Outcome Based Education

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Introduction

Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. As per AICTE guideline and expectations during NBA visits student's performance is evaluated on basis of outcomes include knowledge, skills and attitudes.

In the OBE model, the required knowledge and skill sets for an engineering degree is predetermined through design, delivery and evaluation with various active learning tools during 4 years of graduation. It is a process that involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of higher order learning skills.

In RIT during In Semester Evaluation (ISE) faculties use various active learning tools like MCQ designed and conducted using tools like Slido, Kahoot etc. which ensures active participation of students in teaching learning process. To bridge the gap between theory and practical things used in industries are meet by organizing industry visits, expert lectures and workshops.

In every program curriculum is designed and modified in regular intervals taking inputs from stakeholders such as Industry, Academician, Alumni, Parents and Representatives of Accreditation Agencies. As part of this we have introduced comprehensive exam in semester III to VI so that students will get benefited in their GATE and Campus placement drives. More ever in Semester VIII students opted three track system to get industry exposure through Industry Internship & Project track (IIP), higher study research exposure through Undergraduate Research Experience (URE) and Entrepreneurship Development (ED).

Table of Content

Sr. No	Contents	Page Number
1	Vision and Mission of RIT	4
2	Nomenclature	5
3	Process of Defining Vision and Mission of the Department	6
4	Process of Defining PSOs and PEOs of the Department	7
5	The Program Outcomes (POs) Defined by National Board of Accreditation (NBA)	8
6	Publication and Dissemination	9
7	Course Outcome Statements	11
8	Bloom's Taxonomy	12
9	Methods of CO attainment assessment	12
10	CO assessment process for various courses in the curriculum	13
11	Program Outcome (PO)/Program Specific Outcome (PSO) Assessment	14

Vision and Mission of RIT

VISION

To be a globally recognized institute committed to excellence in academics, research, knowledge creation and delivery to develop socially-responsible professionals.
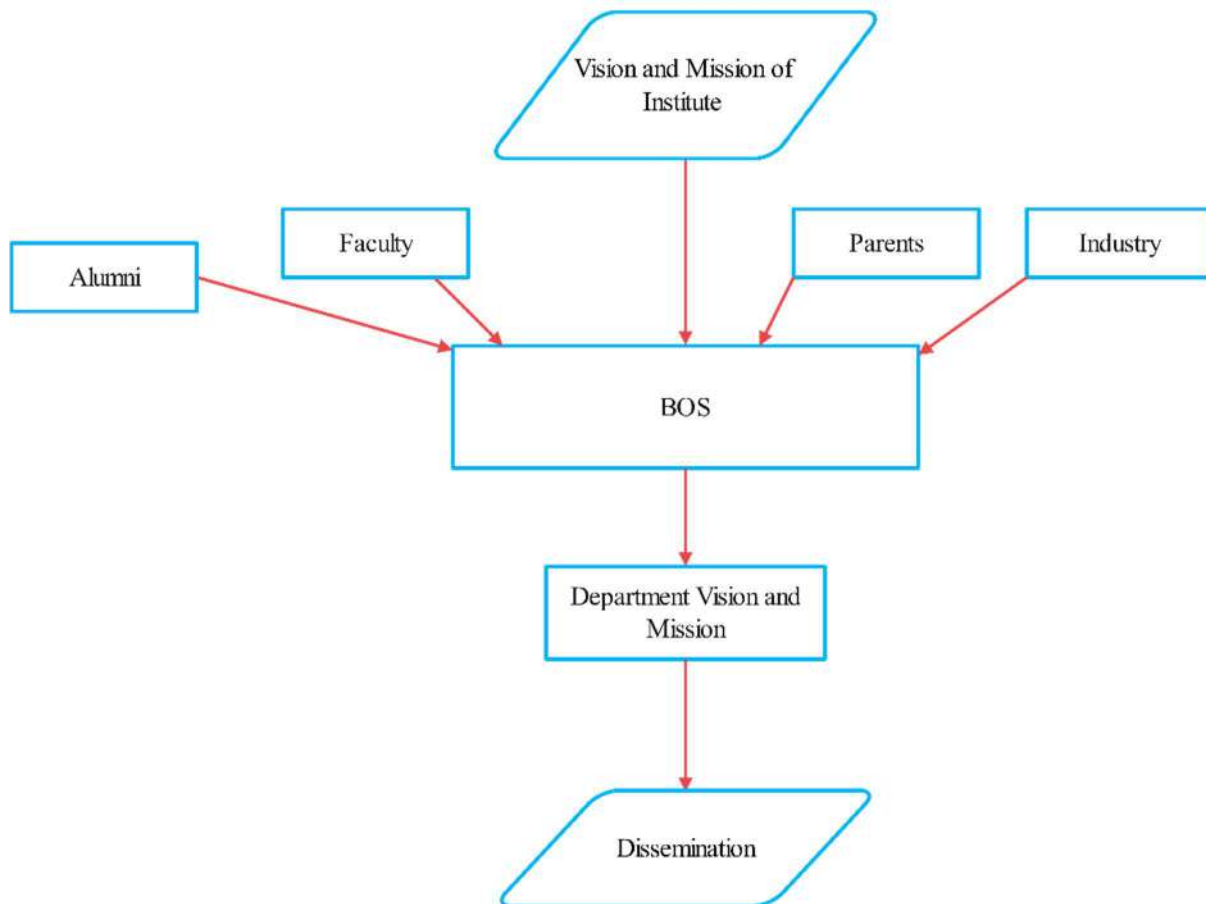
MISSION

- To provide innovation and excellence in academic design, delivery and assessment to ensure holistic development of students for employability, entrepreneurship, and higher education.

- To design and keep the curricula updated, based on changing needs of industry and society worldwide, and to provide experiential learning through industry connect.

- To be at the forefront of emerging technological research, innovation and creation of intellectual property to attract talent.

- To retain talent by building relationships based on professionalism, mutual respect, accountability, engagement and integrity.

- To leverage alumni to inculcate leadership skills, social awareness and a passion for lifelong learning to make students socially-responsible global citizens.

- To build and maintain world-class infrastructure, and adopt modern automation technologies for the purpose of organizational efficiency.

- To identify alternate sources of revenue and augment inflows.

1. Nomenclature

- **Vision:** A vision statement is a document that states the current and future objectives of an institute. The vision statement is intended as a guide to help the institute make decisions that align with its philosophy and declared set of goals.

- **Mission:** The mission statement should define the broad purposes the institute is aiming to achieve, describe the community the program /department is designed to serve, and state the values and guiding principles which define its standards.

- **Program educational objectives (PEOs):** PEOs are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. Knowledge, Skill and Attitude are the three behavioral elements based on which PEOs are constructed.

- **Program Outcomes (POs):** Program outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude and behavior that students acquire through the program.

- **Program Specific Outcomes (PSOs):** Program Specific Outcomes are statements that describe what the graduates of a specific engineering program should be able to do.

- **Course Outcomes (COs):** It is a detailed description of what a student must be able to do at the conclusion of a course.

- **In Semester Evaluation (ISE):** ISE means the evaluation to be held across each semester separately for theory & practical courses with different active tools for evaluation.

- **End Semester Examinations (ESE):** ESE means the examinations to be held at the end of each semester separately for theory & practical part on such dates as the University/College may determine.

2. Process of Defining Vision and Mission of the Department

The following flowchart shows steps are followed to establish Vision and Mission of Department.

Step 1: The Vision & Mission of the Institute is taken as the basis.

Step 2: The Department conducts brain-storming sessions with the faculty on the skill-set required by the local and global employers, Industry Advances in Technology and R & D, and the draft copy of the Vision and Mission of the Department is drafted.

Step 3: The views from Parents, Professional Bodies, Industry representatives, Board of Studies (BOS) and Department Advisory Committee (DAC) are collected and incorporated to revise the draft version based on their inputs.

Step 4: The accepted views are analyzed and reviewed to check the consistency with the vision and mission of the institute.

3. Process of Defining PSOs and PEOs of the Department

- ➢ The Program curriculum is designed by incorporating inputs from members of Board of Studies, Department Advisory Board, Department Programme committee and Academic council constituted by members from various academic institutions, R&D organizations and industry.
- ➢ Inputs are obtained from alumni and other stake holders.
- ➢ Besides, a skill in demand analysis is carried out periodically at the Academic council, Programme Assessment Committee and Department Advisory committee to identify the core areas in the Program domain that are consistent with industry needs.
- ➢ The Centre of Excellence in the department is established based on core areas in the program
- ➢ PSOs are defined based on the Centre of Excellence of the Department. A list of 2 to 4 Program Specific Outcomes (PSOs) that the graduates of the program will attain will be listed here.
- ➢ The PEOs are established to reflect the career and professional accomplishments of the graduates based on the three behavioral elements of Knowledge, Skill and Attitude.

4. The Program Outcomes (POs) Defined by National Board of Accreditation (NBA)

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering graduate. NBA has defined the following twelve POs for an engineering graduate. These are in line with the Graduate Attributes as defined by the Washington Accord.

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

2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions 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 the 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 the information to provide valid conclusions for complex problems.

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.

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 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.

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

5. Publication and Dissemination

The Vision, Mission statement of the Department and Institution, PSO statements, PO and PEO statements are reached to all the students and stake holders of the department. The process of publication and dissemination is described below.

- ➢ College Website
- ➢ Department meeting hall
- ➢ HOD Chamber
- ➢ Laboratories
- ➢ Classrooms
- ➢ Curriculum and Syllabi
- ➢ Course files
- ➢ Department Magazines

The OBE model measures the progress of the graduate in four parameters, which are

- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Program Specific Outcomes (PSO)
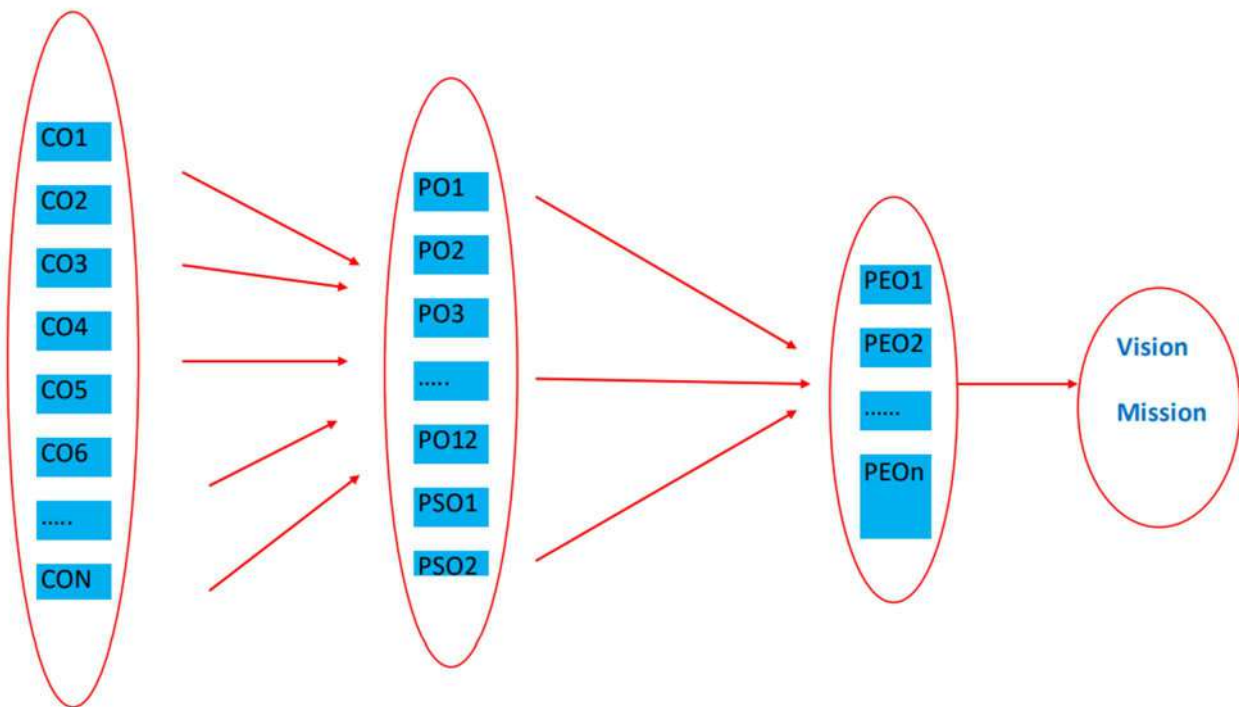- Course Outcomes (CO)

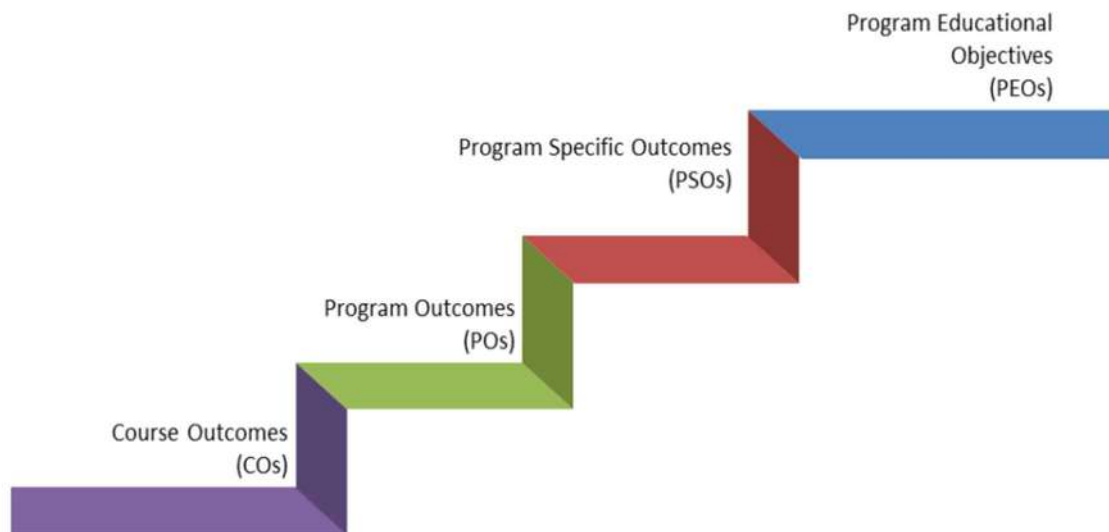Figure 1. Parameters of Outcome Based Education (OBE)

Figure 2: Process for the evaluation of Programme Outcomes POs, PSOs and PEOs

6. Course Outcome Statements

6.1 Course Outcomes (COs): Statements indicate, what a student can do after the successful completion of a course. Every Course leads to some Course Outcomes. The CO statements are defined by considering the course content covered in each module of a course. For every course there may be 5 or 6 COs. The keywords used to define COs are based on Bloom's Taxonomy.

6.2 CO – PO and CO – PSO mapping of courses: All the courses in the curriculum must cover all the POs (and PSOs). For a course, we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix in Course Information Sheet (CIS). The various correlation levels are:

- ➢ **"1"** – Slight (Low) Correlation
- ➢ **"2"** – Moderate (Medium) Correlation
- ➢ **"3"** – Substantial (High) Correlation
- ➢ **"-"** indicates there is no correlation.

6.3 Process involved in CO-PO Mapping:

The role of CO-PO mapping will be assigned to the faculty involved in the teaching-learning process of that particular course. After the course (subject) allotment by the department, the course coordinator of the course has to write appropriate COs for their corresponding course discussing with module coordinator. It should be narrower and measurable statements. By using the action verbs of learning levels (Bloom's Taxonomy), CO's will be designed. CO statements should describe what the students are expected to know and able to do at the end of each course, which are related to the skills, knowledge and behavior (attitude) that students will acquire through the course.

After writing the CO statements, CO will be mapped with PO of the department. The Course Outcome attainment coordinator has to consolidate the COs of the respective year and maintain the documentation of the CO attainment level of the respective year courses as well as documentation of the individual student's extra-curricular and co-curricular activities for PO attainment evaluation.

7. Bloom's Taxonomy

Bloom's Taxonomy was created in 1956 under the leadership of educational psychologist Dr. Benjamin Bloom in order to promote higher forms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts. It is most often used when designing educational, training, and learning processes.
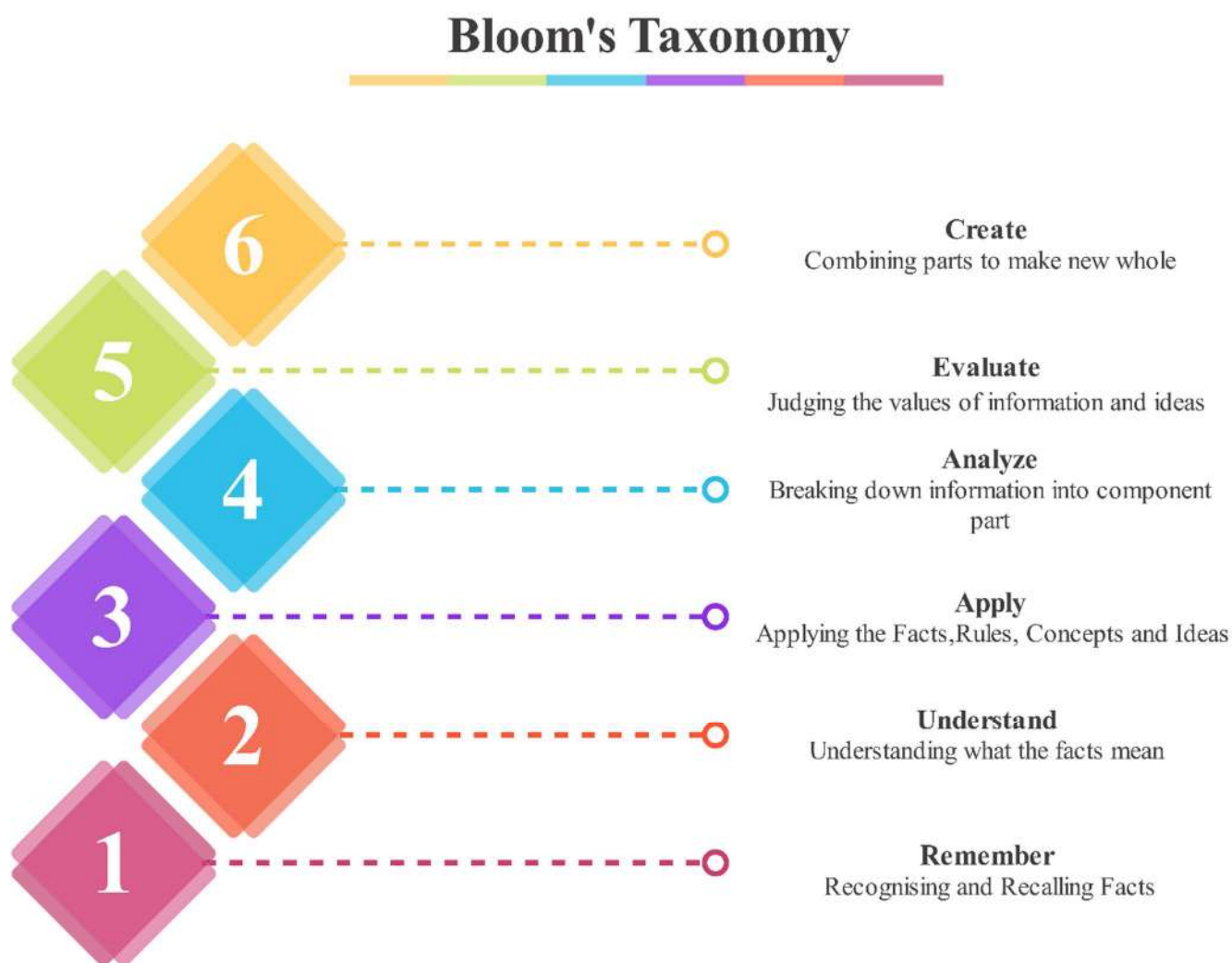

Figure 3: Bloom's Taxonomy

8. Methods of CO attainment assessment

Both direct and indirect method of assessment is followed for Course Outcome (CO) attainment assessment. The weightage for direct attainment is 80% while that for Indirect attainment is 20%. The various assessment tools for direct attainment

assessments are Internal Tests, In-Semester and End Semester Examination and Assignments. The Indirect tool used is Course Exit survey.

9. CO assessment process for various courses in the curriculum

The curriculum is a bundle of various components like Theory courses, Theory with Lab components, Laboratory courses, Mini-Projects, Projects and Internships /In-plant training / Technical seminar. The various direct and indirect assessment tools used to evaluate Program Outcomes & Program Specific Outcomes assessment and the frequency with which the assessment processes are carried out are listed in table.

<p align="center">Table 1. Weightage to various direct and indirect assessment tools</p>

Type of Assessment	weightage	Type	Assessment Tools		Frequency
Direct Attainment	80%	Theory	Internal Evaluation	Cumulative Internal Examination	Two per course
				Unit Tests	
			Semester End Exam		Once per course
		Practical	Internal Evaluation	Daily	Every lab
			Semester Exam		Once per course
		Seminar	Presentation		As per structure
		Project	Review		Minimum twice in semester
			External Viva Voce		Once
			Report		Once
Indirect Attainment	20%	Program Exit Survey	Questionnaire		End of the Program
		Alumni Survey	Questionnaire		Once per year
		Employer Survey	Questionnaire		Whenever possible

10. Program Outcome (PO)/Program Specific Outcome (PSO) Assessment

At the end of each program, the PO/PSO assessment is done from the CO attainment of all curriculum components. As per NBA guidelines, program can appropriately define the attainment level. The attainment level may be set by the particular program or commonly by the institution. The attainment can be made as best the choice by the institution or the program by analyzing the student's knowledge. This can be achieved by using different supporting activities. This attainment is mainly for the purpose of making an esteemed engineer with good analytical, practical and theoretical knowledge about the program by attaining the PO's and PSO's of the program and the institution. For the evaluation and assessment of PO's and PSO's, assessment tools are used.
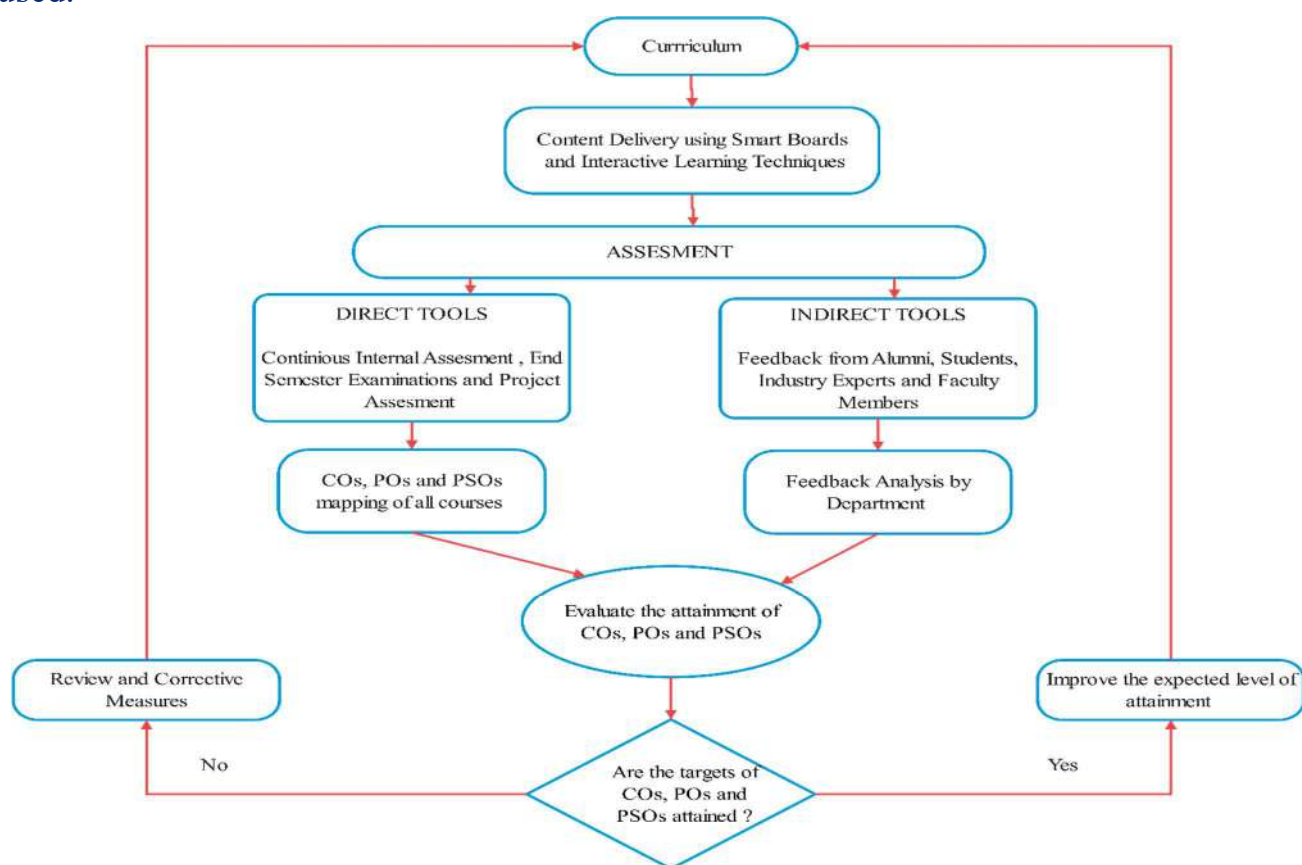

Figure 4 Process flow for Assessment of POs and PSOs

The Program Outcome (PO) attainment and Program Specific Outcome (PSO) attainments are evaluated by direct method with 80% weightage and indirect method with

20% weightage. The Direct attainment level of Particular PO /PSO is determined by taking average of all course outcomes mapping that Program Outcome. Indirect attainment level of PO/PSO is determined based on Surveys.

The various Surveys taken are Student Exit Survey, Employer survey, Alumni survey and Parents feedback. The PO/PSO Attainment Level is fixed as Maximum level of 3 & Minimum level of 1.