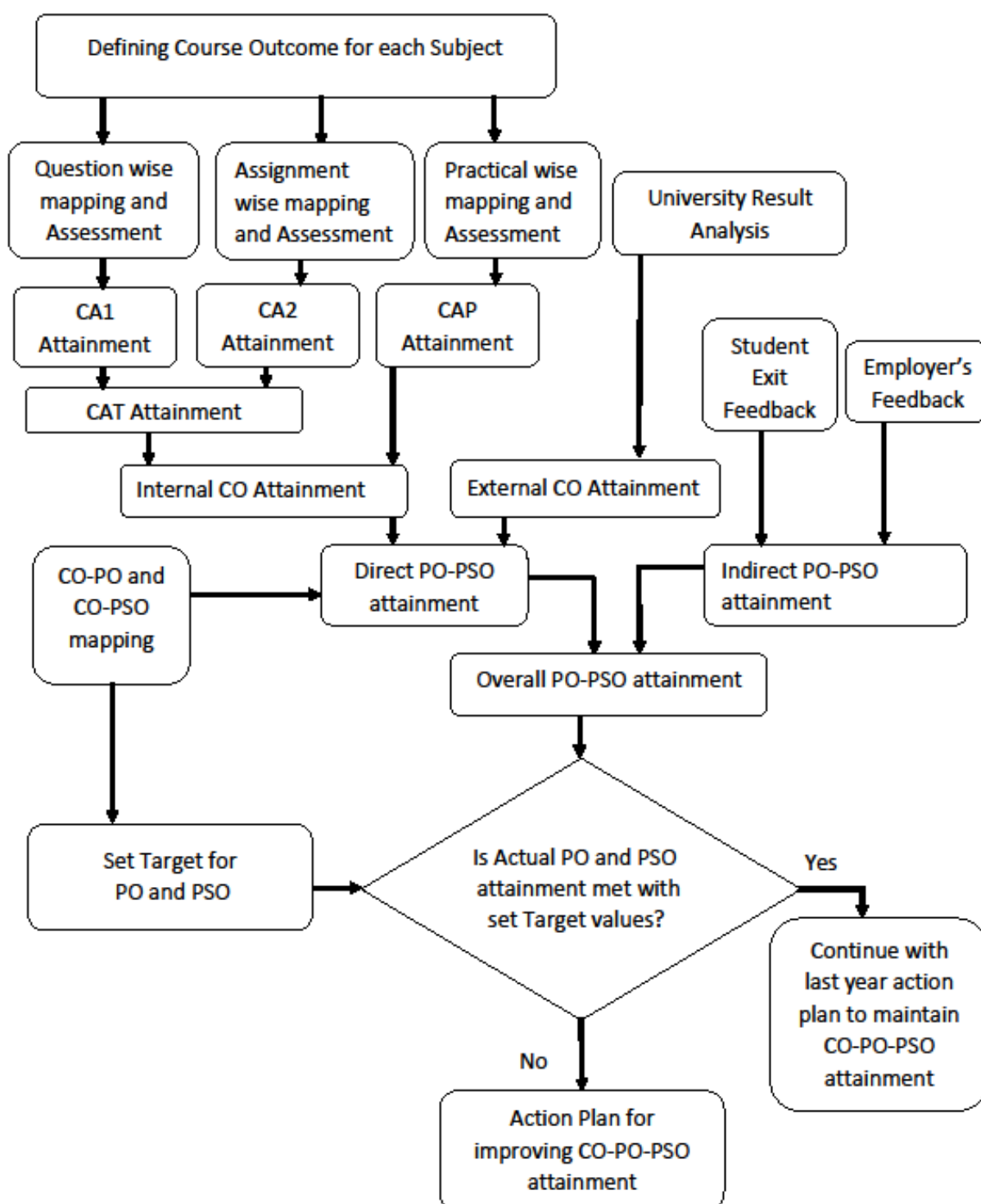
2. **Overall CO Attainment = (80% x Direct CO attainment) + (20% x Indirect CO attainment)**

**# Note: Appropriate % weightage distribution may be considered for any number of direct/indirect assessment tools with proper justification at department/faculty level.**

**Illustration:**

Course CO	PO											PSO		
	1	2	3	4	5	6	8	9	10	11	12	1	2	3
C202.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
C202.2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
C202.3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
C202.4	-	3	-	-	-	-	-	-	-	-	-	-	-	-
C202.5	-	-	3	-	2	-	-	-	-	-	2	-	-	-
C202.6	-	-	-	-	3	2	-	-	-	-	-	3	-	-

## UNIT 14: Continuous Improvement – Summary of Process for CO-PO Attainment



**Summary of Process for CO-PO Attainment**

**A) Contribution of CO in PO attainment and Continuous Improvement (Faculty Level)**

Outcome	Action to be taken by the faculty
High attainment of all CO-PO (>2.5 out of 3)	Set new, higher targets or attainment levels for the next Academic Year (A.Y.).
Moderate attainment of all CO-PO (1.8 to 2.49 out of 3)	Record observations, continue the action plan from the last A.Y. with a plan for improvements.
Low attainment of all CO-PO (0.9 to 1.79 out of 3)	Record observations, assess the target set, revise/improve the action plan of last A.Y. to achieve the attainment with a plan for improvements.
CO-PO not attained, poor performance(<0.9 out of 3)	Record observations, Critical assessment of target with the evaluation Committee, Revise action plan of last A.Y. at the faculty/department level.

**B) PO Attainment and Continuous Improvement (Evaluation Committee and HoD Level)**

Category	Outcome	Action by PC and HoD
Course related	PO attained highly	Include activities with HOT.
	PO not attained highly	Identify concerned courses, plan for immediate improvements, guide, support, and monitor their execution.
Activity related	Activities Conducted	Critical assessment, impact analysis to be done, and revise as per the need for improvements.



## **Program Outcomes (POs)**

**PO 1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO 2: Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO 3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO 4: Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO 5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO 6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO 7: Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO 8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO 9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO 11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO 12: Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **Attainment of Course Outcomes**

### **Describe the assessment processes used to gather the data upon which the evaluation of Course Outcome is based**

(Examples of data collection processes may include, but are not limited to, specific exam/ tutorial questions, assignments, laboratory tests, project evaluation, student portfolios) A portfolio is a collection of artifacts that demonstrate skills, personal characteristics and accomplishments created by the student during study period), internally developed assessment exams, project presentations, oral exams etc.

This section details the required description of the assessment processes and tools used for evaluation of Course Outcome at Electronics and Communication Engineering SCET.

Prior to 2021 SCET was affiliated to Gujarat Technological University, during that following major components were used for evaluating the performance of the students.

#### **End Semester Theory Exam (E) (70 Marks)**

The Comprehensive External Theory Exam comprising the whole curriculum of 70 marks is conducted by Gujarat Technological University at the end of semester.

#### **Progressive Assessment for Theory (M) (30 Marks)**

Progressive assessment comprises of Internal Theory Examination conducted once in a semester plus Tutorial/Assignment/Quiz conducted during semester.

#### **Progressive Assessment for Practical (I) (20 Marks)**

Internal Evaluation is done based on involvement and participation of students in each experiment and quality of term work submitted. Lab Assignment / Quiz / mini projects and viva are conducted in each subject and based on the evaluation of the same, internal marks out of 20 are awarded to the students.

#### **End Semester Practical / Viva Exam (V) (30 Marks)**

Comprehensive External Practical Performance and Viva exam considering all practical aspects of the course like analyzing and applying concepts, designing / implementation / result generation / graph or waveform plotting are assessed at the end of semester.

From AY 2021-22 SCET is constituent college of Sarvajanik University, follows given major components for evaluating the performance of the students.

#### **Term End Semester Theory Exam (TEE) (60 Marks)**

The Comprehensive External Theory Exam comprising the whole curriculum of 60 marks is conducted by Sarvajanik University at the end of the semester.

#### **Continuous Assessment for Theory (CAT) (40 Marks)**

Continuous assessment comprises of Internal Theory Examination conducted once in a semester plus Tutorial/Assignment/Quiz conducted during semester.

#### **Continuous Assessment for Practical (CAP) (20 Marks)**

Continuous internal Evaluation is done based on involvement and participation of students in each experiment and quality of term work submitted. Lab Assignment / Quiz / mini projects and viva are conducted in each subject and based on the evaluation of the same, internal marks out of 20 are

awarded to the students.

### **Term End Semester Practical / Viva Exam (TEP)**

(30 Marks)

Comprehensive External Practical Performance and Viva exam considering all practical aspects of the course like analyzing and applying concepts, designing / implementation / result generation / graph or waveform plotting are assessed at the end of the semester.

### **Computation and details of Result:**

All internal marks are uploaded on the online portal created by the university for each subject for each student.

University (SU/GTU) declares overall results including component wise grades of theory and Practical examinations.

### **Tools for CO measurement:**

Grades are awarded to students as External and Internal exam grades in addition to overall grades, as mentioned in results.

- External grades are computed by combining Term End theory exam grades (E / TEE component) and Term End practical exam (V / TEP component) grades.
- Similarly, Internal grades are computed including Theory Midterm exam (M /CAT component) and continuous Internal Evaluation is done based on involvement and participation of students in each experiment and quality of term work (I / CAP component)

### **Record the attainment of Course Outcomes of all courses with respect to set attainment levels**

(The attainment levels shall be set considering average performance levels in the university examination or any higher value set as target for the assessment years. Attainment level is to be measured in terms of student performance in internal assessments with respect to the Course Outcomes of a course in addition to the performance in the University examination)

## **Process Developed to Validate COs for Undergraduate Program in Engineering**

### **(A) Target setting of Course Outcome of course:**

Course Outcome target in under graduate of Engineering:

**For course target following process is adopted.**

- For course target of 2022-23 previous year target (2021-2022) was considered which include both External as well as internal exam component.
- If the syllabus for a particular subject is changed then for new subject target is set as under.

A. If the new subject had similar contents as per old subject then target was taken from old subject target value.

B. In absence of meeting to the criterion in (A), for new subjects in 2<sup>nd</sup> year 60% attainment target which is approximately 1.8 was set, in 3<sup>rd</sup> year 70% which is 2.1 and in 4<sup>th</sup> year 80% which is 2.4 target is set respectively.

**(B) Actual Course Outcome Attainment calculation:**

Course attainment has mainly two components, Internal and External. Both these components are divided into theory and practical.

**B1 Internal attainment**

For internal attainment various tools are used for theory and practical attainment. Theory which is called CAT component includes CA1 and CA2. Practical has CAP component.

In CA1 component midterm examination is conducted in which all the questions are mapped with CO and marks are awarded for all parts of the questions to each students. Attainment is calculated question wise as well as CO-wise. One example table for subject Digital System Design is shown in the table B1.1. Percentage of students are identified and based on given rubrics attainment level is awarded to CA1 component.

If % of students who scored  $\geq 60\%$  exceeds 60% of max marks, then attainment level = 3

If % of students who scored  $\geq 50\%$  exceeds 50% of max marks, then attainment level = 2

If % of students who scored  $\geq 40\%$  exceeds 40% of max marks, then attainment level = 1

**Table B1.1 Attainment calculation of CA1 component**

Max Marks of Question		4	3	5	4	5	4	5	4	5	4		9	11	5
Question mapped with CO		CO1	CO2	CO3	CO2	CO3	CO2	CO1	CO2	CO1	CO2	Total	Max Marks		
Enrolment Number	Name of Student	Q1 a	Q1 b	Q2 a	Q2 b	OR Q2 a	OR Q2 b	Q3 a	Q3 b	OR Q3 a	OR Q3 b	25	CO1	CO2	CO3
ET23BTEC001	ADITYA TAILOR	4	3	4	0			1	0			12	5	3	4
ET23BTEC002	ANAJWALA MEGHA	2.5	1.5	4	0			2.5	3			13.5	5	4.5	4
ET23BTEC003	AVANI DESHPANDE	3	3			5	4	3	3			21	6	10	5
ET23BTEC004	BHAYANI HELLY	2.5	2			4	4	4	1			17.5	6.5	7	4
ET23BTEC005	BHIMANI BRINDA	4	1	2	4					1	3	15	5	8	2
ET23BTEC006	CHOKSY JAYNEE	1.5	2	2	2					0	2.5	10	1.5	6.5	2
ET23BTEC007	DEVANSHI PATEL	2	1	1	4			4	0			12	6	5	1
ET23BTEC008	FALIT CHOKSI	2.5	2	3	2			2	1			12.5	4.5	5	3
ET23BTEC009	GANDHI BHAVY	2.5	2	4	3			2	1			14.5	4.5	6	4
ET23BTEC010	GARASIA SHIHAB	3	2.5	5	4			1	3			18.5	4	9.5	5
Total Number of students		10	10	8	8	2	2	8	8	2	2	10	10	10	10
% of students scored $\geq 60\%$		80	70	63	50	100	100	38	38	0	100	40	30	40	70
% of students scored $\geq 50\%$		90	80	63	75	100	100	50	38	0	100	70	80	60	70
% of students scored $\geq 40\%$		90	80	88	75	100	100	75	38	0	100	100	90	90	90
Attainment Level based on rubrics		3	3	3	2	3	3	2	1	1	3	2	2	2	3

In CA2 component Tutorial / Assignment / Quiz are conducted. Each component is mapped with CO and marks are awarded for all components to each students. Attainment is calculated component wise as well as CO-wise. One example table for subject Digital System Design is shown in the table B1.2. Percentage of students are identified and based on given rubrics attainment level is awarded to CA2 component.

If % of students who scored  $\geq 60\%$  exceeds 60% of max marks then attainment level = 3

If % of students who scored  $\geq 50\%$  exceeds 50% of max marks then attainment level = 2

If % of students who scored  $\geq 40\%$  exceeds 40% of max marks then attainment level = 1

**Table B1.2 Attainment calculation of CA2 component**

Max Marks of component		5	10	30	10	5	15	<b>Total</b>	10	30	45
Component mapped with CO		CO1	CO2	CO3	CO2	CO1	CO3				
		CO2				CO2					
<b>Enrolment Number</b>	<b>Name of Student</b>	Assignment 1 (NHC)	Assignment 1 (NNS)	Assignment 3 (NNS)	Waveform Test	Assignment 2 (NHC)	Assignment Logisim	<b>25</b>	CO 1	CO 2	CO 3
ET23BTEC001	ADITYA TAILOR	4	9	14.5	0			27.5	4	13	14.5
ET23BTEC002	ANAJWALA MEGHA		10	15	0		12	37		10	27
ET23BTEC003	AVANI DESHPANDE	4	10	29.5	4		15	62.5	4	18	44.5
ET23BTEC004	BHAYANI HELLY	4	8	15	4	5	13	49	9	21	28
ET23BTEC005	BHIMANI BRINDA	2	9	15	4	4	15	49	6	19	30
ET23BTEC006	CHOKSY JAYNEE	4	10	15	0	4	15	48	8	18	30
ET23BTEC007	DEVANSHI PATEL	3	9	24.5	0	4	9	49.5	7	16	33.5
ET23BTEC008	FALIT CHOKSI	4	9	25.5	5	4	15	62.5	8	22	40.5
ET23BTEC009	GANDHI BHAVY		9		0			9		9	
ET23BTEC010	GARASIA SHIHAB	4	8	21	3	4	15	55	8	19	36
Total Number of students		8	10	9	10	6	8		8	10	9
% of students scored $\geq 60\%$		88	100	44	0	100	100		75	60	89
% of students scored $\geq 50\%$		88	100	89	10	100	100		75	70	89
% of students scored $\geq 40\%$		100	100	100	40	100	100		100	80	89
<b>Attainment Level based on rubrics</b>		<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>		<b>3</b>	<b>3</b>	<b>3</b>

In CAP component all the practical is mapped with CO and marks are awarded for all practical to each students based on assessment rubrics. Attainment is calculated for each practical as well as CO-wise. One example table for subject Digital System Design is shown in the table B1.3. Percentage of students are identified and based on given rubrics attainment level is awarded to CAP component.

If % of students who scored  $\geq 60\%$  exceeds 60% of max marks then attainment level = 3

If % of students who scored  $\geq 50\%$  exceeds 50% of max marks then attainment level = 2

If % of students who scored  $\geq 40\%$  exceeds 40% of max marks then attainment level = 1

**Table B1.3 Attainment calculation of CAP component**

Max Marks of Lab		6	6	6	6	6	6	6	6	6	10	15	10
Practical mapped with CO		CO1	CO2	CO2	CO2	CO2	CO2	CO3	CO3	CO3	CO4	CO2	CO3
											CO5		CO4
													CO5
<b>Enrolment Number</b>	<b>Name of Student</b>	Lab 1	Lab 2	Lab 3	Lab 4	Lab 5	Lab 6	Lab 7	Lab 8	Lab 9	Lab 10	Lab 11	ALA
ET23BTEC001	ADITYA TAILOR	5	5	5	4	4	4	5	3	4		4	
ET23BTEC002	ANAJWALA MEGHA	5	6	5	5	5	5	5	5	5		11	6
ET23BTEC003	AVANI DESHPANDE	6	6	6	6	6	6	6	6	6	10	13	10
ET23BTEC004	BHAYANI HELLY	6	6	6	6	6	6	6	6	6	10	12	7
ET23BTEC005	BHIMANI BRINDA	6	6	6	6	6	6	6	6	6	10	12	7
ET23BTEC006	CHOKSY JAYNEE	6	6	6	5	5	5	5	4	5	10	14	10
ET23BTEC007	DEVANSHI PATEL	6	5	6	6	5	5	6	6	6		12	8
ET23BTEC008	FALIT CHOKSI	6	5	6	6	6	5	6	6	5	10	15	10
ET23BTEC009	GANDHI BHAVY	6	5	5	6	5	6	6	6	6	10	11	10
ET23BTEC010	GARASIA SHIHAB	6	6	6	6	6	6	6	6	6		15	10
Total Number of students		10	10	10	10	10	10	10	10	10	6	10	9
% of students scored $\geq 60\%$		100	100	100	100	100	100	100	90	100	100	90	100
% of students scored $\geq 50\%$		100	100	100	100	100	100	100	100	100	100	90	100
% of students scored $\geq 40\%$		100	100	100	100	100	100	100	100	100	100	90	100
<b>Attainment Level based on rubrics</b>		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>

In CAT component weightage of CA1 is 60% and weightage of CA2 is 40% that's why for CAT component weighted average is considered. Table B1.4 show CO wise attainment of CAT component.

**Table B1.4 Attainment calculation of CAP component.**

Component	Weightage	CO1	CO2	CO3	CO4	CO5	CO6
CA1	0.625	2	1	3			
CA2	0.375	3	2	3			
CAT	1	2.375	1.375	3			

For External component TEE and TEP external evaluation sheet is used which is having external grades for End Term University Theory Exam (TEE) and End Semester Practical submission /Viva (TEP) There are three levels associated with grades

Level	Grades Received
3	AA, AB, BB
2	BC, CC
1	CD, DD

The External Evaluation CO attainment is calculated by following formula.

External CO attainment =  $(3*X+2*Y+1*Z)/\text{Total Number of students}$

X=Total students who achieved AA+AB+BB

Y=Total Number of students who achieved BC+CC

Z=Total Number of students who achieved CD+DD

By applying above formula for CO attainment is calculated for TEE and TEP component.

Once individual attainment of component TEE, TEP, CAT and CAP is available, overall attainment is calculated based on weightage average.

Weightage of internal evaluation is 40% and External evaluation is 60%, the weighted average of CO attainment is calculated.

Final Actual CO attainment =  $0.6*\text{External CO attainment} + 0.4*\text{Internal CO attainment}$

Final CO attainment for course =  $0.6*\text{External Weighted Average} + 0.4*\text{Internal Weighted Average}$

Based on Target setting process of (A) and attainment calculation of (B), target is set for all courses at the commencement of the semester and attainment is calculated once university result is available. After computation it was evaluated whether target is matched? If it is matched then 5% higher target is adopted for next academic year. Otherwise, target is kept as it is.

Prior to SU, in GTU following process was used.

For External theory component E and practical component V as well as Internal component theory M and practical component I result sheet is used which is having grades for all components. There are three levels associated with grades.

Level	Grades Received
3	AA, AB, BB
2	BC, CC
1	CD, DD

The External Evaluation CO attainment is calculated by following formula.

External CO attainment =  $(3*X+2*Y+1*Z)/\text{Total Number of students}$

X=Total students who achieved AA+AB+BB

$Y = \text{Total Number of students who achieved BC+CC}$

$Z = \text{Total Number of students who achieved CD+DD}$

By applying above formula CO attainment is calculated for T, V, M and I component.

Once individual attainment of component is available, overall attainment is calculated based on weightage average.

Weightage of internal evaluation is 30% and External evaluation is 70%, the weighted average of CO attainment is calculated.

Final Actual CO attainment  $= 0.7 * \text{External CO attainment} + 0.3 * \text{Internal CO attainment}$

Final CO attainment for course  $= 0.7 * \text{External Weighted Average} + 0.3 * \text{Internal Weighted Average}$

Based on Target setting process of (A) and attainment calculation of (B), target is set for all courses at the commencement of the semester and attainment is calculated once university result is available. After computation it was evaluated whether target is matched? If it is matched then 5% higher target is adopted for next academic year. Otherwise, target is kept as it is.

### **Process Developed to Validate PO, PSO attainment for undergraduate Program**

**The steps towards validation of POs and PSO are as follows:**

Step 1: Define the Vision and Mission of the Department from Vision and Mission of Institute.

Step 2: Define Program Educational Objectives (PEOs) of the Department.

Step 3: Establish relation between PEOs and POs to setup target level of PO attainment.

Step 4: Define relation between Course Outcomes COs and POs as well as COs and PSOs for each course to obtain overall CO mapping with each POs and PSOs.

Step 5: Developing of overall CO-PO and CO-PSO mapping matrix for all courses.

Step 6: Decide attainment target for all courses, POs, and PSOs.

Step 7: Compute overall CO attainment matrix for each course using course assessment tools.

Step 8: Calculate direct PO and PSO attainment for a given course using overall CO-PO and CO-PSO mapping matrix.

Step 9: Calculate direct PO, PSO attainment.

Step 10: Calculate indirect PO, PSO attainment.

Step 11: Compute overall PO, PSO attainment from step 8 and step 9.

Step 12: Compare target level and obtained PO, PSO attainment.

### **Steps are elaborated below**

#### **Steps 1 and 2:**

The vision, Mission and the PEOs of the department are finalized after brainstorming activities and meetings among the staff members, advisory committee member and institute head.

The Program Outcomes are defined as below.



	<b>Engineering Graduates will be able to</b>	<b>Traits/Characteristics Engineers should possess</b>
PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Engineering Knowhow
PO2	Identify, formulate, review research literature, and analyze complex engineering problems.	Problem Analysis
PO3	Design solutions for complex engineering problems with appropriate consideration for the public health and safety.	Design/Development of solutions
PO4	Use research-based knowledge to provide valid conclusions.	Conduct investigations of complex problems
PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT simulator tools with an understanding of the limitations.	Modern Tool usage
PO6	Apply reasoning informed by the contextual knowledge to assess responsibilities relevant to the professional engineering practice.	The engineer and society
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.	Environment and sustainability
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Ethics
PO9	Function effectively as an individual, and as a member or leader in diverse teams.	Individual and team work
PO10	Communicate effectively with the engineering community and with society at large and write effective reports and design documentation, make effective presentations.	Communication
PO11	Demonstrate knowledge and understanding of the engineering principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Management skills
PO12	Recognize the need for, and lifelong learning in the broadest context of technological change.	Life Long learning

The Program Specific Outcomes (PSOs) are defined as below.

	<b>Graduate engineer will be able to</b>
PSO1	Describe, test, analyze, and design different analog, digital and mixed signal circuit systems.

PSO2	Write and debug assembly and higher level program for both analog and digital circuits.
PSO3	Describe, analyse, design and measure critical performance parameters of electronics and communications systems.

**Step 3: Establish relation between PEOs and POs to setup target level of PO attainment.**

POs and PEOs		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO 1	Exhibit an in-depth theoretical and practical knowledge of various engineering aspects and strongly <b>frame</b> their <b>fundamentals</b> for progressing career.	3	3	3	2	1	1	1	1	1	2	3	2
PEO 2	Develop the <b>proficiency</b> with the techniques of Mathematics and ability to evaluate logical arguments to tackle the <b>real world challenges</b> .	3	3	2	1	1	1	1	1	1	2	2	2
PEO 3	Develop <b>innovative ideas pertaining to technical problems</b> based on simulations and various software means.	3	3	3	1	3	3	3	1	1	3	2	3
PEO 4	Establish <b>skillful professionals</b> with attention to team-work, <b>leadership and effective communication</b> within a global, societal and environmental context	2	1	2	1	1	1	1	3	3	3	3	2
PEO	Enhance the	1	1	1	1	3	3	3	3	3	3	3	2

5	performance in a <b>multi-disciplinary domain</b> to achieve professional advancement with <b>increasing responsibilities and ethical ramifications.</b>												
	<b>Target level of outcomes</b>	2.4	2.2	2.2	1.2	1.8	1.8	1.8	1.8	1.8	2.6	2.6	2.2

Mapping Level and their relation

3	High	2		Moderate	1	Low	No Relevant
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**Step 4: Define relation between Course Outcomes COs and POs as well as COs and PSOs for each course to obtain overall CO mapping with each POs and PSOs.**

**Step 5: Developing of overall CO-PO and CO-PSO mapping matrix for all courses of the Programme**

**Step 6: Decide attainment target for all courses, POs, and PSOs.**

**For program target following process is adopted**

1. CO-PO and CO-PSO mapping matrix is considered as an important component of PO attainment. CO-PO mapping average and CO-PSO mapping average was calculated which sets the maximum achievable attainment level for the program outcome.
2. Based on Average CO-PO mapping, CO-PSO mapping target was set for PO, PSO attainment, respectively.
3. For next consecutive year new target is set based on following.

For the next year target is increased by 5% if attainment is achieved and if attainment is not achieved then target is not changed.

**Step 7: Compute overall CO attainment matrix for each course using course assessment tools.**

**Step 8: Calculate direct PO and PSO attainment for a given course using overall CO-PO and CO-PSO mapping matrix.**

The direct PO attainment of a course is given by

$$DCPO_{i,k} = COPO_{i,k} * OCO_i * (1/3)$$

Where, i is the serial number of course, k corresponds to k<sup>th</sup> PO, DCPO – direct course PO attainment, COPO<sub>i,k</sub> – Average CO-PO mapping from CO<sub>i</sub> to PO<sub>k</sub>, OCO<sub>i</sub> – Course attainment for subject i

COPO<sub>i,k</sub> and OCO<sub>i</sub> can be obtained from step 5 and step 6.

For the subject BTEC13302 Digital System Design (subject of sem 3), the  $DCPO_{1,k} = COPO_{1,k} * (1/3 * OCO_1) = 2.29$

The attainment of PO1 and PO12 are calculated as below.

$$DCPO_{1,1} = COPO_{1,1} * 1/3 * OCO_1 = 1.83$$

$$DCPO_{1,12} = COPO_{1,12} * 1/3 * OCO_1 = 1.07$$

If such p subjects are there in one sem, then. The direct PO attainment is calculated as

$$DPO_j = 1/P \left( \sum_{k=1}^n DCPO_{j,k} \right)$$

Similar exercise is done for PSO.

### **Step 9: Calculate direct PO, PSO attainment.**

**As per step 8, PO attainment for all courses were computed and tabulated.**

Indirect assessment is done through student exit feedback survey and employer survey. Program student's survey is given a weight age of 10%, employer and alumni survey are given a weight age of 10%. Survey forms were prepared (hard copy and Google form) and distributed to 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.

### **Step 10: Calculate indirect PO, PSO attainment.**

Average level for each PO has been calculated using the formula. The formula for overall PO attainment is given by,

$$OPO_j = 0.8 * DPO_j + 0.2 * IPO_j. \text{ Where } j=1,2 \dots 12 (12 \text{ POs})$$

Where OPO – overall PO attainment, IPO – Indirect PO attainment, DPO – Direct PO attainment

### **Step 11: Compute overall PO, PSO attainment from step 9 and step 10.**

### **Step 12: Compare target level and obtained PO, PSO attainment.**

Once university results were available, course attainments were computed. Based on all course outcomes, program outcomes, and program specific outcomes were computed using the CO-PO, CO-PSO mapping respectively.

Calculated PO and PSO attainments were compared with the set target levels as described earlier.

## List of Documents

Sr.	Title	Details
1	Vision, Mission of the Institute	Maintain at Deptt. Level (PC & HoD)
2	Vision, Mission of the Program	Maintain at Deptt. Level (PC & HoD)
3	PEO of Program, PEO-PO/PSO Mapping	Maintain at Deptt. Level (PC & HoD)
4	PO and PSO of the Program	Maintain at Deptt. Level (PC & HoD)
5	CO + PO/PSO + Mapping	Maintained by every faculty in Course File
6	Revised Bloom's Taxonomy Level and OBE Framework	Print to be maintained in Course File of Faculty & displayed in department all labs
7	Course List with Course Codes	Maintain at Deptt. Level (PC & HoD)
8	List of PO Assessment Tools	Maintain at Deptt. Level (PC & HoD)
9	List of CO Assessment Tools Used	Maintained by every faculty in Course File
10	Program Assessment Committee & DAB	Maintain at Deptt. Level (PC & HoD)
11	Course and Module Coordinators	Maintain at Deptt. Level (PC & HoD)
12	Course Plan	Along with delivery details and assessment tools by Faculty
13	Attainment Levels/ Targets of all courses of your program	Maintained by every faculty in Course File
14	Rubrics	Course-wise rubrics to be maintained by every Faculty All activity rubrics to be maintained at deptt. Level (PC & HoD)
15	Record of all Assessment Details	Test Papers, Model Answers, Sample Answer Papers, Results, Sample Journals of students, Lab Manuals, Sample Seminar, Project Report & other records related concerned with assessment to be maintained by Faculty
16	Slow-Advanced Learners	Identification, Action Taken Record to be maintained by Faculty
17	Course Exit Survey of every course	To be maintained by concerned Faculty
18	Program Exit Survey, Alumni Feedback, Employer Feedback	End of Final Year: Maintain at Deptt. Level (PC & HoD)
19	CO Attainment	At End of Course: Maintained by Faculty and to be submitted to department
20	PO Attainment	At end of A.Y.: (Direct + Indirect) to be maintained by PC & HoD at Deptt. Level
21	Impact Analysis and Continuous Improvement Related Documents	CO level documents to be maintained by concerned faculty. PO level documents to be maintained by PC and HoD.

## List of Abbreviations

ABET	Adult Basic Education And Training
AICTE	All India Council for Technical Education
BT	Bloom's Taxonomy
BTL	Bloom's Taxonomy Level
CA1	Continuous Assessment 1
CA2	Continuous Assessment 2
CO	Course Outcome
EWS	Economically Weaker Section
ERP	Enterprise Resource Planning
GSIRF	Gujarat State Institutional Rating Framework
HOT	Higher Order of Thinking
ICT	Information and Communication Technology
IEP	International Experience Program
IKS	Indian Knowledge Systems
LOT	Lower Order of Thinking
MOOC	Massive Open Online Courses
NBA	National Board of Accreditation
NEP	National Education Policy
NGO	Non-Governmental Organizations
NiRF	National Institutional Ranking Framework
NPTEL	National Programme on Technology Enhanced Learning
OBE	Outcome Based Education
PC	Program Committee
PO	Programme Outcome
PSO	Program Specific Outcomes
SCET	Sarvajanik College of Engineering & Technology
SSIP	Student Startup and Innovation Policy
STTP	Short Term Training Program
TEE	Theory External Exam