2024

OUTCOME BASED EDUCATION(OBE) HANDBOOK

TSSM'S
Padmabhooshan Vasantdada Patil Institute Of Technology, Pune - 21

Outcome Based Education

Outcomes based education (OBE) is a process that involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than the accumulation of course credits" (Tucker, 2004).

Increase knowledge → **Developing Skill** → **Positive attitude** → **Values** → **Judgement**

About Us

Padmabhooshan Vasantdada Patil Institute of Technology (PVPIT) is governed by The Shetkari Shikshan Mandal, a charitable Trust registered under Bombay Public Trust Act 1950 and Societies Registration Act 1860. The TSSM started the Padmabhooshan Vasantdada Patil Institute of Technology in the academic year 2006-07. The College is approved by All India Council for Technical Education (AICTE), New Delhi, recognized by Government of Maharashtra, Directorate of Technical Education (DTE) and affiliated to University of Pune.

Dr. Prof. T. J. Sawant, President TSSM is renowned entrepreneur and educationalist. He strongly believes that establishment of excellent technical institutions are the key solution to the problem of development of techno-economic society.

He is also Founder Secretary of Jayawant Shikshan Prasarak Mandal (JSPM) which is established in the year 1998 and is known as a leading education group in India, in the very small span with a number of institutes such as Engineering, Management, Pharmacy, Diploma, Computer Application and Pre-Primary, Primary, Secondary School in and around Pune in five campuses.

Padmabhooshan Vasantdada Patil Institute of Technology is housed in a spacious campus at Bavdhan (KD), Chandni Chowk, near Kothrud, Pune, which is surrounded by greenery and mountains. Under the dynamic leadership of Dr. Prof. T. J. Sawant, the institute is progressing by keeping pace with the world. We believe in imparting value based quality engineering education so that, our students will be placed in the industry, public and private sector organization and others. Institute is well known for discipline, good learning environment, and student-centric activities.

01 Vision of Institute

"To satisfy the aspirations of youth force, who want to lead nation towards prosperity through Techno-Economic development."

02 Mission of Institute

"To provide, nurture and maintain an environment of high academic excellence, research and entrepreneurship for all aspiring students, which will prepare them to face global challenges maintaining high ethical and moral standards; by implementing quality practices.."

03 Quality Policy

"We at Padmabhooshaan Vasantdada Patil Institute of Technology are committed to maximize studemt satisfaction through improved performance by imparting value based quality education."

"

Program Outcomes(POs)

Program outcomes describe what students are expected to know and would be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.

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

2. **Problem Analysis**: using first principles of mathematics, natural sciences, and engineering sciences.

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

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 th e information to provide valid conclusions.

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

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.

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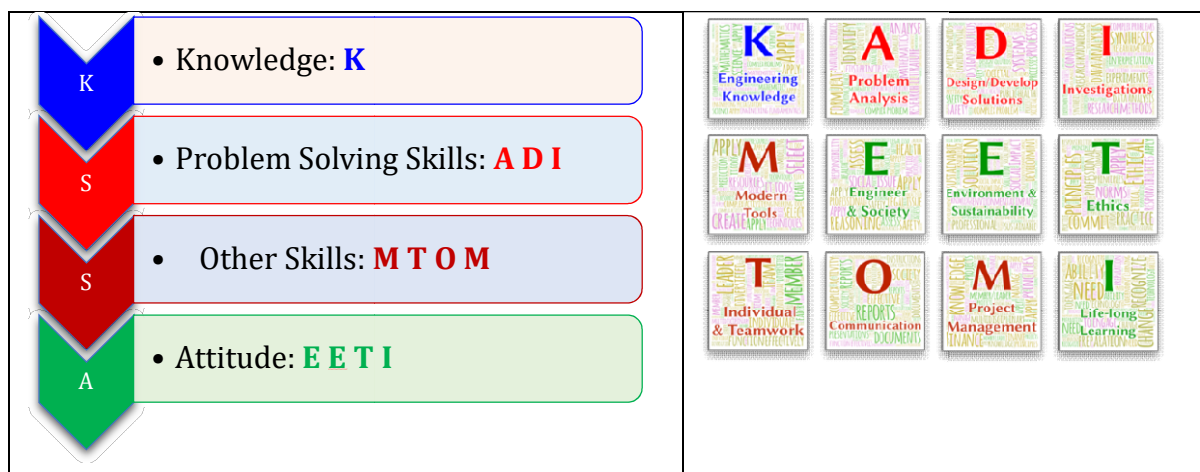
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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

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.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of t h e 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.

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.

Contents

LIST of ABBREVATIONS

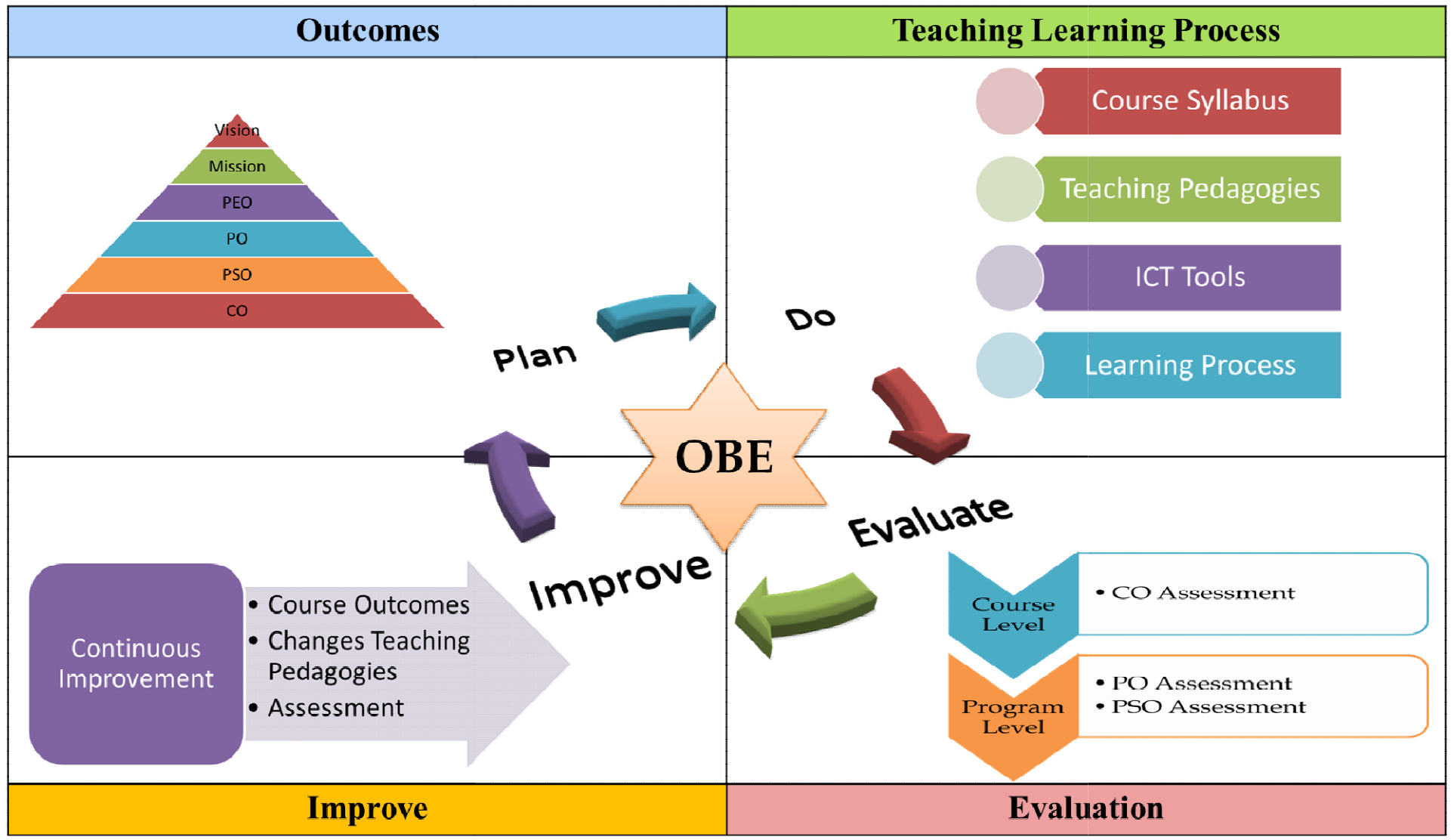|			
OBE	Outcome Based Education	**BTL**	Bloom's Taxonomy Level
LOT	Lower Order of Thinking	**HOT**	Higher Order of Thinking
PEO	Program Educational Objectives	**PO**	Program Outcome
CO	Course Outcome	**PSO**	Program Specific Outcome
UE	University Theory Exam	**POE**	Practical Oral Exam
CES	Course Exit Survey	**HoD**	Head of Department
PC	Program Coordinator	**DAB**	Department Advisory Board
PAC	Program Assessment Committee	**AY**	Academic Year
CG	Curriculum gap	**CBS**	Content Beyond Syllabus

Preamble

Outcome Based Education (OBE) is an educational model that forms the base of a qualityeducation system. There is no single specified style of teaching or assessment in OBE. All educational activities carried out in OBE should help the students to achieve the set goals. The faculty may adapt the role of instructor, trainer, facilitator, and/or mentor, based on the outcomes targeted.OBE enhances the traditional methods and focuses on what the Institute provides to students. It shows the success by making or demonstrating outcomes using tatements "able to do" in favor of students. OBE provides clear standards for observable and measurable outcomes.

Benefits of OBE

- **Clarity:** The focus on outcome creates a clear expectation of what needs to be accomplished by the end of the course.
- **Flexibility:** With a clear sense of what needs to be accomplished, instructors will be able to structure their lessons around the students' needs.
- **Comparison:**OBE can be compared across the individual, class, batch, program and institute levels.
- **Involvement:** Students are expected to do their own learning. Increased student involvement allows them to feel responsible for their own learning, and they should learn more through this individual learning

OBE Framework @ PVPIT

Outcomes	Teaching Learning Process

Vision
Mission
PEO
PO
PSO
CO

Course Syllabus

Teaching Pedagogies

ICT Tools

Learning Process

Plan

Do

OBE

Improve

Evaluate

Continuous Improvement
- Course Outcomes
- Changes Teaching Pedagogies
- Assessment

Course Level
- CO Assessment

Program Level
- PO Assessment
- PSO Assessment

Improve	Evaluation

Outcome Based Education Framework for TSSM's PVPIT
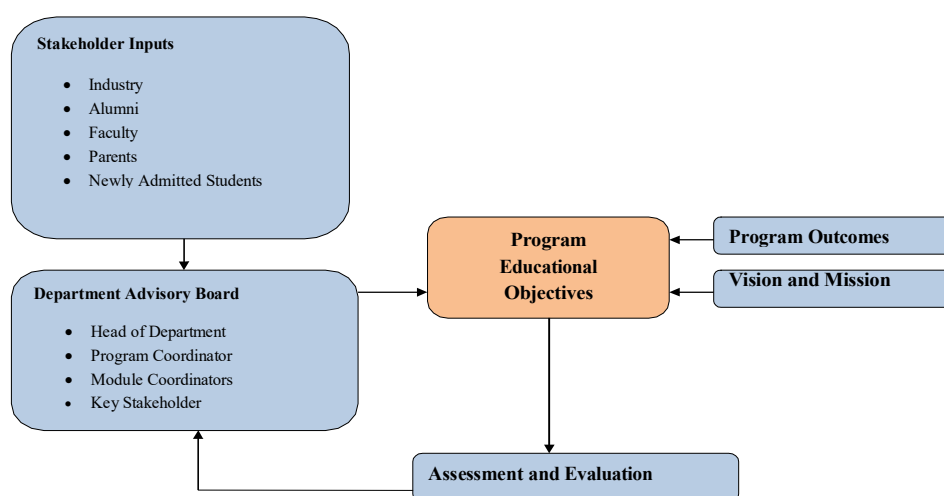
Program Educational Objectives (PEOs)

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

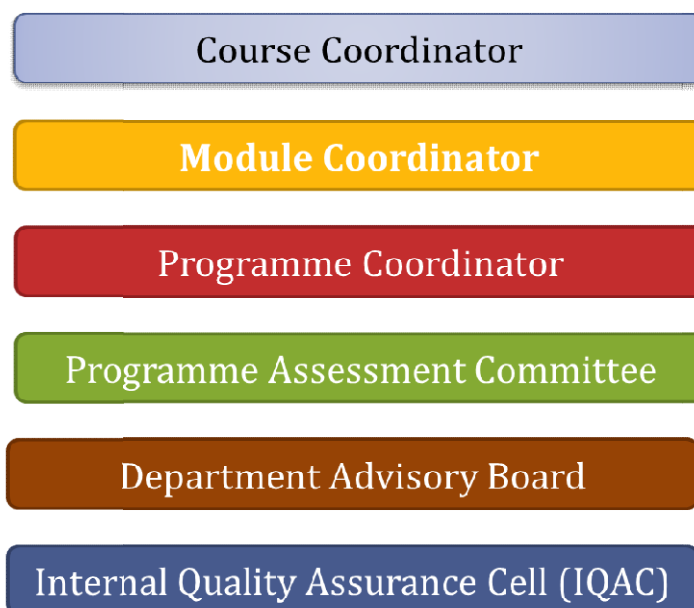## Program Specific Outcomes (PSOs)

Program Specific Outcomes are statements that describe what the graduates of a specific engineering program should be able to do.

Process for establishing PEOs

The employer's survey was taken using ICT tools by sending requisite rubrics to the industries. An entry survey of the newly admitted students was taken to understand their career objectives. Suggestions from parents were taken during Parent-Teacher meetings. Inputs from the alumni were collected and analyzed.PEOs were established based on various inputs received from stakeholders and brainstorming sessions conducted by DAB.

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┌─────────────────────────────┐
│ Stakeholder Inputs          │
│                             │
│   • Industry                │
│   • Alumni                  │
│   • Faculty                 │
│   • Parents                 │
│   • Newly Admitted Students │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐        ┌──────────────────┐     ┌──────────────────────┐
│ Department Advisory Board   │        │ Program          │◄────│ Program Outcomes     │
│                             │───────►│ Educational      │     └──────────────────────┘
│   • Head of Department      │        │ Objectives       │     ┌──────────────────────┐
│   • Program Coordinator     │        │                  │◄────│ Vision and Mission   │
│   • Module Coordinators     │        └──────────────────┘     └──────────────────────┘
│   • Key Stakeholder         │                  │
└─────────────────────────────┘                  ▼
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              └─────────────────────────│ Assessment and Evaluation│
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Administrative System for Implementation of OBE

Course Coordinator

Module Coordinator

Programme Coordinator

Programme Assessment Committee

Department Advisory Board

Internal Quality Assurance Cell (IQAC)

1. Course coordinator:

i) Plan, implement, monitor and review Topic Learning Outcomes (TLOs) and Course Outtcomes(COs).

ii) Evaluation of COs.

iii) Suggest improvements based on attainment of COs.

2. Module coordinator:

i) Coordinate and supervise the faculty teaching the courses in the module

ii) Assessment of COs.

iii) Recommends and facilitates workshop/guest lectures/seminar/FDP to meet the COs.

iv) Analyze the attainment of COs of a particular course and recommends Programme. Coordinator to take appropriate action for improvements.

v) Interact with students, faculty, Programme Coordinator and Head of Department to determine priorities and policies for improvements.

3. Program Coordinator:

i) Schedule programme work in accordance with PEOs and POs.

ii) Oversees daily operations and coordinate activities of programme interrelated with activities of other programmers to ensure optimum efficiency and compliance with appropriate policies and specifications given by HOD.

iii) Monitor and reviews activities of each day

4. Program Assessment Committee

The Program Assessment Committee (PAC) has been formed for monitoring of Computer Engineering departmental activities. The PAC consists of the module coordinators, who periodically monitor departmental activities and evaluate various parameters.

Roles and Responsibilities

- Track the results of Program Outcomes (POs) and Program Specific Outcomes (PSOs), and plan the steps required to achieve POs and PSOs.

- Scheduling of inspection period to ensure assessment of POs and PSOs in a valid time period.

- Preparing periodic program activity reports, progress reports, status reports or other special management reports.

- Motivate the faculty and students to attend conferences, create programs, job models, publish papers and participate in research activities.

- Interact with stakeholders and DAB to facilitate the achievement of POs and PSOs, maintain track record and current status.

5. Department Advisory Board

- The Department Advisory Committee interacts and maintains liaison with key stakeholders.
- The Department Advisory Committee is chaired by HOD who receives the report of the Program Assessment Committee and monitors the progress of the program.
- The committee develops and recommends new or revised goals and objectives of the program.
- The committee also reviews and analyzes the gap between curriculum and Industry requirement and gives necessary feedback or advice actions.
- NPTEL, Spoken tutorial , FDP, STTP / Guest lecturers monitoring
- Suggest improvement in academic plans and recommend standard practices/systems for attainment of PEOs &
- Encourage for industry-institute interactions to bridge up curriculum/industry gap and suggest quality improvement initiatives to enhance employability.
- Redefine existing PEO's, aligning of PEO's to the mission statements and defining program specific outcomes PSOs.
- To propose necessary action plan for skill development of students, required for entrepreneurship development and quality improvement.
- To identify and suggest thrust areas to conduct various activities (final year projects, training courses and additional experiments to meet PSOs and PEOs.
- Submission of report to the IQAC in the prescribed format.

6. Internal Quality Assurance Cell

- Development and application of quality benchmarks/parameters for various academic and administrative activities of the institution;

- Facilitating the creation of a learner-centric environment conducive to quality education and faculty maturation to adopt the required knowledge and technology for participatory teaching and learning process;

- Arrangement for feedback response from students, parents and other stakeholders on quality-related institutional processes;

- Dissemination of information on various quality parameters of higher education;

- Organization of inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles;

- Documentation of the various programs/activities leading to quality improvement;

- Acting as a nodal agency of the Institution for coordinating quality-related activities, including adoption and dissemination of best practices;

- Development of Quality Culture in the institution.

OBE Awareness for Stakeholders

Bloom's Taxonomy

Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in engineering education to structure the assessment as it characterizes complexity and higher-order abilities.

According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:

Level	Descriptor	Level of attainment
1	Remembering	Recalling from the memory of the previously learned material
2	Understanding	Explaining ideas or concepts
3	Applying	Using the information in another familiar situation
4	Analysing	Breaking information into the part to explore understandings and relationships
5	Evaluating	Justifying a decision or course of action
6	Creating	Generating new ideas, products or new ways of viewing things

The Cognitive Process Dimensions -Categories					
Lower Order of thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	**Understand**	**Apply**	**Analyze**	**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**
• Knowledge of terminologies • Knowledge of specific details &elements	• Knowledge of classifications and categories • Knowledge of principles &generalizations • Knowledge of theories, models &structures	• Knowledge of subject specific skills and algorithms • Knowledge of subject specific techniques and methods • Knowledge of criteria for determining when to use appropriate procedures	• Strategic Knowledge • Knowledge about cognitive task, including appropriate contextual and conditional Knowledge • Self-Knowledge

Action Verb for Course Outcomes

Lower Order of Thinking (LOT)			Higher Order of Thinking (HOT)		
Remember	Understand	Apply	Analyze	Evaluate	Create
Define	Explain	Solve	Analyze	Reframe	Design
Describe	Describe	Apply	Compare	Criticize	Create
List	Interpret	Illustrate	Classify	Judge	Plan
State	Summaries	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

ILLUSTration(USEofactionverbw.r.tknowledgeDIMENSIONandorderofthinking):

USE of actionverbs	Factual	Conceptual	Procedural	Met cognitive
Remember	**LIST** properties of soil	**Recognize** characteristic of material	**Explain** working of pump	**Identify** strategies for report writing
Understand	**Summarize** features of a new product.	**CLASSIFy** adhesives by toxicity.	**Explain** assembly instructions.	**Predict** the behavior of member
Apply	**RESPOND** to frequently asked questions.	**Provide** advice to team members	**Carry out** pH tests of water samples.	**USE** modern techniques to get solution

Analyse	**Explain** the selection of tool/ activity.	**Differentiate** LOT and HOT	**Integrate** compliance with regulations.	**ASSESS** the project work
Evaluate	**Select** the appropriate tool	**Determine** relevance of results.	**Judge** efficiency of sampling techniques.	**Reflect** on one's progress.
Create	**Generate** a log of daily activities.	**ASSEMBLE** a team of experts.	**DESIGN** efficient project work flow.	**Create** a learning portfolio.

Steps for Outcomes Assessment

Step 1: Define the mission of your department or program

Step 2: Identify the most important outcomes of the department or program.

Learning outcomes are the knowledge, skills, values, and attitudes that students gain from a learning experience.

- What should students know and be able to do when they have finished their particular program?
- What knowledge, skills, or attitudes distinguish graduates from your program from other students?
- How do these outcomes tie in with the university's mission and educational goals?

Step 3: Ensure that students have adequate opportunities to achieve these outcomes.

Map outcomes with the curriculum. Identify curriculum gap and measures to bridge the gap.

I. Bridge the Knowledge Gap

The knowledge gap is identified by Focus Group and addressed at five levels throughout the course as shown in following Figure
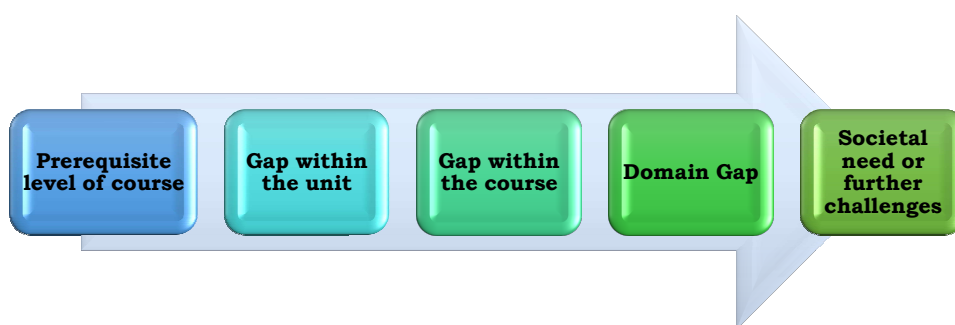

a) **Prerequisite level of course** - This is the fundamental knowledge required before the commencement of the course. The first lecture is the overview of the course contents and focuses on the pre-requisite to understand the subsequent concepts.

b) **Gap within the unit –** This is the knowledge required for understanding the unit. The faculty member provides additional knowledge (if required) for

thorough understanding of the concepts through online course and reference materials. Innovative teaching practices like quizzes and role play are conducted.

c) **Gap within the course** – This is the knowledge required for transition from one unit to other. Variety of topics is covered under a single course. So, additional knowledge is imparted for linking of units.

d) **Domain Gap** – It bridges the gap between courses and engineering practices/ processes which is not addressed in the syllabus. The department conducts various expert lectures, session, workshops through experts from academics as well as industry to bridge the gap. Expert sessions are organized on various topics covering inventions, innovations and research articles.

e) **Societal need or further challenges** – The social needs, environmental concerns for sustainable solution, recent trends in tools and technologies is addressed. Social/field visits/ Guest Lectures are conducted to create awareness about upcoming challenges in the field and sensitizing them about the social needs.

Apart from addressing the gaps in curriculum, additional activities are conducted at course level and program level to address program outcomes.
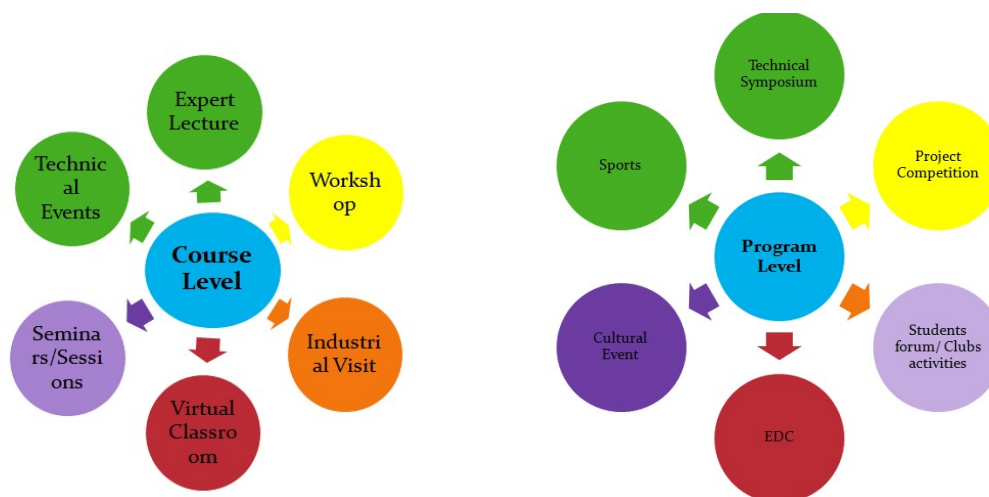
Course Level   **Program Level**

The Institute has initiated the following measures to bridge the identified curricular gaps.

- **Guest lecturers:** Experts from industry and academia are invited to deliver lectures on the latest trends and thrust areas in Computer Engineering.

- **Technical talk:** Students are kept updated about the advances in technologies through technical seminars.

- **Workshops & Training Programs:** The Department has introduced a novel initiative for students, wherein they are encouraged to participate in hands-on workshops, and project training programs, thereby enhancing their application skills.

- **Soft Skill Training:** The department emphasizes personality development through soft skills training programs to improve the employability of students.

- **Industrial visits:** Visits to industries of repute are organized every year to keep the students abreast with applications of Computer Science and Engineering.

- **Internships:** Students are encouraged to take up short-term internships in industries and recognized R&D centers to understand industry practices.

- **Mini Projects:**

  Students can obtain practical experience by completing mini-projects. It is a group activity in which a group of students works on a specific problem statement in the engineering domain to gain problem-solving experience using the information and resources available and under the guidance of a course coordinator.

- **Technical Competitions & Conferences:**

  Various competitions and technical events, such as project competitions, quizzes, coding competitions, and international conferences, are organized by the department.

- **Extra Classes to bridge course Gap/Topic Gap:**

  Extra lectures are conducted by faculty members to bridge the course and topic gaps, and to ensure that the curricula are covered by the Pos.

Step 4: Define assessment procedure towards these outcomes. Assessment is done by direct and indirect means.

Direct methods of evaluating student learning provide tangible evidence that a student has acquired a skill, demonstrates a quality, understands a concept, or holds a value tied to a specific outcome.

Indirect methods provide more intangible evidence, demonstrating characteristics associated with learning but only implying that learning has occurred.
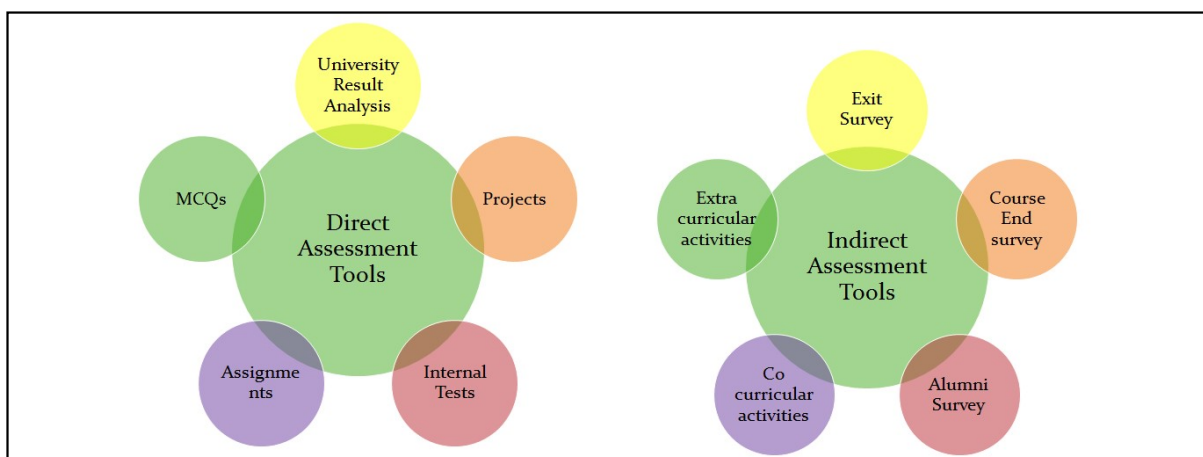
Step 5: Develop the assessment plan.

**Step 6: Carry out the assessment**

Direct assessment is undertaken by conducting Midterm test (covering 3 Cos), End term test (covering 3 Cos), two assignments (covering 3 Cos each) and MCQ on every CO. Indirect assessment is carried out by conducting course end survey, lab end survey, exit survey, employers survey, co-curricular activities, extracurricular activities etc.

Step 7: Collect, analyze, communicate, and report on your findings.

After assessment information is collected, the results need to be analyzed and communicated in useful ways to the faculty, who can consider changes to teaching methods, the curriculum, resource availability and scheduling, course content, and other factors. At the end of the year, faculty members should complete an assessment report, similar in format to the plan, stating each course's learning outcomes, assessment tools used, results of the assessment, and how the results were used to make changes to help students and improve learning

Step 8: Take action based on those findings

Assessment results are meant to be used: to improve teaching and inform decision-making and resource allocation.
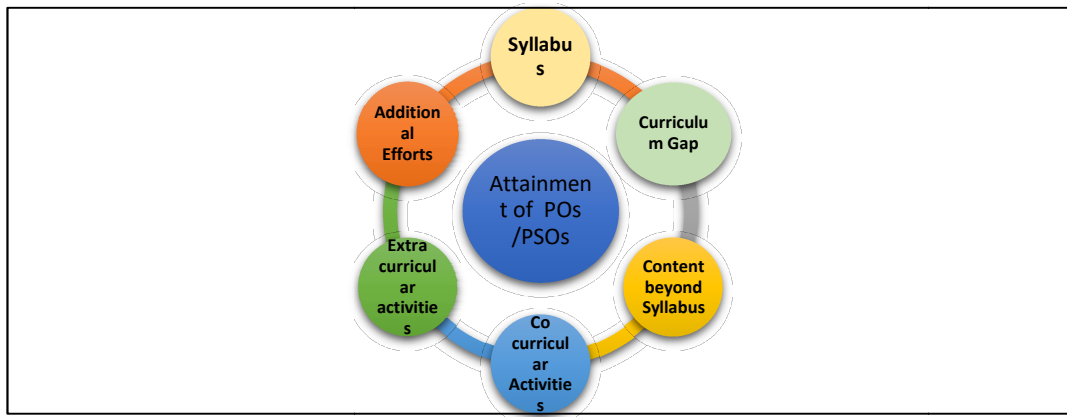
Course Outcomes

"Statements of observable student actions that serve as evidence of the Knowledge, Skills and Attitudes acquired in a course". Each course is designed to meet (about 6). The Course Outcomes are stated in such a way that they can be actually measured. They are framed considering the BLOOM's Taxonomy and covering course objectives. POs are attained through program specific Core Courses. Course Outcome statement may be broken down into two main components: Action Words and Learning statement.

- **Action Word:** An action word that identifies the performance to be demonstrated; It represents a cognitive/ affective/ psychomotor activity the learner should perform. An action is indicated by an action verb, occasionally two, representing the concerned cognitive process(es).

- **Cognitive Process (Action Verb):** Remember, Understand, Apply, Analyze, Evaluate, Create

- **Knowledge**: Represents the specific knowledge from any one or more of the eight knowledge categories viz Factual, Conceptual, Procedural, Metacognitive, Fundamental Design Principles, Criteria & Specifications, Practical Constraints, Design instrumentalities

- **Condition**: Represents the process the learner is expected to follow or the condition under which to perform the action (This is an optional element of CO)

- **Criteria:** Represent the parameters that characterize the acceptability levels of performing the action (This is an optional element of CO)

- **Learning statement :**Learning statement that specifies what learning will be demonstrated in the performance;

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

CO-PO Relationship

Each CO can be identified to address a subset of POs. Based on the number of COs and the sessions dedicated to them it is possible to identify the strength of mapping (1, 2 or 3) to POs. Based on these strengths of selected POs a CO matrix can be established. The mapping is a matrix with rows as COs and columns as POs. Each element/cell of the matrix has a value in {--, 1, 2, 3}. The meaning associated with the values are as follows:

-- this CO (row) has nil/very small/insignificant contribution to the PO(column)

1 → relevant and small significance

2 → medium or moderate and

3 → strong

These values have to be justified in the T-L-A of the course, particularly in terms of the BLOOM Level of the questions/Problems

Assessment Tools for COs

Direct and indirect tools measure the attainment of the COs. The process for Course outcome attainment is articulated in figure 3.2.1.

Direct Method: Direct attainment displays the student's knowledge and skills from their performance. It can be determined from the students' performance in all the relevant assessment tools – like internal assessments, assignments, quizzes, and university examinations. These methods provide a sampling of what students know and/or can do and provide strong evidence of student learning.
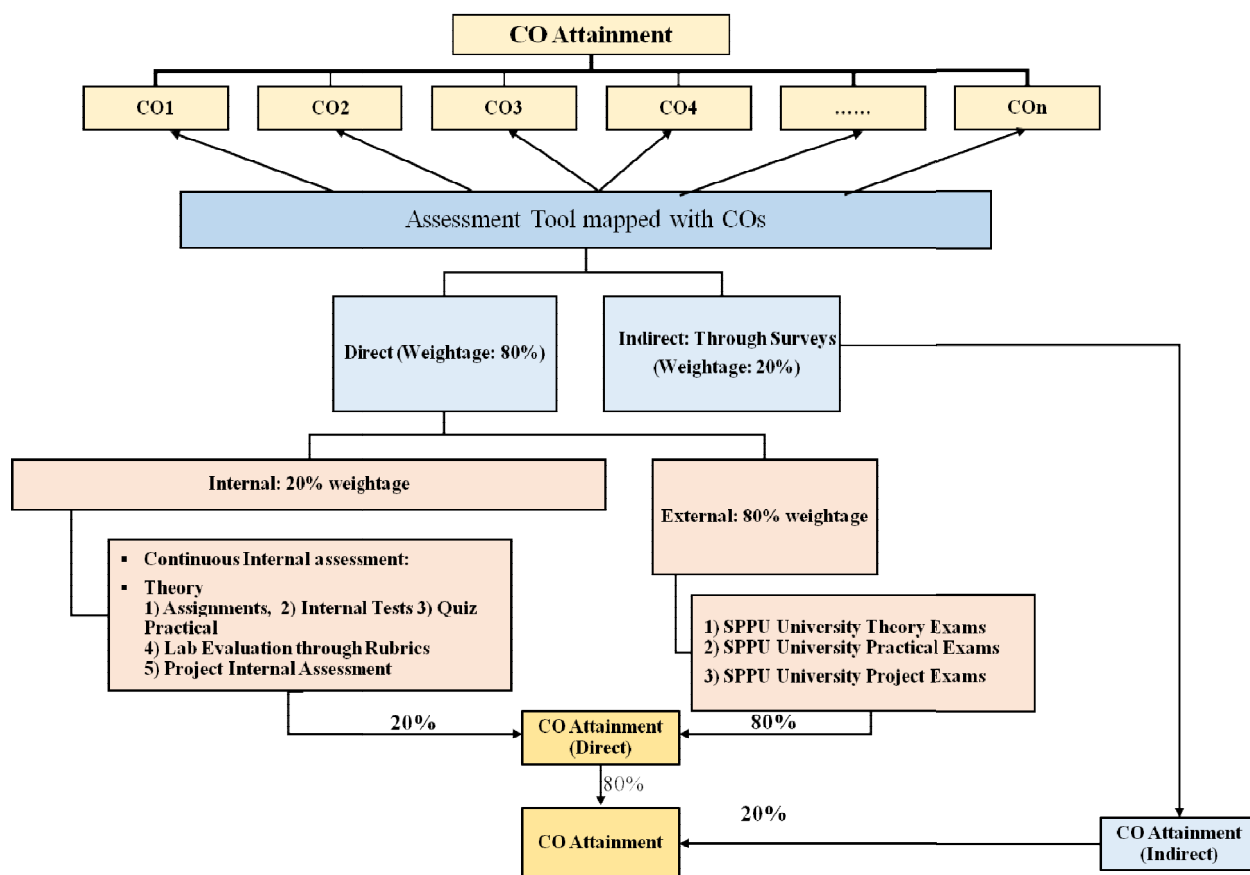
List of Assessment Tools

Sample CO Assessment Tools

- Mid Term Test

- End Term Test

- Quiz

- Assignment

- Practical/ Lab work

- Industrial Visit, Workshop

- Other Task/Activity

- University Exam

- Oral/POE

- Course Exit Survey

• External Feedback (External Examiner/Trainer, Campus Placement Technical Expert, Parent Feedback, Exit Feedback, Faculty feedback, Employer and Industry Feedback)

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

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

Direct Assessment Tools

• **Internal Tests:** The theory exams are conducted twice in a semester, one at mid-term and the second at end-term. The questions of the test paper are mapped with CO and Blooms Level. The CO-wise obtained question marks are collected for each student and processed to get the attainment of CO.

• **Quiz /Online Exam:** The MCQ type online internal test and its mapping with CO are conducted during the semester. The CO-wise obtained question marks are collected for each student and processed to get the attainment of CO.

• **Assignment:** Two assignments per course are given and their mapping with CO and Blooms Level. The CO-wise obtained question marks are collected for each student and processed to get the attainment of CO.

• **University Exam:** The SPPU conducts two theory exams in the semester and end-semester. University also conducts practical, oral, project, seminar, and term work examinations. As the university does not provide the question-wise marks obtained by students, the total marks obtained are analyzed to get course attainment.

• **Project Work:** The attainment of COs through project work is done at two levels. The internal assessment is done through a rubric. The project assessment and review details are mentioned in criteria 2.2.3 C. At the end of the course, the external evaluator assesses the project work and assigns the

mark. CO attainment is calculated based on the rubric and marks obtained in the final examination.

- **Indirect Method:** Indirect methods such as surveys and interviews ask the stakeholders to reflect on students' learning. They assess opinions or thoughts about the graduate's knowledge or skills. Indirect measures can provide information about graduates' perception of their learning and how different stakeholders value this learning.

Indirect Assessment Tools

- **Course end survey:** The objectives and outcomes are defined for a course by the course coordinator. At the end, of course, feedback is taken from students about course outcome attainment through scoring rubrics. The analysis of feedback determines the achievement of COs.
- In attaining COs, 70% weightage is for external assessment and 30% for internal. The internal assessment method involves both direct (80%) and indirect (20%). Refer to figure 3.2.1.
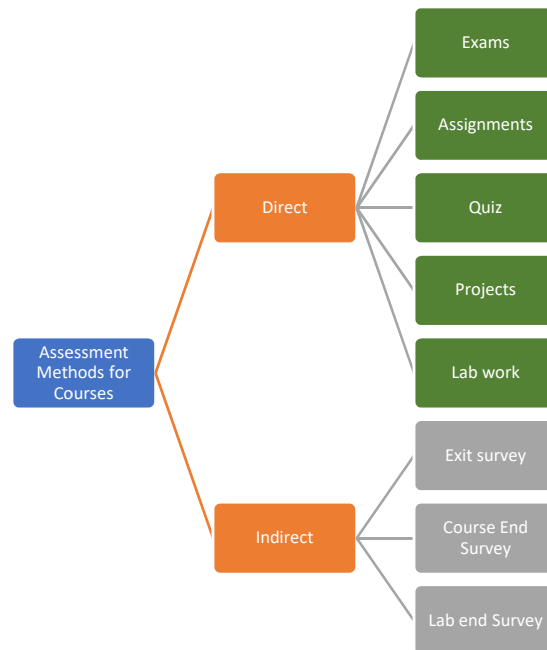
A) **List &assessment process**

Table: List & Assessment process

Type & Assessment	Assessment Tool	Frequency	Data Collected
Direct (Internal)	Test	Twice in semester	Marks obtained against maximum allocated for a CO.
	MCQ	After every unit	Marks obtained against maximum allocated for a CO.
	Assignment	Twice a semester	Marks obtained against maximum allocated for a CO.
	Lab Experiment	For each exp. Performed	Analytical Rubric score of students against mapped CO
	Projects Rubrics	2 reviews/	Students will be divided into

		semester.	groups; wherein each group will have a maximum of 5 students. A faculty will mentor every group.
Direct (External)	University Exam	As per the course Structure Provided by BoS	Marks Obtained against maximum allotted for a course
Indirect (Internal)	Course end/Lab end Survey	At the end of each semester	Self-assessment rubric score mapped to each CO.
	Student Activity (Visit/mini.Proj.)	As per the Curriculum Requirement	Rubric score / Report assessment of a Student against mapped CO
	Seminar	At the end of each semester	Self-assessment rubric score mapped to each CO.

Activity Based Learning

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.

The quality /relevance of the assessment process

The Module Coordinator and Program Coordinator ensure the effectiveness of the CO assessment process. The general process practice observed is shown in 3.2.1(a).
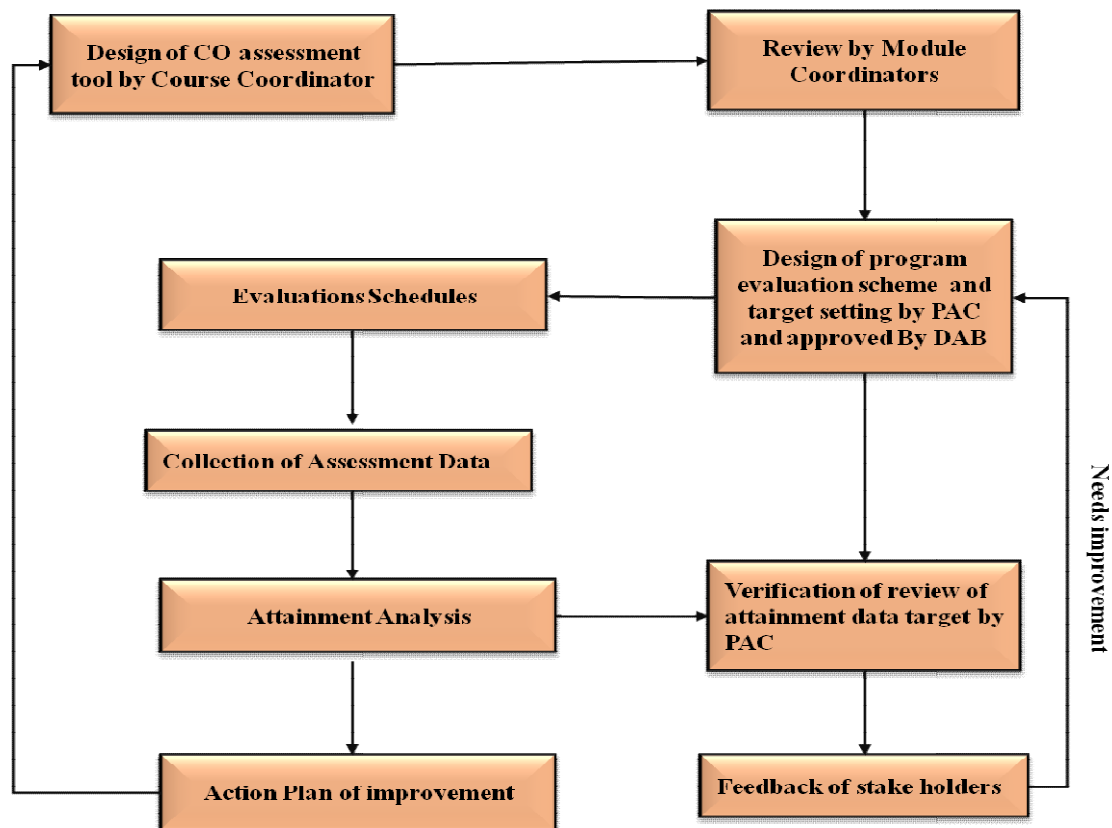

Figure: Quality of assessment process

Based on the results achieved and stakeholders' feedback, the assessment process is reviewed and refined in DAB.

- Instructors propose the assessment tools and the target marks /levels as per Bloom's taxonomy, content & criteria mentioned in the course outcome
- The module co-coordinators review the course evaluation tools & targets set by the instructor and suggest changes if required.
- Program Assessment Committee (PAC) prepares the detailed evaluation plan of the program by setting the targets for CO/PO attainment and subsequent approval from Department Advisory Board (DAB). Table (b) describe the target set for a course (410242) as a sample attainment level for CO/PO/PSO.
- The Department's academic Calendar is prepared & published for information to stakeholders.
- As per the academic plan, the course instructor implements the assessment tools at their level and carries out data analysis to get the following details.
    1. No. of students achieving the set target.
    2. Questions not attempted by the majority of students.
    3. Attainment level achieved by students.

Attainment is calculated only for the intersection of CO-PO/PSO, mapped with level 1/2/3.

CO Attainment

Attainment is calculated only for the intersection of CO-PO/PSO, mapped with level 1/2/3.

Threshold: The minimum percentage of marks that a student needs to obtain is the course threshold. For example, the threshold for all the courses under the Computer Engineering program is 60% for internal assessment and taken as average marks for the external evaluation.

The target for CO attainment, set at the start of the course, is the percentage of students getting more than <mark>university</mark> average marks obtained for previous course exams or assigned by the program committee.

Attainment Levels:

Attainment Level 1: More than 50% but less than 60% students scoring more than 60% marks out of the relevant maximum marks.

Attainment Level 2: Equal to or more than 60% but less than 70% students scoring more than 60% marks out of the relevant maximum marks.

Attainment Level 3: More than 70% of students scored more than 60% marks out of the relevant maximum marks.

Process of Attainment of Course Outcomes (COs)

1. Find total marks of CO through various assessment techniques like Question Papers, Assignments, MCQ tests etc.
2. Calculate 60% of total marks for internal assessment tools

   Eg. Consider total marks for CO1=30 marks

   Calculate 60% of total marks. CO1=30*60/100 =18 marks
3. Calculate the total number of students scoring more than target value ie (60%)

   Eg. No of students securing >18 marks= 68 students
4. Calculate percentage of students securing more than threshold value(60% of maximum marks)

   Eg. Out of total strength calculate number of students securing more than 18 marks =48

   Assume total strength of class 70. Then 48/71* 100= 68%
5. Identify Attainment Level .
   a. Attainment Level 1: 50 to 60% →1
   b. Attainment Level 2: 60 to 70% →2
   c. More than 70% →3

   Eg. As attainment is 68% attainment level is 3

Measuring Course Outcomes attained through University Examinations

As university does not provide useful indicators target is stated in terms of percentage of students getting more than the university average marks. University Examination consists of In-semester Exam and End Semester Exam for third year and final year and online exam for second year.

Step to be followed:

1. Total Number of students appeared. Eg. 134 students

2. Total university marks include In-semester Exam and End Semester Exam for third year and final year and online exam for second year. Calculate average marks scored in university examination for a course. Eg. 62.9

3. Find the number of students securing more than 62.9 marks (Threshold Marks)

   Assume 76 students scored more than 62.9 marks (Threshold Marks).

4. Calculate the percentage of students securing more than average marks

   Assume 67% students secured more than 62.9 marks (Threshold Marks)

5. Identify Attainment Level.

   a. Attainment Level 1: 50 to 60% →1

   b. Attainment Level 2: 60 to 70% →2

   c. More than 70% →3

   Eg. Percentage attained is 67% so attainment level is 2

Overall Course Outcome Attainment:

1. Calculate attainment through Internal assessment and University Examinations

   Assume CO1 attainment as follows:

   Attainment through University Examination: Substantial i.e. 3

   Attainment through Internal Assessment: Moderate i.e. 2

2. Take average attainment

   (70% of University level) + (30% of Internal level) i.e. 0.60 * 3 +0.4 * 2 = 1.8 +0.8=2.6

So final CO1 attainment is 2.7 through direct method.

CO Attainment through indirect method i.e. Course End Survey

Conduct a course end survey at the end of each course individually. The questions in the course end survey elicit response from the students regarding their perception of attainment of each course outcome. The marks typically between 1 to 5 on a richter scale for each CO reflect the response for each CO. Precentage of the makrs scored for each CO is the indirect attainment of CO.

Final Attainment for one CO = (0.8* CO Attainment through direct method +0.2*CO Attainment through indirect method.

Action Plan for Course

At the end of semester, course coordinator analyses the final attainment and make suggestions regarding improvement.

PO Assessment Tools

Sample Indirect PO Assessment Tools

• Program Exit Survey

• Alumni Survey

• Employer Survey of Alumni

• Parent Feedback

The data collection processes for attaining the POs are based on direct and indirect tools. The attainment of the COs is linked to the attainment of the POs (Program Outcome).

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┌─────────────────────┐
│  PO/PSO Attainment  │
└─────────────────────┘
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Direct Tools
Through COs
CO-PO mapping
CO-PSO mapping and
Attainment

Overall PO/PSO attainment
=0.8*Direct Attainment+0.2*indirect attainment

Indirect Tools
Through Feedback and
Surveys

PO/PSO attainment by course– Avg of PO/PSO attainment through CO-PO/CO - PSO matrix

PO/PSO attainment through indirect tool

PO/PSO attainment through CO-PO/PSO

PO/PSO of Course attainment=(CO attainment*CO-PO mapping strength)/3

CO attainment through internal and external tools(Direct)

Analysis of
i. Exit Survey
ii. Employer Feedback
iii. Faculty Feedback
iv. Cocurricular and extra curricular activities

a) Direct methods:

The performance of the students in internal assessments and university exams will lead to the attainment of Course Outcomes'. The direct tools employed are MCQ, Test, assignment, Quiz, lab, and project rubrics.

The attainment of each PO is calculated through the CO-PO mapping matrix and based on the level of CO attainment.

PO/PSO attainment = CO attainment level * (CO-PO/PSO mapping level/3)

b) Indirect methods

Indirect methods involve feedback and surveys from stakeholders to get the perception level of learning. The opinion is sought in Richter scale rating from 1,2,3, for the questions based on performance indicators/POs/PSOs

- **Exit Survey**

The Exit survey is conducted on completion of the last semester of the program by Guardian Faculty Member (GFM). The rubric is formulated for the attainment of

each PO. The questionnaire is set for self-assessment of the level to which each PO is achieved. The questions will be rated by the outgoing batch in the range of 3, 2, and 1, and the exit survey attainment will be calculated accordingly.

- **Employer Survey**

The employer feedback is sought from the industry representative associated with T&P. The rubric is formulated for the attainment of each PO however, the questionnaire involves the competency indicators of a graduate.

- **Faculty Feedback.**

The faculty gives feedback on the outgoing batch based on the students' performance during the four-year program. The rubric is formulated for the attainment of each PO. The questionnaire is set for self-assessment of the level to which each PO is achieved.

- **Co-Curricular activity**

At the end of each semester, students give feedback on the learning and participation experience in various co and extra-curricular activities conducted during the semester at the course as well as program level.

List of assessment tools and frequency

Broadly the data collection to measure attainment of PO and PSOs is done through a direct and indirect method. The list of the assessment tool is stated in table 3.3.1(a)

Table 3.3.1(a) Data collection for each PO/PSO attainment

Tool	Frequency	Type	PO/PSO	Data Collected
Test(Internal)	2	Direct	PO 1-5 PSO 1-3	Actual
Assignment(Internal)	2	Direct	PO 1-5 PSO1-3	CO attainment based on % the
Lab Assessment (Internal)	For every lab	Direct	PO 4-10 PSO 1	age of students scoring the set

Project Assessment (Internal)	2	Direct	PO 2-12 PSO – 1,2,3	target
Student Activity (Internal) (visits/CBS/mini project/ case studies/scenario assignment/ group presentations/extra curricular activities	On need basis	Direct	PO2-12 PSO 1,2	
SPPU Exam (External)	1	Direct	PO 1-5, PSO 1-3	
Exit Summary	At the exit of the program	Indirect	All PO/PSO	Indirect Attainment level of each PO/PSO based on survey/feedback analysis
Employer	1	Indirect	Relevant PO/PSO	

The UG program of the department is affiliated with SPPU and follows the courses as defined by BOS. The curriculum is enriched by incorporating curriculum gaps and content beyond the syllabus. As per the guidelines of NBA (Tier II institutes), 80% weight age is given to direct measurement and 20% to indirect measurement, as shown in fig. 3.3.1(a)

The direct attainment is calculated through the CO-OP/PSO co-relation matrix and based on actual attainment of COs, while indirect attainment is obtained through exit survey, faculty feedback, and students' activity.

The curricular and extra-curricular activities are mapped to POs/PSOs, and data is recorded in the form of feedback from participating students. Hence these tools are considered indirect tools.

PAC verifies the attainment data & reviews of target achievement.

The program level report is prepared. The assessment results are published.

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SPPU Exam (External)	1	Direct	PO 1-5, PSO 1-3	
Exit Summary	At the exit of the	Indirect	All PO/PSO	Indirect Attainment level

| | program | | | of each PO/PSO |
| Employer | 1 | Indirect | Relevant PO/PSO | based on survey/feedback analysis |

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The program level report is prepared. The assessment results are published.

The Quality/relevance of assessment tool/process used

The POs stated by NBA generally has three learning domain is knowledge, skill, and attitude. Further, the skill domain is subdivided into problem-solving skills and supporting other skills. Based on the learning domain and associated POs the proper tool is employed to map and collect the data.

Table 3.3.1(b): Relevance of assessment tool.

Learning domain	POs	Tool	Data collection theme

Knowledge	PO1	i)Test ii)SPPU exam	Each question is mapped with CO PO BL and analysis of marks obtained set target
Problem-solving skill	PO 2 3 4 5	i)assign ii)mini/ major project iii) Lab assessment iv)Co-curricular activities (Coding Competitions, Hackathons, Project Competitions, etc)	A rubric is designed with performance indicators and analysis of rubric score obtained against the set target
Supporting Skill	PO 9 10 11	i)lab assessment ii)Project iii) Co-curricular activities (Coding Competitions, Hackathons, Project Competitions, etc)	A rubric is designed with performance indicators and analysis of rubric score obtained against the set target
Attitude	PO 6 7 8 12	i)lab assessment ii)Project iii) Co-curricular activities(Sankalp, NSS, Road safety, etc)	A rubric is designed with performance indicators and analysis of rubric score obtained against the set target

PO Attainment

The PO/PSO attainment threshold is set considering the number of courses mapping PO/PSO and average mapping percentage. The attainment levels are increased if the said PO/PSO is attained for three years.

PO/PSO attainment = CO attainment percentage * (CO-PO/PSO mapping level / 100)

Like-wise PO attainment for all courses is calculated.

Direct attainment = {(Sum of various attainment levels obtained from courses which mapped with particular PO) / (Total number of courses which mapped with particular PO)}

Attainment level will be the summation of levels divided by the. of courses

Indirect Assessment

Surveys, analysis, customized to an average value as per levels 1, 2 & 3.

Assumed level - 2

Total PO attainment

PO Attainment level will be 80% of direct assessment + 20% of indirect assessment i.e.

Overall PO/PSO Attainment

Prepare a table of CO-PO Attainment

Direct attainment level of a PO & PSO is determined by taking average across all courses

addressing that PO and/or PSO.

Indirect attainment level of PO & PSO is determined based on the student exit surveys,

employer surveys, co-curricular activities, extracurricular activities etc.

For overall attainment level, 80% weightage is given to direct assessment and 20% weightage to indirect assessment through surveys from students.

Sample list of activities with BTL

ACTIVITIES	PossibleBTL	PO Mapping
Tutorial- Write-ups	Understand, Apply	AnyrelevantPOfrom1to4
Practical-Experiments	Understand, Apply, Analyse, Evaluate, Create	Any Relevant PO
Test/Quiz	Understand, Apply, Analyse	AnyrelevantPOfrom1to4
Students' Seminar	Understand, Apply, Analyse	Any PO from 1, 2, 8, 10
Case Study	Understand, Apply, Analyse	Any Relevant PO
Presentation/Oral	Understand	
Guest Lecture	Understand	
Visits	Understand	
Survey & Analysis	Apply & Analyse	
Workshop/Hands-on Training	Apply, Analyse, Evaluate	
Task	Evaluate, Create	
Minor Project	Create	

Activity Planning GUIDELINES (PO5 to PO12)

Sr. No.	Activity	Contact Hours	MinimumAssessmentTool	Mapping Level
1	Seminar Presentation Case Study Guest Lecture	1 to 6 hrs	Feedback or Quiz or Rubric Based Assessment	1

	Visits		
	Survey & Analysis		
2	Visits	7 to 20 Hrs	i) Feedback or Quiz	2
	Survey & Analysis		ii) Rubric Based Assessment for Report, Presentation etc.	
	Workshop / Hands - on Training			
	Task			
3	Workshop/Hands - on Training	Morethan 20 Hrs	i) Feedback or Quiz	3
	Task		ii) Rubric Based Assessment for each PO	
			iii) Impact analysis	
	Minor Project			

Continuous Improvement

a)Contribution of CO and PO attainment and continuous improvement (Faculty Level)

Outcome	Action to be taken by faculty
High attainment of all CO-PO (>2.5 out of 3)	Set new higher targets or attainment levels for next Academic Year (A.Y.).
Moderate attainment of all CO-PO (1.8 to 2.49 out of 3)	Record observations, Continue action plan of last A.Y. with 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 action plan of last A.Y. to achieve the attainment with plan forimprovements.
CO-PO not attained, poor performance(<0.9 out of 3)	Record observations, Critical assessment of target with Program Assessment Committee (PAC), Revise action plan of last A.Y. at faculty/department level.

b)PO attainment and Continuous Improvement (PAC)

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

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