SETHU INSTITUTE OF TECHNOLOGY

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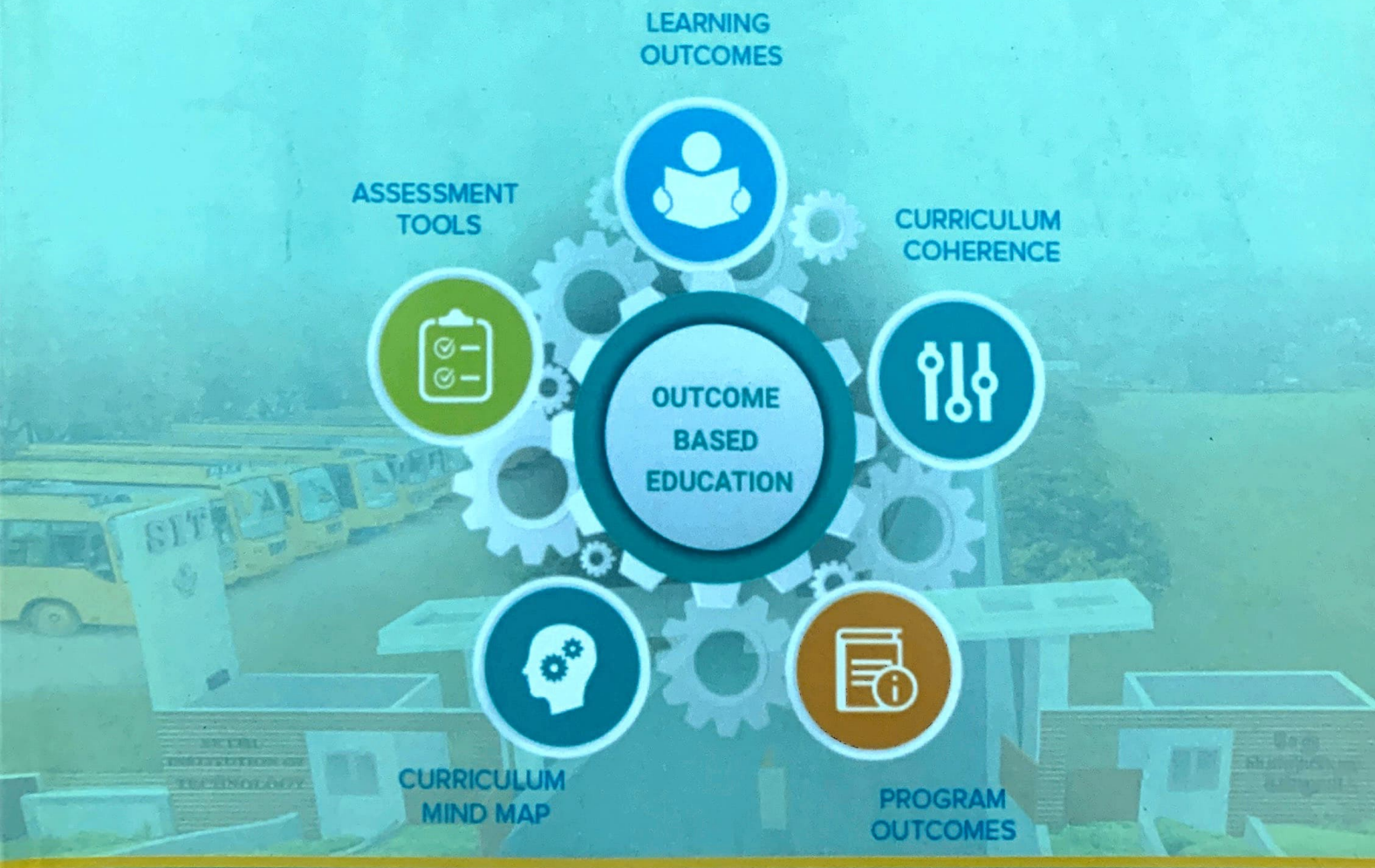
A Handbook on
OUTCOME BASED EDUCATION



SETHU INSTITUTE OF TECHNOLOGY

AN AUTONOMOUS INSTITUTION | ACCREDITED WITH 'A' GRADE BY NAAC

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Preface

This handbook is a reference to help faculty, staff, students and stakeholders understand the Outcome-Based Education (OBE) system implemented in Sethu Institute of Technology. The handbook serves as a valuable guideline for the Departments to frame Vision and Mission Statements. This also helps the Departments to establish and assess Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs) for the programs that are offered. The handbook provides guidelines for the faculty members to write Course Outcomes (COs) for various levels of Bloom's Taxonomy, map COs with POs and PSOs, prepare assessment questions for various levels of Bloom's Taxonomy. The processes for designing the Curriculum and to ensure the compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes are presented. Details related to the processes and procedures for the assessment of attainment of PEOs, POs, PSOs and COs are given. The formats used for the assessment are presented in the Annexure.

Chapter 1
Outcome Based Education

1.1 Definition of Outcome Based Education:

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). Outcomes basically describe knowledge, skills and behavior of students based on the three domains of educational objectives such as cognitive, psychomotor and affective domain given by Benjamin Bloom in his book "*Taxonomy of educational objectives: the classification of educational goals"* in the year 1956.OBE has its origin in USA in 1980s. Medical Profession was the first to adopt OBE. Outcome-based methods have been adopted in education systems around the world, at multiple levels. Australia and South Africa adopted OBE policies in the early 1990s but have since been phased out. The United States has had an OBE program in place since 1994 that has been adapted over the years. In 2005 Hong Kong adopted an outcome-based approach for its universities. Malaysia implemented OBE in all of their public schools' systems in 2008. The European Union has proposed an education shift to focus on outcomes, across the EU. In India OBE is adopted in Engineering education since 2014. Implementation of OBE is essential to get accreditation by National Board of Accreditation (NBA) and National Assessment and Accreditation Council (NAAC).

1.2 Washington Accord:

The Washington Accord was established in 1989 which is an international agreement among bodies responsible for accrediting engineering degree programs to accept undergraduate engineering degrees that were obtained using OBE methods. It recognizes the substantial equivalency of programs accredited by those bodies and recommends that graduates of programs accredited by any of the signatory bodies be recognized by the other bodies as having met the academic requirements for entry to the practice of engineering. Signatories have full rights of participation in the Accord. Qualifications accredited or recognized by other signatories are recognized by each signatory as being substantially equivalent to accredited or recognized qualifications within its own jurisdiction. Provisional signatories are recognized as having appropriate systems and processes in place to develop towards becoming a full signatory. The following are the Signatories of Washington Accord.

- **Australia** - Represented by Engineers Australia (EA) (1989)
- **Canada** - Represented by Engineers Canada (EC) (1989)
- **China** - Represented by China Association for Science and Technology (CAST) (2016)
- **Chinese Taipei** - Represented by Institute of Engineering Education Taiwan (IEET) (2007)
- **Hong Kong China** - Represented by Hong Kong Institution of Engineers (HKIE) (1995)
- **India** - Represented by National Board of Accreditation (NBA) (2014)
- **Ireland** - Represented by Engineers Ireland (EI) (1989)
- **Japan** - Represented by Japan Accreditation Board for Engineering Education (JABEE) (2005)
- **Korea** - Represented by Accreditation Board for Engineering Education of Korea (ABEEK) (2007)
- **Malaysia** - Represented by Board of Engineers Malaysia (BEM) (2009)
- **New Zealand** - Represented by Engineering New Zealand (EngNZ) (1989)
- **Russia** - Represented by Association for Engineering Education of Russia (AEER) (2012)
- **Singapore** - Represented by Institution of Engineers Singapore (IES) (2006)
- **South Africa** - Represented by Engineering Council South Africa (ECSA) (1999)
- **Sri Lanka** - Represented by Institution of Engineers Sri Lanka (IESL) (2014)
- **Turkey** - Represented by Association for Evaluation and Accreditation of Engineering Programs (MÜDEK) (2011)
- **United States** - Represented by Accreditation Board for Engineering and Technology (ABET) (1989)
- **United Kingdom** - Represented by Engineering Council United Kingdom (ECUK) (1989)
- **Pakistan** - Represented by Pakistan Engineering Council (PEC) (2017)
- **Peru** - Represented by Instituto de Calidad Y Acreditacion de Programas de Computacion, Ingeneria Y Technologia (ICACIT) (2018)
- **Bangladesh** - Represented by The Institution of Engineers Bangladesh (IEB)
- **Costa Rica** - Represented by ColegioFederado de Ingenieros y de Arquitectos de Costa Rica (CFIA)
- **Mexico** - Represented by Consejo de Acreditación de la Enseñanza de la Ingeniería (CACEI)
- **Philippines** - Represented by Philippine Technological Council (PTC)
- **Chile** - Represented by AgenciaAcreditadoraColegio De Ingenieros De Chile S A (ACREDITA CI)

1.3 Principles of OBE

Four principles guide the transformational OBE approach, taken together they strengthen the conditions for both learner and teacher success:

- clarity of focus
- design down
- high expectations
- expanded opportunities

Outcomes Based Principles – explanation & application

Table 1.1 OBE Principles and Applications

(Source: Spady, 1994; Killen, 2000)

OBE Principles	Explanation	Applications to practice
Clarity of focus	❖ Focus on what want learners be able to do successfully	❖ Help learners develop competencies ❖ Enable predetermined significant outcomes ❖ Clarify short- & long-term learning intentions ❖ Focus assessments on significant outcomes
Design down	❖ Begin curriculum design with a clear definition of the significant learning that learners are to achieve by the end of their formal education	❖ Develop systematic education curricula ❖ Trace back from desired end results ❖ Identity "learning building blocks" ❖ Link planning, teaching & assessment decisions to significant learner outcomes
High expectations	❖ Establish high, challenging performance standards	❖ Engage deeply with issues are learning ❖ Push beyond where normally have gone
Expanded opportunities	❖ Do not learn same thing in same way in same time	❖ Provide multiple learning opportunities matching learner's needs with teaching techniques

1.4 The OBE Framework

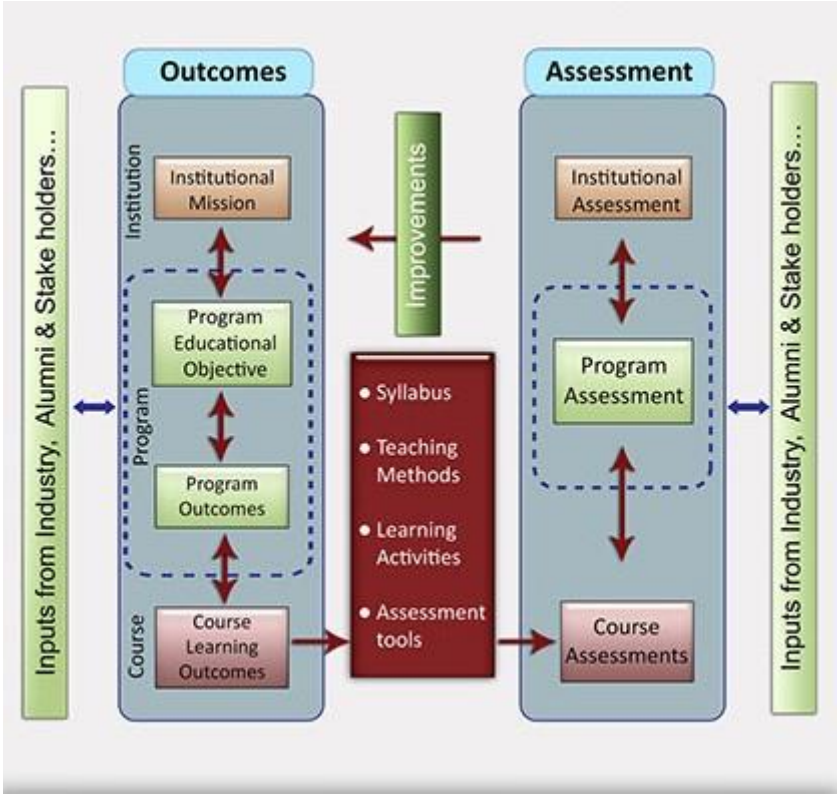


Fig 1.1 OBE Framework

The OBE approach is a continuous process of education wherein the curriculum, teaching and learning strategies, and assessment tools are improved continuously. The OBE learning process can be stated into four steps:

a) Plan (Syllabus Writing/Review)–The Course Learning Outcomes are aligned with the ELGA, PEO and Student Outcomes. The syllabi reflect strategies (learning plan) for achieving the outcomes, as well as for measuring the outcomes assessment)

b) Implement (Course Delivery)-Carry out the learning plan and strategies planned for producing the outcomes

c) Measure / Assess (Assessment) -Carry out the strategies planned for measuring the learning outcomes and objectives. Collect this data and analyze it to determine the results. (Assessment Phase). This phase is where feedback is obtained.

d) Respond / Improve (Continuous Quality Improvement) -Determine what needs to be changed to make improvements. These changes are the basis of new or revised outcomes and objectives for the next cycle of the process. This process can be looked at on a program or course level

The statement of learning that is framed at the Institute level is defined in the form of Institutional Vision and Mission. The Department level Vision and Mission statements are derived from the Institutional Vision and Mission statements. At the programme level Programme Educational Objectives and Programme Outcomes and Course Outcomes are framed. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve.Program outcomes describe what students are expected to know and 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.Course Outcomes (COs) are statements that describe the knowledge or skills the students should acquire by the end of a particular course. CO is designed to support and be measurable against PO& PSO. CO is very specific to each individual course.

e) Assessment – Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of programme educational objectives and programme outcomes.

f) Evaluation – Evaluation is one or more processes, done by the evaluation team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which programme educational objectives or programme outcomes are being achieved, and results in decisions and actions to improve the programme.

g) Mapping – Mapping is the process of representing, preferably in matrix form, the correlation among the parameters. It may be done for one to many, many to one, and many to many parameters.

1.5 Key Constituents of OBE:

The following components form the key constituents of OBE.

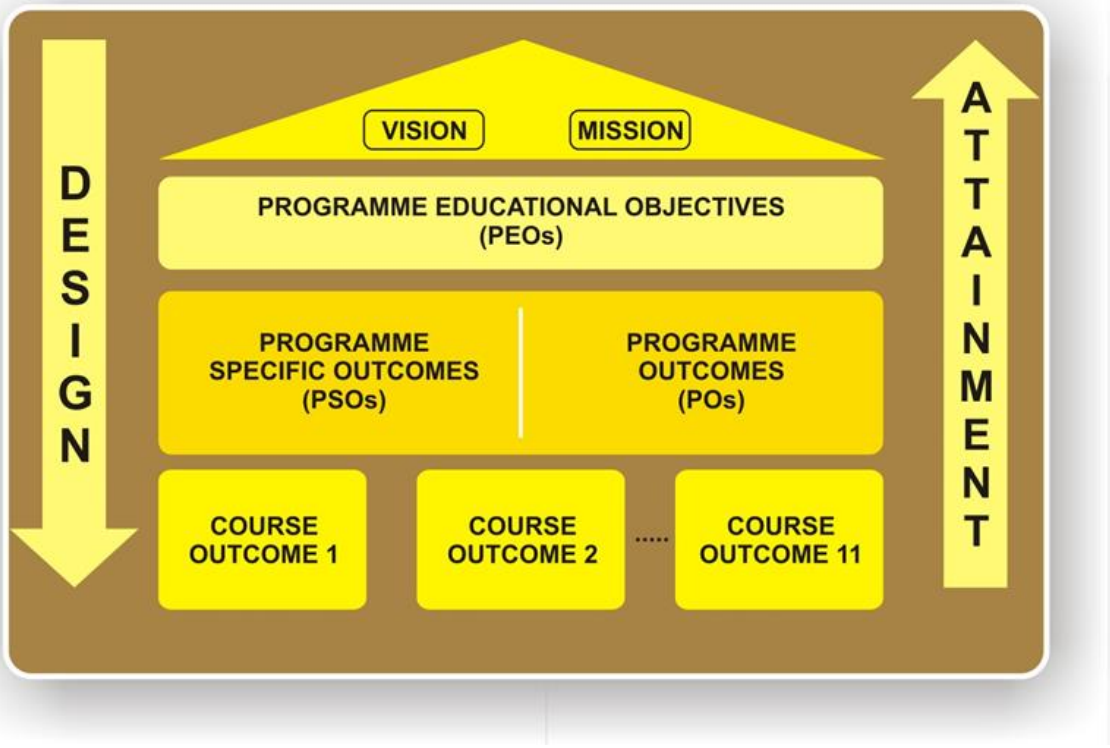


Fig. 1.2 Key Constituents of OBE

Vision is a futuristic statement that the institution / department would like to achieve over a long period of time. The Vision and Mission statements of the Department should align with the Vision and Mission statements of the Institution.

Example 1: Vision: Create high-quality engineering professionals

Example 2: Vision: To be a premier university that propagates thegeneration and dissemination of knowledge in cutting edge technologies

Mission statements are essentially the means to achieve the vision

Example 1: offer a well-balanced programme of instruction, practical experience, and opportunities for overall personality development.

Example 2: To deliver quality academic programs based on state-of-the-art R&D.

Program Educational Objectives

PEOs are broad statements that describe the career and professional achievements that the program is preparing the graduates to achieve within the first few years after graduation.

Guidelines for the PEOs

- PEOs should be consistent with the mission of the Institution
- The number of PEOs should be manageable
- PEOs should be achievable by the program
- PEOs should be specific to the program
- PEOs should be based on the needs of the constituencies

Program Outcomes

Program outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Guidelines for the POs

Program outcomes basically describe knowledge, skills and behaviour of students as they progress through the program as well as by the time of graduation and must reflect all GAs specified by NBA.

Program Specific Outcomes (PSOs):

Program Specific Outcomes are statements that define the technical attributes that are specific to the program the graduates demonstrate by the time of graduation

Course Outcomes (COs):Course Outcomes are narrower statements that describe what students are expected to know, and be able to do at the end of each course. These relate to the skills, knowledge, and behaviour that students acquire through the course.

Chapter 2
Bloom's Taxonomy

Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. It is developed to provide a common language for teachers to discuss and exchange learning and assessment methods. Specific learning objectives can be derived from the taxonomy, though it is most commonly used to assess learning on a variety of cognitive levels. The three lists cover the learning objectives in Cognitive, Affective and Psychomotor domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities.

The models were named after Benjamin Bloom, who chaired the committee of educators that devised the taxonomy. He also edited the first volume of the standard text, *Taxonomy of Educational Objectives: The Classification of Educational Goals.* In the original version of the taxonomy, the cognitive domain is broken into the following six levels of objectives.In the 2001 revised edition of Bloom's taxonomy, the levels are slightly different: Remember, Understand, Apply, Analyze, Evaluate and Create. The Course Outcomes are written in various levels of Bloom's Taxonomy. The assessment questions are also set in the corresponding Bloom's taxonomy level. The diagrams given below show the different levels in the three domains of Bloom's Taxonomy.

2.1 Levels in Cognitive Domain:

The cognitive domain involves knowledge and the development of intellectual skills (Bloom, 1956). This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories of cognitive process starting from the simplest to the most complex as shown below

Fig. 2.1 Levels in Cognitive Domain

2.2 Levels in Psychomotor Domain:

The psychomotor domain (Simpson, 1972) includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. Thus, psychomotor skills rage from manual tasks, such as digging a ditch or washing a car, to more complex tasks, such as operating a complex piece of machinery or dancing.

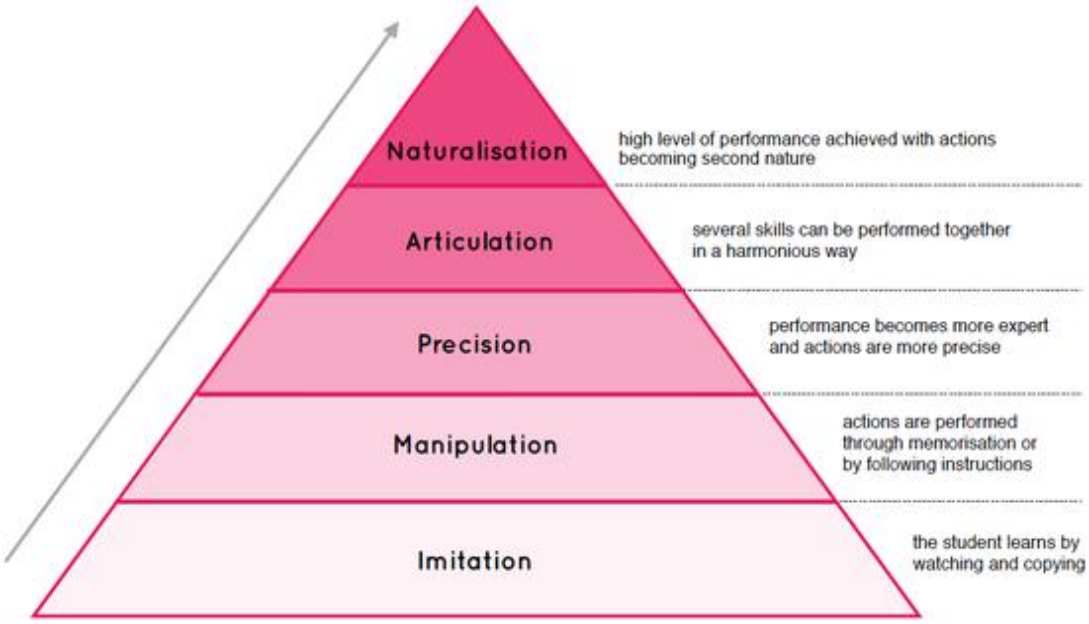


Fig. 2.2 Levels in Psychomotor Domain

2.3 Levels in Affective Domain:

The affective domain (Krathwohl, Bloom, Masia, 1973) includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes. The five major categories are listed from the simplest behavior to the most complex:

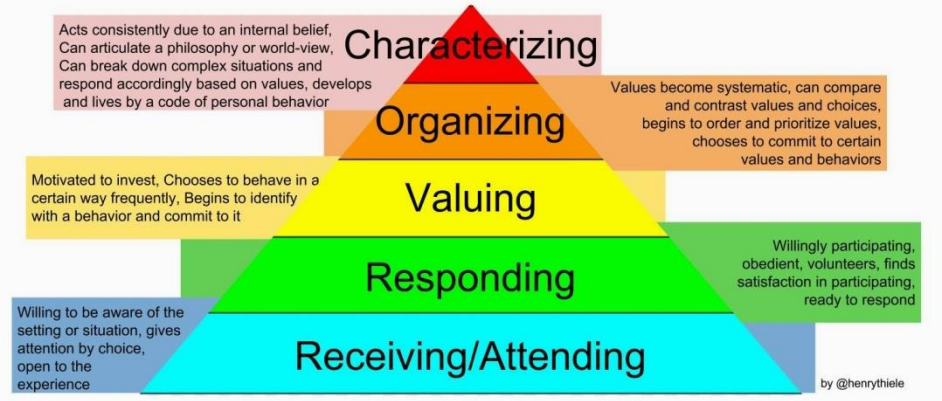


Fig. 2.3 Levels in Affective Domain

Chapter 3
Administrative Set Up for Implementing Outcome based Education

An Administrative system is in place in the Institution and the Departments for effective implementation of Outcome Based Education.The various entities involved in the implementation of OBE is shown in the Figure below. The detailedfunctions of the various committees and the compositions are given in detail in Annexure I:

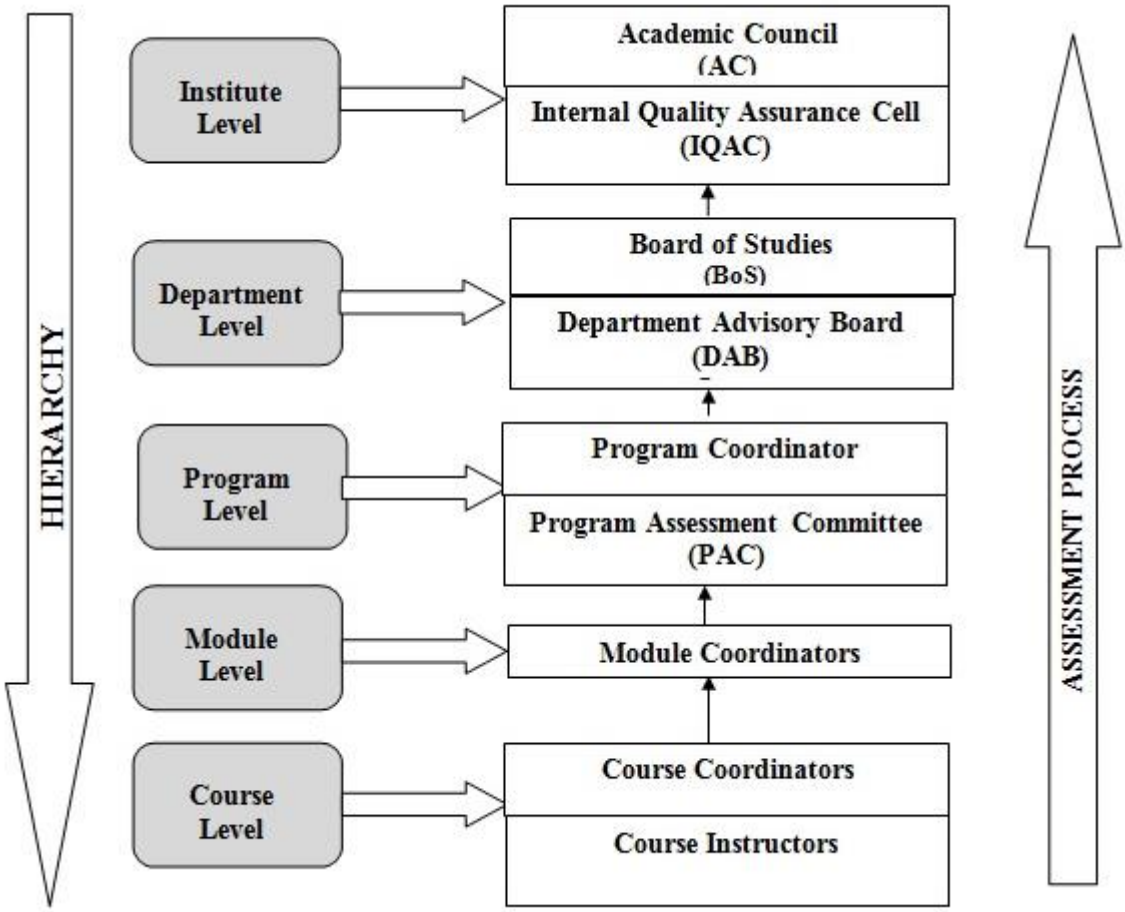


Fig. 3.1 Administrative Setup for OBE Implementation

3.1 Committees Responsible for OBE Implementation

Academic Council

The Academic Council is solely responsible for all academic matters, framing of academic policy, approval of courses, regulations, syllabi etc.,

Board of Studies

Board of Studies is responsible for framing the syllabi, reviewing& updating them and introducing new courses etc.,

Internal Quality Assurance Cell (IQAC)

A cell with industry and alumni members is responsible for development and application of quality benchmarks and parameters for various academic and administrative activities of the institution.

Curriculum Planning and Evaluation Cell (CPEC)

A General Body having members from all programmes consolidates the input from stakeholders & statutory bodies and provides framework and guidelines for curriculum design and evaluation.

Programme Assessment Committee(PAC)

A Committee of the Programme with faculty & student memberswhich is responsible for Draft Curriculum and Syllabus and analyze the attainment of outcomes.

Department Advisory Board (DAB)

An Advisory body of the Department with Academic peer members and Industry experts'other stakeholders which provides suggestions are given on draft curriculum and syllabus.

Programme Coordinator

Programme Coordinator, the head of the Programme is responsible for the curriculum design, OBE implementation, outcome attainment analysis and implementation of the suggestions for improvement.

Module Coordinator

A Senior faculty member from each domain, guides the Course coordinators in their domain towards preparation of Course Outcomes and course contents to meet the POs and PSOs

Course Coordinator

Senior faculty member among the Course Instructors handling the same course develops course content to meet programme outcomes/ course outcome

Course Instructor

The faculty member who handles the coursefacilitates students learning and conducts assessment for the attainment analysis of Course Outcomes

Chapter 4
Establishing the Goal Statements:
Vision, Mission, PEOs, POs, PSOs and COs.

The goal statements are established with inputs from the stakeholders and the guidelines of the statutory bodies and accrediting agencies**.**

4.1. Process for defining the Vision and Mission of the Department

- The faculty members of the Department prepare the Draft Vision and Mission Statements considering the inputs from the Stakeholders. The Department Vision and Mission statements are prepared in alignment with the Institute vision and Mission statements.
- The Program Assessment Committee (PAC) further refines the Department Vision and Mission Statements.
- The Department Vision and Mission Statements are discussed in the Department Advisory Board (DAB) and Board of Studies (BoS) meetings and suggestions are obtained.
- If changes are recommended by the members of DAB and BoS, the Vision and Mission statements are redrafted by the faculty members of the Department and submitted to the Academic Council for approval.

  The various steps involved in defining the Vision and Mission statements is given in Fig. 4.1

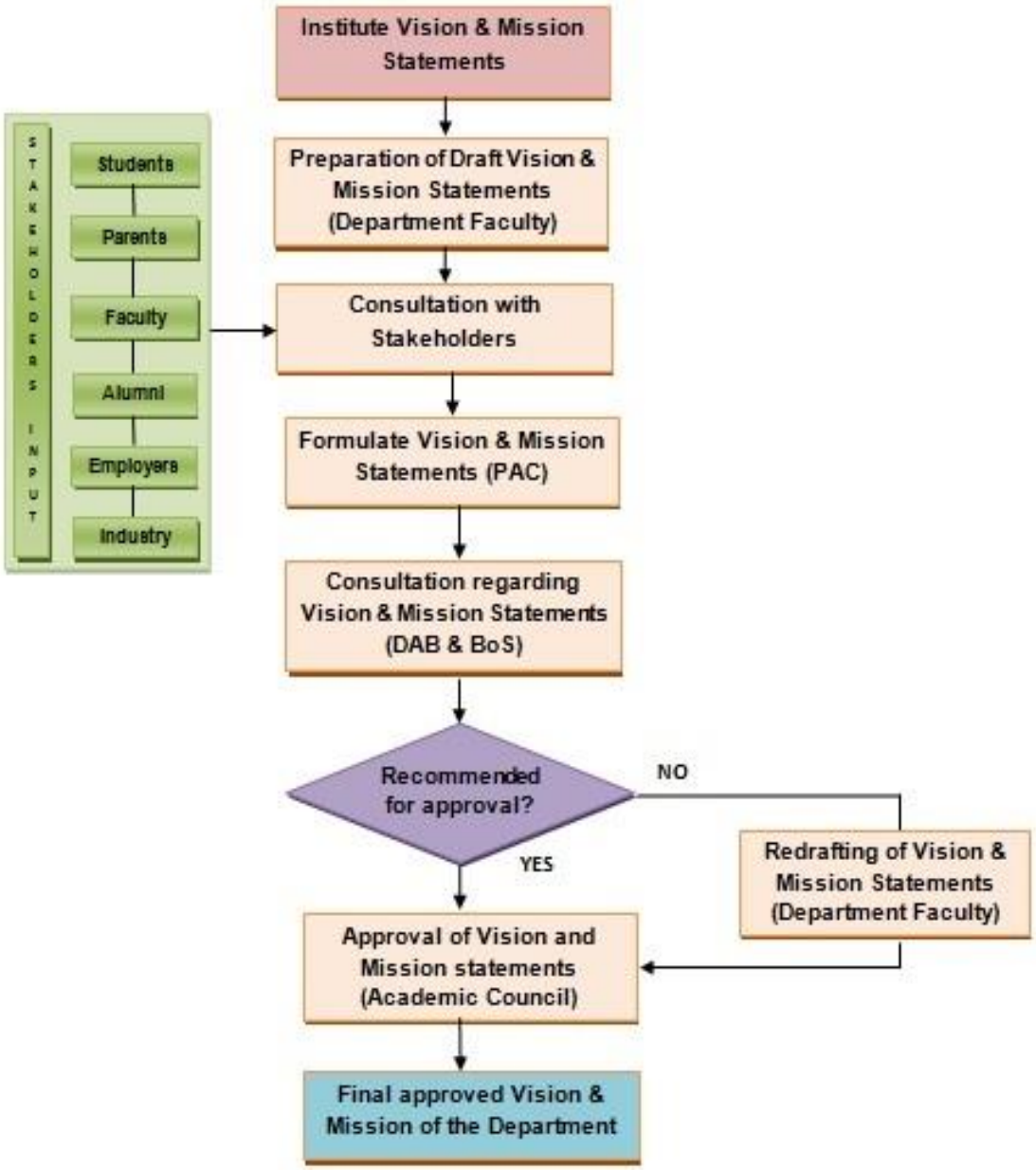


Fig. 4.1 Process of Defining Vision & Mission of the Department

When framing the Vision and Mission of the Department the alignment with the Vision and Mission statements of the Institution must be ensured. The key components of Institute Vision and Mission Statements should be mapped. Example:

Institute Vision: To promote excellence in technical education and scientific research for the benefit of the society

Department Vision - IT: To promote excellence in producing competent IT Professionals to serve the society through technology and research

Table 4.1 Mapping of Key Elements of the Institute Vision with Department Vision

Institute Vision: Distinct Elements	Department Vision : Distinct Elements
To promote excellence in technical education	To promote excellence in producing competent IT Professionals
Scientific research	Technology and research
Benefit of the Society	To serve the society

Institute Mission and Department Mission

The key elements of Institute Mission and Department Mission are mapped to ensure correlation.

Example

INSTITUTE MISSION:

1. To provide quality technical education to fulfill the aspiration of the student and to meet the needs of the Industry.
2. To provide holistic learning ambience.
3. To impart skills leading to employability and entrepreneurship.
4. To establish effective linkage with industries.
5. To promote research and development activities.
6. To offer services for the development of society through education and technology.

DEPARTMENT MISSION:

1. To provide quality technical educational experience to enable the graduates to become leaders in their chosen profession.
2. To educate through modern teaching tools and experiential learning to produce proficient engineer.
3. To develop skills in recent technological trends and design software and to facilitate various co-curricular activities to enhance employability and entrepreneurship.
4. To establish collaboration with industries for transfer of technical knowledge.
5. To promote research activities among faculty members and students.
6. To offer beneficial services to the society.

Table 4.2 Mapping of Key Elements of the Institute Mission with Department Mission

S.No.	Institute Mission: Key Elements	Department Mission: Key Elements
1.1	Provide quality technical education	Provide quality technical educational experience
1.2	Fulfill the aspiration of the student	Enable the graduates to become leaders in their chosen profession
2	Provide holistic learning ambience	Educate through modern teaching tools and experiential learning
3	Impart skills leading to employability and entrepreneurship	Facilitate various co-curricular activities to enhance employability and entrepreneurship
4	Establish effective linkage with industries	Establish collaboration with industries
5	Promote Research and Development activities	Promote research activities among faculty members and students
6	Offer services for the development of society	Offer beneficial services to the society

4.2 Process for defining the PEOs of the Program

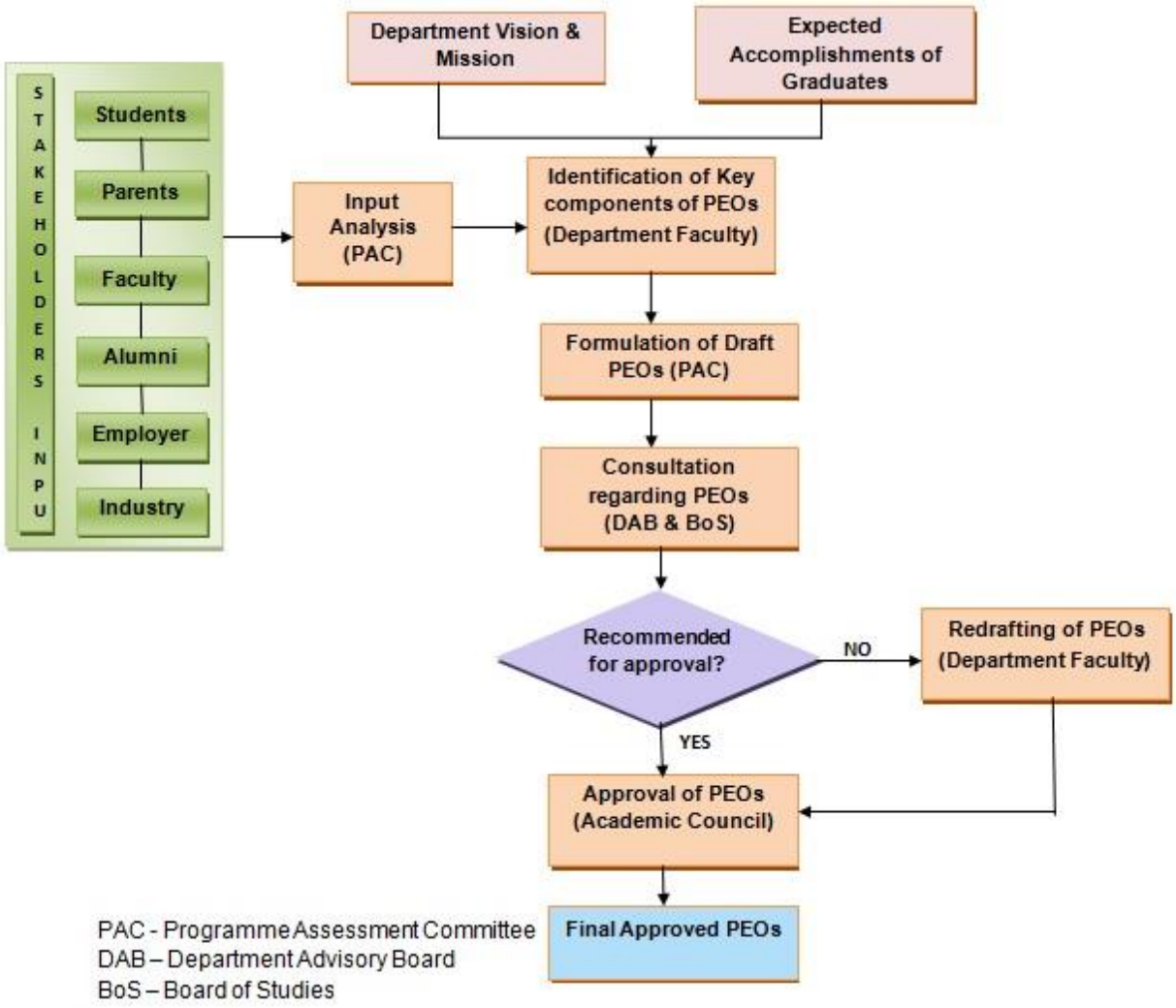


Fig 4.2 Process of Defining the PEOs

- The faculty members of the Department identify the key components of PEOs considering the inputs from the Stakeholders the Vision and Mission Statements of the Departments.
- As the PEO statements reflect the career and professional accomplishments of graduates, the expected accomplishments of graduates is also taken as one of the main inputs in identifying the key components of PEOs.
- The Program Assessment Committee (PAC) formulates the draft PEO statements

- The PEO Statements are discussed in the Department Advisory Board (DAB) and Board of Studies (BoS) meetings and suggestions are obtained.
- If changes are recommended by the members of DAB and BoS, the PEO statements are redrafted by the faculty members of the Department and submitted to the Academic Council for approval.

4.3 Process for defining the POs & PSOs

Program Outcomes (POs)

The Program Outcomes are aligned with the graduate attributes of NBA that are mentioned below:

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

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

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.

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.

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.

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

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

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

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large. Some of them are, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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.

Lifelong 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.

Program Specific Outcomes are written based on the faculty competency, infrastructure facilities and the curricular components.

Program Specific Outcomes (PSOs)

It is suggested to have two PSOs for each program

PSOs can be written based on the

- Faculty competency
- Courses available in the Curriculum and
- Infrastructure facilities

4.4 Writing Course Outcomes

Course Outcomes are statements of what the faculty intend for students to

- Know (Cognitive)
- Think (Affective)
- Do (Psychomotor)

when they complete the course

- Course Outcome statements must be
  - learner-centered
  - specific and measurable
  - meaningful for faculty and students
  - representative of a range of thinking skills
  - written at various levels of Blooms Taxonomy
  - should reflect the level of correlation with POs and PSOs

When writing course outcomes, one need to:

- Focus on outcomes, not processes
- Start each outcome with an action verb.
- Use only one action verb per learning outcome
- Avoid vague verbs such as *know and understand.*
- Check that the verbs used reflect the level of learning required
- Ensure that outcomes are observable and measurable
- Write the outcomes in terms of what the learner does, not what the instructor does.
- Check that the outcomes reflect knowledge, skills, or attitudes required in the workplace.
- Check that there are the appropriate number of outcomes
- (at least five per course)
- Check that the outcomes fit within program and course goals

4.4.1 Course Outcome Examples (Theory Courses):

Name of the Course:Design of Machine Elements

CO 1: Apply the knowledge of basic design concepts to solve the problems under steady and variable stresses developed in the machine members. (Apply)

CO 2: Design the couplings and shafts based on the various types of the stress developed. (Create)

CO 3: Design temporary and permanent joints for mechanical assembly. (Create)

CO 4: Design Energy Storing Elements for various applications with safety considerations. (Create)

CO 5: Design bearings, seals gaskets and connecting rods for various applications. (Create)

Name of the Course:Compiler Design

CO1: Analyze the fundamentals of algorithm performance by using Probabilistic, Amortized and Mathematical analysis. (Analyze)

CO2: Analyze Brute force and divide and conquer strategies for sorting, searching and nonlinear traversal problems. (Apply)

CO3: Apply Dynamic programming and Greedy strategies to solve shortest path problems. (Apply)

CO4: Apply Backtracking and Branch and Bound strategies to solve complex engineering problems. (Apply)

4.4.2 Defining Course Outcomes for Special Courses

a. Project work
b. Mandatory Courses
c. Other Special type of Courses

The Course Outcomes of Project Work, Mandatory Courses and Other Special type of courses were discussed. It is proposed that the Course Outcomes of Project Wok may be:

Course Outcomes for Project Work

After successful completion of the course students will be able to:

1. Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.(PO1, PO3, PO7)[Create-K6]
2. Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion. (PO2, PO4) [Analyze-K4]
3. Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice (PO5, PO8) [Apply-K3]
4. Test and Evaluate the performance of the developed solution using appropriate techniques and tools (PO2, PO5) [Evaluate-K5]
5. Apply management principles to function effectively in the project team for project execution (PO9, PO11) [Organize-A4]
6. Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs. (PO6, PO7, PO12) [Respond-A2]

7. Write effective reports and make clear presentation to the engineering community and society (PO10) [Organize-A4]

Course Outcomes for Technical Project and Fabrication and Design Project

After successful completion of the course students will be able to:

1. Identify and formulate a technical problem to reach substantiated conclusion using basic technical knowledge(PO1, PO2)[K4-Analyze]
2. Design/Develop proto type / model for societal needs applying the basic engineering knowledge.(PO3, PO6)[K3-Apply]
3. Evaluate the performance of the developed solution using appropriate techniques and tools (PO5)[K5-Evaluate]
4. Apply management principles to function as a team (PO10, PO11)[Affective Domain]
5. Communicate the technical information effectively (PO9)[Affective Domain]

Course Outcomes for the three categories of Mandatory Courses

It is proposed to have Course Outcomes for the three categories of Mandatory Courses in the three domains of Bloom's taxonomy as given below:

Personality and Social Development (Affective Domain)

After successful completion of the course students will be able to:

- Demonstrate the societal, environmental, health, safety, legal and cultural values to the society (Responding) (PO6-Engineer and Society, PO7-Environment and Sustainability, PO9 - Individual and Team Work)
- Conceive, plan and function effectively as an individual, and as a member or leader in diverse teams (PO9 - Individual and Team Work)

Skills Development (Skill Domain)

After successful completion of the course students will be able to:

- Demonstrate the ability to communicate effectively (PO10 - Communication)
- Recognize the need for, have the preparation and the ability to engage independent and life-long learning. (PO12 - Life Long Learning)

Value Education (Cognitive Domain)

After the successful completion of this course, the students will be able to:

- Explain the social and personal values of life (PO8 - Ethics)
- Describe the importance of human rights (PO8 - Ethics)
- Analyze key issues related to values of life and human rights and propose appropriate solutions to the situations (PO8 - Ethics)

Chapter 5
Correlation among the Goal Statements

5.1 General Correlation

The goal statements need to have a meaningful correlation among them. The general mapping is as shown below.

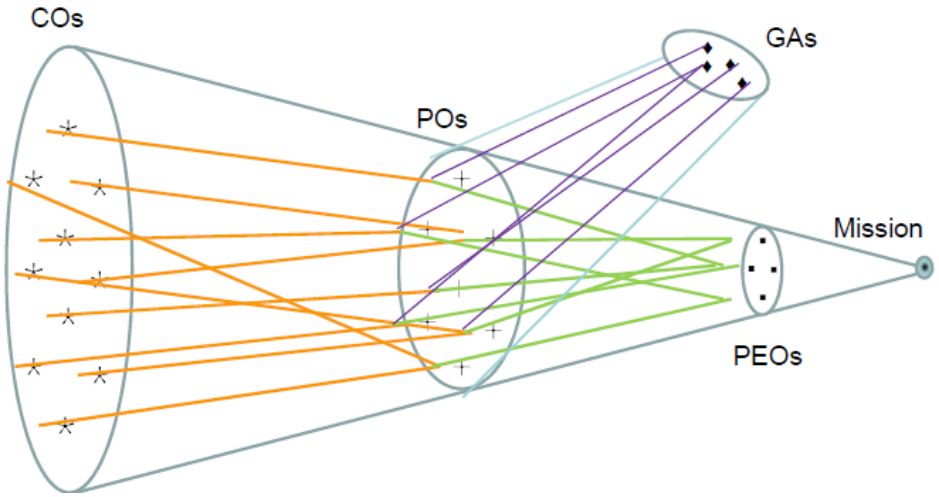


Fig. 5.1 Correlation between Goal Statements

OBE process starts from defining Vision and Mission of the department in accordance with the Vision and Mission of the Institution. The PEOs are derived from the Mission of the Department. The POs are framed in alignment with the Graduate Attributes defined by NBA. The COs are defined for all the courses and mapping between COs and POs and PSOs is established having strong, moderate and weak correlation.

5.2 Consistency of PEOs with Mission of the Department

A "Mission of the Department – PEOs matrix" with justification and rationale of the mapping need to be established

Table 5.1 Mapping of PEOs and Mission of the Department

PEO Statements	MISSION OF THE DEPARTMENT					
	M1	**M2**	**M3**	**M4**	**M5**	**M6**
	To provide quality technical educational experience	To educate through modern teaching tools and experiential learning	To develop skills in recent technological trends and design software	To establish collaboration with industries for transfer of technical knowledge	To promote research activities among faculty members and students	To offer beneficial services to the society
PEO 1 Develop technical competency to become professionals with expertise in core areas of mechanical engineering.	3	3	3	2	2	-
PEO 2 Practice Life Long Learning to solve real time problems and for career development.	2	-	3	-	3	2
PEO 3 Develop professional skills to meet the global standards with ethical and social responsibility.	2	-	3	3	3	3

5.3 Correlation between PEOs and POs/PSOs of the Program

The Program Educational Objective Statements must be consistent with the Mission of the Department and also align with the POs and PSOs. The POs and PSOs prepare the students towards the accomplishments of graduates. The Correlation between PEOs and POs/PSOs can be given as

Strong	Medium	Week

Table 5.2 Mapping of PEOs and Pos& PSOs

PEO Statements	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO-I														
PEO-II														
PEO-III														

5.4 Mapping of COs with POs and PSOs

- CO statements must align with statements of POs and PSOs
- Correlation levels are:

Strong	Medium	Week

- CO statements determine the degree of correlation
- Each CO shouldcorrelate at different levels with a few POs and PSOs
- All the POs and PSOs must be addressed by the COs of the curriculum of that program

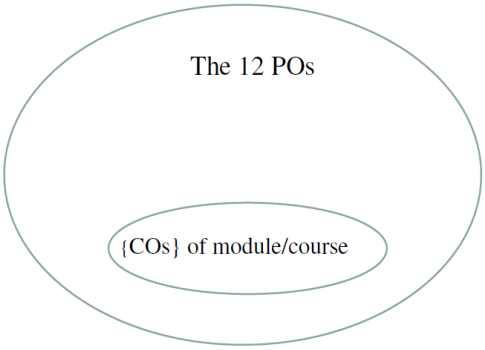


Fig. 5.2 COs and POs

The **first five POs** deal with **Complex Engineering problems**. Complex Engineering Problems have the following features:

- May or may not have a unique solution
- Can be solved in many ways leading to different solutions
- Not completely defined and require students to make a few choices
    - Ex. Cost, Power requirement, life span etc
- Generally not encountered at the end of text book chapters
- CO-PO/PSO Mapping is evidenced by
    - CO Statements
    - Assessment Questions and
    - Assessment Criteria

<u>CO Statement</u>

For strong correlation a part of PO/PSO statement should be embedded in the CO statements

<u>CO Assessment question & Assessment Criteria must align with</u>

- Bloom's Taxonomy level
- PO correlation

Some Examples:

a) PO1 - Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems. (Apply)

Example – 1:

Name of the Course: Electronic Circuits

Course Outcome

Upon successful completion of the course, students will develop ability to:

Apply knowledge of electronic circuits to design amplifiers

CO Assessment Question:

Design an amplifier using BJTs, given

Signal Source : 500mV (peak to peak)

Impedance : 100 KOhm

Load : 1 KOhm

Output Required: 1V (peak to peak)

Problem does not state:

1. What is amplifier configuration?
2. What is the reasoning behind the choice?
3. What would be the device characteristics?
4. Whether feedback is required?

All these require knowledge of engineering specialization - So this is a complex engineering problem

Example – 2:

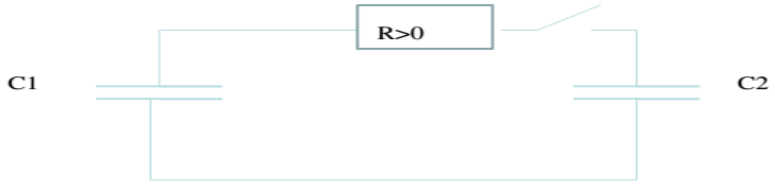
Basic Electric Circuits

Course Outcome

Upon successful completion of the course students will be able to:

Apply laws of Physics through Modeling of Electromagnetic fields phenomenon as lumped parameter circuit elements

CO Assessment Question



Capacitors are of the same value, 1F; Initially, C1 is charged to V volts, and C2 is in a fully discharged state. The switch s closed at t = 0. Determine the energy dissipated in R at t = infinity

CO ASSESSMENT QUESTION

In this case, CO-PO Mapping is very high because:

a) A part of PO statement is embedded in CO Statement - apply laws of physics In CO Assessment Question

b) Complex Engineering problem is asked

Example – 3:

Thermodynamics

Course Outcome

Upon successful completion of the course students will be able to:

Compute heat, energy and work transfer

CO ASSESSMENT QUESTION

Problem:

- A rapidly spinning paddle wheel raises the temperature of 200ml of water from 21 degrees Celsius to 25 degrees. How much a) work is done and b) heat is transferred in this process?

Solution:

- In this problem the work is done by the friction force. All the work will go to increase the internal energy of the water, which can be calculated as:

$$Q = mc\Delta T = 0.2 * 4200 * 4 = 3360\ J$$

specific heat of water, $m = 1000 * 200 * 10^{-6} = 0.2\ kg.$

Where $c = 4200\ J/kg$ -

There is no heat transfer in the process.

Table 5.3 Mapping of COs with Correlation Levels w.r.to PO Level: Apply

PO Level: Apply				
Correlation Level	**CO Level & CO Assessment Question Level**	**PO Embedded in CO Statement**	**Identifiers Addressed**	**Complex Engg. Problem**
Strong	Apply	Yes	Yes	Yes
Medium	Apply	No	Yes	No
Weak	Understand/ Remember	No	Yes	No

Example – 3 : Thermodynamics
Topic – Basic Concepts
Course Outcome
Upon successful completion of the course students will be able to:
Compute heat, energy and work transfer
Correlation Level: ?

Example – 4 : Cryptography and Network Security

Topic – Data Encryption Standard
Course Outcome
Upon successful completion of the course students will be able to:
Explain various block cipher standards

CO ASSESSMENT QUESTION

Question: Explain Data Encryption Standard Algorithm with an example
CO Level : Understand
CO Assessment Question level : Understand
PO Statement embedded in CO Statement : No
Complex Engineering Problem : No
Correlation Level : ?

PO2 – 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 (Analyze)
Example – 1: Electronic Circuits

Course Outcome
Upon successful completion of the course students will be able to:
Analyze the existing system/circuits and determine the specifications of additional circuits

Assessment Tools

- As the tasks involved are: Identify, Research Literature, and Formulate; such problems would typically be found in: home assignments, mini or major projects, or tutorials. *{ A problem may have one or more of the above possibilities }*
- This PO is about making Informed Choices using engineering knowledge

CO Assessment Question

An Example for PO 2

- Given for a "Home Assignment"
- Task: Determine Specifications for an Audio amplifier for a dynamic microphone and output for "aux" input of a power amplifier.
- One needs to study material (often an appropriate handbook) to figure out meaningful specifications
- Such an activity would cover most aspects of PO 2

Table 5.4 Mapping of COs with Correlation Levels w.r.to PO Level: Analyze

PO2 Level : Analyze				
Correlation Level	**CO Level & CO Assessment Question Level**	**PO Embedded in CO Statement**	**Identifiers Addressed**	**Complex Engg.Problem**
Strong	Analyze	Yes	Yes	Yes
Medium	Analyze	No	Yes	No
Weak	Apply/ Understand/ Remember	No	Yes	No

Example – 1: Electronic Circuits

Course Outcome

Upon successful completion of the course students will be able to:

Analyze the existing system/circuits and determine the specifications of additional circuits

Correlation Level: ?

PO3 - Design/development of solutions:

Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations. (Create)

Example : Electronic Circuits - II

Topic – SMPS

Course Outcome

Upon successful completion of the course students will be ableto:

Design electronic circuits with consideration for public health, safety and environmental conditions

CO-PO Mapping:

Strong Correlation with

PO3 – Design and Development of Solutions

PO7 – Environment and Sustainability

PO8 - Ethics

PO9 – Individual and Teamwork

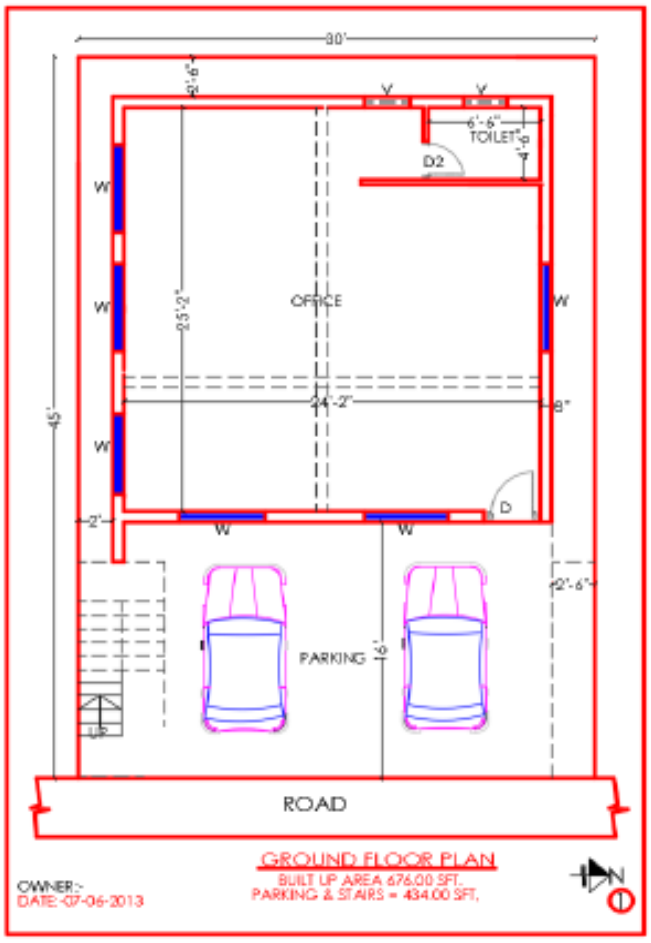
CO ASSESSMENT QUESTION

Group Assignment: Design a SMPS for 12V, 500 mA

Evaluation should include aspects such as:

- Design is basically sound and in working condition – PO3
- Report shows EMI/EMC issues taken into account- Environment – PO7
- Designing according to the norms of engineering practice – PO8
- Effectiveness of Teamwork – PO9

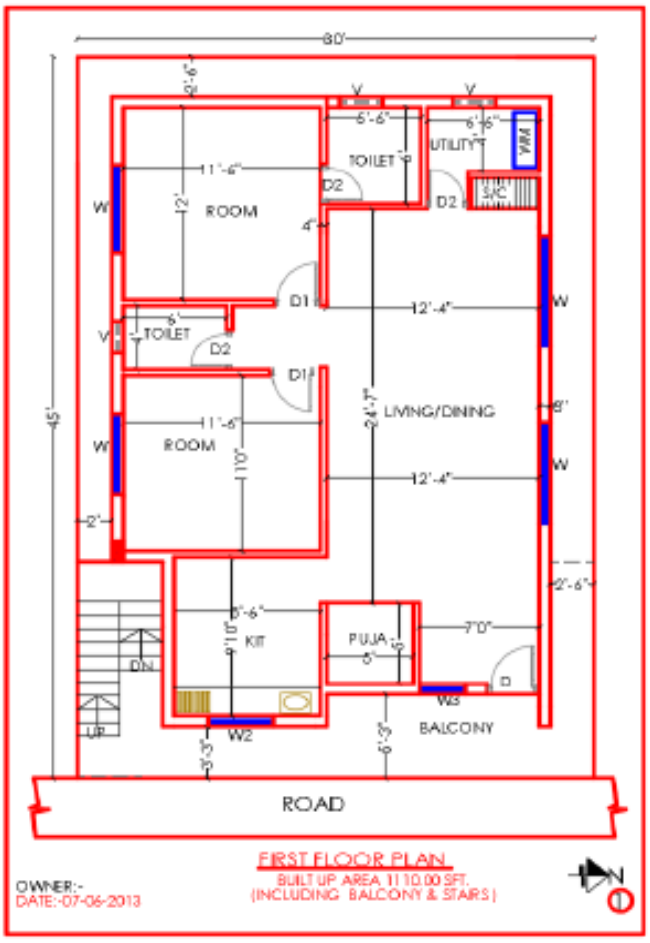
A Residential building comprising of ground +3 upper floors has been proposed using a RCC framed structure infilled with 200mm thick cement concrete block masonry wall as main and 100mm thick cement concrete block masonry walls as partition walls. Propose a suitable slab beam and column layout. Analyze and design an interior slab, an interior beam, an interior column stairs and column footing. The floor plan are attached



GROUND FLOOR PLAN

BUILT UP AREA 676.00 SFT.
PARKING & STAIRS = 434.00 SFT.

OWNER:-
DATE:-07-06-2013



FIRST FLOOR PLAN

BUILT UP AREA 1110.00 SFT.
(INCLUDING BALCONY & STAIRS)

OWNER:-
DATE:-07-06-2013

Chapter 6
Processes Influencing the Attainment of Outcomes

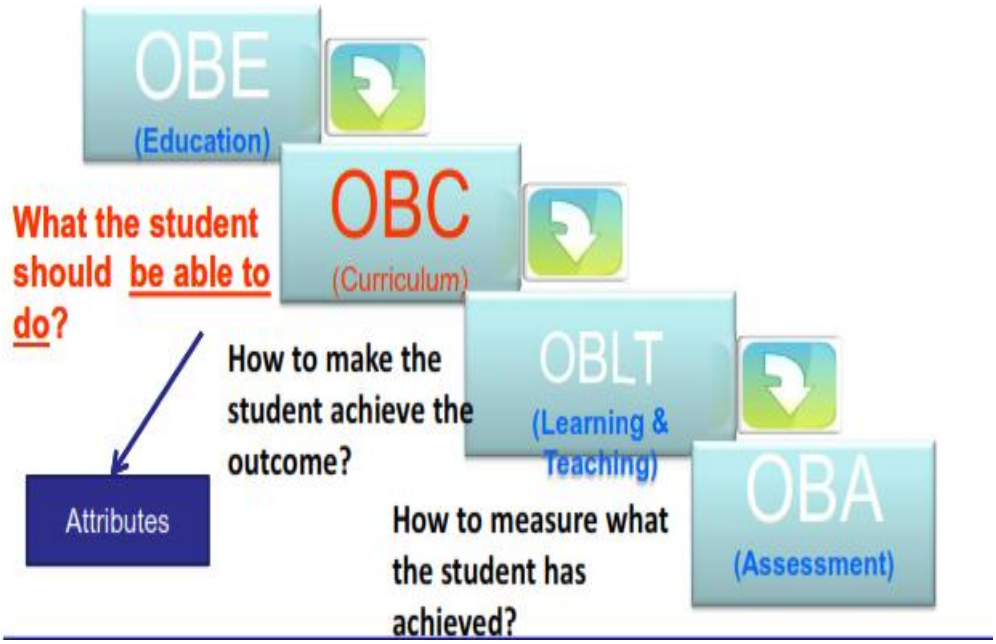


Fig. 6.1 Components of OBE

Outcomes-based education means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences. This means starting with a clear picture of what is important for students to be able to do, then organizing the curriculum, instruction and assessment to make sure this learning ultimately happens The premise of OBE is what the students learn, whether students learn successfully is more important than when and how students learn (Spady, 1994: 8). In other words, in the process of designing programme curriculum, the outcomes of the learning is emphasized and pre-determined, that is, what is expected from the learning after the students have graduated in order to equip them with the necessary skills and capabilities before they enter the work place, then going backward with curriculum design, programme outcomes and course outcomes, the development of instructions, delivery modes and appropriate assessments methodologies.

The OBLT is performed in the classroom level based on the Outcomes. The students' knowledge and skills are assessed to measure the attainment of COs and POs.

Generally, the process of education can be classified into curriculum design process, Curriculum delivery process or Pedagogy and Curriculum Assessment Process. In traditional education process also, all the processes are developed and followed unmindful of the outcomes, whereas in the Outcome based Education process, all the processes need to be improved based on the attainment or level of attainment of the Outcomes. The Program needs to facilitate the attainment of Outcomes and the processes affecting the outcomes should be properly monitored.

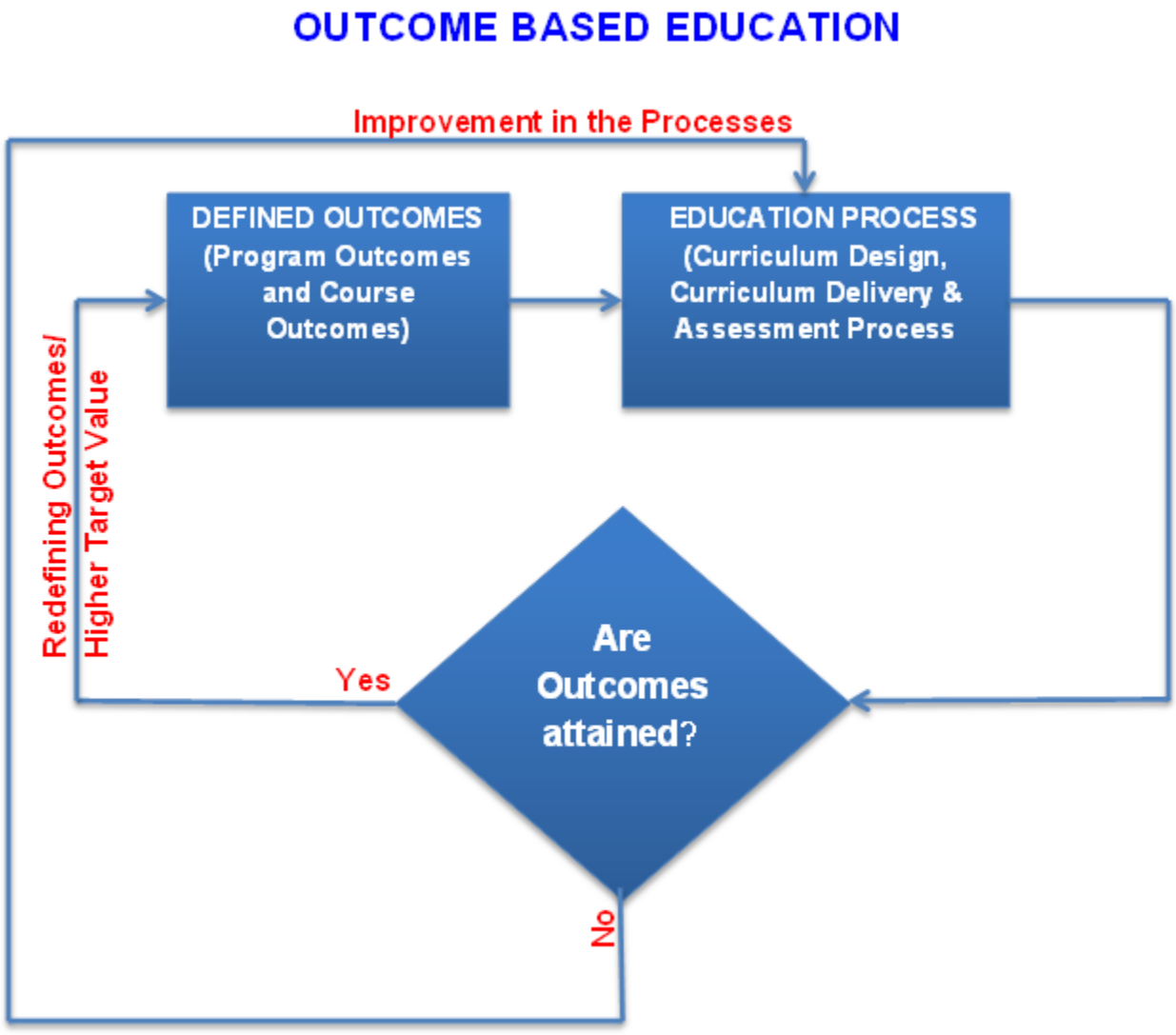


Fig 6.2 Process of Outcome based Education

The Processes influencing the attainment of Outcomes are:

- Curriculum Design Process or Outcome based Curriculum (OBC)
- Curriculum Delivery Process (Pedagogy) or Outcome based Learning Teaching (OBLT)
- Curriculum Assessment Process or Outcome based Assessment (OBA)

The entire process of Outcome Based Education can be represented through the flow diagram given in Fig. 6.2

The process of OBE starts with defining Outcomes (Program Outcomes and Course Outcomes). The education process which includes the Curriculum design, Curriculum delivery and the Assessment facilitates the attainment of the Outcomes. The Outcome Attainment analysis results in improvement of the education process and/or redefining the Outcomes.

6.1 Outcomes and Education Process:

In the traditional education process Outcomes are not defined, attempts are not made to attain the outcomes and improvements are rarely considered. In Outcome based Education, the Outcomes are defined and it may be considered as the input target parameters for the education process. The education process has to be designed to attain the defined outcomes. The process has to be improved to attain the target i.e. outcomes. The attainment of outcomes has to be verified or checked to make necessary improvements. The entire Outcome based Education can be considered or explained using famous Deming Cycle.

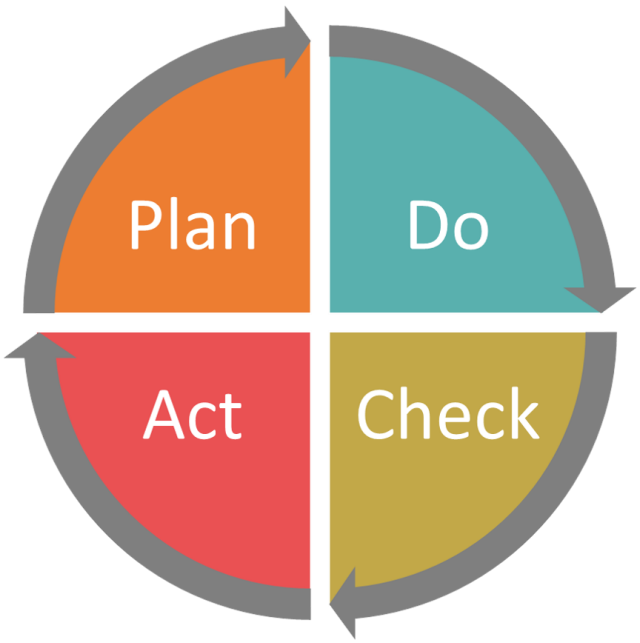


Fig. 6.3 Deming Cycle

Table 6.1 Deming Cycle and OBE

Plan	Defining Program Outcomes and course outcomes considering vision, mission and PEOs and feedback from stakeholders etc
Do	Curriculum Design process, Curriculum Delivery process and Assessment Process
Check	Assessment of attainment of Outcomes
Act	Improvements in the processes

It can be clearly understood that the attainment can be achieved by making improvements in the curriculum design process, curriculum delivery process and assessment process. These processes influence the attainment of outcomes and it should be clearly understood how these processes influence the attainment of outcomes.

6.2 Outcome Attainment and Influencing Processes:

6.2.1 Curriculum Design Process or Outcome Based Curriculum (OBC)

The program outcomes provide the clear outline for the curriculum design process. The Program Coordinator should properly design the curriculum to meet the requirements of the Program Outcomes. If curriculum is not properly designed, it is difficult to attain the Program Outcomes to a reasonable level. The proper design of curriculum necessitates a matrix called Program Articulation Matrix, which connects or maps Program Outcomes and curriculum for better understanding. The curriculum should be improved and refined using Program Articulation Matrix. Similarly, Course outcomes are defined and the syllabus for the courses should be properly framed to attain the course outcomes. The proper design of syllabi for the courses necessitate a matrix called Course Articulation Matrix, which connects or maps Program Outcomes and Courses/Course Outcomes for better understanding.The syllabi should be improved and refined using Program Articulation Matrix. After assessing the attainment of outcomes, the necessary improvements should be always made in the curriculum.

6.2.2 Curriculum Delivery Process (Pedagogy) or Outcome based Learning Teaching (OBLT):

In the traditional method, a teacher teaching to the best of his ability is considered to be the method of pedagogy. The OBE pedagogy focuses on student centric or learner centric learning. How far the student is able to attain the knowledge, skills and attributes are focused now. It is essential that proper teaching learning methods have to be designed, so that it promotes the ability of the students to attain the necessary knowledge, skills and attributes. Innovative learning methods, collaborative learning methods, project based learning methods etc. help the students involve themselves in the learning. If proper pedagogy is not followed, the attainment of course to a desired level is not possible. The responsibility of the course teacher to design proper learner centric content delivery is very vital. After assessing the attainment of Course outcomes, the necessary improvements should be always made in the curriculum delivery or pedagogy.

6.2.3 Curriculum Assessment Process or Outcome based Assessment (OBA):

The design of the curriculum assessment is very essential to attain the expected level of the outcomes. Course Outcomes are expected to be defined using Blooms Taxonomy. Similarly, the assessment tools should be also in the necessary level of Blooms Taxonomy. If the assessment questions in a design oriented course is in the lower level of Blooms Taxonomy, the expected outcome cannot be achieved. Designing proper assessment for a course needs much effort and proper planning. The innovative assessment is necessary to properly attain the expected level of the outcome. Project work is a special kind of course in which no syllabus is provided for the course and the curriculum delivery is also not done, except through the guidance of the supervisor. Hence, the assessment is the vital process in the project work to promote the attainment of the outcomes. Hence, proper rubrics should be designed to attain the expected level of the outcomes. The responsibility of the course teacher to design proper assessment process is very vital for the attainment the outcomes. After assessing the attainment of Course outcomes, the necessary improvements should be always made in the assessment process.The details of each of these process is given is Chapters 7, 8 and 9.

6.3Assessment of Attainment of Outcomes

Even though curriculum assessment and Outcome attainment assessment processes are interrelated, but they are different. For Outcome based Education, it is the verification process or checking process. It is already explained using Deming Cycle. After checking or after assessing the attainment of the Outcomes, necessary improvements should be made in the processes given in 6.3. It is a very vital process, whether the outcome based education is progressing as per the stipulated quality parameters i.e. outcomes. The detailed process for the assessment of attainment of outcomes is explained in Chapters 10 & 11.

Chapter 7
Curriculum Design Process

The Design of appropriate Curriculum is a vital process to ensure the attainment of Outcomes.

7.1 Curriculum Design

The Departments have an effective mechanism for developing the program curriculum with the involvement of forums such as:

- Curriculum Planning and Evaluation Cell (CPEC)
- Program Assessment Committee (PAC)
- Department Advisory Board
- Board of Studies (BoS)
- Academic Council

7.2 Forums Involved in Curriculum Design

Curriculum Planning and Evaluation Cell (CPEC)

The College has a Curriculum Planning and Evaluation Cell (CPEC) for designing and evaluating the curriculum and syllabus of B.E/B.Tech /M.E programs under autonomous regulations. The CPEC consolidates the inputs from stake holders the guidelines from statutory bodies and technology forecast by the national level industrial organizations/associations and provides the framework and the guidelines for curriculum design and development. The CPEC has members from all academic programs and the Principal is the Chairman of the Cell.

Program Assessment Committee (PAC)

Every program has a Program Assessment Committee (PAC), which is responsible for the design and development of the draft curriculum. The Chair Person of the committee is the Head of the Department, and the members are faculty members and student representatives of the program.

Department Advisory Board

Department Advisory Board is the advisory body of the Department. The Head of the Department is the Chair Person of the Board, all faculty of the department are the members of the board and Industrial experts are also members of the board. The draft curriculum and syllabus is placed before the board and the suggestions given by the industrial experts are considered for review of the curriculum and syllabus.

Board of Studies (BoS)

Board of Studies (BoS) have been formed to prepare syllabi, suggest methodologies for innovative teaching and evaluation techniques and to coordinate research, extension and other academic activities in the department. The final draft syllabus prepared by the department is placed before the BoS and it is reviewed extensively. The BoS recommends necessary modifications and suggestions in the curriculum and syllabus and recommends the modified curriculum and syllabus to the academic council.

Academic Council

Academic Council is constituted as per the guidelines of UGC and it is the apex body for approving the curriculum & syllabus and academic regulations. The curriculum and syllabus recommended by various BoS is placed before the Council. After careful scrutiny, the Academic Council approves the curriculum & syllabus and academic regulations with necessary modifications and suggestions.

The suggestions and modifications given by the Academic Council is scrupulously carried out and the approved syllabus is followed in the corresponding batches of UG/PG programs. The approved curriculum & syllabus and academic regulations are also submitted to the University.

The steps involved in the process of curriculum design is as shown in Fig. 8.1

7.3 Inputs from Stakeholders for Curriculum Design

The inputsfrom stakeholders are considered as one of the main factors in the design of curriculum and syllabi. Whenever changes are planned in the curriculum and syllabi feedback is obtained from them.

Feedback from Students

The students are given a questionnaire to give their opinion for inclusion or deletion of a course. The suggestions are carefully analyzed and the necessary changes are made in the curriculum and syllabi based on the need assessment.

Feedback from faculty members

Faculty members provide their feedback regarding the general curriculum design and development of the program, new topics to be introduced and its relevance and the obsolete topics to be deleted or modified

and reasons thereof. They also provide suggestions for introduction of new courses in the curriculum.

Feedback from Alumni

Alumni feedback about the curriculum and syllabi is obtained every year. The feedback is analyzed the changes recommended are incorporated if necessary.

Feedback from Employers

Feedback from employers is obtained every year to assess the suitability of the curriculum for employment opportunities and to update /modify the curriculum as per the need of the industries.

Feedback from Parents

Feedback is obtained from parents for updatingthe curriculum and syllabi.

7.4 Process for Designing Program Curriculum

7.4.1 Input/Gap Analysis:

The Program Assessment Committee (PAC) of the Program identifies the gap in the latest curriculum and syllabi based on the factors such as Vision and Mission statements of the Department, PEOs, POs, PSOs, Program Specific Criteria of the relevant International Professional Society of the program, the guidelines from statutory bodies, technology forecast by the national level industrial organizations/associations and the attainment analysis of the PEOs, POs, PSOs and COs of previous batches. It also considers the inputs given by the various stakeholders.

7.4.2 Formulation of Draft Curriculum and Syllabi

The faculty members of the Department scrupulously plan for effective design and development of curriculum. For drafting the curriculum and syllabi they take into consideration the outcome of the input/Gap analysis done by PAC and the inputs given by the CPEC of the College.

7.4.3 Review of Draft Curriculum and Syllabi by PAC

The draft curriculum and syllabi designed by the Department faculty is reviewed by the Program Assessment Committee (PAC) which consists of internal stakeholders.

7.4.4 Review of Draft Curriculum and Syllabi by DAB

The draft curriculum and syllabi is placed before the Department Advisory Board and the suggestions given by the members are considered for review of the curriculum and syllabi.

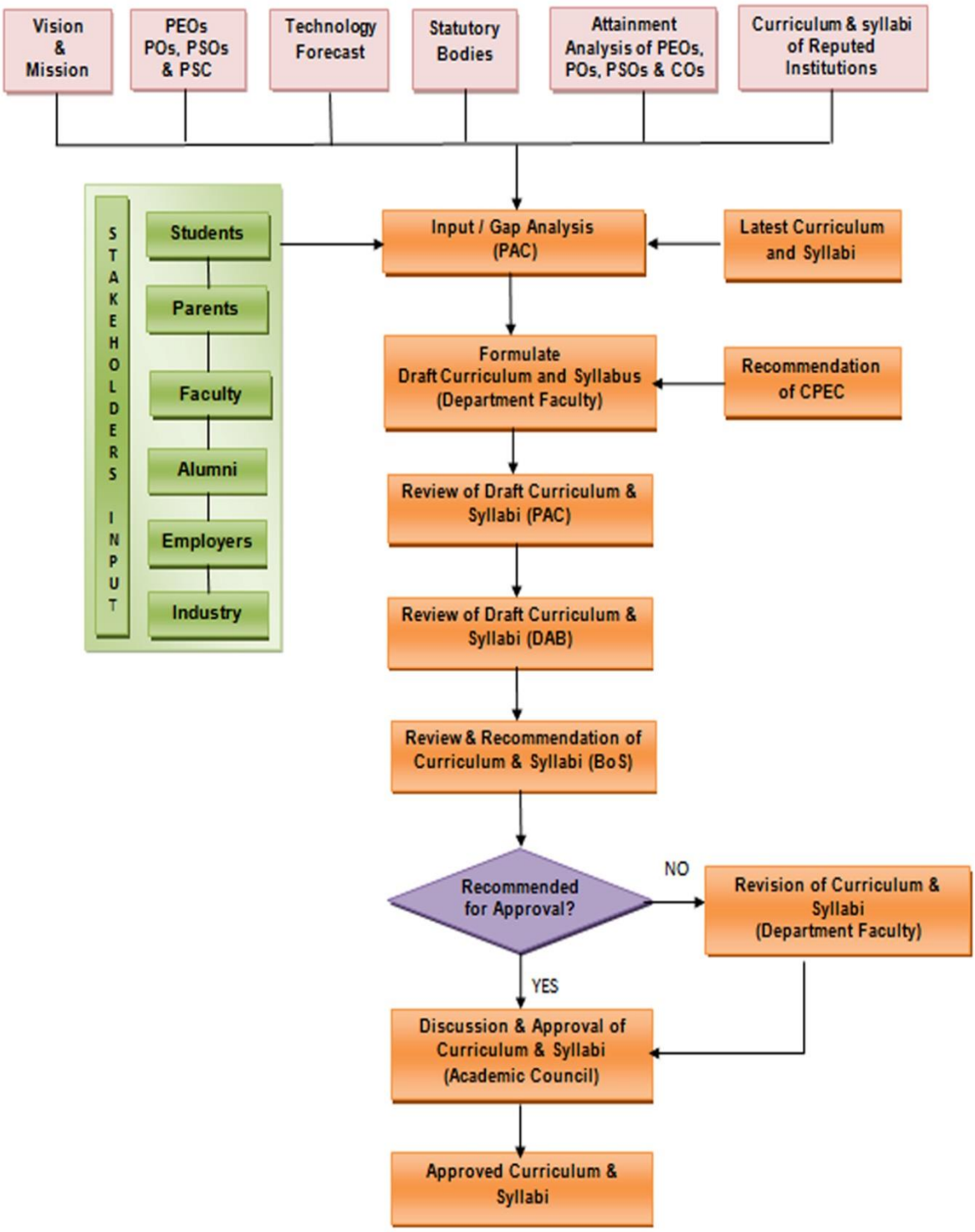


Fig. 7.1 Process for designing the Program Curriculum

7.4.5 Review and Recommendation of Curriculum and Syllabi by Board of Studies

The final draft syllabus prepared by the department is placed before the BoS and it is reviewed extensively. If changes are suggested, the faculty members of the department carry out the necessary modifications in the curriculum and syllabi. The BoS recommends the curriculum and syllabi to the academic council for approval.

7.4.6 Approval by Academic Council

The curriculum and syllabi recommended by various BoS is placed before the Council. After careful scrutiny, the Academic Council approves the curriculum & syllabus and academic regulations with necessary modifications and suggestions.

The suggestions and modifications given by the Academic Council is scrupulously carried out and the approved syllabi is followed in the corresponding batches of UG/PG programs. The approved curriculum & syllabus and academic regulations are also submitted to the University.

7.5 Articulation Matrices

There are two types of articulation matrices namely Program Articulation Matrix and Course Articulation Matrix.These matrices show the correlation between Courses/Course Outcomes and POs/PSOs. If the Course/CO matches strongly with a particular PO/PSO then 3 is assigned, if it matches moderately then2 is assigned or if the match is low then 1 is assigned else it is marked with " - " symbol.

7.5.1. Program Articulation Matrix

Documents how the curriculum insures that a student achieves Program Outcomes and Program Specific Outcomes through the courses offered by the Program. It establishes the correlation between the courses and the POs & PSOs.

Table 7.1 Program Articulation Matrix

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C101												
C202												
C303												
....												
....												
C4...												

Steps for preparing the Program Articulation Matrix:

- List all the Courses of the Program in the Program Articulation Matrix
- The correlation levels for each course is taken from the final consolidated correlation level (last row) of the corresponding Course Articulation Matrix

7.5.2. Course Articulation Matrix

Shows how the Course insures that a student achieves Program Outcomes and Program Specific Outcomes through the Course Outcomes of a particular course offered by the Program.

Table 7.2Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C202.1													
C202.2													
C202.n													
C202													

Steps for preparing the Course Articulation Matrix

- List all the Course Outcomes in the Course Articulation Matrix
- Do all the strong mapping first
- Mark Medium and Weak Correlations
- The final consolidated correlation level is the maximum correlation level mentioned in that column

7.6 CO-PO/PSO Mapping

The courses and course outcomes should have meaningful correlation with PO/PSO and contribute towards the attainment of PO/PSO. Hence, CO-PO/PSO mapping is necessary to ensure proper correlation between them.

- CO-PO/PSO Mapping is evidenced by
  - CO Statements
  - Assessment Questions and
  - Assessment Criteria
- For strong correlation a part of PO/PSO statements should be embedded in the CO statements
- CO Assessment question & Assessment Criteria must align with Bloom's Taxonomy level & PO correlation

Table 7.3Mapping of COs with Correlation Levels

Correlation Level	CO Level & CO Assessment Question Level	PO Embedded in CO Statement	Identifiers Addressed	Complex Engg. Problem
Strong	**Apply**	**Yes**	**Yes**	**Yes**
Medium	**Apply**	**No**	**Yes**	**No**
Weak	**Understand/ Remember**	**No**	**Yes**	**No**

The detailed procedure is given in Section 5.4

7.7 Process to identify extent of compliance of the Curriculum for attaining the Program Outcomes and Program Specific Outcomes

- The Program Outcomes and the Program Specific Outcomes are the statements that define the Graduate attributes. The faculty members identify the courses required to attain the POs and PSOs. The analysis of stakeholder's inputs by the Program Assessment Committee is also taken into consideration and the courses and draft curriculum are framed.

- The faculty members prepare the Program Articulation matrix that shows the correlation of the draft courses with the POs and PSOs.

- The Course instructors define the Course outcomes that help to attain the POs and PSOs. The Course Articulation Matrices for all the courses are prepared by them to show the correlation of the COs with the POs and PSOs.

- The Program Assessment Committee identifies the gap in the draft curriculum and courses to attain the POs and PSOs based on the Program Articulation and Course Articulation matrices.

- If the draft curriculum and courses are not compliant for the attainment of POs and PSOs changes are made in the curriculum and courses. If it is compliant then the standard curriculum design process is initiated.

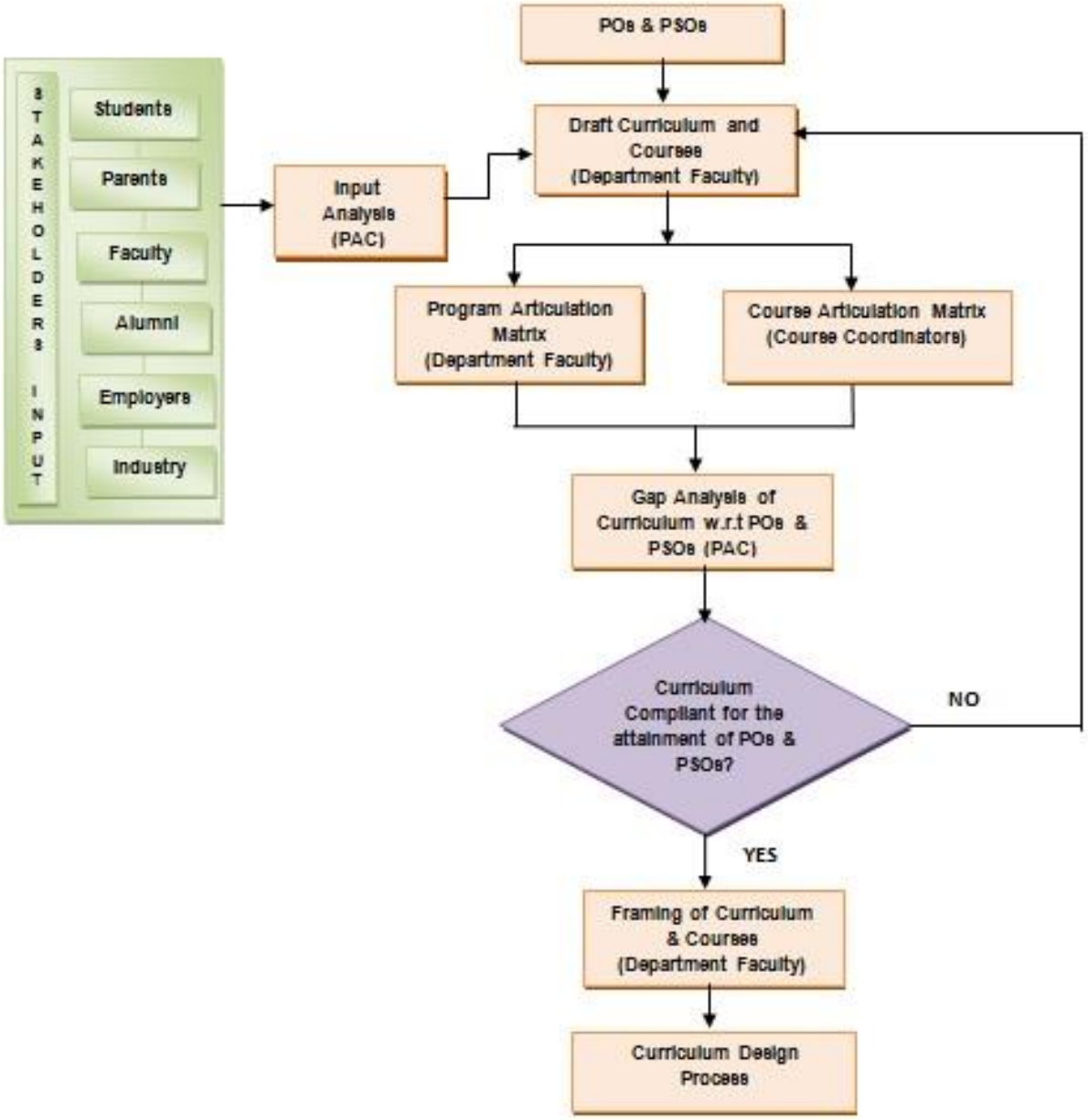


Fig. 7.2 Process Chart for Identifying the Extent of Compliance of the Curriculum for Attaining the POs And PSOs

Chapter 8
Curriculum Delivery/Pedagogy

Modern curriculum delivery /pedagogical methods has undergone vast changes related to Outcome based Education and learner centric approach. As the Outcome based Education insists on the higher level of cognitive ability like create, evaluate, analyze and apply, an effective curriculum delivery is needed. The program outcomes outlines not only cognitive ability but also the attributes related to affective and psychomotor domain. Hence, curriculum delivery is a challenge to the teachers and it should effectively contribute to the attainment of the outcomes. Learner centric curriculum delivery, which promotes students involvement in learning is essential. Innovative teaching methods, collaborative learning, project based learning, activity based learning, ICT tools etc. are the modern approaches for effective curriculum delivery. But, it is the responsibility of the course teacher to properly design the curriculum delivery to attain the outcomes effectively. Proper planning is needed for content delivery of each lesson or topic. If appropriate content delivery is used, the learner can attain the necessary attributes and abilities and the expected outcome can be attained. Hence, curriculum delivery process/ pedagogy is an important process and it plays a major role in the attainment of outcomes. The various curriculum delivery approaches that can enhance the attainment of the outcomes are discussed in this chapter.

Student-centric learning methods aim at fostering transferable skills such as problem-solving, critical thinking and reflective thinking through interaction with teachers and fellow students. The following student-centric learning approaches are followed. These techniques kindle the spirit of students and invite their attention, as they are quite different and interesting compared to conventional teaching methodologies. The commonly practiced methods are

- Mind Mapping
- Z-A Technique
- Think Pair Share
- Visualizations
- Video Lectures
- Flipped Class Room
- Collaborative Learning
- Industrial Visit
- Project Based Learning
- Case Study
- Simulation
- Teaching with Real World Example

Chapter 9
Curriculum Assessment Process

The aim of assessment is to enhance learning. Assessment is an integral part of teaching and learning. Assessment should be properly designed to promote desired level of learning. Continuous Internal assessment and summative assessment are mainly followed in order to monitor the progress of the attainment of necessary knowledge, skills, abilities and attributes. The students should attain the ability to solve complex problems of the society. Real life problems are complex in nature. The assessment process should properly address this and proper design of assessment questions with complex problems is essential to attain the proper level of the outcome. Conventional tests are not alone the assessment method and innovative assessment methods should be designed for each course to ensure the proper level of attainment. Courses like Project work, Technical project highly rely on assessment process only to ensure the proper attainment of the outcomes. Proper assessment will enhance the ability to attain the expected level of the outcomes. It is the responsibility of the course teacher to design proper assessment method to ensure the attainment of outcomes. Proper rubrics should be developed for assessment of seminar, assignment, projects etc. Hence assessment is an important process and proper design of assessment method is essential to facilitate the attainment of expected level of outcome.

9.1 Assessment Techniques

The assessment techniques are very important and AICTE and UGC have initiated reforms in assessment techniques and examinations to attain the outcomes effectively. The assessment techniques should properly assess the knowledge, skills and attributes/behavior acquired during the course of study.The commonly practiced assessment techniques are:

- Tests
- Assignment
- Quiz/ Online Quiz
- Seminar
- Project
- Technical/Design Project
- Lab Experiment
- Oral Examination/ Viva voce
- Power point presentation
- Industrial visit report

- Case study report
- Open book Test to assess higher level of ability

For some of the assessment techniques proper rubrics should be developed.There are three components of rubrics and they are: (i) criteria/ performance Indicator: the aspects of performance that will be assessed, (ii) descriptors: characteristics that areassociated with each dimension, and (iii) scale/level of performance: a rating scale that defines students' level of mastery within each criterion.

Proper design of assessment technique for higher order cognitive abilities is a challenge to the teacher. Worldwide several attempts are being made to address these challenges. AICTE has recommended the following are the few educational experiences to teach and assess professional outcomes and higher order cognitive abilities:

•Course projects

•Open-ended experiments in laboratories

•Project-based learning modules

•MOOCS

•Co-Curricular experiences

•Mini / Minor projects

•Final year projects

•Internship experiences

•E-portfolios of student works

9.2Assessment through Rubrics

A rubric is an assessment tool that clearly indicates achievement criteria across all the components of any kind of student work. Rubrics include one or more dimensions on which performance is rated, and a rating scale for each dimension. Dimensions are generally referred to as criteria, the rating scale as levels, and definitions as descriptors. There are different types of Rubrics such as:

- Analytic and Holistic
- Generic or Task Specific

Analytic:

Information to/about individual student competence

- Communicate expectations
- Diagnosis for purpose of improvement and feedback

Holistic:

Overall examination of the status of the performance of a group of students

Generic:

- General rubric that can be used across similar performance (used across all communication task or problem solving tasks)
- Big picture approach
- Element of subjectivity

Task Specific:

- Can only be used for a single task
- Focused approach
- Less subjective

A sample Rubrics to assess Communication Skill is given below:

Table 9.1 Rubrics to assess Communication Skill

	Unsatisfactory 1	**Developing 2**	**Satisfactory 3**	**Exemplary 4**	**Score**
Understanding of audience and purpose	Demonstrates poor understanding of audience and purpose	Demonstrates some understanding of audience and purpose	Demonstrates understanding of audience and purpose	Demonstrates specific understanding to relationship between audience and purpose	
Main Idea and topic	Main idea unclear and topic is only partially limited	Main idea clear or implicit and topic is partially limited	Main idea clear and topic is limited	Main idea very clearly stated and topic is effectively limited	
Voice and tone	Voice noticeably generic or inappropriate	Voice and tone adequate to audience/ purpose although often generic or predictable	Voice & tone consistent & appropriate although somewhat generic or predictable in places.	Voice & tone are consistent & appropriate to the audience/purpose	
Language	There are numerous minor errors and some major errors in sentence construction	There are some common errors (minor and major) errors in sentence construction	There are a few minor major errors in sentence construction	Few, if any, minor error in sentence construction	

Chapter 10
Assessment of Attainment of Course Outcomes (COs)

The assessment of attainment of Course Outcomes is mainly based on the performance of the students in the Continuous Internal Assessments/Periodical Tests and the End Semester Examinations. Feedbacks are also received from the students for the assessment of Outcomes. The detailed process for the assessment of attainment of COs is presented below.

The assessment of attainment of Course Outcomes is done every semester. The assessment Tools and Process used for the Assessment of Attainment of Course Outcomes are:

The assessment of attainment of Course Outcomes is done based on the performance of students in the Continuous Internal Examinations (CIE) and the Semester End Examinations (SEE) through direct and indirect assessment tools. The direct assessment tools in CIE are tests, assignment, lab exercise, case study and in SEE the University or Autonomous End Semester Examination as shown in Fig. 3.2.1. The indirect assessment tool is the Course Exit Survey that is obtained from the students for each course at the end of the semester is the.

- The course committee which consists of the course coordinator and the course instructors of the course calculates the attainment of COs and prepares the report of CO attainment along with the suggestions for improvement.
- Course Outcome attainment analysis is performed by the Programme Assessment Committee and the suggestions given for improving the attainment is reviewed.
- The review of CO attainment analysis is done by the Internal Quality Assurance Cell (IQAC), Department Advisory Board (DAB) and Board of Studies (BoS). The members of these forums also give further suggestions for improving the attainment.
- Finally, the Academic Council reviews the attainment analysis of COs and suitable actions are initiated for improving the curriculum/ Course content, content delivery and assessment to enhance CO Attainment.

10.1Process for the assessment of attainment of Course Outcomes

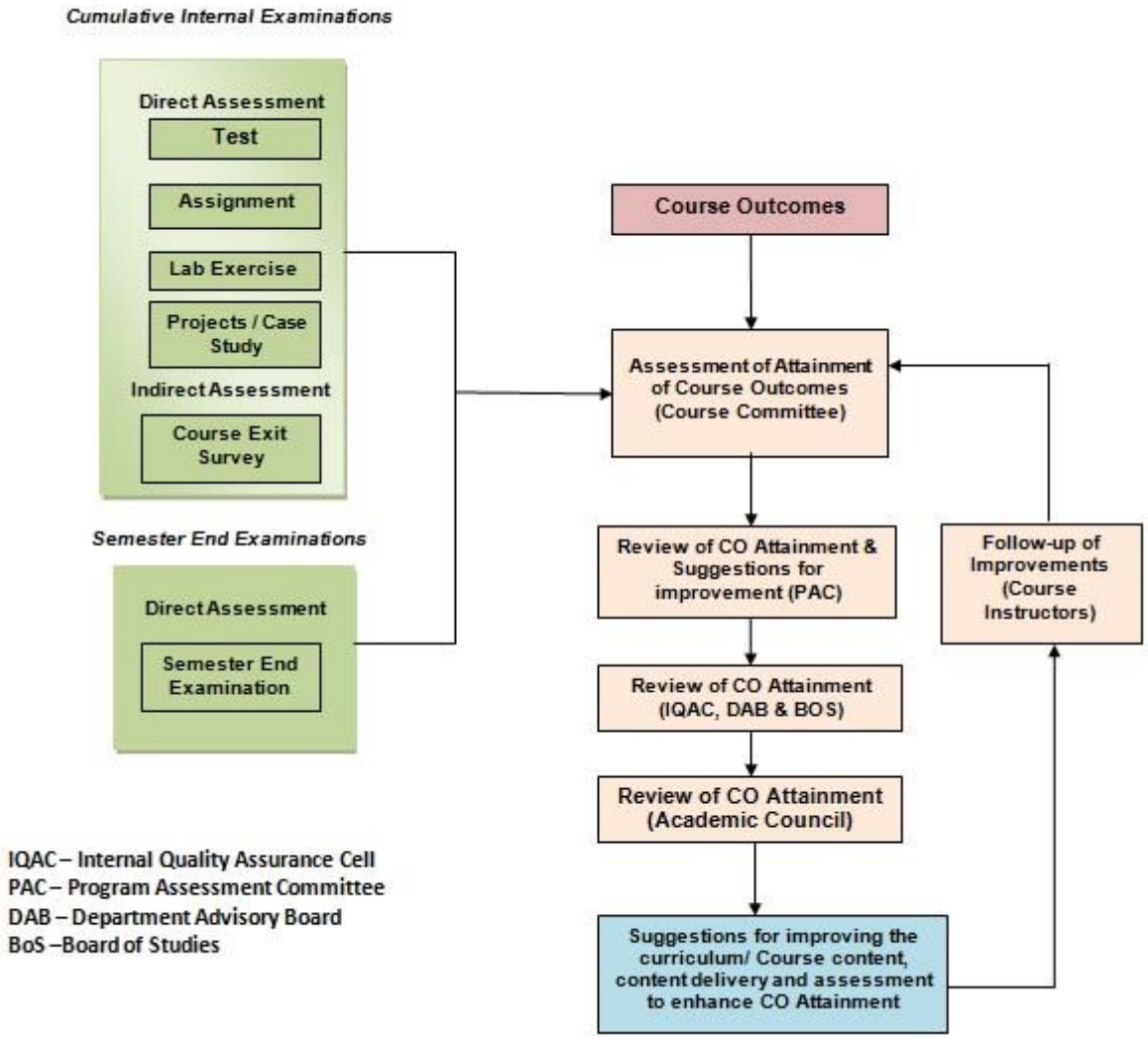


Fig. 10.1 Process for the assessment of attainment of Course Outcomes

Process for Mapping the Assessment Questions

The questions for assessment of COs should align with:

- Blooms taxonomy level of the Course Outcome
- Correlation Level of CO-PO Mapping

Examples are given in Section 5.4

10.2 Procedure for measuring the attainment of Course Outcomes for Theory Courses

The Assessment of Attainment of Course Outcomes (Theory and Lab) is done in two aspects such as:

1. Course Outcome-wise Attainment
2. Student-wise Attainment

The following are two components of examination for the courses and both components are considered for assessment:

1. Continuous Internal Examination (CIE)
2. Semester End Examination (SEE)

10.2.1. Continuous Internal Examination (CIE)

i) CIE Assessment Tools for Theory Courses:

Direct Assessment Tools	▪ Periodical Test ▪ Assignment ▪ Project ▪ Presentation ▪ Case Study
Indirect Assessment Tool	▪ Course Exit Survey

ii) CIE - Direct Assessment Tools and Procedure for Theory Courses:

When other assessment tools are used in addition to the Periodical Tests, weightages could be fixed as per the following guidelines:

Table 10.1Direct Assessment Tools and Procedure for Theory Courses

Assessment Tool	Weightage	Remarks	Formula
Common Assignment (CA)	20%	➢ Common question can be given to all the students ➢ All the students must submit assignment	CIE_{Direct}= 0.8*PT+0.2*CA

Group Assignment (GA)	40%	➢ Different questions should be given to different groups ➢ All the students must submit assignment	CIE_{Direct}= 0.6*PT+0.4*GA
Case Study (CS)	50%	➢ Case study may cover more than one CO. ➢ Students must be encouraged to give presentations in groups. ➢ Rubrics may be used for assessment	CIE_{Direct}= 0.5*PT+0.5*CS
Mini Project (MP)	50%	➢ Students must do the projects by themselves either individually or in groups	CIE_{Direct}= 0.5*PT+0.5*MP
Quiz (QZ)	30%	➢ Quiz may be conducted through Moodle	CIE_{Direct}= 0.7*PT+0.3*QZ
Seminar (SR)	40%	➢ Rubrics may be used for assessment	CIE_{Direct}= 0.6*PT+0.4*SR

iii) Procedure for Fixing Threshold in CIE- Direct Assessment:

- If Class average is less than 50%, then Threshold is 50%
- If Class average is between 50% and 60%, then Threshold is the Class average
- If Class average is more than 60%, then Threshold is 60%

iv) Attainment through CIE - Direct Assessment:

CIE_{Direct} = % of students getting more than the threshold

v) CIE - Indirect Assessment Tool

Tool: Course Exit Survey

Feedback is obtained for individual courses at the end of every semester from all students to address the attainment of course outcomes. The attainment is measured in a four point scale. The different categories of the Course Outcomes in the survey forms are given scores as:

Table 10.2 Course Exit Survey Score Pattern

A- Excellent	B - Good	C - Satisfactory	D – Needs Improvement
4	3	2	1

The average score in percentage is calculated as,

$$\textbf{Average Score} = \frac{(4\times a)+(3\times b)+(2\times c)+(1\times d)}{4N}\times 100$$

a - No. of responses marked A b - No. of responses marked B

C - No. of responses marked C d - No. of responses marked D

N- Total Number of Students

vi) Attainment through CIE - Indirect Assessment:

$CIE_{Indirect}$= Average Score in the Survey

vii) Attainment through CIE

$$\textbf{CIE}_{\textbf{Attainment}} = 0.8 * \textbf{CIE}_{\textbf{Direct}} + 0.2* \textbf{CIE}_{\textbf{Indirect}}$$

10.2.2. Semester End Examination (SEE)

Tool: End Semester Examination

i) Procedure for Fixing Threshold in SEE - Direct Assessment:

a) Anna University Batches Threshold Percentage: Pass marks

b) Autonomous Batches Threshold Percentage

- If Class average is less than 50%, then Threshold is 50%
- If Class average is between 50% and 60%, then Threshold is the Class average
- If Class average is more than 60%, then Threshold is 60%

ii) Attainment through SEE:

$SEE_{Attainment}$ = % of students getting above the Threshold Percentage

- **Attainment** - % of students getting more than the threshold

10.2.3 Overall Attainment: Course Outcome wise Attainment

$$CO_{Attainment} = 0.5 * CIE_{Attainment} + 0.5 * SEE_{Attainment}$$

Target of CO Attainment	**-**	**At least60%**
Attainment Level I	-	60% to 69 %
Attainment Level II	-	70% to 79%
Attainment Level III	-	80% and above

10.3 Procedure for measuring the attainment of Course Outcomes for Lab Courses

10.3.1 Continuous Internal Examination (CIE)

i) CIE Assessment Tools for Lab Courses:

Direct Assessment Tools	▪ Performance in Regular Lab Classes ▪ Model Exam ▪ Mini Project
Indirect Assessment Tool	▪ Course Exit Survey

Table 10.3Direct Assessment Tools and Procedure for Lab Courses

Type	Assessment Tool	Weightage	Formula
Type 1	Model Exam (ME)	60%	CIE_{Direct}= 0.6*ME+0.4*PL
	Performance in Lab Classes	40%	
Type 2	Model Exam (ME)	40%	CIE_{Direct}= 0.4*ME+0.2*PL+0.4MP
	Performance in Lab Classes	20%	
	Mini Project (MP)	40%	

ii) Procedure Attainment Assessment through Model Exam (Direct tool):

<u>Case 1:</u> If the information on the experiment done by the students in Model Exam is available:

The attainment of students who have done experiments corresponding to the respective COs may be calculated

CO	CO 1	CO 2	CO 3	CO 4
Experiments	1, 3	2, 4, 7	5, 6, 8	9, 10

Ex. If 10 students have done Experiments 1 or 3 in the Model Exam which are mapped with CO1, then the attainment of those students may be calculated for CO1.

<u>Case 2:</u>If the information on the experiment done by the students in Model Exam is not available:

The Marks obtained Model Examination is considered for all COs

iii) Threshold percentage for Direct Assessment

Average or 75 %

iv) Attainment through CIE - Direct Assessment:

CIE_{Direct} = % of students getting more than the threshold

v) Procedure for Assessment through Indirect tools

The procedure is same as Theory Courses

vii) Attainment through CIE

$$\mathbf{CIE_{Attainment} = 0.8 * CIE_{Direct} + 0.2* CIE_{Indirect}}$$

10.3.2 Semester End Examination (SEE)

<u>Tool:</u> End Semester Examination

i) Procedure for Fixing Threshold in SEE - Direct Assessment:

a) Anna University Batches Threshold: **'C' Grade and above**

b) Autonomous Batches: Threshold percentage

- If average is less than 60%, then Threshold is 60%
- If average is between 60% and 70%, then Threshold is the Class average
- If average is more than 70%, then Threshold is 70%

10.3.2 Attainment through SEE:

$SEE_{Attainment}$ = % of students getting above the Threshold Percentage

10.3.3 Overall Attainment: Course OutcomewiseAttainment

$$\mathbf{CO_{Attainment} = 0.5 * CIE_{Attainment} + 0.5 * SEE_{Attainment}}$$

Target of Attainment **- Atleast** 70%
Attainment Level I - 70% to 79%
Attainment Level II - 80% to 89%
Attainment Level III -90% and above

10.4 Procedure for Attainment of Course Outcomes for First Year Courses

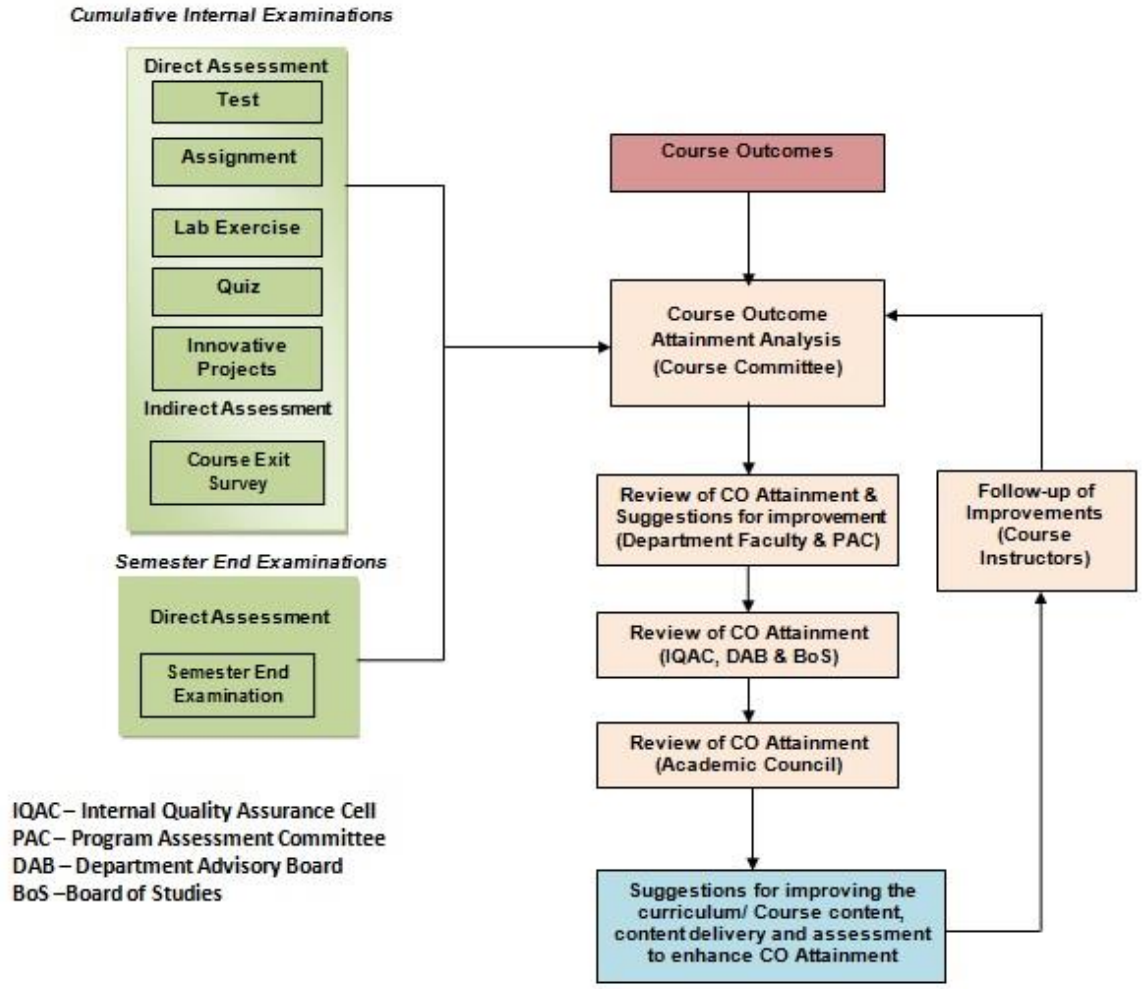


Fig. 10.2 Process for the Assessment of Attainment of COs of First Year Courses

Assessment of attainment of Course outcomes are same as that of the other courses except that that the attainment analysis is done by Science & Humanities faculty members and the report of CO attainment along with the suggestions for improvement is given to the respective Program Head of the students for further review and for the calculation of PO attainment.

10.5 Procedure for measuring the attainment of Course Outcomes for First Year Theory Courses

10.5.1 Continuous Internal Examination (CIE)

i) Tools for Assessment Processes

Table 10.4 Tools for Assessment Processes

S. No.	Direct Assessment Tool	Tool Description
1	Continuous Internal Examination (CIE) Theory courses	1. Continuous Internal Test (Periodical Test (PT)) comprises of 3 tests carrying each of 50, 75, 100 marks with 90,135,180 minutes duration respectively. 2. Common Assignment (CA) / Outcome Based Projects(OBP)with weightage of 25 % (Common question can be given to all the students) 3. Quiz (QS) - weightage of 25% 4. Oral Presentation(OP) - with weightage of 100% (Technical English, Business English & Presentation Skills)
2	Semester End Examination (SEE)	1. Theory courses: Semester End Examination carries 100 marks with equal weightage for all course outcomes. 2. Laboratory courses: Semester End Examination (SEE) carries 100 marks with50% weightage.

ii) Attainment calculation of individual COs for direct assessment of theory courses is estimated as per the formulae mentioned below:

Table 10.5 Direct Assessment (CIE) for Theory Courses

Sl.No.	Courses	Assessment Tool for CIE	Formula
1.	Basic Sciences – Mathematics, Physics, Chemistry	Test (PT),Common Assignment (CA) / Outcome Based Projects (OBP) and Quiz(QS)	CIE_{Direct}= 0.5*PT+0.25*CA/OBP+0.25*QS
2.	Humanities and Social Sciences - English	Test (PT) and Quiz(QS)	CIE_{Direct}= 0.5*PT+0.5*QS
		Test (PT) and Common Assignment (CA)	CIE_{Direct}= 0.5*PT+0.5*CA
		Oral Presentation (OP)	CIE_{Direct}= 1.0*OP
		Test (PT)	CIE Direct= 1.0*PT
3.	Engineering Sciences	Test (PT) and Quiz(QS) / Common Assignment (CA)	CIE_{Direct}= 0.8*PT+0.2*QS / CA

10.5.2Attainment of COs through CIE & SEE for Theory Courses

i) Procedure for Fixing Threshold in CIE& SEE- Direct Assessment:

- If Class average is less than 60%, then Threshold is 50%
- If Class average is more than 60%, then Threshold is 60%

ii) Attainment through CIE& SEE - Direct Assessment:

CIE_{Direct}= % of students getting more than the threshold
SEE_{Direct}= % of students getting more than the threshold

10.5.3 Overall Attainment: Course Outcome wise Attainment

$$CO_{Attainment} = 0.5 * CIE_{Attainment} + 0.5 * SEE_{Attainment}$$

Target of Attainment - **Atleast**70%
Attainment Level I - 70% to 79%
Attainment Level II - 80% to 89%
Attainment Level III - 90% and above

10.6 Procedure for measuring the attainment of Course Outcomes for First Year Lab Courses

10.6.1 Continuous Internal Examination (CIE)

Table 10.6 Direct Assessment (CIE) for Laboratory Courses

Assessment Toolfor CIE	Formula
Performance in regular lab classes (PL) Model Laboratory (ME)	**CIE_{Direct}= 0.4*PL+0.6*ME**

10.6.2Attainment of COs through CIE & SEE for Lab Courses

i) Threshold for CIE &SEE- Direct Assessment for Lab Courses

- CIE - Both Model Exam and Performance in Lab Classes: 65% (Basic Sciences – Physics, Chemistry)
- SEE - Threshold: 60%(Basic Sciences – Physics, Chemistry)
- CIE & SEE - Class average or 70% (Engineering Sciences)

ii) Attainment through CIE & SEE - Direct Assessment:

- CIE_{Direct}= % of students getting more than the threshold
- SEE_{Direct}= % of students getting more than the threshold

10.6.3 Overall Attainment: Course Outcome wise Attainment

$$CO_{Attainment} = 0.5 * CIE_{Attainment} + 0.5 * SEE_{Attainment}$$

Target of Attainment - **Atleast**70%
Attainment Level I - 70% to 79%
Attainment Level II - 80% to 89%
Attainment Level III - 90% and above

10.7 Procedure for Assessment of Attainment of Course Outcomes for Project Work

Guidelines for the Assessment of Project Work

1. Assessment Criteria for Project Work (CIE & SEE)
3. Rubrics for Assessment
4. Assessment of COs based on Review Marks
5. Mapping of COs with POs
6. Assessment of POs

10.7.1 Assessment Criteria for Project Work (CIE & SEE)

a) Continuous Internal Examination (CIE)

Review 1:

- Problem Identification/Identification of Societal issues (PO1) - 40 Marks
- Literature Survey (PO2) - 30 Marks
- Communication - Oral (PO10) - 30 Marks

Review 2:

- Analysis of Design requirements (PO2,PO4) - 30 Marks
- Addressing public health, safety, cultural and societal and environmental needs (PO3, PO6, PO7) - 20 Marks
- Team Work (PO9) - 30 Marks
- Modern Engineering & IT Tools used (PO5) - 20 Marks

Review 3:

- Adopting the norms of engineering practice (PO8) - 20 Marks
- Synthesis and valid conclusion of the project (PO4) - 30 Marks
- Project Management and Finance (PO11) - 30 Marks
- Novelty (PO12) - 20 Marks

b) Semester End Examination (SEE)

In Viva-voce Examination the assessment for Project Report is considered. Report (PO10)

Table 10.7 Mapping of Course Outcomes with Reviews

Course Outcome	Assessment Tools
1. Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.(PO1, PO3, PO7) - [K6-Create]	Review 1 & Review 2
2. Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion. (PO2, PO4) [K4-Analyze]	Review 1, Review 2 & Review 3:
3. Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice (PO5, PO8) [K3-Apply]	Review 2 & Review 3
4. Test and Evaluate the performance of the developed solution using appropriate techniques and tools (PO2, PO5) [K5-Evaluate]	Review 2
5. Apply management principles to function effectively in the project team for project execution (PO9, PO11) [Affective Domain]	Review 2 & Review 3
6. Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs. (PO6, PO7, PO12) [Affective Domain]	Review 2 & Review 3
7. Write effective reports and make clear presentation to the engineering community and society (PO10) [Psychomotor Domain]	Review 1 & Report

10.7.2 Rubrics for Assessment

Table 10.8 Rubric for Assessment of Project work

S.No.	Review Criteria	Excellent (9,10)	Very Good (7,8)	Good (5,6)	Satisfactory (3,4)	Needs Improvement (1,2)
Review 1						
R 1.1 Applying Engineering knowledge for Problem Identification/Identification of Societal issues (PO1, PO6) - 40 Marks						
1	Definition of the Problem					
2	Motivation for the Problem					
3	Objectives of the Project Work					
4	Usefulness/Relevance to the society					
R 1.2 Literature Survey (PO2,PO4) - 30 Marks						
1	Quantum of Literature referred					
2	Quality of literature referred					
3	Inference from the Literature Survey					
R 1.3 Communication - Oral (PO10) - 30 Marks						
1	Voice and tone					
2	Language					
3	Responsiveness					
Review 2						
R 2.1 Analysis of Design requirements (PO2,PO4) - 30 Marks						
1	Analysis of design requirements					
2	Design of experiments for analyzing data/Functional Block/Architectural Design					
3	Meeting the Design Requirements					
R 2.2 Addressing public health, safety, cultural and societal and environmental needs (PO3, PO6, PO7) - 20 Marks						
1	Consideration for public health, safety and cultural aspects					
2	Consideration for social and environmental aspects					
R 2.3 Team Work (PO9) - 30 Marks						
1	Working with others					
2	Listening to others views					

3	Contribution to the Project Work					
R 2.4 Modern Engineering & IT Tools used (PO5) - 20 Marks						
1	Identification of appropriate tool					
2	Proper usage of the Modern tool					
Review 3						
Adopting the norms of engineering practice (PO8) - 20 Marks						
1	Adopting ethical norms and procedures for the design					
2	Acknowledgement for using other's published results or ideas					
Synthesis and valid conclusion of the project (PO4) - 30 Marks						
1	Experimental Results					
2	Analysis/Interpretation of Results					
3	Conclusion of the Project Work					
Project Management and Finance (PO11) - 30 Marks						
1	Time management					
2	Finance management/Cost Analysis					
3	Sharing of Work among the members					
Novelty (PO12) - 20 Marks						
1	Extent of advanced learning to carry out the project					
2	Novelty of the Project Work & Scope for Extension					

Course Outcomes	**Review 1**			**Review 2**				**Review 3**			
	R 1.1	R 1.2	R 1.3	R 2.1	R 2.2	R 2.3	R 2.4	R 3.1	R 3.2	R 3.3	R 3.4
CO 1	√				√						
CO 2		√		√					√		
CO 3							√	√			
CO 4		√		√			√				
CO 5						√				√	
CO 6	√				√						√
CO 7			√								

10.7.3 Assessment of COs based on Review Marks

Table 10.9 Detailed Assessment of COs based on Review Marks of Project work

Course Outcomes	Review Criteria				Total Marks
CO 1	• Applying Engineering knowledge for Problem Identification/Identification of Societal issues *{Review 1}* • Addressing public health, safety, cultural and societal and environmental needs *{Review 2}*	R1.1 (40)	R2.2 (20)	-	60
CO 2	• Literature Survey *{Review 1}* • Analysis of Design requirements *{Review 2}* • Synthesis and valid conclusion of the project *{Review 3}*	R1.2 (30)	R2.1 (30)	R3.2 (30)	90
CO 3	• Adopting the norms of engineering practice *{Review 3}* • Modern Engineering & IT Tools used *{Review 2}*	R3.2 (30)	R2.4 (20)	-	50
CO 4	• Literature Survey *{Review 1}* • Analysis of Design requirements *{Review 2}* • Modern Engineering & IT Tools used *{Review 2}*	R1.2 (30)	R2.1 (30)	R2.4 (20)	80
CO 5	• Team Work *{Review 2}* • Project Management and Finance *{Review 3}*	R2.3 (30)	R3.3 (30)	-	60
CO 6	• Applying Engineering knowledge for Problem Identification/Identification of Societal issues *{Review 1}* • Addressing public health, safety, cultural and societal and environmental needs *{Review 2}* • Novelty *{Review 3}*	R1.1 (40)	R2.2 (20)	R3.4 (20)	80
CO 7	• Communication - Oral *{Review 1}*	R1.3 (30)			30

10.7.4 Mapping of COs with POs

Table 10.10 Mapping of Cos with POs for Project work

PO / CO	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO 1	3		3				3					
CO 2		3		3								
CO 3					3			3				
CO 4		3			3							
CO 5									3		3	
CO 6						3	3					3
CO 7										3		
	3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

10.7.5Assessment of POs

Table 10.11 Assessment of POs using COs and Review Marks of Project work

Program Outcomes (POs)	Course Outcomes (Cos)	Maximum Marks
PO 1	CO 1	60
PO 2	CO 2 & CO 4	170
PO 3	CO 1	60
PO 4	CO 2	90
PO 5	CO3 & CO4	110
PO 6	CO 6	80
PO 7	CO 1 & CO 6	140
PO 8	CO 3	50
PO 9	CO 5	60
PO 10	CO 7	30
PO 11	CO 5	60
PO 12	CO 6	80

10.8 Procedure for Assessment of Attainment of Course Outcomes for Technical Project and Fabrication and Design Project

Guidelines for the Assessment ofTechnical Project and Fabrication and Design Project

1. Assessment Criteria for Technical Project and Fabrication and Design Project (CIE & SEE)
2. Rubrics for Assessment
3. Assessment of COs based on Review Marks
4. Mapping of COs with POs
5. Assessment of POs

10.8.1 Assessment Criteria for Technical Project and Fabrication and Design Project (CIE& SEE)

a) Continuous Internal Examination (CIE)

Review 1:

- Applying Engineering knowledge for Problem Identification /Identification of Societal issues (PO1, PO6) - 40 Marks
- Literature Survey (PO2) - 30 Marks
- Communication - Oral (PO10) - 30 Marks

Review 2:

- Analysis of Design requirements (PO2,PO3) - 40 Marks
- Team Work (PO9) - 30 Marks
- Modern Engineering & IT Tools used (PO5) - 30 Marks

Review 3:

- Synthesis and valid conclusion of the project (PO4) - 40 Marks
- Project Management (PO11) - 30 Marks
- Report (PO10) – 30 Marks

b) Semester End Examination (SEE)

In Viva-voce Examination the assessment for Project Report is considered. Report (PO10)

10.8.2 Rubrics for Assessment

Table 10.11 Rubric for Assessment of Technical Project and Fabrication and Design Project

S.No	Review Criteria	Excellent (9,10)	Very Good (7,8)	Good (5,6)	Satisfactory (3,4)	Needs Improvement (1,2)
Review 1						
Applying Engineering knowledge for Problem Identification/Identification of Societal issues (PO1, PO6) - 40 Marks						
1.	Definition of the Problem					
2.	Motivation for the Problem					
3.	Objectives of the Project Work					
4.	Usefulness/Relevance to the society					
Literature Survey (PO2,PO4) - 30 Marks						
1.	Quantum of Literature referred					
2.	Quality of literature referred					
3.	Inference from the Literature Survey					
Communication - Oral (PO10) - 30 Marks						
1.	Voice and tone					
2.	Language					
3.	Responsiveness					
Review 2						
Analysis of Design requirements (PO2,PO3) - 40 Marks						
1	Analysis of design requirements					
2	Design of experiments for analyzing data/Functional Block/Architectural Design					
3	Meeting the Design Requirements					
4	Design Criteria and Specifications					
Team Work (PO9) - 30 Marks						
1	Working with others					
2	Listening to others views					
3	Contribution to the Project Work					
Modern Engineering & IT Tools used (PO5) - 30 Marks						
1	Identification of appropriate tool					

2	Proper usage of the Modern tool					
3	Testing of project modules and use of appropriatetools/techniques.					
Review 3						
Synthesis and valid conclusion of the project (PO4) - 40 Marks						
1	Experimental Results					
2	Analysis/Interpretation of Results					
3	Conclusion of the Project Work					
4	Technical Knowledge and Awareness related to the Project					
Project Management and Finance (PO11) - 30 Marks						
1	Time management					
2	Finance management/Cost Analysis					
3	Sharing of Work among the members					
Report (PO10) – 30 Marks						
1	Organization of the report					
2	Diagrams and Illustrations					
3	Acknowledgement for using other's published results or ideas					

Course Outcomes	**Review 1**			**Review 2**			**Review 3**		
	R 1.1	R 1.2	R 1.3	R 2.1	R 2.2	R 2.3	R 3.1	R 3.2	R 3.3
CO 1	√	√							
CO 2				√					
CO 3						√	√		
CO 4					√			√	
CO 5			√						√

10.8.3 Mapping of COs based on Review

Table 10.12 Mapping of COs based on Review of Technical Project and Fabrication and Design Project

	Course Outcomes	Review Criteria
1	Identify and formulate a technical problem to reach substantiated conclusion using basic technical knowledge(PO1, PO2)[K4-Analyze]	Review 1
2	Design/Develop proto type / model for societal needs applying the basic engineering knowledge.(PO3, PO6)[K3-Apply]	Review 2
3	Evaluate the performance of the developed solution using appropriate techniques and tools (PO5)[K5-Evaluate]	Review 2 & 3
4	Apply management principles to function as a team (PO10, PO11)[Affective Domain]	Review 2 & 3
5	Communicate the technical information effectively (PO9)[Affective Domain]	Review 1 & 3

Table 10.13 Detailed Assessment of COs based on Review Marks of Technical Project and Fabrication and Design Project

Course Outcomes	Review Criteria	R 1	R2	R3	Total Marks
CO 1	• Applying Engineering knowledge for Problem Identification /Identification of Societal issues (PO1, PO6) - 40 Marks *{Review 1}* • Literature Survey (PO2) - 30 Marks *{Review 1}*	R 1.1 (40) R 1.2 (30)			**70**
CO 2	• Analysis of Design requirements (PO2,PO3) - 40 Marks *{Review 2}*		R 2.1 (40)		**40**
CO 3	• Synthesis and valid conclusion of the project (PO4) - 40 Marks *{Review 3}* • Modern Engineering & IT Tools used (PO5) - 30 Marks		R 2.3 (30)	R 3.1 (40)	**70**
CO 4	• Team Work (PO9) - 30 Marks *{Review 2}* • Project Management (PO11) - 30 Marks *{Review 3}*		R 2.2 (30)	R 3.2 (30)	**60**
CO 5	• Communication - Oral (PO10) - 30 Marks *{Review 1}* • Report (PO10) – 30 Marks *{Review 3}*	R 1.3 (30)		R 3.3 (30)	**60**

10.8.4 Mapping of COs with POs

Table 10.13Mapping of COs with POs of Technical Project and Fabrication and Design Project

PO / CO	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO 1	3	3				3						
CO 2		3	3									
CO 3				3	3							
CO 4									3		3	
CO 5										3		
	3	**3**	**3**	**3**	**3**	**3**			**3**	**3**	**3**	

10.8.5 Assessment of POs

Table 10.14 Assessment of POs using COs and Review Marks of Technical Project and Fabrication and Design Project

Program Outcomes (POs)	Course Outcomes (Cos)	Maximum Marks
PO 1	CO 1	70
PO 2	CO 1 & CO 2	110
PO 3	CO 2	40
PO 4	CO 3	70
PO 5	CO 3	70
PO 6	CO 1	70
PO 7	-	-
PO 8	-	-
PO 9	CO 3	70
PO 10	CO 3	70
PO 11	CO 3	70
PO 12	-	-

CHAPTER 11

Assessment for Attainment of
PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Assessment of attainment of Program Outcomes and Program Specific Outcomes is an important process to evaluate the successful implementation of the OBE process. The assessment should consider all the relevant parameters and proper assessment tools and process should be developed. In this chapter, the assessment tools and process used for assessment of attainment of Program Outcomes and Program Specific Outcomes are discussed.

11.1 Assessment Tools and Processes Used for the Assessment of Attainment of Program Outcomes and Program Specific Outcomes

- The assessment of attainment of Program Outcomes (POs) and Program Specific Outcomes (PSOs) is done based on the performance of students in the Direct Assessments and the Indirect Assessments. The direct assessment is based on course outcome attainment analysis report and rubrics developed. The indirect assessment is the Exit survey form for the corresponding courses and program, student portfolio, Employer survey form and the performance of the students in Nationally Normed Exams.
- POs & PSOs attainment analysis is performed by the Programme Assessment Committee and suggestions `given for improving the attainment is reviewed.
- The review of POs & PSOs analysis is done by the Internal Quality Assurance Cell (IQAC), Department Advisory Board (DAB) and Board of Studies (BoS). The members of these forums also give further suggestions for improving the attainment.
- Finally, the Academic Council reviews the attainment analysis of POs & PSOs and suitable actions are initiated for improving the curriculum/ Course content, content delivery, assessment and other related activities to enhance POs & PSOs Attainments.

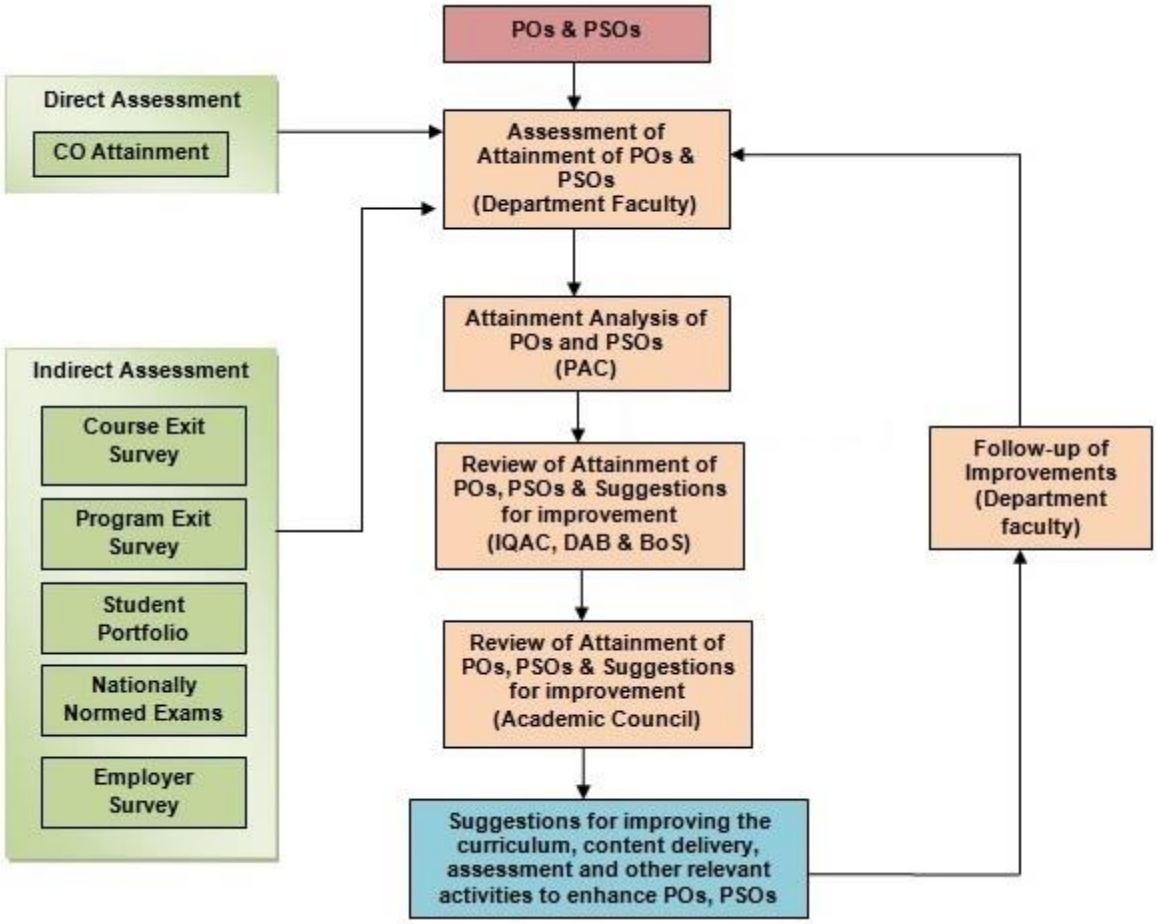


Fig. 11.1 Process for the assessment of attainment of POs and PSOs

11.2 Procedure for measuring attainment of Program Outcomes (POs) and Program Specific Outcomes (PSOs)

11.2.1 Assessment Tools:

Direct Assessment Tools	▪ Course Outcome Attainment
Indirect Assessment Tool	▪ Program Exit Survey ▪ Employer Survey ▪ Student Portfolio ▪ Nationally - Normed Examination

11.2.2 Attainment of POs/PSOs through Direct Tools (PO_{Direct})

Direct Assessment of POs/ PSOs has only one tool ieCourseOutcomesAttainment

Attainment of POs/PSOs through Direct Tools, PO_{Direct}

$$PO_{Direct} = PO_{CO}$$

PO Attainment through CO Attainment, (PO_{CO})

$$PO_{co} = \sum \frac{\%\ of\ CO Attainment X Correlation Level of CO \& PO Mapping}{Sum of the Correlation Levels}$$

where the Correlation Levels are:

3 - Strong Correlation
2 - Medium Correlation
1 - Weak Correlation

11.2.3 Attainment of POs/PSOs through Indirect Tools ($PO_{Indirect}$)

Weightages for the Indirect Tools:

S.No.	Name of the Indirect Tool	Weightage
1.	Student Portfolio & Nationally - Normed Exams	10%
2.	Exit Survey	50%
3.	Employer Survey	40%

$$PO_{Indirect} = 0.1 * PO_{Portfolio} + 0.5 * PO_{Exit\ Survey} + 0.4 * PO_{Employer\ Survey}$$

11.2.4 Overall Attainment : POs & PSOs

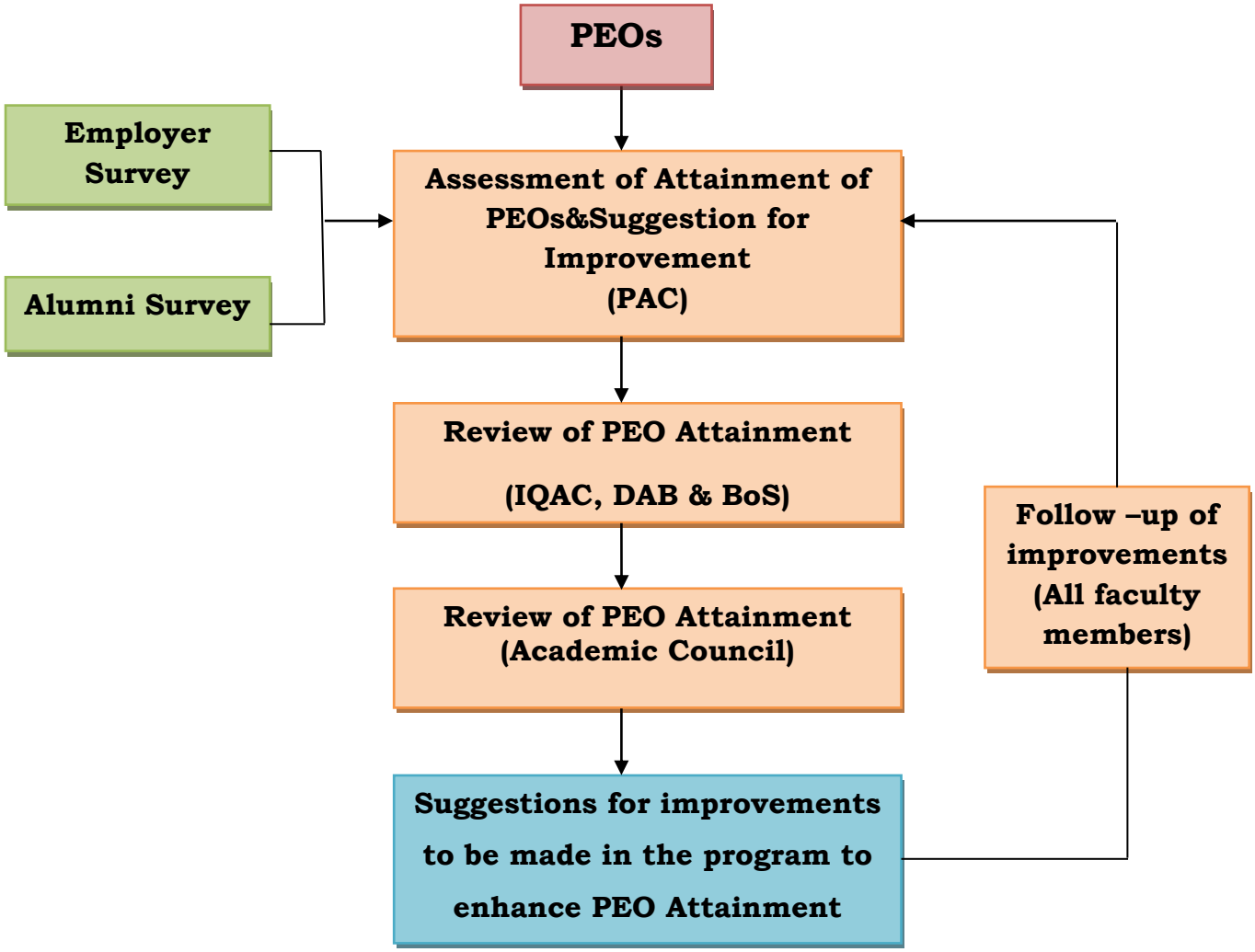
$$PO_{Attainment} = 0.8 * PO_{Direct} + 0.2 * PO_{Indirect}$$

CHAPTER 12

Assessment forAchievement of

PROGRAM EDUCATIONAL OBJECTIVES

Program Educational Objectives provides the purpose of the program and the objectives should be reached to ensure that the expected accomplishments by the graduates after few of graduation. These accomplishments can be measured through the feedback obtained from Employer and Alumni.



- ***PAC – Program Assessment Committee***
- ***IQAC–Internal Quality Assurance Cell***
- ***DAB – Department Advisory Board***
- ***BoS – Board of Studies***
- ***PEOs - Program Educational Objectives***

Fig. 12.1 Process for the assessment of achievement of PEOs

12.1 Assessment Processfor the Assessment of Achievement of Program Educational Objectives

- The achievement of PEOs is analyzed using the indirect tools such as Alumni Survey, Employer Survey and focus group meetings with the employers/alumni. Employer Survey form and Alumni Survey form are designed to assess the achievement of the PEOs.
- Performance Matrices are provided in the Survey form to assess the achievement of the respective PEO.

Example: Assessment of PEO through the Performance Matrices in the Survey forms

PEO 1: B.E. Mechanical Engineering

Develop technical competency to become professionals with expertise in core areas of mechanical engineering. (Core competency)

Performance Matrices in Alumni Survey Form

- ❖ Ability to exhibit technical competence in your career
- ❖ Ability to develop/guide projects in core areas of mechanical engineering

Performance Matrices in Alumni Survey Form

- ❖ Ability to exhibit technical competence by the employee
- ❖ Ability to develop/guide projects in core areas of mechanical engineering

Measurement of PEO Achievement Percentage through Survey Forms

The achievement of the PEOs is measured using the feedback obtained through the survey forms with proper weightage.

Measurement PEO achievement using four point scale survey form

A- Excellent	B - Good	C - Satisfactory	D – Needs Improvement
4	3	2	1

The average score in percentage is calculated as given below:

$$\textbf{Average Score} = \frac{(4\times a)+(3\times b)+(2\times c)+(1\times d)}{4N}\times 100$$

a - No. of responses marked A b - No. of responses marked B

C - No. of responses marked C d - No. of responses marked D

N- Total Number of Students

PEO Achievement percentage = [(0.6 X S_{Alumni}) + (0.4 X $S_{Employer}$)]

S_{Alumni}- *Average Percentage of achievement through Alumni Survey forms*

$S_{Employer}$-*Average Percentage of Achievement through Employer Survey forms*

- The Programme Assessment Committee (PAC) submits the report of the PEO attainment analysis with the suggestions for improvements to the DAB.
- The DAB reviews the recommended changes to curriculum, content delivery or PEO assessment tools

CHAPTER 13

PROGRAM REVIEW

A Program Review is a rigorous, systematic, objective, impartial, expert-based examination, evaluation and self-evaluation of how effectively a program is working, as part of the on-going pursuit of higher levels of achievement and quality in the Institution, and in the service of program improvement. A program review involves: evaluation and self-evaluation; internal peer review; the involvement of external parties with the appropriate disciplinary expertise; and student, alumni, faculty and administrative input.

A Program Review includes:

- Preparation and submission of a self-evaluation document
- Review of the self-evaluation document by the Program Review Panel
- Collection and submission of additional documentation to the Program Review Panel
- Scrutiny of the documentation by the Program Review Panel
- A visit by the Program Review Panel to the Department offering Program
- Report submission to the appropriate authorities about the strength and weakness of the program, areas for improvement, and recommendations for further action
- Following the receipt of the report, a follow-up action plan for the program's development

13.1 Program Review Procedure:

Program review is conducted by peer review organized by the institution. Program Review is also conducted through external experts by applying for accreditation. Usually the National Board of Accreditation an external accreditation agency for Engineering Programs, reviews the program submits the report for further action. The following Program review process is adopted for the Programs:

- Program Review conducted by the Institution (Internal): Academic Audit
- Program Review conducted by External Experts: NBA Accreditation

13.1.1 Program Review by Academic Audit:

Academic audit is performed by a group of internal and external experts and their recommendations are incorporated to improve the quality of Education. The Academic Audit which is conducted once in a year reviews the progress of the programs.

Types of Audit:

1 Department Audit

2 Exam Cell Audit

Scope of Audit:

A) Program Audit

Quality assessment of:

- Curriculum Design and Development Process
- Teaching, Learning and Evaluation Process
- Research and Development Process
- Faculty Development Process
- Student support Process

B) Exam Cell Audit

- Quality assessment of:
- Question Paper Setting Process
- Examination Conducting Process
- Valuation Process
- Student Grievance Redressal Process

The Audit team submits its report to the appropriate authorities and suitable corrective actions are initiated.

13.1.2 Program Review through NBA Accreditation:

The program review is also carried out through external experts and the Program coordinator shall apply for the NBA accreditation. Expert team visits the Institution and evaluate the Program based on the following Criteria.

- Vision, Mission and Program Educational Objectives
- Program Curriculum and Teaching –Learning Processes
- Course Outcomes and Program Outcomes
- Students' Performance
- Faculty Information and Contributions
- Facilities and Technical Support
- Continuous Improvement
- First Year Academics
- Student Support Systems
- Governance, Institutional Support and Financial Resources
- Process of NBA Accreditation

The NBA Expert team submits its report to the Accreditation Agency the program receives the report from NBA. After receiving the report suitable corrective actions are initiated.

13.1.3 Program Review Analysis by IQAC

The audit report and the accreditation evaluation report are analyzed by the IQAC and recommend suitable corrective actions to the program coordinator. IQAC is also monitors the improvements made by the Programs based on the Program review and evaluation report.

13.1.4 Action Taken for Improvements by the Programs

After analysis, the respective Departments and Sections carry out necessary corrective action and improvements are made in the Program. Program level monitoring is also carried out through Program Assessment Committee (PAC) and it also reviewed in the IQAC.

Program Review is an important procedure for the successful conduct of the Program. It helps the Program to find out the areas in which improvements have to be made. The improvements made by the Program enhance the Quality of the Program.

Outcome based Education is an effective tool for

Quality Development of the Program!

Annexure I

Administrative Setup and Functions of Various Committees

Academic Council

Composition of Academic Council

1. The Principal (Chairman)
2. All the Heads of Departments in the college
3. Four teachers of the college representing different categories of teaching staff by rotation on the 11 basis of seniority of service in the college.
4. Not less than four experts/academicians from outside the college representing such areas as Industry, Commerce, Law, Education, Medicine, Engineering, Sciences etc., to be nominated by the Governing Body.
5. Three nominees of the university not less than Professors.
6. A faculty member nominated by the Principal (Member Secretary).

Functions of the Academic Council

The Academic Council shall have powers to:

a) Scrutinize and approve the proposals with or without modification of the Boards of Studies with regard to courses of study, academic regulations, curricula, syllabi and modifications thereof, instructional and evaluation arrangements, methods, procedures relevant thereto etc., provided that where the Academic Council differs on any proposal, it shall have the right to return the matter for reconsideration to the Board of Studies concerned or reject it, after giving reasons to do so.
b) Make regulations regarding the admission of students to different programmes of study in the college keeping in view the policy of the Government.
c) Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels.
d) Recommend to the Governing Body proposals for institution of new programmes of study.
e) Recommend to the Governing Body institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same.

f) Advise the Governing Body on suggestions(s) pertaining to academic affairs made by it.
g) Perform such other functions as may be assigned by the Governing Body.

Internal Quality Assurance Cell (IQAC)

Composition of the IQAC

IQAC may be constituted in every institution under the Chairmanship of the Head of the institution with heads of important academic and administrative units and a few teachers and a few distinguished educationists and representatives of local management and stakeholders.

The composition of the IQAC may be as follows:

1. Chairperson: Head of the Institution
2. Teachers to represent all level (Three to eight)
3. One member from the Management
4. Few Senior administrative officers
5. One nominee each from local society, Students and Alumni
6. One nominee each from Employers /Industrialists/Stakeholders
7. One of the senior teachers as the coordinator/Director of the IQAC

Functions

a) Development and application of quality benchmarks
b) Parameters for various academic and administrative activities of the institution
c) 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;
d) Collection and analysis of feedback from all stakeholders on quality-related institutional processes;
e) Dissemination of information on various quality parameters to all stakeholders;
f) Organization of inter and intra institutional workshops, seminars on quality related themes and promotion of quality circles;
g) Documentation of the various programmes/activities leading to quality improvement;

h) Acting as a nodal agency of the Institution for coordinating quality-related activities, including adoption and dissemination of best practices;
i) Development and maintenance of institutional database through MIS for the purpose of maintaining /enhancing the institutional quality;
j) Periodical conduct of Academic and Administrative Audit and its follow-up
k) Preparation and submission of the Annual Quality Assurance Report (AQAR) as per guidelines and parameters of NAAC.

BOARD OF STUDIES

Composition of Board of Studies

1. Head of the Department concerned (Chairman).
2. The entire faculty of each specialization.
3. Two subject experts from outside the Parent University to be nominated by the Academic Council. 12
4. One expert to be nominated by the Vice-Chancellor from a panel of six recommended by the college principal.
5. One representative from industry/corporate sector/allied area relating to placement.
6. One postgraduate meritorious alumnus to be nominated by the principal.The Chairman, Board of Studies, may with the approval of the principal of the college, co-opt:
    a) Experts from outside the college whenever special courses of studies are to be formulated.
    b) Other members of staff of the same faculty.

Term: The term of the nominated members shall be three years.

Meetings: The Board of Studies shall meet at least twice a year.

Functions

The Board of Studies of a Department in the college shall:

a) prepare syllabi for various courses keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and approval of the Academic Council;
b) suggest methodologies for innovative teaching and evaluation techniques;

c) suggest panel of names to the Academic Council for appointment of examiners; and
d) coordinate research, teaching, extension and other academic activities in the department/college.

Department Advisory Board (DAB)

Composition of Department Advisory Board

1. Head of the Department concerned (Chairman).
2. 2/3 student members from each year
3. 1/2 Alumni members
4. 1/2 Parents
5. 2 External Experts (1 academicians and 1 industrialists)
6. All faculty members of the dept.

Functions:

a) Reviews the curriculum and syllabi
b) Reviews and approves the statements of Vision, Mission, PEOs and POs.
c) Performs gap analysis to identify the improvements to be made in the Curriculum and Courses
d) Reviews the attainment of PEOs, POs and Cos
e) Suggests improvements to be made on course delivery methods and assessment tools to attain the Course Outcomes to meet the performance targets
f) Analyzes the need for redefining PEOs and POs
g) Monitors the achievement of Vision and Mission of the Department

Program Assessment Committee (PAC)

Composition of Program Assessment Committee

1. Head of the Department concerned (Chairman).
2. 3 student members from each year
3. Domain coordinators (or) Five senior faculty members of the Department

Functions:

a) Develops the draft curriculum of the programme
b) Plans the activities required for the attainment of PEOs and POs
c) Plans the Assessment Process for PEOs and POs
d) Fixes the performance target for the attainment of PEOs and POs

e) Prepares the Employer and Alumni survey forms to analyze the attainment of PEOs
f) Analyzes the inputs from the stakeholders for framing PEOs, POs and for curriculum design
g) Analyzes the necessary inputs in the PEO and PO assessment process and quantifies the attainment of PEOs and POs
h) Prepares the Employer and Student Exit Survey forms to analyze the attainment of POs
i) Reviews the report of CO attainment submitted by the course coordinators
j) Plans the improvements to be made for the attainment of PEOs, POs and COs
k) Prepares a report containing the details of attainment of PEOs, POs and COs and submits a report to the Department Advisory Board

Programme Coordinator – Head of the Department

Functions

a) Facilitates and monitors the effective implementation of OBE in the teaching learning process
b) Schedules the activities required for the attainment of PEOs and POs
c) Prepares the report of PEO and PO attainment after analyzing the various assessment results in the Programme Assessment Committee and submits the same to the Department Advisory Board
d) Prepares the report of PEO and PO attainment along with the suggestions given by the DAB members and submits the same to the IQAC
e) Initiates the further improvement process through the Department faculty to meet the performance targets

Domain/Module Coordinator

A Senior faculty member from each domain

Functions

a) Guides the Course coordinators in their domain towards preparation of Course Outcomes and course contents to meet the POs

b) Monitors the effectiveness of the teaching learning process towards attainment of course outcomes
c) Prepares the consolidated report of Course Outcome Attainment along with the suggestions for improvement and submits the same to the Programme Assessment Committee

Course Coordinator

Senior faculty member among the Course Instructors handling the same course

Functions

a) Performs the following activities in consultation with the Course Instructors
    i. Develops the course contents to meet the programme outcomes/course outcomes
    ii. Plans the content delivery methods for the various topics of the course
    iii. Plans the assessment tools to be used for the attainment analysis of Course Outcomes
    iv. Fixes the performance targets for each course outcome
    v. Prepares of Course Exit Survey
    vi. Plans the improvements to be made on course delivery methods and assessment tools to attain the Course Outcomes

b) Monitors the effectiveness of the teaching learning process towards attainment of course outcomes
c) Receives the Course Outcome Attainment details from the Course Instructors
d) Prepares the report of Course Outcome Attainment along with the suggestions for improvement and submits the same to the Domain Coordinator.

Course Instructor

Functions

a) Facilitates students learning
b) Conducts assessment for the attainment analysis of Course outcomes
c) Suggests improvements on course delivery methods and assessment tools to be made to attain the Course Outcomes

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COURSE EXIT SURVEY

Department of ----------

Academic year: 2019 – 2020

Name of the Course: ---------- **Sem.:** V

Name of the Course Instructor: _____ Sec.:

The Course Instructor

Please provide a ranking for overall impression about the performance of Course instructor. For each statement below please provide your ranking with a tick mark in the appropriate number.

4 - Excellent	3 - Good	2 - Satisfactory	1 – Needs improvement

S.No.	Question Text	4	3	2	1
1.	Presented the Course in a well organized manner				
2.	Stimulated interest in the course				
3.	Explained the Course content very clearly				
4.	Asked questions to promote interaction and reflective thinking				
5.	Used appropriate content delivery methods				
6.	Clarified all the doubts				
7.	Offered compliments for creativity				
8.	Engaged the class regularly and maintained discipline				
9.	Returned the valued answer scripts promptly providing feedback on the performance				
10.	Covered the entire syllabus at appropriate pace				

The Course:

Please provide a ranking for your overall impression of the course. For each statement please indicate your degree of agreement by circling the appropriate number.

4 – Strongly agree	3 - Agree	2 - Neutral	1 – Disagree

S.No.	Question Text	4	3	2	1
1.	The course is relevant to the programme of study				
2.	The course is at the right level for you				
3.	The course contents are sufficient				
4.	The recommended text and reference books are useful				
5.	The Course outcome assessment methods are appropriate				

The Course Outcomes:

By the end of this course, you should have the following skills and knowledge. Please rate your level of achievement for each of the outcomes.

S.No.	Question Text	4 Highest	3	2	1 Lowest
1.	Ability to apply FFTs for efficient implementation of linear convolutions.				
2.	Ability to design IIR and FIR filters				
3.	Ability to analyze signals and systems in both the time and frequency domain.				
4.	Ability to use CT and DT Fourier series.				
5.	Ability to apply the properties of the Fourier transform, Laplace transform and z-transform to real systems.				
Please offer any other additional comments.					

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STUDENT EXIT SURVEY ON PROGRAMME

Evaluation of Undergraduate Experience:

The list below contains some abilities and types of knowledge that may be developed in a B.E./B.Tech. Degree Program. Please indicate the extent to which each capacity was enhanced by your Undergraduate experience at Sethu Institute of Technology.

Your Responses below are for purpose of Evaluation							
A – Very Much		**B**- Moderately	**C** –Very Little	**D** – None			
S.No.	Question Text			Extent enhanced by SIT Experience			
				A	**B**	**C**	**D**
1	I can use my knowledge in mathematics science and engineering for practical purposes. ***(Engineering knowledge)***						
2	I can identify, plan and solve engineering problems***.(Problem Analysis)***						
3	I can use my engineering knowledge to create something new according to the needs***.(Design and development of solutions)***						
4	I can judge the situation and choose alternative solution to a problem when necessary***.(Investigation of complex problems)***						
5	I can use the necessary techniques, skills and modern engineering tools available at the time for engineering practice***.(Modern tool usage)***						
6	I can understand current affairs such as politics, socio-economic issues well***.(Engineer and Society)***						

7	I can identify and analyze social and environmental aspects of engineering activities***(Environmental sustainability)***				
8	I can understand my professional and ethical responsibilities***.(Ethics)***				
9	I can lead and supervise works and group of people with confidence***.(Teamwork)***				
10	I can work effectively in group of people from various departments and disciplines***.(Teamwork)***				
11	I can write my theory papers very effectively in English ***(Communication - written)***				
12	I can communicate orally, without difficulty, my subject and personal thoughts in English***(Communication - oral)***				
13	I can use the basic business financial management concepts in the planning, budgeting and allocation of resources in engineering projects. ***(Project Management and Finance)***				
14	I can learn new subjects on my own***.(Self learning)***				
15	I can continuously learn the developments in my subjects throughout my life**.(Lifelong learning)**				
16	**(PSO1)**				
17	**(PSO2)**				
18. Please offer any other additional comments for improvement of the programme.					

NAME : **SIGNATURE:**

BRANCH :

Estd : 1995

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EMPLOYER SURVEY ON PROGRAMME (PO ASSESSMENT)

Name of our Alumnus/Alumna			
Year of Passing		Branch	
Name and Address of the Organization			
Designation & Job Function			

Please rate the alumnus/alumna in the following aspects

A – Excellent	**B**- Good	**C** –Satisfactory	**D** – Needs improvement

S.No.	**Question Text**	Rate the alumnus			
		A	**B**	**C**	**D**
	I. Knowledge				
1.	Ability to apply Math Science and Engineering Knowledge (Engg. Knowledge)				
2.	Ability to formulate problems formulation and solve them (Problem Analysis)				
3.	Ability to collect and analyze appropriate data(Investigation of complex problems)				
4.	Ability to design a system component, procedures or process (Design and development of solutions)				
5.	Ability to learn new technologies (Life long learning)				
6.	Ability to use modern engineering tools (Modern tool usage)				
7.	(PSO1)				
8.	(PSO2)				
	II. Communication Skills (Communication)				
9.	Ability to communicate effectively				
10.	Ability to write reports				
11.	Ability to make presentations				
	III. Interpersonal Skills (Individual and Team work)				

12.	Ability to work in team				
13.	Ability to work with difficult colleagues				
14.	Ability to work and think independently				
15.	Ability to respect others views				
	IV. Management / Leadership Skills (Project Management and Finance)				
16.	Ability to manage time and do multitasking				
17.	Ability to manage human and material resources				
18.	Ability to make decisions				
	V.General				
19.	Ability to follow rules and regulations (Ethics)				
20.	Ability to respect ethical values (Ethics)				
21.	Ability to analyze social and environmental aspects of engineering activities (Environment and Sustainability)				
22.	Ability to understand current affairs such as political and socio-economic issues (Engineer and Society)				

Finally, in the space below and at your discretion, please comment on the strengths and weakness of SIT graduates as they have been hired into your business and perhaps ways in which we might change our program to accommodate your specific needs in a more efficient manner.
Please offer any other additional comments.

Thank you once again for your help.

Name	
Designation	
Official Address	

Date:

Company Seal **Signature**

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ALUMNI SURVEY ON PROGRAMME (PEO ASSESSMENT)

Date:

The Alumni Survey provides us with your evaluation of the utility of your SIT experience after you have had a chance to test it in the world. Please respond to the following questions so that the Department may benefit from your view of how the educational objectives were met and how the experience could be improved.

Name			
Mobile Number		E-Mail I.D.	
Year of Passing		Branch	
Qualification			
Current Employer			
Position & Job Function			
Status in the organization	Temporary ☐ Probationary ☐ Permanent ☐		
Official Address		Residential Address	

Your Responses below are for purpose of Evaluation							
A – Excellent		**B**- Good	**C** –Satisfactory	**D** – Needs improvement			
				Extent Enhanced by SIT Experience			
				A	**B**	**C**	**D**
	I. **Core Competence**						
1	Technical skills at the time of starting your career						
2	Improvement in technical and theoretical knowledge						
	II. Communication Skills						
3	Oral Communication						
4	Report Writing						
5	Presentation Skills						
	III. Interpersonal Skills						
6	Ability to work in team						
7	Ability to work in multicultural team						
8	Ability to work and think independently						
9	Ability to respect others views						
	IV. Life Long Learning						
10	Ability to learn and adapt to new technologies						
11	Interest shown in updating knowledge						
12	Please rate the level of satisfaction of SIT's learning experience						

	I. Core Competence	
1	What is the core area in which you are working?	
2	Mention the number of projects you have completed so far	
3	How many papers have you published in journals?	
4	Have you applied for/received any patents?	
5	How many promotions have you received since joining? Please give the details	
6	Are you working in Development section or R&D section?	
	II. Communication	
7	How often do you make presentations in meetings?	

8	How many official documents (project proposals, project reports) have you prepared so far?	
	III. Interpersonal Skills	
9	How many members are there in your team?	
10	Your position in the team (Team member / Team Leader)	
	II. Life Long Learning	
11	Have you obtained any professional certifications after B.E. qualification?	
12	Have you undergone any training programme inside or outside your organization? If yes, please give the details	**Yes** / **No** No. of Training Programmes:
13	Have you received any postgraduate degree. If so, please give the details	Name of the Degree : Year of Passing : Name and address of the Institution :

14. What aspects of SIT's learning experience in your Department were most memorable and/or beneficial?
15. What aspects of SIT's curriculum of your programme do you feel could be improved?
16. Please offer any other additional comments.

Thank you once again for your help.

Date:

Signature

Estd : 1995

SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti – 626 115.

(An Autonomous Institution)

Accredited by NAAC with 'A' Grade

Phone No. : **04566 – 308001 (4 lines*) Fax No. :* 04566 – 308000 *Website:* www.sethu.ac.in**

EMPLOYER SURVEY ON PROGRAMME (PEO ASSESSMENT)

Name of the Alumnus / Alumna			
Year of Passing		Branch	
Name and Address of the organisation			
Designation & Job Function			
Status of the alumnus in your organization	Temporary ☐ Probationary ☐ Permanent ☐		
Did the alumnus get appointment in your organization through campus interview?	YES ☐ NO ☐		

Please rate the alumnus/alumna in the following aspects.							
A – Excellent		**B**- Good	**C** –Satisfactory	**D** – Needs improvement			
				A	**B**	**C**	**D**
	I. Core Competence						
1	Technical skills at the time of joining						
2	Improvement in technical and theoretical knowledge						
	II. Communication Skills						
3	Oral Communication						
4	Report Writing						
5	Presentation Skills						
	III. Interpersonal Skills						
6	Ability to work in team						

7	Ability to work with difficult colleagues				
8	Ability to work and think independently				
9	Ability to respect others views				
	IV. Life Long Learning				
10	Ability to learn and adapt to new technologies				
11	Interest shown in updating knowledge				
	V. Ethics				
12	Ability to follow rules and regulations (Ethics)				
13	Ability to respect ethical values (Ethics)				
14	Please rate the level of satisfaction of SIT graduates as employees in your organization				

	I. Core Competence	
1	What is the core area in which the alumnus is working?	
2	How many projects has our alumnus completed successfully?	
3	Has the alumnus published any paper in journals? (Life Long Learning)	
	II. Communication	
4	How often does the alumnus make presentations in meetings	
5	How many official documents (Project Proposals and Project Reports) has the alumnus prepared?	
	III. Interpersonal Skills	
6	How many members are there in his team?	
7	The position of the alumnus in his team (Team member/Team Leader)	
	II. Life Long Learning	
8	Has our alumnus undergone any training programme inside or outside your organization? If yes, please give the details	Yes/No No. of Training Programmes:

Finally, in the space below and at your discretion, please comment on the strengths and weakness of SIT graduates as they have been hired into your business and perhaps ways in which we might change our program to accommodate your specific needs in a more efficient

manner.
Please offer any other additional comments.

Thank you once again for your help.

Name	
Designation	
Official Address	

Date:

Company Seal **Signature**