Outcome Based Education(OBE)- Policy

Lakireddy Bali Reddy College of Engineering
(Autonomous)
Mylavaram – 521230

1. Preamble

The institution adopts Outcome-Based Education (OBE) as a core academic framework to ensure that graduates achieve clearly defined competencies aligned with industry, society, and global standards. This policy integrates Outcome-Based Curriculum Design, Outcome-Based Teaching–Learning, and Outcome Attainment and Evaluation mechanisms.

2. Objectives

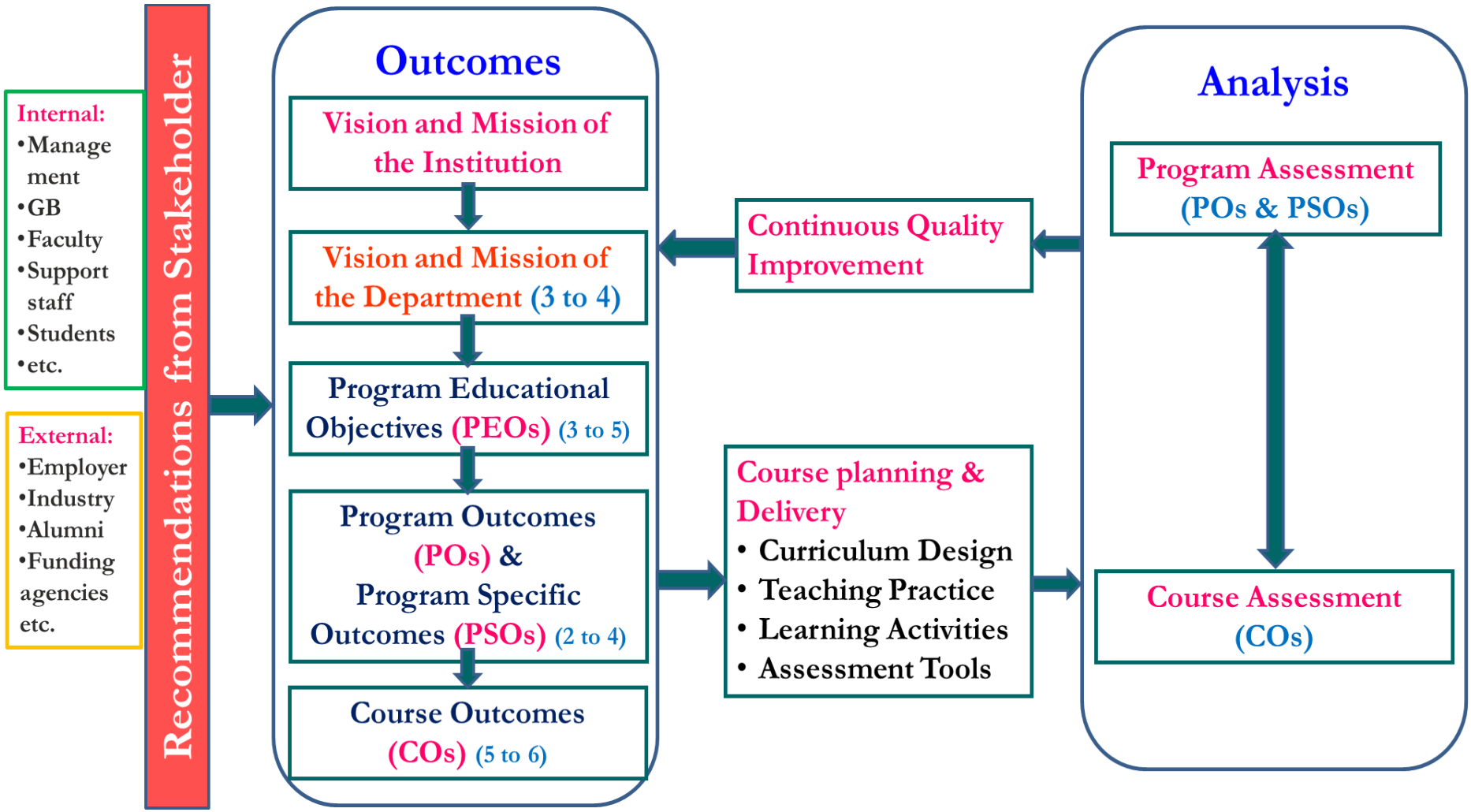
- To align academic programs with Program Outcomes (POs), Program Specific Outcomes (PSOs), and Course Outcomes (COs)
- To implement student-centric and experiential learning approaches
- To ensure continuous assessment and outcome attainment tracking
- To promote multidisciplinary, skill-based, and holistic education (as per NEP 2020)
- To enhance employability, innovation, and lifelong learning skills

3. Scope

This policy applies to:

- All UG/PG engineering programs
- Faculty, students, and academic administrators
- Curriculum design, delivery, and assessment processes

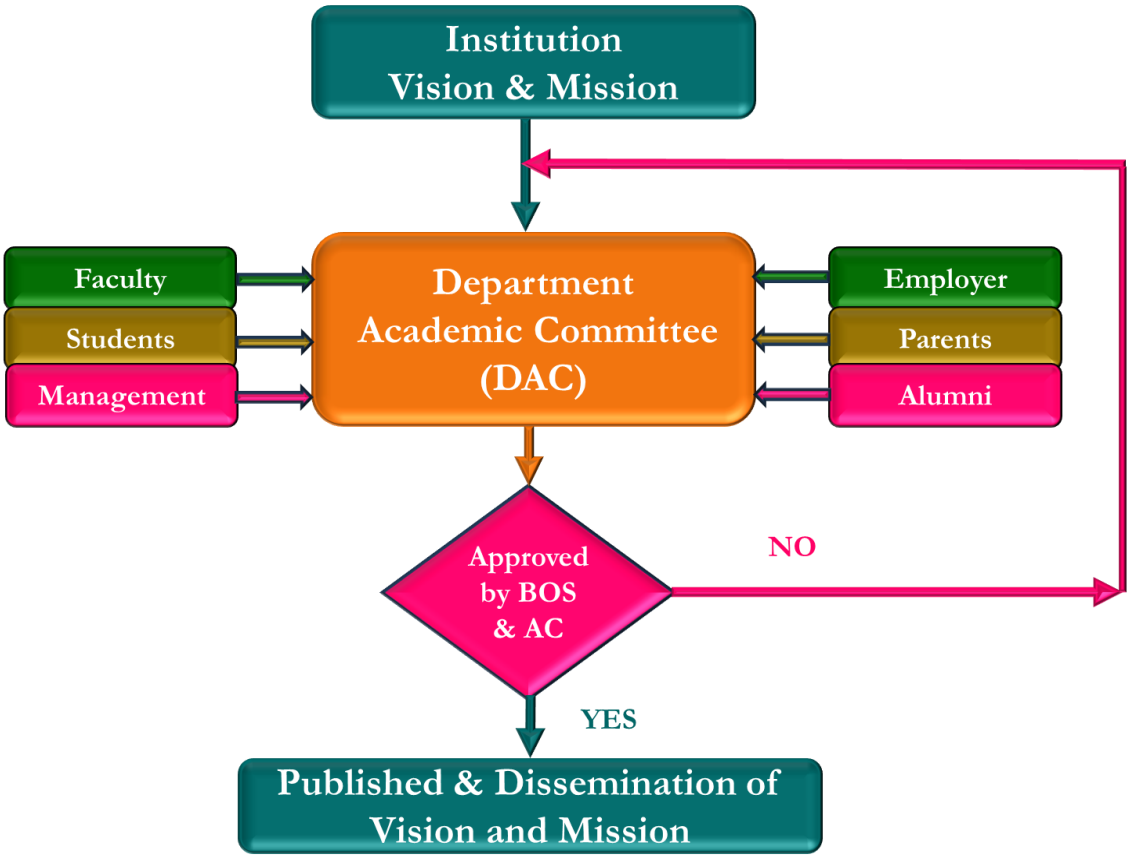
4. OBE FRAMEWORK:



4.1 .VISION, MISSION AND PROGRAM EDUCATIONAL OBJECTIVES

Process for defining the Vision and Mission of the Department

The department formulated its vision and mission statements through a consultative process involving the stakeholders of the department, the future scope of the department and the societal requirements as shown in Fig.



Process for defining the Vision and Mission of the Department

In establishing the vision and mission statements of the department, the following steps were followed.

The Vision and mission of the Institute is considered as a basis for identifying the Vision and Mission of the Department. These statements are arrived through brainstormed in a meeting consisting of the entire faculty and feedback from alumni and other stake holders. The proposed Vision and Mission statements of the Department are then approved by the Departmental Academic Committee, BoS and subsequently by the Academic council.

To achieve vision & Mission, department is committed to attaining national and international recognition among peer institutions for excellence in both research and teaching by:

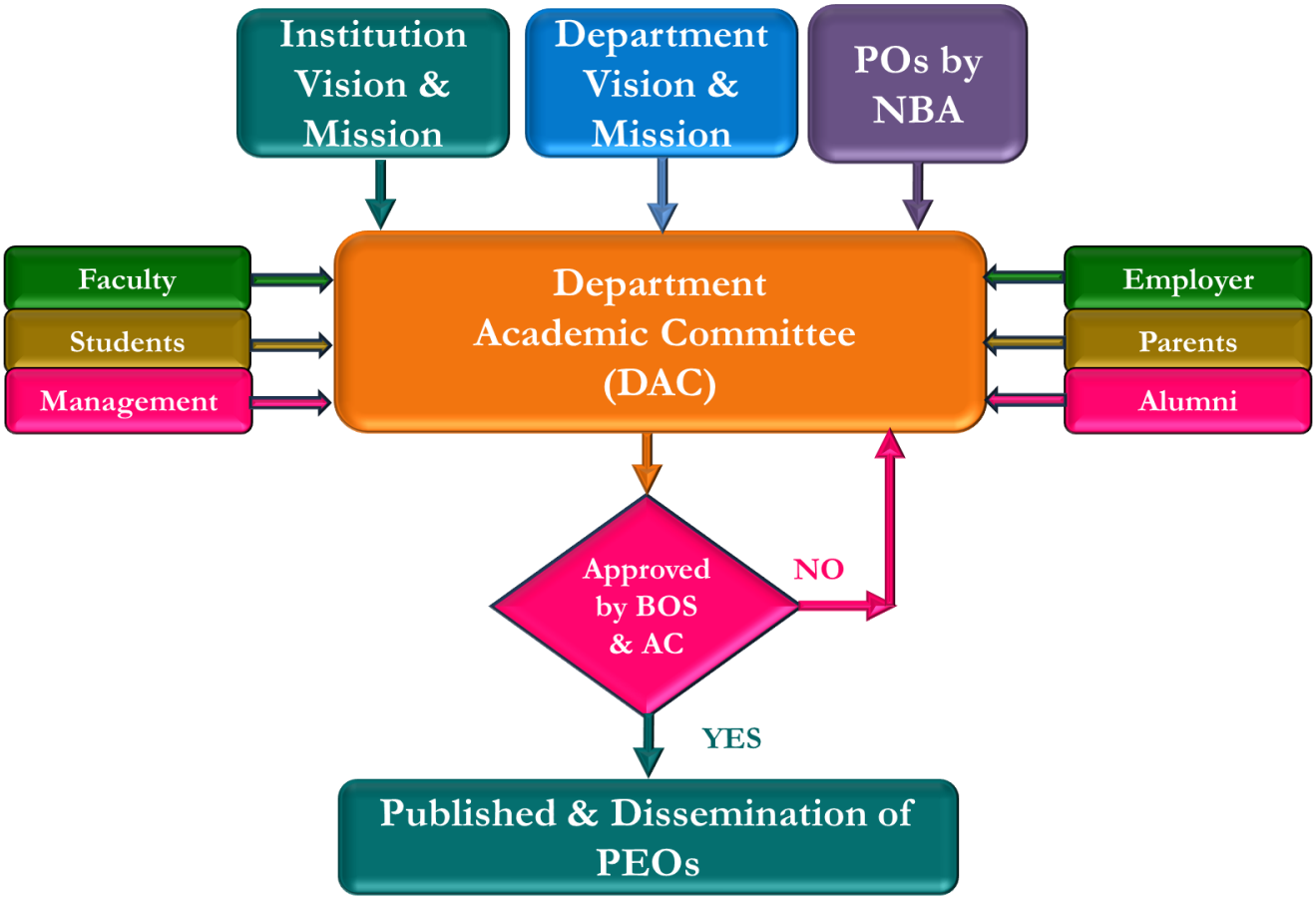
- Producing Graduating students who are well educated in technical knowledge, with solid communication & teamwork skills, sensitive to societal needs and possess high ethical standards
- Partnering with academic, industrial and government entities and consultancy to multinational and other blue-chip companies
- Updating and strengthening the quality of its programs according to the needs of the society
- Sustaining an entrepreneurial culture by public/private partnerships
- Keeping pace with scientific and technological progress in engineering
- Achieving higher quality placement while retaining 100 % placement as measured by number of top companies visiting campus e.g. high turnover companies, blue-chip companies etc.
- Increasing
  - ✓ publications in high Impact Factor Journals
  - ✓ number of citations per faculty member
  - ✓ number of PhDs (at least one per faculty member per year)

Four levels of outcomes from OBE are:

1. Program Educational Objectives (PEOs)
2. Program Outcomes (POs)
3. Program Specific Outcomes (PSOs)
4. Course Outcomes (COs)

4.2. Program Educational Objectives (PEOs)

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. PEOs are about professional and career accomplishment after 4 to 5 years of graduation. PEOs can be written from different perspectives like Career, Technical Competency and Behaviour. The PEOs of the program are identified through a process involving all the stakeholders, the future scope of the department and the societal requirements. The process involved in preparing PEOs is as below:



Process for defining the PEOs of the Program

The PEOs are established through the following steps:

1. Vision and Mission of the Institute and Department are taken as the basis to interact with the stakeholders.
2. The Graduate attributes are taken into account apart from information collected from Alumni in terms of career achievements, contribution to society, ethical practices and intellectual contributions.
3. Program Coordinator consults the stakeholders in the light of current status of the institute, teaching learning environment, student and faculty quality and infrastructure. Feedback from prospective employers and current employers of alumni are collected.
4. Department Academic Committee (DAC) reviews and recommends within the guidelines defined for the formulation of the PEOs. Every program may have 03 to 05 PEOs.
5. The proposed PEOs are submitted to BoS for approval.
6. PEOs approved by BoS are ratified by the Academic Council.

Adequacy in respect of publication & dissemination

The process for disseminating Vision, Mission, and PEOs is both comprehensive and strategic, ensuring they reach all stakeholders effectively. The department's purpose is to clearly communicate to all stakeholders. Stakeholders' feedback is highly valued and actively incorporated into the strategic planning process. Based on this input the department will set measurable goals and objectives which will serve as benchmarks for evaluating success and effectiveness over time. Vision, Mission, and PEOs are published through:

- **Institute Website**
- **Department Webpage**
- **On-Campus Locations**: HOD cabin, staff rooms, Classrooms, Laboratories
- **Publications and Digital Platforms**: Course structure and syllabi, Department Brochure, Laboratory manuals
- **Print Media:** Institute Brochure, Syllabi booklets

This meticulous approach ensures that the Vision, Mission, and PEOs are consistently Communicated across multiple channels, fostering clear and effective engagement with all Stakeholders. The Vision, Mission Process and PEOs are disseminated to the stakeholders as follows:

i). Students:

- **Orientation Day:** Vision and mission statements are clearly communicated to newly admitted learners and their parents.
- **Induction Program:** Detailed discussions on the vision, mission, and PEOs.
- **Classroom and Laboratory Displays:** Posters and banners with the Vision, Mission, and PEOs are displayed in classrooms, laboratories, and other prominent areas within the department.
- **Student Handbook:** Every student receives a handbook that includes detailed information about the department's Vision, Mission, and PEOs.
- **Regular Interactions:** Faculty members regularly discuss these objectives during lectures and practical sessions to ensure that students understand how they align with academic goals.

ii). Faculty:

- **Faculty Development Programs:** During faculty development programs and workshops, the Vision, Mission, and PEOs are communicated.
- **Departmental Meetings:** The Vision, Mission, and PEOs are discussed and reinforced during department-level meetings, ensuring they remain central to faculty activities.

iii). Parents:

- **Orientation Day:** Vision and mission statements are clearly communicated to newly admitted learners and their parents.
- **Parent-Teacher Meetings:** During these meetings, parents are informed about the department's Vision, Mission, and PEOs to align their expectations with the department's goals.
- **College Website:** Parents can access this information via the official college website, which outlines the educational objectives and values of the department.

- **Graduation Day:** On the occasion of Graduation Day, parents are briefed regarding how various PEOs have been attained by the passing out students.

iv). Alumni:

- **Alumni Engagement Programs:** During alumni meetings and events, the Vision, Mission, and PEOs are communicated to keep alumni connected to the department's evolving objectives.
- **Alumni Portal and Newsletters:** Alumni receive periodic newsletters, which include the department's ongoing alignment with its Vision, Mission, and PEOs.

v). External Stakeholders:

- **Industry-Institute Interaction:** During the collaborative meetings, internships, MoUs, and workshops with industry partners, the department's Vision, Mission, and PEOs are shared to foster alignment with industry expectations and opportunities.
- **Brochures and Reports:** The department provides brochures, annual reports, and placement reports to companies, outlining its Vision, Mission, and PEOs to attract potential recruiters and collaborators.

vi). Regulatory and Accrediting Bodies:

- **Accreditation and Audit Reports:** The Vision, Mission, and PEOs are included in documentation for accreditation bodies such as NAAC, NBA, and AICTE, as well as in audit reports to demonstrate the department's commitment to quality education.
- **Presentations and Documentation:** During reviews to external committees, these objectives are presented to demonstrate alignment with various accrediting bodies.

This multi-level approach ensures that all stakeholders are aware of and enlightened with the department's Vision, Mission, and PEOs, thereby committing towards achieving these objectives. This ensures comprehensive communication and engagement across all levels of the institution.

4.3. Program Outcomes (POs)

POs are narrower statements that describe what students are expected to know and be able to do upon the graduation. POs are related to the skills, knowledge and behaviour that students acquire in their matriculation through the program. POs are Graduate Attributes (GAs) defined by NBA as per Washington Accord. POs are to be specific, measurable and achievable. The Pos are:

PO No.	PO Statement
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. (WK1 to WK4)
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. (WK1 to WK4)
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. (WK5)
PO4	**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. (WK8)
PO5	**Engineering Tool Usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 to WK6)
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. (WK9)
PO8	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO10	**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.
PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

SUSTAINABLE DEVELOPMENT GOALS

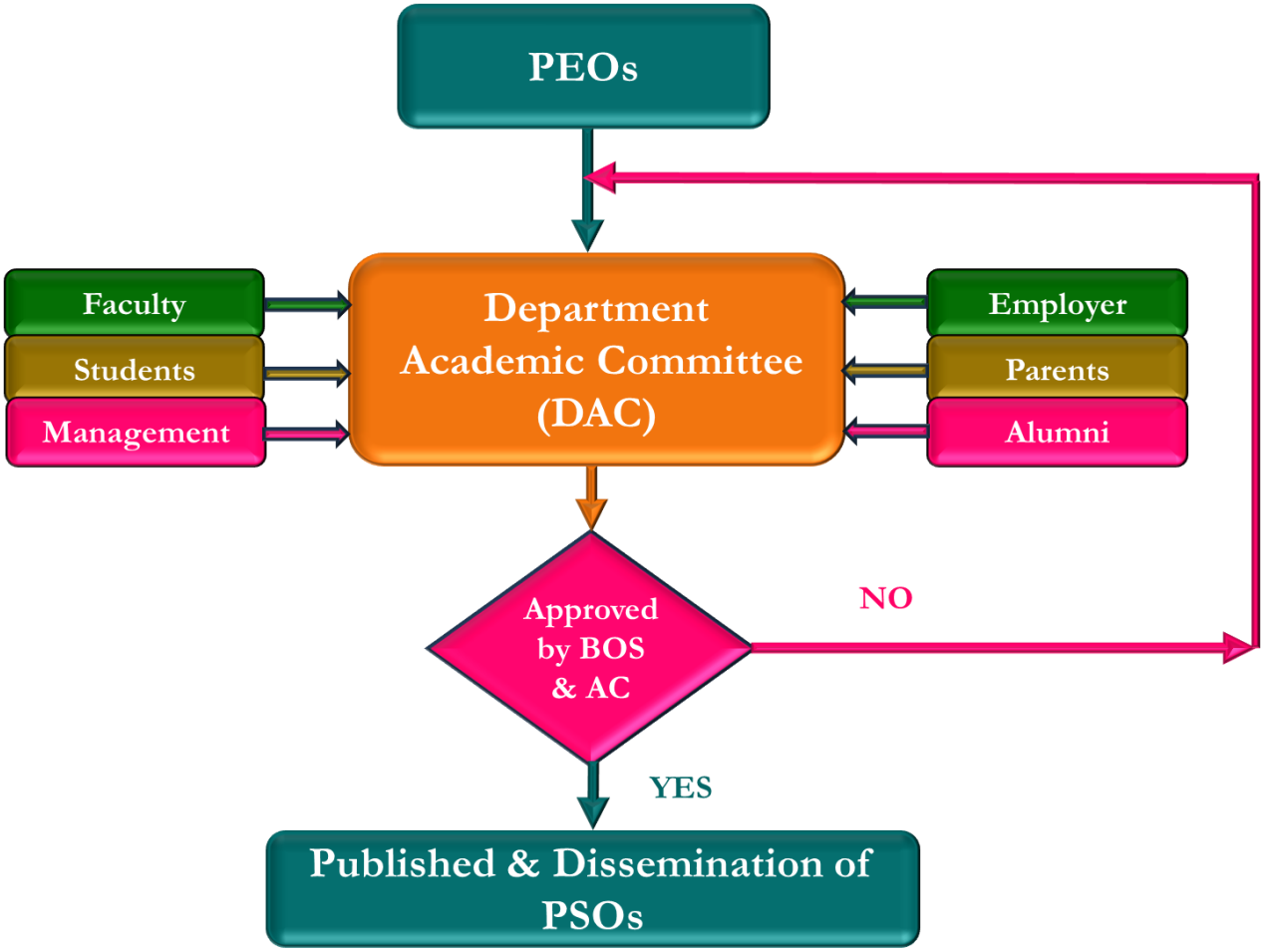
The Sustainable Development Goals or Global Goals are a collection of 17 interlinked global goals designed to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The SDGs were set up in 2015 by the United Nations General Assembly and are intended to be achieved by 2030.

LBRCE stands at the forefront of a transformative journey, where ideals are not confined to textbooks but woven into the fabric of everyday actions. Our commitment to Sustainable Development Goals (SDGs) is not just a statement but a living, breathing ethos that guides every decision and initiative we undertake. As one of the best engineering colleges in India, LBRCE employs a multifaceted approach to bridge the gap between theory and practice, propelling forward the implementation of SDGs with unwavering dedication and innovative strategies.

The 17 SDGs are integrated - that is, **Sustainable Development Goals** recognize that action in one area will affect outcomes in others, and that development must balance social, economic, and environmentalsustainability.

4.4. Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are statements that describe what the graduates of a specific engineering program should be able to do. Up to 03 PSOs are recommended The process involved in preparing PSOs is as below:



Process for defining the PSOs of the Program

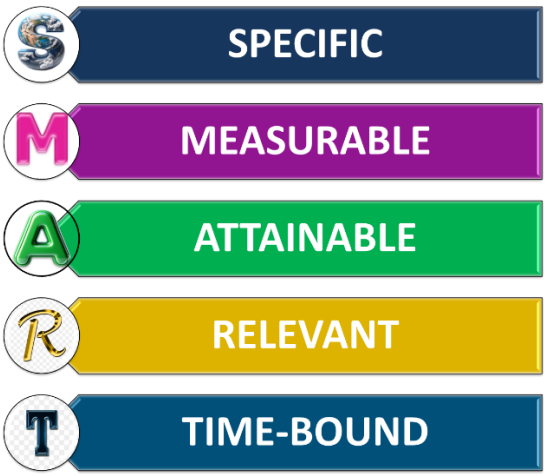
4.5. Course Outcomes (COs)

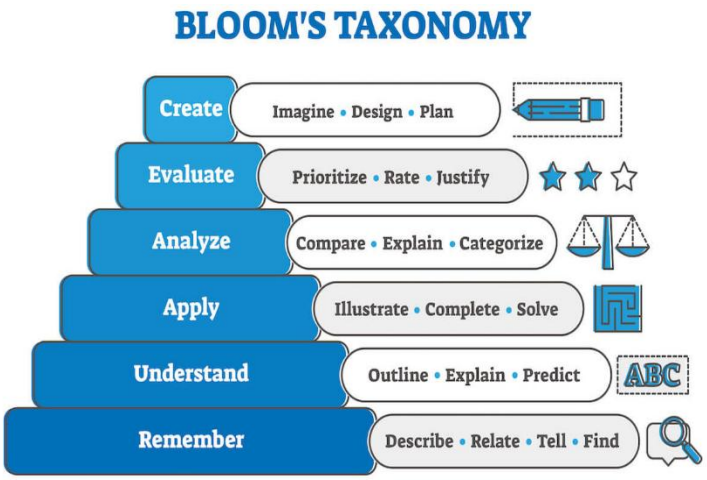
A Course Outcome is a formal statement of what students are expected to learn in a course. COs are related to the skills, knowledge and behaviour that students acquire in their matriculation through the course. When creating Course Outcomes remember that the outcomes should clearly state what students will do or produce to determine and/or demonstrate their learning. Course outcome statements refer to specific knowledge, practical skills, areas of professional development, attitudes, higher- order thinking skills, etc. that faculty members expect students to develop, learn, or master during a course.

A well-formulated set of Course Outcomes will describe what a faculty member hopes to successfully accomplish in offering their particular course(s) to prospective students, or what specific skills, competencies, and knowledge the faculty member believes that students will have attained once the course is completed. The maximum number of outcomes for a course is expected to be around 6. The following parameters to be consider while defining course outcomes.

- **Context and level:** Consider the context and level of the outcomes.
- **Types of outcomes:** Define multiple types of outcomes at each level.
- **Measurability:** Ensure that each outcome is measurable in some way.
- **Alignment:** Ensure that the outcomes are aligned with other outcomes and the goals of the department or college.
- **Action verbs:** Use action verbs to describe the intended cognitive process and what the learner is expected to do.
- **Student-centered:** Write outcomes from the student's perspective and in language they can understand.
- **Concise:** Write outcomes in short, succinct sentences.
- **Meaningful:** Emphasize higher-order thinking and ensure outcomes are consistent with the learning outcomes of the department or college.
- **Achievable:** Ensure that the outcomes are achievable within the time available.
- **Mapping:** Map the course outcomes to the program outcomes (POs).

Structure of Course Outcomes





Action: Represents a cognitive/ affective/ psychomotor activity (Bloom's Taxonomy) the learner should perform. An action is indicated by an action verb, occasionally two, representing the concerned cognitive process(es).

Knowledge: Represents the specific knowledge from any one or more of the eight knowledge Categories

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

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

The process for defining course outcomes involves several steps, including:

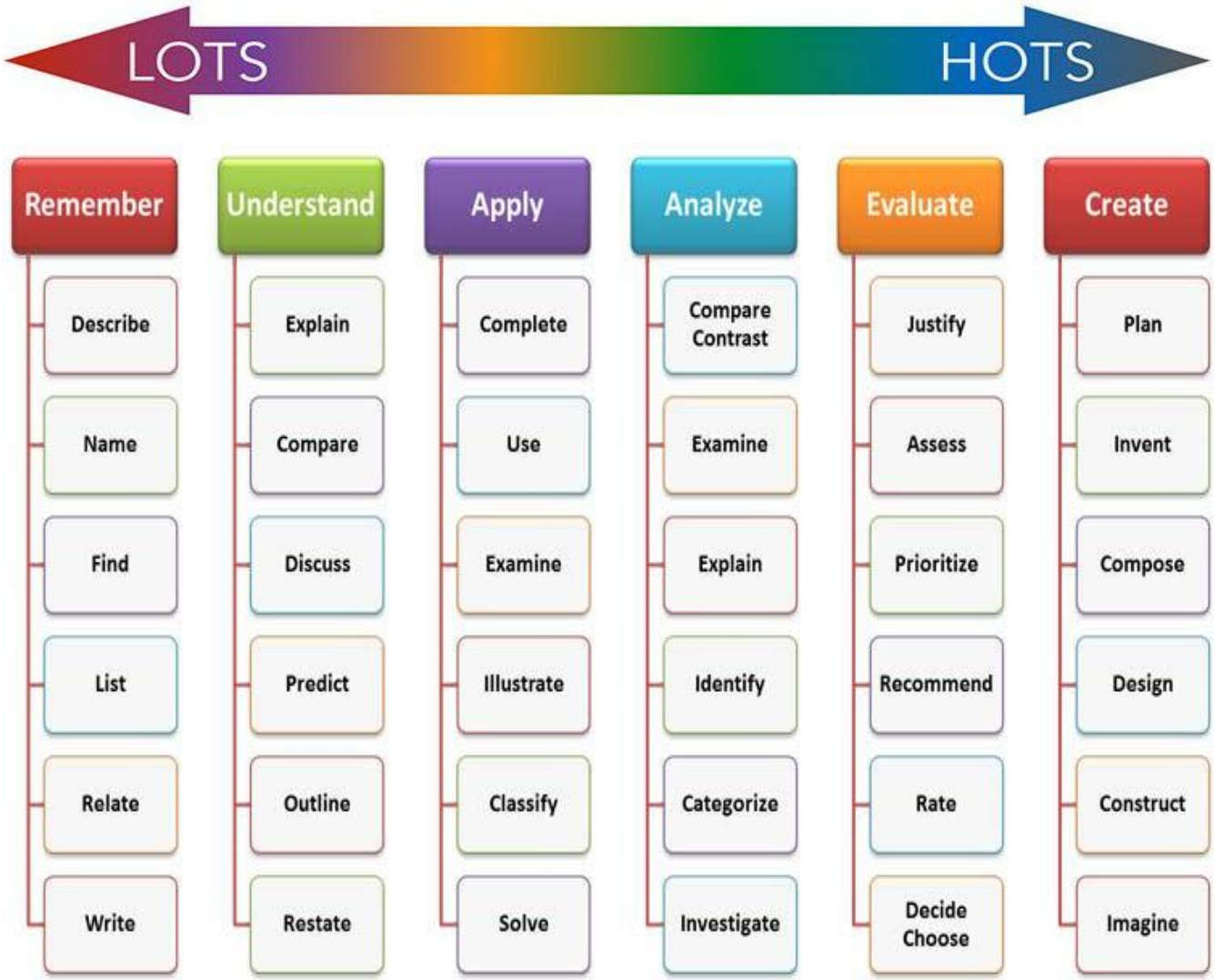
The Course Outcomes and targets are framed through discussion with course instructor, Course Coordinator Committee (CCC), Module Coordinator committee (MCC), Programme Assessment Committee (PAC), Department Academic Committee (DAC) and finally approved in BoS meetings. The prepared COs are in line with POs and PSOs statement of the program.

List of Action Words Related to Critical Thinking Skills

Here is a list of action words that can be used when creating the expected student learning outcomes related to critical thinking skills in a course. These terms are organized according to the different levels of thinking skills contained in Anderson and Krathwohl's (2001) revised version of Bloom's taxonomy.

Here is the revised Bloom's document with action verbs, which we frequently refer while writing COs for our courses.

The cognitive process dimensions- categories:



Action Verbs for Assessment

Bloom's Level	Skill Demonstrated	Question cues / Verbs for tests
1. Remember	• Ability to recall of information like facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria. • Ability to recall methodology and procedures, abstractions, principles, and theories in the field. • knowledge of dates, events, places • mastery of subject matter	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when and where
2. Understand	• understanding information • grasp meaning. • translate knowledge into new context. • interpret facts, compare, contrast. • order, group, infer causes. • predict consequences	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
3. Apply	• use information. • use methods, concepts, laws, theories in new situations. • solve problems using required skills or knowledge. • Demonstrating correct usage of a method or procedure	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
4. Analyse	• break down a complex problem into parts. • Identify the relationships and interaction between the different parts of a complex problem. • identify the missing information, sometimes the redundant information and the contradictory information, if any	classify, outline, break down, categorize, analyse, diagram, illustrate, infer, select
5. Evaluate	• compare and discriminate between ideas. • assess value of theories, presentations • make choices based on reasoned argument. • verify value of evidence • recognize subjectivity. • use of definite criteria for judgments	assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
6. Create	• use old ideas to create new ones. • Combine parts to make (new)whole, • generalize from given facts. • relate knowledge from several areas. • predict, draw conclusions	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

4.5.1. CO-PO Course Articulation Matrix

Mapping Course Articulation Matrix shows the educational relationship (Level of Learning achieved) between course outcomes and program outcomes for a course. This matrix strongly indicates whether the students can achieve the course outcomes. The matrix can be used for any course and is a good way to evaluate a course syllabus. You need to understand the intention of each POs and the Bloom's level to which each of these action verbs in the POs correlates to. Once you have understood the POs then you can write the COs for a course and see to what extent each of those CO's correlate with the POs/PSOs.

The program outcomes are achieved through a curriculum that offers number of courses. Each course has defined course outcomes that are linked to the program outcomes and a set of performance criteria that are used to provide quantitative measurement of how well course outcomes are achieved. The course outcomes are directly and quantitatively assessed and are tied to the program outcomes. Therefore, if the course outcomes are met that provides direct quantitative evidence that program outcomes are met. The corelation level of COs of each course with POs and PSOs as defined below

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

Action verbs used in the POs and the nature of POs, stating whether the POs are technical or non-technical are shown below

Type	POs	Action Verb(s) in POs	Bloom's level(s) for POs	Bloom's level(s) for COs
Technical Skills	PO -1	Apply	L3	• Bloom's L1 to L4 for theory courses. • Bloom's L1 to L5 for laboratory courses. • Bloom's L3 to L6 for project work, and experiential learning.
	PO -2	Identify	L2	
		Formulate	L6	
		Review	L2	
	PO -3	Design	L6	
		Develop	L3, L6	
	PO -4	Analyze	L4	
		Interpret	L2, L3	
		Design	L6	
	PO -5	Create	L6	
		Select	L2, L6	
		Apply	L3	

Type	POs	Bloom's level(s) for COs
Non-Technical Skills	PO -6	**Thumb Rule:** If Bloom's L1 Action Verbs of a CO: Correlates with any of PO6 to PO12, then assign 1. If Bloom's L2 to L3 Action Verbs of a CO: Correlates with any of PO6 to PO12, then assign 2. If Bloom's L4 to L6 Action Verbs of a CO: Correlates with any of PO6 to PO12, then assign 3
	PO -7	
	PO -8	
	PO -9	
	PO -10	
	PO -11	
	PO -12	

Summary of CO-PO Relation (Key shortcuts)

Bloom's Level	POs
Remember	PO6 to PO12
Understand	PO1 (Engineering Knowledge) and PO12 (Life-long learning)
Apply	PO1 (Engineering Knowledge) PO4 (Conduct investigations of complex problems) and PO12 (Life-long learning)
Analyze	PO2 (Problem Analysis) PO4 (Conduct investigations of complex problems) PO7 (Environment and Sustainability) and PO11 (Project Management and Finance)
Evaluate	PO2 (Problem Analysis) PO4 (Conduct investigations of complex problems) PO6 (The Engineer and Society) PO7 (Environment and Sustainability) PO9 (Individual and Teamwork) PO10 (Communication) PO11 (Project Management and Finance)
Design	PO3 (Design/Development of Solutions) PO5 (Modern Tool Usage) PO11 (Project Management and Finance)
Create	PO5 (Modern Tool Usage) PO7 (Environment and Sustainability)

4.5.2. Process for mapping the values for CO-PO Matrix

1. Identify the key competencies of POs/PSOs to each CO and make a corresponding mapping table with assigning correlation level at the corresponding cell. One observation to be noted is that the first five POs are purely technical in nature, while the other POs are non-technical.
2. Justify each CO - PO/PSO mapping with a justification statement and recognize the number of vital features mentioned in the justification statement that are matching with the given Key Attributes for Assessing Program Outcomes. Use a combination of words found in the COs, POs/PSOs and your course syllabus for writing the justification.
3. Make a table with number of key competencies for CO – PO/PSO mapping with reference to the maximum given Key Attributes for Assessing Program Outcomes.
4. Make a table with percentage of key competencies for CO – PO/PSO mapping with reference to the maximum given Key Attributes for Assessing Program Outcomes.
5. Finally, Course Articulation Matrix (CO - PO / PSO Mapping) is prepared with COs and POs and COs and PSOs on the scale of 1 to 3 based on the following strategy.

Rules for CO-PO articulation:

- If CO addressing 50% of PIs of respective PO, then weightage is 3.
- If CO addressing 30% to 50% of PIs respective PO, then weightage is 2.
- If CO tags to 1%≤ 30% of PIs of respective PO, then weightage is 1.

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

Competency	Performance Indicators (5)
1.1 Demonstrate competence in mathematical modelling	1.1.1 Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problems
	1.1.2 Apply advanced mathematical techniques to model and solve mechanical engineering problems
1.2 Demonstrate competence in basic sciences	1.2.1 Apply laws of natural science to an engineering problem
1.3 Demonstrate competence in engineering fundamentals	1.3.1 Apply fundamental engineering concepts to solve engineering problems
1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply program core engineering concepts to solve engineering problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Competency	Performance Indicators (13)
2.1 Demonstrate an ability to identify and formulate complex engineering problem	2.1.1 Articulate problem statements and identify objectives
	2.1.2 Identify engineering systems, variables, and parameters to solve the problems
	2.1.3 Identify the mathematical, engineering, and other relevant knowledge that applies to a given problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe complex problems into interconnected sub-problems
	2.2.2 Identify, assemble, and evaluate information and resources.
	2.2.3 Identify existing processes/solution methods for solving the problem, including forming justified approximations and assumptions
	2.2.4 Compare and contrast alternative solution processes to select the best process.

2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Combine scientific principles and engineering concepts to formulate model/s (mathematical or otherwise) of a system or process that is appropriate in terms of applicability and required accuracy.
	2.3.2 Identify assumptions (mathematical and physical) necessary to allow modelling of a system at the level of accuracy required.
2.4 Demonstrate an ability to execute a solution process and analyse results	2.4.1 Apply engineering mathematics and computations to solve mathematical models
	2.4.2 Produce and validate results through skilful use of contemporary engineering tools and models
	2.4.3 Identify sources of error in the solution process, and limitations of the solution.
	2.4.4 Extract desired understanding and conclusions consistent with objectives and limitations of the analysis

PO3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

Competency	Performance Indicators (13)
3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms.	3.1.1 Recognize that need analysis is key to good problem definition
	3.1.2 Elicit and document, engineering requirements from stakeholders
	3.1.3 Synthesize engineering requirements from a review of the state-of-the-art
	3.1.4 Extract engineering requirements from relevant engineering Codes and Standards
	3.1.5 Explore and synthesize engineering requirements considering health, safety risks, environmental, cultural and societal issues
	3.1.6 Determine design objectives, functional requirements and arrive at specifications
	3.2.1 Apply formal idea generation tools to develop multiple engineering design solutions

3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.2 Build models/prototypes to develop a diverse set of design solutions
	3.2.3 Identify suitable criteria for the evaluation of alternate design solutions
3.3 Demonstrate an ability to select an optimal design scheme for further development	3.3.1 Apply formal decision-making tools to select optimal engineering design solutions for further development
	3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development.
3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Refine a conceptual design into a detailed design within the existing constraints (of the resources)
	3.4.2 Generate information through appropriate tests to improve or revise the design

PO4: 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.

Competency	Performance Indicators (10)
4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem, its scope and importance for purposes of investigation
	4.1.2 Examine the relevant methods, tools and techniques of experiment design, system calibration, data acquisition, analysis, and presentation
	4.1.3 Apply appropriate instrumentation and/or software tools to make measurements of physical quantities
	4.1.4 Establish a relationship between measured data and underlying physical principles.
4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop an experimental approach, specify appropriate equipment and procedures.
	4.2.2 Understand the importance of the statistical design of experiments and choose an appropriate experimental design plan based on the study objectives

4.3 Demonstrate an ability to analyse data and reach a valid conclusion.	4.3.1 Use appropriate procedures, tools, and techniques to conduct experiments and collect data
	4.3.2 Analyse data for trends and correlations, stating possible errors and limitations
	4.3.3 Represent data (in tabular and/or graphical forms) to facilitate analysis and explanation of the data, and drawing of conclusions
	4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations**.**

Competency	Performance Indicators (6)
5.1 Demonstrate an ability to identify/ create modern engineering tools, techniques, and resources.	5.1.1 Identify modern engineering tools such as computer-aided drafting, modelling, and analysis; techniques and resources for engineering activities
	5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems.
5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques, and resources	5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.
	5.2.2 Demonstrate proficiency in using discipline-specific tools
5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1 Discuss limitations and validate tools, techniques, and resources
	5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

Competency	Performance Indicators (2)
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional, and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation, and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

Competency	Performance Indicators (4)
7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1 Identify risks/impacts in the life cycle of an engineering product or activity
	7.1.2 Understand the relationship between the technical, socio-economic, and environmental dimensions of sustainability
7.2 Demonstrate an ability to apply principles of sustainable design and development	7.2.1 Describe management techniques for sustainable development
	7.2.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Competency	Performance Indicators (3)
8.1 Demonstrate an ability to recognize ethical dilemmas	8.1.1 Identify situations of unethical professional conduct and propose ethical alternatives
8.2 Demonstrate an ability to apply the Code of Ethics	8.2.1 Identify tenets of the program professional code of ethics
	8.2.2 Examine and apply moral & ethical principles to known case studies

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Competency	Performance Indicators (7)
9.1 Demonstrate an ability to form a team and define a role for each member	9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team
	9.1.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective teamwork, to accomplish a goal.
9.2 Demonstrate effective individual and team operations--communication, problem-solving, conflict resolution and leadership skills	9.2.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills
	9.2.2 Treat other team members respectfully
	9.2.3 Listen to other members
	9.2.4 Maintain composure in difficult situations
9.3 Demonstrate success in a team-based project	9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Competency	Performance Indicators (7)
10.1 Demonstrate an ability to comprehend technical literature and document project work	10.1.1 Read, understand and interpret technical and non-technical information
	10.1.2 Produce clear, well-constructed, and well-supported written engineering documents
	10.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear
10.2 Demonstrate competence in listening, speaking, and presentation	10.2.1 Listen to and comprehend information, instructions, and viewpoints of others
	10.2.2 Deliver effective oral presentations to technical and non-technical audiences
10.3 Demonstrate the ability to integrate different modes of communication	10.3.1 Create engineering-standard figures, reports and drawings to complement writing and presentations
	10.3.2 Use a variety of media effectively to convey a message in a document or a presentation

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

Competency	Performance Indicators (5)
11.1 Demonstrate an ability to evaluate the economic and financial performance of an engineering activity	11.1.1 Describe various economic and financial costs/benefits of an engineering activity
	11.1.2 Analyse different forms of financial statements to evaluate the financial status of an engineering project
11.2 Demonstrate an ability to compare the costs/benefits of alternate proposals for an engineering activity	11.2.1 Analyse and select the most appropriate proposal based on economic and financial considerations.
11.3 Demonstrate an ability to plan/manage an engineering activity within time and budget constraints	11.3.1 Identify the tasks required to complete an engineering activity, and the resources required to complete the tasks.
	11.3.2 Use project management tools to schedule an engineering project, so it is completed on time and on budget.

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

Competency	Performance Indicators (6)
12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1 Describe the rationale for the requirement for continuing professional development.
	12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap.
12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current.
	12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field.
12.3 Demonstrate an ability to identify and access sources for new information	12.3.1 Source and comprehend technical literature and other credible sources of information.
	12.3.2 Analyse sourced technical and popular information for feasibility, viability, sustainability, etc.

Program Outcomes – Competencies – Performance Indicators (CSE and IT)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.	
Competency	**Indicators (5)**
1.2 Demonstrate competence in mathematical modelling	1.2.1 Apply the knowledge of discrete structures, linear algebra, statistics and numerical techniques to solve problems 1.2.2 Apply the concepts of probability, statistics and queuing theory in modeling of computer-based system, data and network protocols.
1.5 Demonstrate competence in basic sciences	1.5.1 Apply laws of natural science to an engineering problem
1.6 Demonstrate competence in engineering fundamentals	1.6.1 Apply engineering fundamentals
1.7 Demonstrate competence in specialized engineering knowledge to the program	1.7.1 Apply theory and principles of computer science and engineering to solve an engineering problem
PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	
Competency	**Indicators (14)**
2.1 Demonstrate an ability to identify and formulate complex engineering problem	2.1.1 Evaluate problem statements and identifies objectives 2.1.2 Identify processes/modules/algorithms of a computer-based system and parameters to solve a problem 2.1.3 Identify mathematical algorithmic knowledge that applies to a given problem
2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1 Reframe the computer-based system into interconnected subsystems 2.2.2 Identify functionalities and computing resources. 2.2.3 Identify existing solution/methods to solve the problem, including forming justified approximations and assumptions 2.2.4 Compare and contrast alternative solution/methods to select the best methods 2.2.5 Compare and contrast alternative solution processes to select the best process.
2.3 Demonstrate an ability to formulate and interpret a model	2.3.1 Able to apply computer engineering principles to formulate modules of a system with required applicability and performance. 2.3.2 Identify design constraints for required performance criteria.
2.4 Demonstrate an ability to execute a solution process and analyze results	2.4.1 Applies engineering mathematics to implement the solution. 2.4.2 Analyze and interpret the results using contemporary tools.

	2.4.3 Identify the limitations of the solution and sources/causes. 2.4.4 Arrive at conclusions with respect to the objectives.
PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.	
Competency	**Indicators (14)**
3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms	3.1.1 Able to define a precise problem statement with objectives and scope. 3.1.2 Able to identify and document system requirements from stake- holders. 3.1.3 Able to review state-of-the-art literature to synthesize system requirements. 3.1.4 Able to choose appropriate quality attributes as defined by ISO/IEC/IEEE standard. 3.1.5 Explore and synthesize system requirements from larger social and professional concerns. 3.1.6 Able to develop software requirement specifications (SRS).
3.2 Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1 Able to explore design alternatives. 3.2.2 Able to produce a variety of potential design solutions suited to meet functional requirements. 3.2.3 Identify suitable non-functional requirements for evaluation of alternate design solutions.
3.3 Demonstrate an ability to select optimal design scheme for further development	3.3.1 Able to perform systematic evaluation of the degree to which several design concepts meet the criteria. 3.3.2 Consult with domain experts and stakeholders to select candidate engineering design solution for further development
3.4 Demonstrate an ability to advance an engineering design to defined end state	3.4.1 Able to refine architecture design into a detailed design within the existing constraints. 3.4.2 Able to implement and integrate the modules. 3.4.3 Able to verify the functionalities and validate the design.
PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	
Competency	**Indicators (8)**
4.1 Demonstrate an ability to conduct investigations of technical issues consistent with their level of knowledge and understanding	4.1.1 Define a problem for purposes of investigation, its scope and importance 4.1.2 Able to choose appropriate procedure/algorithm, dataset and test cases. 4.1.3 Able to choose appropriate hardware/software tools to conduct the experiment.

4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop appropriate procedures/methodologies based on the study objectives
4.3 Demonstrate an ability to analyze data and reach a valid conclusion	4.3.1 Use appropriate procedures, tools and techniques to collect and analyze data 4.3.2 Critically analyze data for trends and correlations, stating possible errors and limitations 4.3.3 Represent data (in tabular and/or graphical forms) so as to facilitate analysis and explanation of the data, and drawing of conclusions 4.3.4 Synthesize information and knowledge about the problem from the raw data to reach appropriate conclusions
PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	
Competency	**Indicators (6)**
5.1 Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.1 Identify modern engineering tools, techniques and resources for engineering activities 5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems
5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modeling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs. 5.2.2 Demonstrate proficiency in using discipline-specific tools
5.3 Demonstrate an ability to evaluate the suitability and limitations of tools used to solve an engineering problem	5.3.1 Discuss limitations and validate tools, techniques and resources 5.3.2 Verify the credibility of results from tool use with reference to the accuracy and limitations, and the assumptions inherent in their use.
PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	
Competency	**Indicators (2)**
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at the global, regional and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.1.2 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public
PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.	
Competency	**Indicators (4)**

7.1 Demonstrate an understanding of the impact of engineering and industrial practices on social, environmental and in economic contexts	7.1.1 Identify risks/impacts in the life-cycle of an engineering product or activity 7.1.2 Understand the relationship between the technical, socio-economic and environmental dimensions of sustainability
7.2 Demonstrate an ability to apply principles of sustainable design and development	7.2.1 Describe management techniques for sustainable development 7.2.2 Apply principles of preventive engineering and sustainable development to an engineering activity or product relevant to the discipline
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	
Competency	**Indicators (3)**
8.1 Demonstrate an ability to recognize ethical dilemmas	8.1.1 Identify situations of unethical professional conduct and propose ethical alternatives
8.2 Demonstrate an ability to apply the Code of Ethics	8.2.1 Identify tenets of the ASME professional code of ethics 8.2.2 Examine and apply moral & ethical principles to known case studies
PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	
Competency	**Indicators (7)**
9.1 Demonstrate an ability to form a team and define a role for each member	9.1.1 Recognize a variety of working and learning preferences; appreciate the value of diversity on a team 9.1.2 Implement the norms of practice (e.g. rules, roles, charters, agendas, etc.) of effective team work, to accomplish a goal.
9.2 Demonstrate effective individual and team operations-- communication, problem-solving, conflict resolution and leadership skills	9.2.1 Demonstrate effective communication, problem-solving, conflict resolution and leadership skills 9.2.2 Treat other team members respectfully 9.2.3 Listen to other members 9.2.4 Maintain composure in difficult situations
9.3 Demonstrate success in a team-based project	9.3.1 Present results as a team, with smooth integration of contributions from all individual efforts
PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	
Competency	**Indicators (7)**
10.1 Demonstrate an ability to comprehend technical literature and document project work	10.1.1 Read, understand and interpret technical and non-technical information 10.1.2 Produce clear, well-constructed, and well-supported written engineering documents 10.1.3 Create flow in a document or presentation - a logical progression of ideas so that the main point is clear

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PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	
Competency	**Indicators (6)**
12.1 Demonstrate an ability to identify gaps in knowledge and a strategy to close these gaps	12.1.1 Describe the rationale for the requirement for continuing professional development 12.1.2 Identify deficiencies or gaps in knowledge and demonstrate an ability to source information to close this gap
12.2 Demonstrate an ability to identify changing trends in engineering knowledge and practice	12.2.1 Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current 12.2.2 Recognize the need and be able to clearly explain why it is vitally important to keep current regarding new developments in your field
12.3 Demonstrate an ability to identify and access sources for new information	12.3.1 Source and comprehend technical literature and other credible sources of information 12.3.2 Analyze sourced technical and popular information for feasibility, viability, sustainability, etc.

5. OBE CURRICULUM DEVELOPMENT

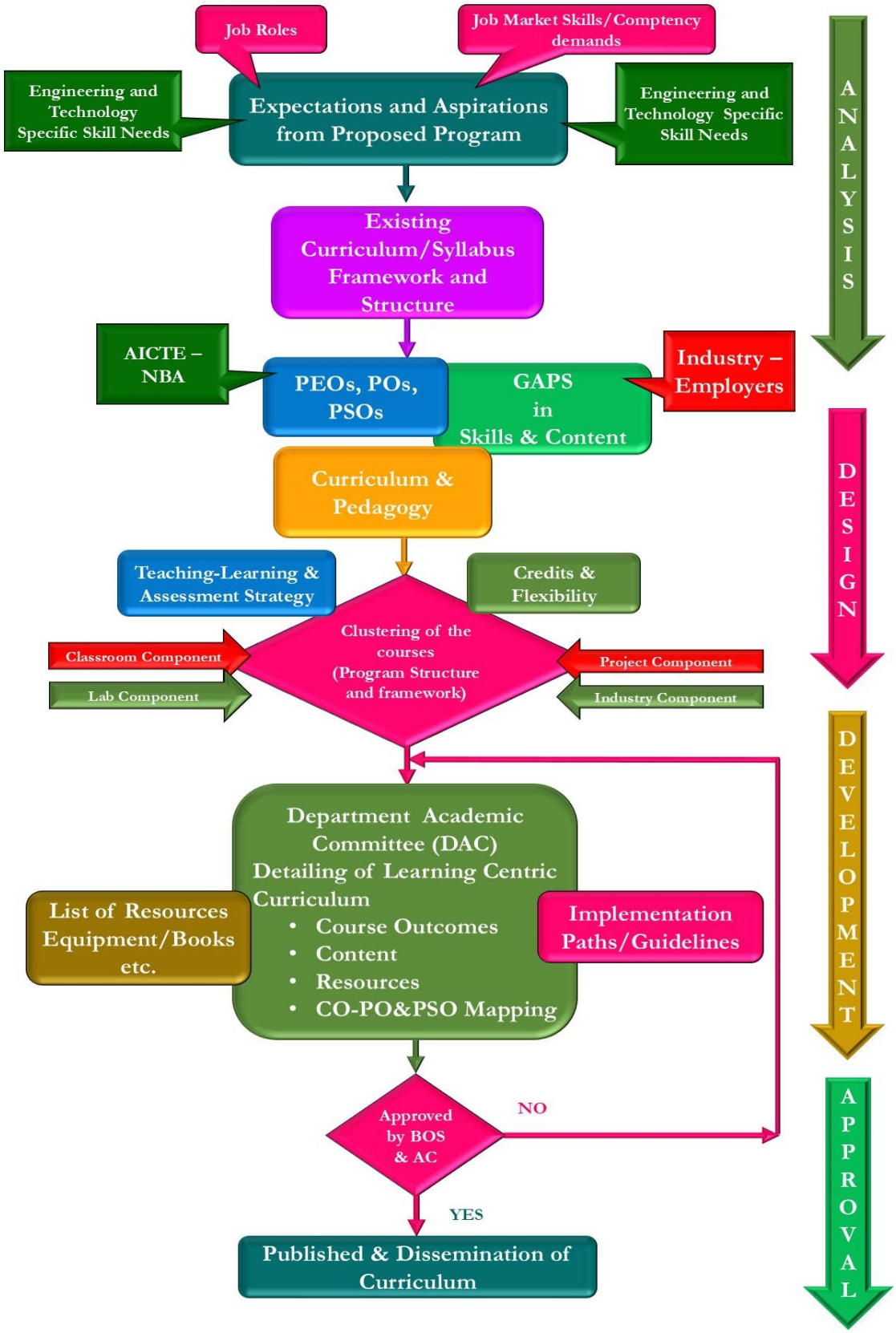
a). Process for designing the program curriculum

A well-structured multi-step process has been put in place for the design of program curriculum to ensure that the curriculum is continuously updated and stays in sync with the fast-paced changes in the industry requirements.

While designing the syllabus, each department referred to the feedback provided by stakeholders, Program Educational Objectives, Program Outcomes (POs) given by NBA and Program Specific Outcomes (PSOs).

The content design followed a unified approach of having five/six units of syllabus with relevant COs.

After the department faculty deliberates upon the drafted Syllabi, COs and CO-PO/PSO mappings, it is sent to the Program Assessment Committee (PAC), which consists of Module Coordinators and Senior Professor/HOD as Chairman for fine tuning the entire syllabus. Subsequently, the Department Academic Committee (DAC), which is the highest decision-making internal body discussed the contents, after which the draft is placed before the Board of Studies (BoS). After verification by BoS, the drafted curriculum is placed before the AC (Academic Council) for its approval.



Process for designing the program curriculum

1. Number of courses in each course category are decided in the programme curriculum considering the
    - NEP 2020
    - AICTE model curriculum
    - Andhra Pradesh State Council for Higher Education (APSCHE)
    - JNTUK, Kakinada University curriculum
2. The model curriculum structure prescribed by AICTE was supplied to all the departments and they were advised to study the curriculum structure of two prominent educational institutions along with AICTE prescription and come out with a structural design of their program curriculum
3. After coming to a consensus, a unified structure for all departments was decided. This structure was passed on to departments to design syllabus for each course.
4. Feedback is obtained from Faculty during Department Academic Committee (DAC), Module Coordinator Committee (MCC), Course Coordinator Committee (CCC) & Program Assessment Committee (PAC) meetings
5. Feedback is collected from students through Class Review Committee (CRC) meetings, Program Exit Survey & Student Satisfaction Survey (SSS)
6. Feedback is collected from Industry Experts, Alumni and Academic experts through email or in person during their visits.
7. The collected feedback is analyzed to evolve the broad technical areas in which the students' knowledge, technical and professional skills have to be imparted and assessed.
8. The courses are identified and the curriculum is formed for the POs and PSOs.
9. Course Outcomes (COs) are then written for each course in alignment with the POs and PSOs. The syllabus content is prepared for each CO and thus the syllabi for all the courses are developed.
10. The drafted curriculum and syllabi is reviewed in the department and verified to meet the guidelines.
11. The curriculum and the syllabi are then presented to the Board of Studies (BoS) which is typically conducted twice in a year.
12. Comments/Suggestions by the BoS committee members for improvements are incorporated in the curriculum and syllabi.

13. Comments/Suggestions by Academic Council Meeting are incorporated in the final version of the curriculum and the syllabi and after the approval of Academic Council they are published/disseminated.
14. Periodic changes in the curriculum are made based on the changing technologies and job market demands. Feedback is solicited from various industry experts. Every department has its own Board of Studies (BoS), which is a statutory body headed by HoD.
15. The BoS includes external members - one member is from Industry, One university nominee, one Alumni, and other members are from reputed academic institutions.

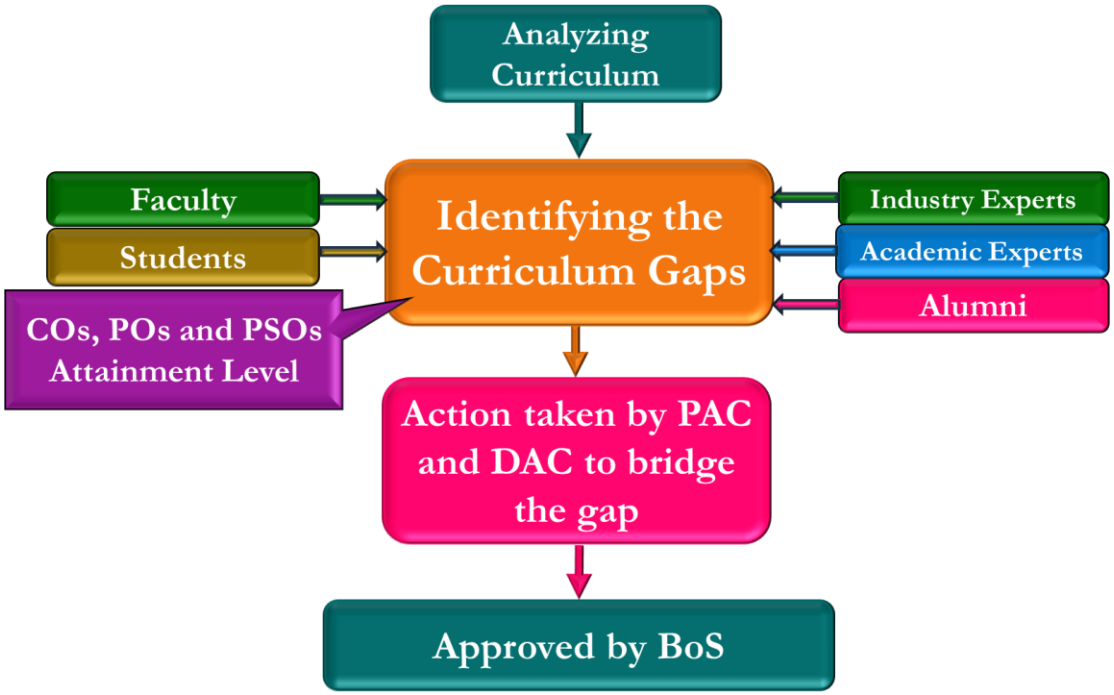
b). Process used to identify extent of compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes

In general, Curriculum blends the composition of basic science, Engineering Sciences, humanities and professional courses, as well as core and elective courses. If some components required to obtain COs/POs, the department carries out "Gap Analysis" in respective domains. To bridge the identified gap, content outside the syllabus is covered through varies activities. Identification of Gap through effective participation of Internal and External stakeholders.

The following process used to identify extent of compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes

1. Course Coordinator goes through his/her course syllabus.
2. All Course Coordinators survey the latest trends/technologies in respective field with involvement of Internal and external stakeholders and identify the components missing (if any) in the course.
3. In addition, COs, POs and PSOs attainment levels are taken into account when assessing the extent of compliance of the curriculum.
4. At the department level all the identified gaps are classified as per the modules.
5. Compiled list of the curricular gaps is reported to the Program Assessment Committee (PAC).
6. Then, the DAC examines the compliance levels of the curriculum with specified POs & PSOs and recommends appropriate actions and prepare the calendar of events to bridge the identified gap.

7. Expert from industry covers contents through hands-on sessions and lectures. The value addition courses, certification courses and industrial visits help to attain particular POs and PSOs of the program to a higher level.
8. List of the curricular gaps are discussed in BoS meetings.
9. The curriculum gaps suggested by stakeholders are considered while preparing department calendar of events which includes Extra-Curricular Activities, Extension Activities and Co-curricular Activities.
10. The curriculum is formulated and reviewed once in 3 years through the Board of Studies (BoS) meetings.



Process used to identify extent of compliance of curriculum for attaining the POs and PSOs

Component	Implementation	Evidence
CO–PO Mapping	Defined for all courses	Course files
Bloom's Taxonomy	Integrated into syllabus	Lesson plans
Skill-Based Courses	Added in curriculum	Syllabus copies
Internship Mandate	Credits assigned	Internship logs

c). Strategies for Education Reforms (Institutional Action Plan for NEP 2020 Implementation)

i). Strategic Initiatives

NEP 2020 Focus Area	Institutional Action Plan	Implementation Status	Evidence
Multidisciplinary Education	Introduced open electives across departments	Implemented	BoS minutes, curriculum structure
Skill-Based Learning	Value-added & certification courses	Ongoing	Course completion reports
Experiential Learning	Project-based, internships	Implemented	Internship records, project reports
Digital Learning	LMS, online platforms	Implemented	LMS usage reports
Holistic Development	NSS, clubs, co-curricular activities	Ongoing	Activity reports
Continuous Assessment	OBE-based evaluation reforms	Implemented	CO attainment reports

ii). Curriculum Design Mapping with NEP 2020 (Multidisciplinary / interdisciplinary)

Aspect	NEP Requirement	Institutional Practice	Evidence
Open Electives	Cross-disciplinary learning	Students choose courses from other branches	Curriculum handbook
Minor/Honors Programs	Flexibility & depth	Introduced specialization tracks	Academic regulations
Interdisciplinary Projects	Real-world problem solving	Projects involving multiple domains	Project reports
Industry Integration	Skill alignment	Industry-based electives	MoUs, guest lectures

In the institution, academic programmes are designed to adopt a multidisciplinary learning approach. The students studying in one branch of engineering can acquire a minor degree in another branch of engineering by studying the courses for a total credits of 20. The minor degree is in addition to the original degree awarded to the student. The open Elective subjects are being offered from the 5th semester to the 8th semester. The students can choose interdepartmental subjects based on their preferences.

ii). Academic bank of credits (ABC)

Component	Action Taken	Evidence
ABC Registration	Students registered on ABC portal	ABC ID records
Credit Transfer	Provision for credit mobility	Academic regulations
Credit Accumulation	Credits stored digitally	ABC account screenshots
Multiple Entry/Exit	Exit options with certification	Policy document

Academic Bank of Credits (ABC) is a virtual/digital storehouse that contains information on the credits earned by individual students throughout their learning journey. It will enable students to open their accounts and give multiple options for entering and leaving colleges or universities. There will be "multiple exits" & "multiple entries" points during the higher education tenure & credits will be transferred through the ABC seamlessly.

ABC can be considered as an authentic reference to check the credit record of any student at any given point in time. The Academic Bank will be accountable for opening, closing, and validating the academic accounts of students. It will carry out tasks such as credit accumulation, credit verification, and credit transfer/redemption of students. The ABC accounts of students will be registered using National Academic Depository (NAD).

The LBRCE is in the process of implementing the Academic Bank of Credits for all the students for storing their credits in ABC. LBRCE created awareness among all the students on NAD and NAD process is already initiated and some students already utilized this opportunity. However, institute is contemplating to register for ABC through NAD.

iii). Skill development:

National Educational Policy (NEP-2020) redefines the employability skills in students. The students shall adhere to the standards of the National Skills Qualification Framework (NSQF) and industry 4.0. The World is changing fast and students should capture present industry needs and he/she should be self-reliant.

To cope with technological advancements and to bridge the gap between the Institution and industry, LBRCE established Industry Institute Interaction Cell and the Skill Development centres in collaboration with International organizations like Indo-Euro Synchronization, Aachen, Germany and Andhra Pradesh State Skill Development Corporation (APSSDC).

The institution has undertaken a comprehensive approach towards promotion of innovation, incubation, and entrepreneurship. While identifying the need for a concerted strategy, the institution realized that not just fragmented endeavours, but a pragmatic ecosystem needs

to be developed. LBRCE started the Centre for Innovation, Incubation and Entrepreneurship (CIIE) for nurturing and encouraging students with innovative business ideas. Also, this centre organize awareness programs on entrepreneurship liaisons with industry bodies and other agencies in incubating and facilitating start up ventures by students. The centre also offers guidance on career planning, apart from behavioural counselling in order to make students feel emotionally secure, confident and practical while facing the various professional challenges in future.

iv). Appropriate integration of Indian Knowledge system (teaching in Indian Language, culture, using online course)

India is a treasure of value of culture, developed over thousands of years and manifested in the form of arts, works of literature, customs, traditions, linguistic expression, artefacts, heritage sites, and more. The people are benefiting from this culture wealth daily, in the form of visiting India for tourism, experiencing Indian hospitality, purchasing India's handicrafts and handmade textiles, reading the classical literature of India, practicing yoga and meditation, and participating in unique festivals, among many other aspects. The NEP 2020 stress the importance of preservation and importance of India's cultural wealth must be considered with high priority.

LBRCE is actively involved in the promotion of integration of the Indian knowledge system in different forms. We believe that it is necessary to include subjects in their course curriculum regarding the essence of Indian traditional knowledge and the constitution of India. Every engineering student has to go through these subjects for their overall growth and development. In view of this, the subjects namely Universal Human Values, the Constitution of India, etc., were included in the curriculum of all branches of engineering. LBRCE conducts Yoga training classes to stress relief, flexibility, and immunity boost up to the students as well as the faculty. We are contemplating implementing music, and fine arts, as audit courses in the curriculum when revised in the coming years.

v). APAAR (Automated Permanent Academic Account Registry)

Component	Action Taken	Evidence
APAAR ID Creation	Students registered for APAAR	Student ID database
Integration with ABC	Linked academic credits	System reports
Digital Academic Records	Centralized academic tracking	ERP/LMS reports

6. Outcome – Based Teaching-Learning

A). Processes followed to improve quality of Teaching & Learning

i). Adherence to Academic calendar

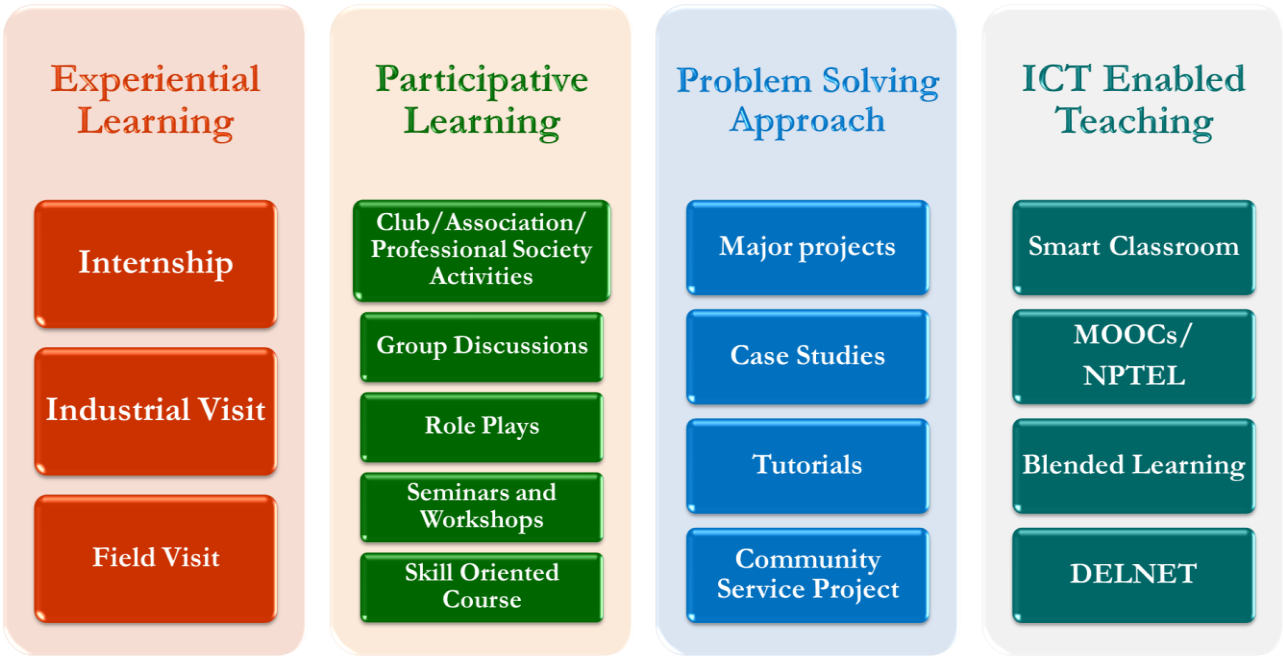
The Institute prepares a well-planned academic calendar every year just after receipt of the University academic calendar. It is a coordinated effort by CAB and Controller of Examinations (CoE). The academic calendar provides perfect balance between academic and non-academic activities, teaching and examination schedule. The time tables were prepared by considering the academic calendar and the scheme of periods given in the course structure with specified class room. The time table includes Theory classes, Tutorial classes, Laboratory practice (Practical), Association/Sports activities, Self Learning etc.

Every faculty member prepares a 'Course Handout' for every course and it is placed in the website at the beginning of the semester and is dually approved by the Head of the department. The number of hours in the teaching plan of the course is framed depending on the no. of periods allotted in time table and made available to the students. According to the lesson plan, work done has been inculcated in the academic file to ensure coverage of syllabus duly monitored by Head of the department. Steps are taken to ensure strict adherence to the academic plan by all Faculty members. Regular academic audit is conducted by the Academic Audit Committee and it is monitor by Dean (Academic) and IQAC.

At the beginning of academic year, programme coordinator prepares the calendar of academic events like Workshops, Conferences, visiting faculty lectures, Industrial visits etc. to bridge the identified curriculum gaps.

ii). Use of Various instructional methods and pedagogical initiatives:

The Institute is planning to initiate student-centered classrooms and to reduce the traditional teaching practices. The faculty members use innovative teaching approaches or practices. Besides the chalk and talk method of lecture, the faculty uses the following methods:

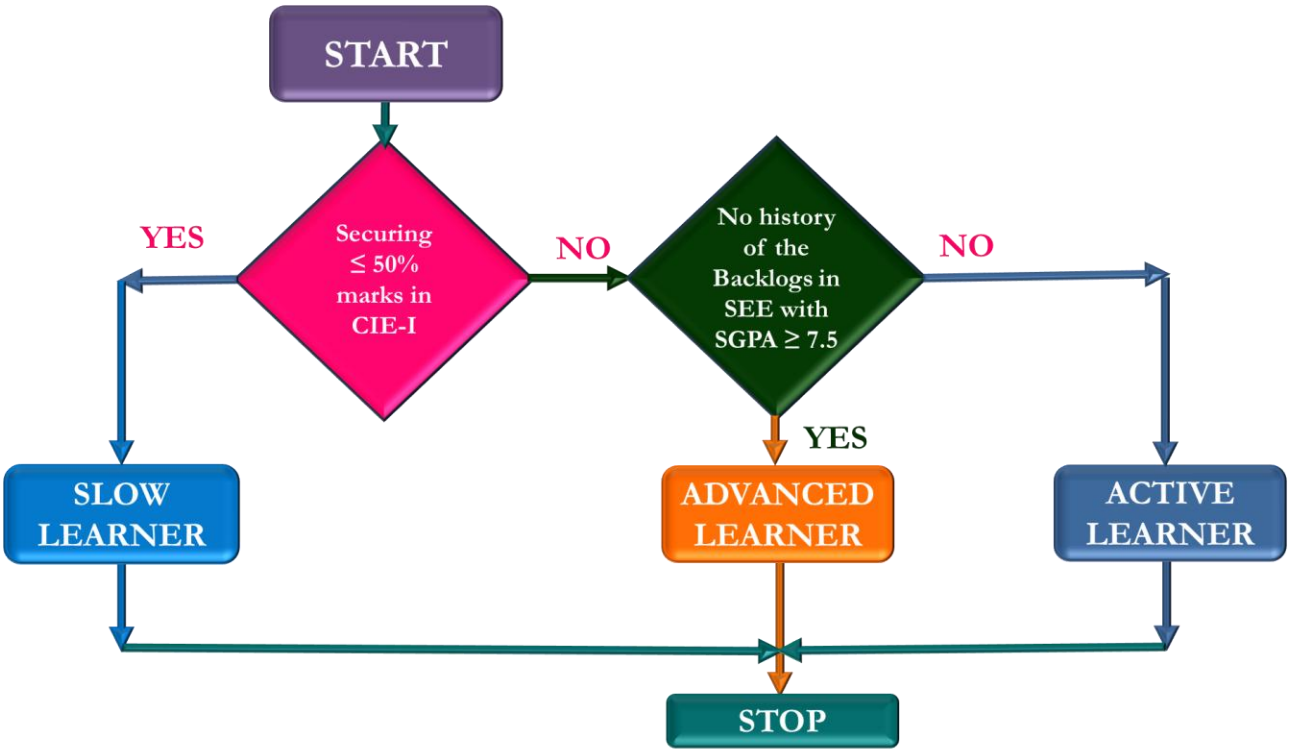


iii). Methodologies to support weak students and encourage bright students:

Guidelines to identify weak students

Criteria for Identifying Slow and Advanced Learners

The institute provides equal learning opportunities for every student at all levels of learning. Following each student's admission, an institute-level induction program will be held at the start of the academic year. In accordance with AICTE mandatory student induction program guidelines, an extensive induction program to enable all students to cope with engineering education will be provided.



Process of identifying Slow Learners and Advanced Learners

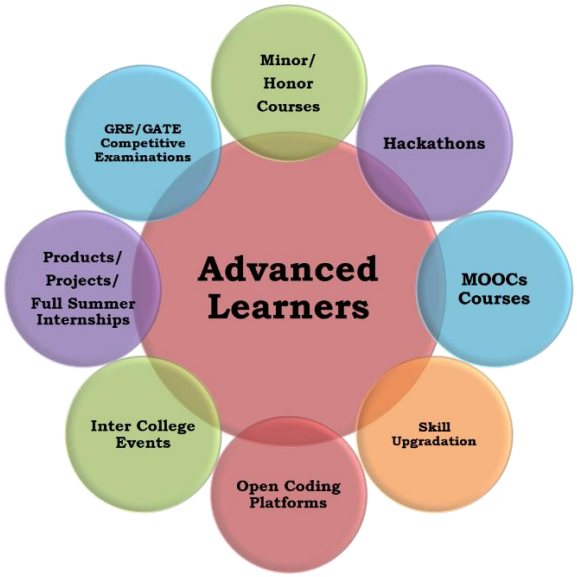
Faculty must deal with a variety of students in the classroom; some are highly intelligent and learn quickly, some are relatively weak and learn slowly, and others are somewhere in the middle. As a result, determining the talents of the students in the class is essential. Based on their abilities, certain students require merely direction, while others the need hard effort and consistent attention, and still others require motivation.

Based on their preceding exam performance, current subject performance, and class observation, learning speed students can be classified in three groups namely advanced learners, active learners, and slow learners. Each type of students has different learning attitudes and learning habits. A faculty must adapt a teaching methodology such that he/she may not lose the attention of the slow learners, continuously motivate the active learners and not turn off the advanced learners. It is mandatory for all the faculty to identify the students' learning skills in their courses. It also requires the faculty members to maintain the actions taken on different learning categories of students.

Advanced Learners

The term advanced learner refers to students who can participate in learning activities more efficiently and quickly than others in the class, achieving higher scores. They have more potential in terms of understanding, retention, memory, critical thinking, creativity, and contextualisation. They may also exhibit hardworking characteristics and typically outperform the majority of their classmates. These students are more gifted and talented than the rest of the class. These students are prepared to take on more advanced study and educational responsibilities. They may introduce new concepts and tactics, as well as take the lead in teaching and learning activities.

Special Programs for Advanced Learners



Advanced Learner Activities

- **Minor/Honor Courses**: Students with CGPA of 7.5 or higher are encouraged to take up any one additional course of the next higher semester as decided by the Program head.
- **MOOCs through** NPTEL-Swayam
- **Skill-Up Program**: A specially designed employability course to achieve high impact jobs.
- **A full semester internship** leading to research publication.
- **GRE/GATE/Competitive exams**: Special counselling will be given, and classes will be held separately.
- Encouraged to participate in co-curricular activities like symposia, workshop, and conferences, participate in activities of LBRCE's clubs and facilitated to organize

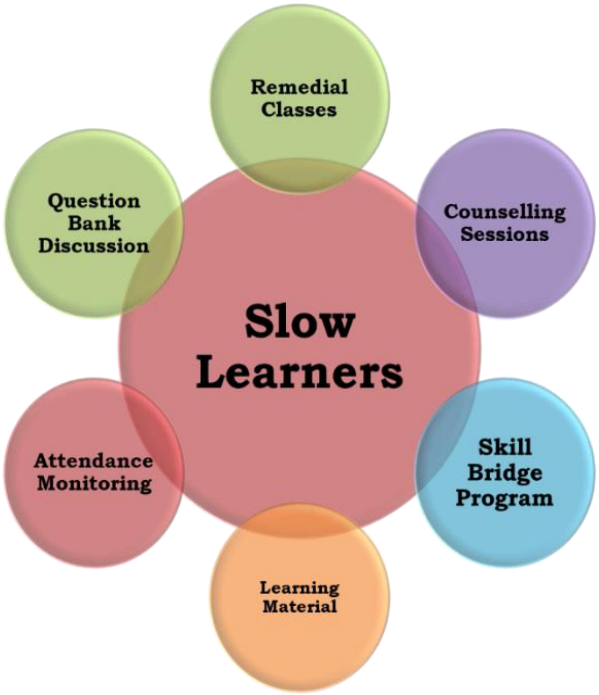
technical events.

- Motivated to participate in national and international competitions like Codevita, HackwithInfy, SAE Supra, SAE Aero Design.
- Opportunities for availing international fellowship positions.

Slow Learners

Individuals who struggle to learn at the same rate as their classmates are referred to as "slow learners." It is crucial to note that this does not necessarily imply that they are incapable of learning; rather, they may require extra assistance, resources, and/or time to completely comprehend and remember material.

Special Programs for Slow Learners



Slow Learners Activities

Slow learners must be approached with patience, sensitivity, and understanding. Slow learners might benefit from additional support from the institution in both their academic and personal life. This may involve individualised instruction and tutoring, the use of visual aids or other teaching tactics, the cultivation of their interests and strengths, and the provision of emotional support and encouragement. Slow learners may attain success and realise their full potential with the correct strategy and tools.

- **Remedial Classes:** conducted for both theory and practical sessions.

- **Counselling Sessions:** Assist students in their weak areas of performance and suggest improvements.
- **Personal attention:** Providing special attention on non-academic parameters such as Communication Skill, Public Speaking, decide on Carrier Goals, and Managing Academics & Personality.
- Conducting target oriented intensive sessions at institute instead of traditional classroom teaching.
- Providing short and specific direction to students to bring them to level of active learners.
- **Skill Bridge Program:** A specially designed courses for job guarantee are conducted.

Active learners

Active learners are excel to the level of advanced learners while having minimal drive.

Special Programs for Active Learners

- Motivating the students to participate in technical events.
- Grouping them with advanced learner for better interaction and development
- Mentoring mechanism for excellence
- Extra problem-solving practice.
- Increasing students' ambitions and hope
- Skill Bridge Program: A specially designed courses for job guarantee are conducted
- Encourage the students to participate in open coding platforms to improve the ratingsin respective platforms.

iv). Quality of classroom teaching:

- All the classrooms are spacious with good ventilation, furnished with bigger desks and well equipped with wider boards for conducting the regular theory classes.
- Smart Boards/Projector based classrooms help Faculty members to bring lessons to life with rich, powerful activities that grabs student's attention, blending real time assessment and real-world experience into the learning process.
- For each theory course, the syllabus, lesson plan, course objectives, course outcomes and assessment criteria are informed to the students at the beginning of the classes/semester.
- To make the students involved in regular classes, the activity-based learning is also being practiced by the course faculty such as.,
    a. The students are grouped together and the groups are instructed to choose topic from the syllabus.
    b. When one group is asked to present a seminar a seminar of 10 minutes and the other group is made to ask questions. This enables the students to interact, think and discuss.
- Teaching learning process is continuously monitored by the HOD and reviewed by Dean (Academics).
- **Class Review Committee (CRC)** meetings are conducted periodically in order to monitor and evaluate the quality of classroom teaching and the resultant report is submitted to HoD for reviewing

v). Conduct of Experiments:

- Laboratory sessions are particularly useful to students to visualize abstract topics learnt in class on firsthand basis.
- Lab Manual is prepared by the Lab in-charge and same is made available to students at the beginning of the semester.
- In order to ensure the effective laboratory teaching the class is divided into batches depending on the total strength of the class.
- The students are instructed about the experimental procedures and safety measures before the commencement of practical session as per course handout.

- A demonstrative presentation is given by the teacher concerned at the beginning of lab course
- The students are allowed to do the entire experiment on their own with the guidance of a faculty
- The students will observe and measure the experimental data accurately, systematically and present data very clearly.
- The students analyze and interpret experimental data and derive the final results. This knowledge helps them connect and understand the theory part of the same course.
- The lab observation and record note books were periodically corrected so as not to have any pending of experiments being done. In other words, there is active involvement of the members of faculty before, during and after the experiment.

vi). Evaluation of Laboratory Work and Workshop (Continuous and SEE)

The institution adopts a structured and outcome-based approach for evaluating laboratory and workshop courses, ensuring alignment with the Outcome-Based Education (OBE) practices.

A. Evaluation of Experiments Conducted in Workshops / Laboratories

i). Continuous Assessment (CA):

- Laboratory performance is continuously evaluated based on:
  - ✓ Preparation before experiment (understanding of theory and procedure)
  - ✓ Execution of experiment (methodology, use of equipment, safety practices)
  - ✓ Observation and data recording
  - ✓ Result analysis and interpretation
  - ✓ Viva-voce
- Each experiment carries defined marks, and performance is recorded in laboratory assessment sheets.
- Regular submission and evaluation of laboratory records/observation books is ensured.
- Attendance, discipline, and adherence to safety norms are also considered.

ii). Semester End Examination (SEE):

- The SEE for laboratory courses includes:
  - ✓ Execution of a given experiment/problem
  - ✓ Result demonstration and validation
  - ✓ Viva-voce examination by external examiner
- Standard evaluation guidelines and marking schemes are followed to ensure uniformity.
- External examiners ensure objectivity and fairness in evaluation.

B. Use of Rubrics for Assessing Student Performance with Relevance to COs/POs

- Clearly structured rubrics are developed for laboratory and workshop courses covering:
  - ✓ Experiment setup and procedure
  - ✓ Technical skills and tool handling
  - ✓ Accuracy of results and analysis
  - ✓ Report writing and documentation
  - ✓ Communication skills during viva
- COs are further linked to Program Outcomes (POs) and Program Specific Outcomes (PSOs)

Implementation:

- Rubrics are shared with students in advance to ensure clarity of expectations.
- Faculty use rubrics to maintain consistency and objectivity in evaluation.
- CO attainment is calculated based on CA and SEE components.

Continuous Improvement and Documentation

- Laboratory course files include:
  - ✓ List of experiments with CO mapping
  - ✓ Rubrics and evaluation sheets
  - ✓ Sample student records and assessment reports

CO attainment analysis and action plans **vii). Student feedback on teaching learning process and actions taken:**

- In the institution, student feedback on teaching learning process is collected in following different ways from the students.
  - ✓ Class Review Committee meetings Twice in a semester within the department
  - ✓ Online feedback through central system Twice in a semester
  - ✓ Student Satisfaction Survey at the end of academic year
- The consolidated feedback report is sent to the respective departments for discussion and action taken.
- If the students feedback falls below 80%, the faculty will be counselled individually by the HOD/Dean(Academics)/Principal and the faculty encouraged to attend the MOOCs, STTP, FDP, seminar, workshop etc. to upgrade their knowledge and skills and suggestion will be given to further improvement of performance.

B). Quality of end semester examination, internal semester question papers, assignments and evaluation

B.1 Evaluation of Continuous Assessment: Assignments, Unit Tests, Mid-Term, etc.

A. Process for Setting and Evaluation of Internal Semester Question Paper

The institution follows a systematic and transparent process for setting and evaluating internal semester question papers in alignment with OBE practices.

Question Paper Setting:

- Course Coordinator/instructor prepares the question paper by ensuring Adequate syllabus coverage, Appropriate difficulty level, Absence of ambiguity or errors based on the course syllabus, defined Course Outcomes (COs)
- Questions are designed to address different levels of Bloom's Taxonomy
- Each question is explicitly mapped to COs and indicated in the question paper.
- The final approved question paper is securely handled to maintain confidentiality.

Evaluation Process:

- Evaluation is carried out using a standardized answer key / scheme of valuation.

B. Quality of Questions and Appropriateness of Mapping with COs

- Question papers are designed to ensure:
  - ✓ Relevance to COs and alignment with teaching-learning activities
  - ✓ Coverage across all cognitive levels (knowledge to higher-order thinking)

- ✓ Inclusion of analytical, application-based, and problem-solving questions

- A CO-wise distribution of marks is ensured to maintain balance.
- Moderation ensures that:
  - ✓ Questions are clear, unambiguous, and appropriately framed
  - ✓ Mapping between questions and COs is accurate and justified
- Course files maintain question papers with CO mapping matrices as evidence.

C. Assessment of CO Coverage in Unit Tests / Class Tests / Mid-Term Tests / Assignments

- Each assessment component (unit test, mid-term, assignment, quiz) is:
  - ✓ Designed with explicit CO mapping
  - ✓ Assigned weightage for each CO
- CO attainment is calculated using student performance data from all CIE components.
- Tools used:
  - ✓ CO-wise marks distribution sheets
  - ✓ Attainment calculation formats (direct assessment)
- The analysis ensures:
  - ✓ Identification of strong and weak COs
  - ✓ Monitoring of individual and class performance trends
- Corrective actions such as remedial classes, tutorials, and additional assignments are planned for low attainment areas.

D. Sharing of Post-Evaluation Feedback with Students for Performance Improvement

- Evaluated answer scripts are returned to students within a stipulated time.
- Faculty provides:
  - ✓ Written comments and corrections
  - ✓ Discussion of common mistakes in class
  - ✓ Model answers / solutions are shared for better understanding.
- Performance analysis (CO-wise and test-wise) is communicated to students.
- Analysis is reviewed at department level meetings (PAC & DAC).
- Remedial measures (extra classes, mentoring, peer learning) are implemented
- Advanced learners are given enrichment tasks

B.2. Evaluation of the Semester End Examination (SEE) Question Paper

The institution adopts a rigorous and confidential process for setting, evaluating, and reviewing Semester End Examination (SEE) question papers in alignment with Outcome-Based Education (OBE) practice.

A. Process for Setting and Evaluation of Semester-End Examination Question Paper

Question Paper Setting:

- The SEE question paper is prepared by internal/external subject experts nominated by the Controller of Examinations (CoE).
- A detailed question paper blueprint is developed to ensure:
  - ✓ Coverage of all Course Outcomes (COs)
  - ✓ Balanced distribution across all units
  - ✓ Appropriate weightage for different cognitive levels (Bloom's Taxonomy L1–L6)
- Each question is mapped to COs, and mapping is verified during moderation.
- A moderation process is carried out by a subject expert to ensure:
  - ✓ Academic rigor and correctness
  - ✓ Clarity and absence of ambiguity
  - ✓ Uniformity across different courses
- Strict confidentiality procedures are followed in question paper handling and printing.

Evaluation Process:

- Evaluation is conducted through centralized valuation under the supervision of the CoE.
- Scheme of valuation are prepared in advance for consistency.
- Chief Examiner is appointed for every course to monitor the uniformity among the evaluators.
- Scrutiny is carried out to maintain reliability.
- Any discrepancies are resolved through expert review mechanisms.

B. Quality of Questions and Appropriateness of Mapping with COs

- The SEE question paper is designed to:
  - ✓ Ensure direct alignment with COs and course content
  - ✓ Cover all COs with appropriate weightage distribution
- The paper structure ensures:
  - ✓ Mix of short answer, descriptive, and problem-solving questions
  - ✓ Assessment across various cognitive levels
- CO mapping validation is performed during moderation to ensure accuracy.
- Documentation maintained includes:
  - ✓ Final question paper with CO mapping
  - ✓ Blueprint and moderation reports

C. Transparency of Post Evaluation Process

- The institution ensures transparency and fairness in evaluation through:
  - ✓ Publication of results within a stipulated time frame
  - ✓ Provision for revaluation and recounting
- The results are discussed and analysed in result committee before publishing the result
- The results are ratified in Academic Council
- CO attainment analysis is performed using SEE results and shared with faculty for continuous improvement.

C). Quality of student projects

i). Identification of projects and allocation methodology to Faculty Members

Quality of the project is measured in terms of processes related to project identification, allotment, continuous monitoring, evaluation including demonstration of working prototypes and enhancing the relevance of projects. A senior faculty member is assigned the responsibility as project coordinator, who handles all the activities related to the student project work such as planning, scheduling and execution.

Following flowchart shows the detail of the selection process for the major project.

- A project coordinator is appointed by the Head of the Department who is responsible for planning, scheduling and execution of all the activities related to the student project work.
- Project batches is usually decided based on their academic performance so that the academically weaker students are grouped along with the bright students.
- Announcement of project group formation is done through the notice board in fifth semester.
- A notice will be displayed outlining the various project themes and areas to help students identify their preferences
- Students are provided with a brief idea of various fields for selecting the project.
- The list of previous year projects are made available in the department library.
- Students are requested to submit their interested area
- Project guides are assign for each of the group based on their domain expertise
- After receiving titles from the students along with reference papers, the committee will accept the abstract after peer review. After acceptance of abstract, students are allowed to do projects either internal or external.
- The project guides also encourage and provide guidelines to students to participate in project exhibitions and to publish their project work in reputed journals / conferences / technical paper presentation or project competitions.
- The faculty member encourages students to apply for funding for their project work.

ii). Types and relevance of the projects and their contribution towards attainment of POs and PSOs.

Final year projects are widely classified into application, product and research type. Various tools and technology are used by the students for implementation of their projects. All projects are mapped to POs and PSOs. Each project is evaluated with internal marks and is graded according to their project quality for which rubrics are designed and with their contribution towards attainment of PO's.

iii). Evaluation of Projects

In the final semester, a student must register for an internship; and in parallel, should work on a project with well-defined objectives. At the end of the semester, the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated by an external examiner.

a) Continuous Internal Evaluation:

The performance of a student shall be evaluated based on two reviews conducted by a three-member committee, consisting of two senior faculty and a project supervisor constituted by the HoD. The average marks of the two reviews will be considered for CIE.

b) Semester End Examination:

The student shall submit a duly certified project report to the department on a specified time. They shall make a presentation on the project work before a three-member committee consisting of external examiner, internal examiner (HoD/Senior Faculty) and project supervisor.

c) Rubrics Design and PO/PSO Mapping

- Comprehensive rubrics are developed for project evaluation, explicitly linking each assessment parameter to relevant POs and PSOs.
- Each rubric criterion is assigned performance levels (Excellent, Good, Satisfactory, Needs Improvement) with corresponding marks/weightage.
- The rubrics ensure quantitative measurement of attainment, enabling systematic evaluation of learning outcomes.

d) Assessment of Technical and Problem-Solving Aspects

The rubrics evaluate the following dimensions related to engineering problem-solving:

- Complexity of the problem addressed (PO2, PO3)
- Design and development of solutions (PO3)
- Consideration of cost, feasibility, and constraints (PO5, PO11)
- Relevance to environmental sustainability and societal needs (PO6, PO7)

This ensures that projects reflect real-world engineering challenges and sustainable practices.

e) Assessment of Professional Skills

In addition to technical competencies, rubrics are used to evaluate professional and transferable skills, including:

- Teamwork and collaboration (PO9)
- Communication skills (oral and written presentations, reports) (PO10)
- Application of project management principles such as planning, scheduling, and execution (PO11)

These parameters ensure holistic development of students beyond technical knowledge.

f) Continuous and Comprehensive Evaluation

- Project evaluation is conducted in multiple phases before starting of the project (Problem identification), Mid of the Project (Analysis and Design), and End of the project (Implementation and Future Scope).
- Each phase uses rubrics to ensure continuous assessment and feedback.
- Internal and external examiners participate in the evaluation to maintain transparency and quality.

g) Documentation and Evidence

- Completed rubrics, evaluation sheets, and assessment records are systematically maintained in course files/project files.
- Evidence for attainment of COs, POs, and PSOs, are documented and verified during academic audits.

h) Outcome

The rubric-based evaluation system ensures:

- Objective and transparent assessment
- Direct mapping to POs/PSOs for attainment calculation

Improved quality of student projects aligned with industry and societal needs

D). Initiatives related to industry internship/summer training

- The academic regulation provides a summer vacation for a duration of 6 weeks. As per the curriculum the pre-final year students are encouraged to apply and get internship in a reputed institute/organization/industry for a period of 4-6 weeks during summer vacation.
- The student has to execute a project work preferably at industry/R&D institution. Oral assessment about the industrial exposure obtained by the students has been made in the immediate next semester.
- The IIIC and Internship Coordinator will facilitate and monitor the student's internship program.
- The Department will strongly encourage students to undergo Internship during vacation.
- The student shall make a midterm presentation of the activities undertaken during the internship to a panel comprising internship coordinator, a senior faculty from the Department and Head of the Department.
- The student has to submit internship report to the Department.
- Effectiveness of this process is analyzed through feedback from the student's through their performance in examinations/Viva-Voce, from the Alumni and Industries etc.
- Feedback from Industries is used for the improvement in training for further batches.
- Corrective actions are taken to further develop industry trainings based on student feedback and impact analysis.

i). Evaluation of Industrial Training/ Internship (Continuous and SEE)

A student shall undergo Internship for a period of 6-8 weeks and his/her performance shall be evaluated by a committee consists of an external examiner; head of the department; and a senior faculty member of the department. The internship can be carried out at reputed industries / research laboratories /premier institutions. A student shall submit a report on the training undergone, along with a certificate from the organization.

A. Relevance of Internships / Industrial Training

The institution ensures that industrial training and internships are highly relevant to the programme outcomes (POs) and aligned with current industry requirements. The relevance is maintained through:

- **Learning Objectives:** Clearly defined learning objectives and expected outcomes are communicated before commencement.
- **Curriculum Integration:** Internships are embedded as mandatory components within the curriculum, typically during pre-final and final years, ensuring experiential learning.
- **Domain Alignment:** Students are encouraged to undertake internships in core engineering domains or interdisciplinary areas relevant to their programme.
- **Industry Collaboration:** MoUs with industries, R&D organizations, and startups facilitate meaningful exposure to real-world engineering problems.
- **Approval Mechanism:** Each internship is vetted and approved by an internship coordinator based on:
    - ✓ Nature of work (design, analysis, development, research, etc.)
    - ✓ Relevance to course outcomes (COs) and Program Outcome (POs)

This structured approach ensures that internships contribute effectively to technical competency, problem-solving skills, professional ethics, teamwork, and communication abilities, thereby supporting attainment of POs.

B). Rubrics for Assessing Industrial Training / Internships

Clearly structured rubrics based assessment system is used for both Continuous Evaluation (CE) and Semester End Evaluation (SEE).

i. Continuous Evaluation (CE) Components

- Periodic progress reports
- Feedback
- Faculty mentor evaluation
- Logbook / internship diary

ii. Semester End Evaluation (SEE) Components

- Demonstration of work
- Presentation and viva-voce
- Final report evaluation

iii. Sample Rubric Parameters

Criterion	Description	Mapped POs
Problem Identification	Ability to understand and define real-world engineering problems	PO1, PO2
Technical Knowledge Application	Application of engineering fundamentals and modern tools	PO1, PO5
Design/Development Skills	Innovation and solution development	PO3
Experimentation & Analysis	Data collection, interpretation, and validation	PO4
Teamwork & Leadership	Collaboration in industrial environment	PO9
Communication Skills	Report writing and presentation	PO10
Professional Ethics	Workplace ethics and responsibility	PO8
Lifelong Learning	Adaptability and self-learning	PO12

Each parameter is assessed on a performance scale (e.g., Excellent, Good, Average, Poor) with corresponding score ranges.

C). Appropriateness of Mapping with Programme Outcomes (POs)

- Each rubric criterion is explicitly mapped to relevant POs, ensuring outcome-based evaluation.
- The mapping is validated by the Department Academic Committee (DAC) and periodically reviewed.
- Weightages are assigned based on the significance of each PO in internship learning.

d). Continuous Improvement Mechanism

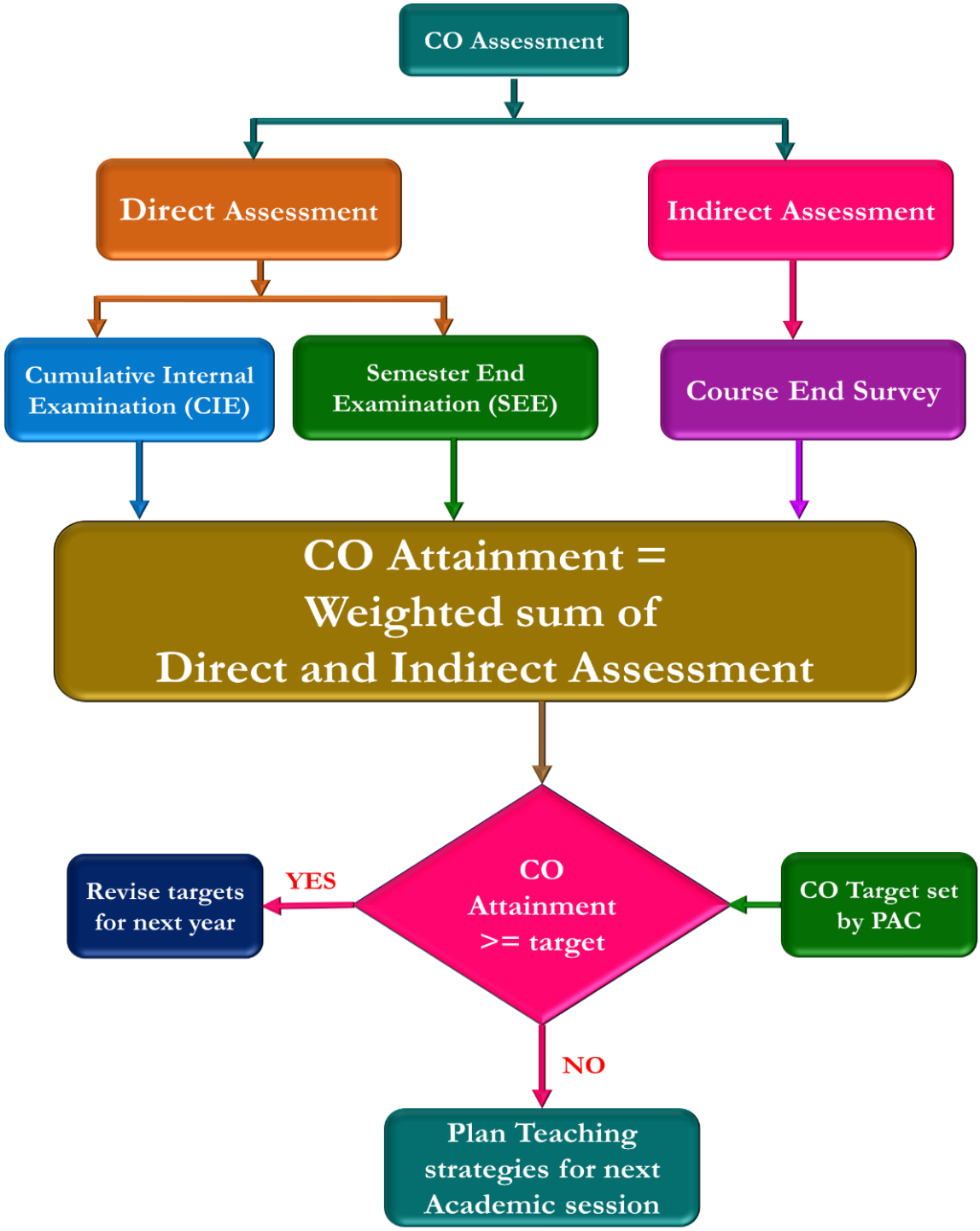
- Feedback from industry mentors, students, and faculty is systematically collected.
- Identified gaps are addressed by:
  - ✓ Updating internship guidelines
  - ✓ Strengthening industry partnerships
  - ✓ Refining rubrics and evaluation parameters
- Best practices and exemplary internships are documented and shared.

7. Outcomes Attainment

7.1. COs Attainment

7.1.1. Assessment tools and processes used for Course Outcome

The assessment tools and process used for computation of COs is shown below:



Course Outcomes assessment tools and attainment process

COs are evaluated based on the performance of students in a CIE and SEE. The process of course outcome assessment is based on performance of the students in CIE, SEE. Each question in mid/semester end/assignment are mapped to the corresponding CO and the overall attainment of that CO is based on percentage of students scored more than 60% of marks.

The following tools are used for the attainment of course outcomes

a). Theory Course:

i). Direct Assessment Tools:

Mid-Semester Examinations: Performance assessment is carried out during the examination sessions which are held twice in a semester. Each and every exam is focused on attaining the COs.

Quiz examination: Performance assessment is carried out during the examination sessions which are held twice in a semester. Each and every exam is focused on attaining the course outcomes.

Assignment: Each and every student is assigned with course related tasks during every course work and assessment will be done based on their performance. Grades / Marks are assigned depending on their innovation in solving/deriving the problems.

Semester End Examination (SEE): Semester End examination is a metric for assessing whether the entire COs are attained or not. Examination is more focused on attainment of course outcomes and program outcomes using a descriptive exam.

ii). Indirect Assessment Tools:

Course End Survey is conducted for every theory course at the end of the course

b). Practical / Laboratory:

i). Direct Assessment Tools:

Continuous Internal Evaluation: The Lab evaluation is also done on a regular basis based on the student Day-to-Day performance during the laboratory session and Internal examination conducted at the end of the semester. Lab records are to be submitted on the next turn describing the work done on the previous turn

Semester End Examination(SEE): These end-semester practical examinations are of 3 hours duration and cover the entire syllabus of the course. It should generally satisfy all course outcomes for a particular course. The COs are evaluated based on the set attainment levels.

ii). Indirect Assessment Tools:

Course End Survey is conducted for every theory course at the end of the course

c). Project

i). Direct Assessment Tools:

The Projects the regularity and performance in the Departmental evaluation is considered apart from the evaluation of the Supervisor. Students are encouraged to produce Research Papers / working projects and demonstratable results and credit is given to them. The project work is evaluated according to the student performance in reviews conducted as per the schedule. The predetermined rubrics are used to evaluate the parameters in the reviews.

ii). Indirect Assessment Tools:

Course End Survey is conducted for every theory course at the end of the course

7.1.2. Weightages for Assessment tools

The following process is followed for the computation of course outcomes.

I). Theory courses (UG & PG) – R23

a). Direct Assessment tools

i) Cumulative Internal Examinations (CIE) (40%)

a) Mid exams (25 %)
b) Assignments (5 %)
c) Quizzes (10 %)

ii) Semester End Examinations (SEE) (60 %)

COs Direct Attainment:

[25 % of (a) + 5 % of (b) +10 % of (c)] + 60 % of SEE

b). Indirect Assessment tools

- Course end survey (10 %)

COs Attainment = 90 % of Direct Attainment +10 % of Indirect Attainment

Mechanism of CO Attainments:

$$\boldsymbol{CO\ Attainment\ (Direct)} = \frac{\text{Number of Students cored } \geq \text{ 60\% marks}}{\text{Number of students attempted the question}}$$

$$\boldsymbol{CO\ Attainment\ (Couurse\ End\ Survey)} = \frac{\text{Weighted sum of student respose}}{\text{Number of students submitted the survey}} * \frac{3}{5}$$

Attainment level of COs	
Target	**Attainment level**
<40% of Students got more than 60% of Marks	1
40% to <60% of Students got more than 60% of Marks	2
>=60% of Students got more than 60% of Marks	3

Initial Target for COs	
Blooms Level	**CO Target**
Create level – L6	>1.30
Evaluate level – L5	>1.30
Analysis level – L4	>1.50
Apply level – L3	>1.80
Understanding level – L2	>2.10
Remembering level – L1	>2.40

Revision of CO Target (after two years) :

- If the average CO attainment of two batches is greater than the target, then increase the target upon approval of DAC and ratified by the BoS.
- If the average CO attainment of two batches is less than the target, then retain the target for further observations.

II) Practical Courses (UG & PG)

a). Direct Assessment tools

i). CIE (40%)

a). Day to Day Evaluation (10%)
b). Record (10%)
c). Internal Examination (20%)

ii). SEE (60%)

COs Direct Attainment:
[10% of (a) + 10% of (b) + 20% of (c)] + 60% SEE

b). Indirect Assessment tools

- Course end survey (10 %)

COs Attainment = 90 % of Direct Attainment +10 % of Indirect Attainment

Mechanism of CO Attainments:

$$\boldsymbol{CO\ Attainment\ (Direct)} = \frac{\text{Number of Students cored } \geq \text{ 60\% marks}}{\text{Number of students attempted the question}}$$

$$\boldsymbol{CO\ Attainment\ (Couurse\ End\ Survey)} = \frac{\text{Weighted sum of student respose}}{\text{Number of students submitted the survey}} * \frac{3}{5}$$

Attainment level of COs	
Target	**Attainment level**
>10% to <50% of Students got more than 60% of Marks	1
50 to <80% of Students got more than 60% of Marks	2
>=80% of Students got more than 60% of Marks	3

Initial Target for COs	
Blooms Level	**CO Target**
Create level – L6	>1.50
Evaluate level – L5	>1.50
Analysis level – L4	>1.80
Apply level – L3	>2.10
Understanding level – L2	>2.40
Remembering level – L1	>2.70

Revision of CO Target (after two years) :

- If the average CO attainment of two batches is greater than the target, then increase the target upon approval of DAC and ratified by the BoS.
- If the average CO attainment of two batches is less than the target, then retain the target for further observations.

7.2. POs and PSOs Attainment

7.2.1. Assessment tools and processes used for measuring the attainment of each Program Outcome and Program Specific Outcomes

a). Direct assessment:

- The performance of the students in the examinations during the semester in each course is used to compute the level of attainment of the POs and PSOs through the mapping of questions to COs & COs to POs and PSOs.
- CO-PO & PSO mapping for all the courses in the program is prepared by the program coordinator.
- An Excel sheet is used to compute the attainment level of the POs and PSOs
- The attainment of the POs & PSOs is computed as a weighted average of attainment of the COs that are mapped to the given POs & PSOs.

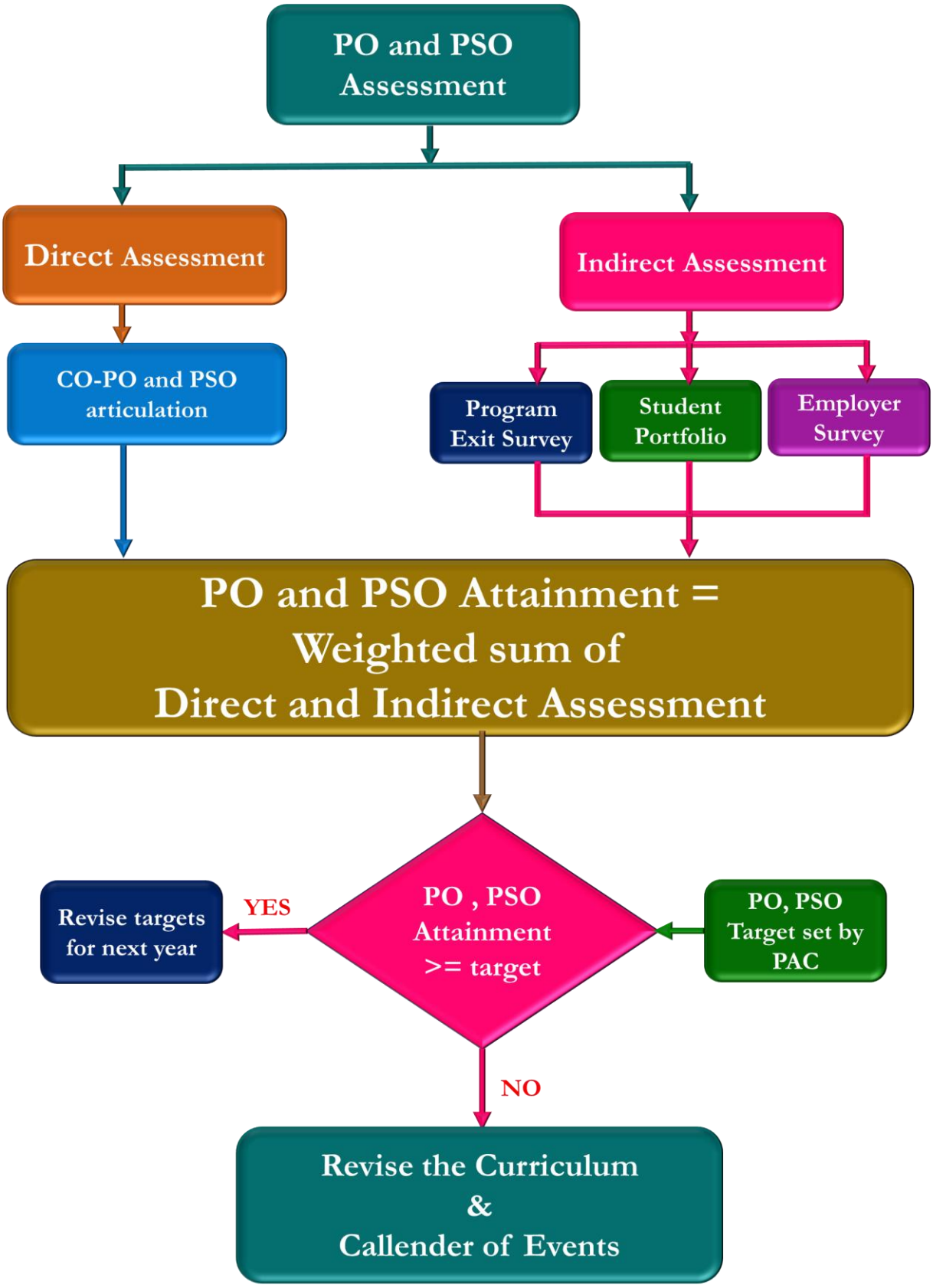
b). Indirect assessment:

The following indirect assessment tools are used for calculating PO & PSO attainments.

- Program exit survey
- Student portfolio

Program Exit Survey: An exit survey is conducted for students who have graduated out of the department for that year. It contains 15 questions (12 questions related to PO each, 3 questions for PSO), for each question student provides the grade in the scale of 1 to 5. (1-Poor, 5- Excellent).

Student Portfolio: Student portfolio is calculated based on the student participation in Co-Curricular activities, Extra-curricular activities, Extension activities and Placement and Higher studies during the course of study



POs and PSOs assessment tools and attainment process

7.2.2. Weightages for Assessment tools

I). Computation of POs & PSOs – UG

A). Direct Assessment (70%)

- **COs –POs & PSOs articulation**

$$PO_j\ \ Attainment(Direct) = \frac{\sum_{i=1}^{i=k}(Level\ of\ CO_i - PO_j\ mapping * CO_i\ attainment)}{\sum level\ of\ CO_i - PO_j\ mapping}$$

$$PSO_j\ \ Attainment(Direct) = \frac{\sum_{i=1}^{i=k}(Level\ of\ CO_i - PSO_j\ mapping * CO_i\ attainment)}{\sum level\ of\ CO_i - PSO_j\ mapping}$$

Where

k is the no.of Cos tagged with the j^{th} PO/PSO

j = 1 to no.of POs/PSOs

B). Indirect Assessment tools (30%)

(a). Student exit surveys (10%)

(b). Employer surveys (10%)

(c). Student Portfolio (10%)

POs and PSOs Attainment =

70% of Direct Attainment + [10% of (a) + 10% of (b) + 10% of (c)]

Target for POs and PSOs

- Initially targets are fixed for POs and PSOs based on the difficulty level in the range of 1.8 - 2.1

Revision of POs and PSOs Target (after two batches):

- If the average POs and PSOs attainment of two batches is greater than the target, then increase the target upon approval of DAC and ratified by the BoS.
- If the average POs and PSOs attainment of two batches is less than the target, then retain the target for further observations.

II). Computation of POs – PG

A). Direct Assessment (80%)

- COs –POs articulation

$$PO_j\ \ Attainment(Direct) = \frac{\sum_{i=1}^{i=k}(Level\ of\ CO_i - PO_j\ mapping * CO_i\ attainment)}{\sum level\ of\ CO_i - PO_j\ mapping}$$

Where

k is the no.of Cos tagged with the j^{th} PO/PSO
j = 1 to no.of POs/PSOs

B). Indirect Assessment tools (20%)

(a). Student exit surveys (5%)

(b). Employer surveys (5%)

(c). Student Portfolio (10%)

POs Attainment =

80% of Direct Attainment +5% of (a) + 5% of (b) + 10% of (c)

Target for POs and PSOs

- Initially targets are fixed for POs based on the difficulty level in the range of 1.8 - 2.1

Revision of PO Target (after two batches) :

- ✓ If the average POs attainment of two batches is greater than the target, then increase the target
- ✓ If the average POs attainment of two batches is less than the target, then retain the target for further observations.

R-20 Regulations:

i) Computation of COs

- Since there is choice for questions in the examinations the CO component is to be considered if the question is attempted by more than **10% of the total students**
- Question assessment, threshold value is to be taken as **maximum of class average mark or 60% of the marks** allocated to the question.
- **Question assessment value** $= \frac{No.of\,students scored \geq threshold value}{No.of\,students attempted the question}$
- Each question is tagged to a corresponding CO with weightage
- Weightages for CIE and SEE:
  - ✓ **CIE - 40%) –** (25% MID Exams+10% Quiz+05% Assignments)
  - ✓ **SEE (60%)**

ii).Target for COs

- Initially based on the Level of CO
  - ✓ **Theory Course:** High Level COs (L4,L5,L6) – (55%-65%), Low Level COs (L1,L2,L3) - (65%-75%)
  - ✓ **Laboratory Course:** High Level COs (L4,L5,L6) – (60%-70%), Low Level COs (L1,L2,L3) - (70%-80%)
- After two years:
  - ✓ If the average CO attainment of two bathes is Greater than the target then increase the target
  - ✓ If the average CO attainment of two bathes is Less than the target then retain the target for further observations

iii) Computation of POs & PSOs

- Weightages for Direct and Indirect assessment tools:
  - **a) Direct Assessment (COs) :70% (80% for MBA)**
  - **b) Indirect Assessment :30% (20% for MBA)**
    - ✓ **Program Exit Survey (10%)**
    - ✓ **Student Portfolio (20%) (10% for MBA)**

iv).Target for POs and PSOs

- Initially targets are fixed for POs and PSOs based on the difficulty level in the range of 60%-70%

After two batches of graduation:

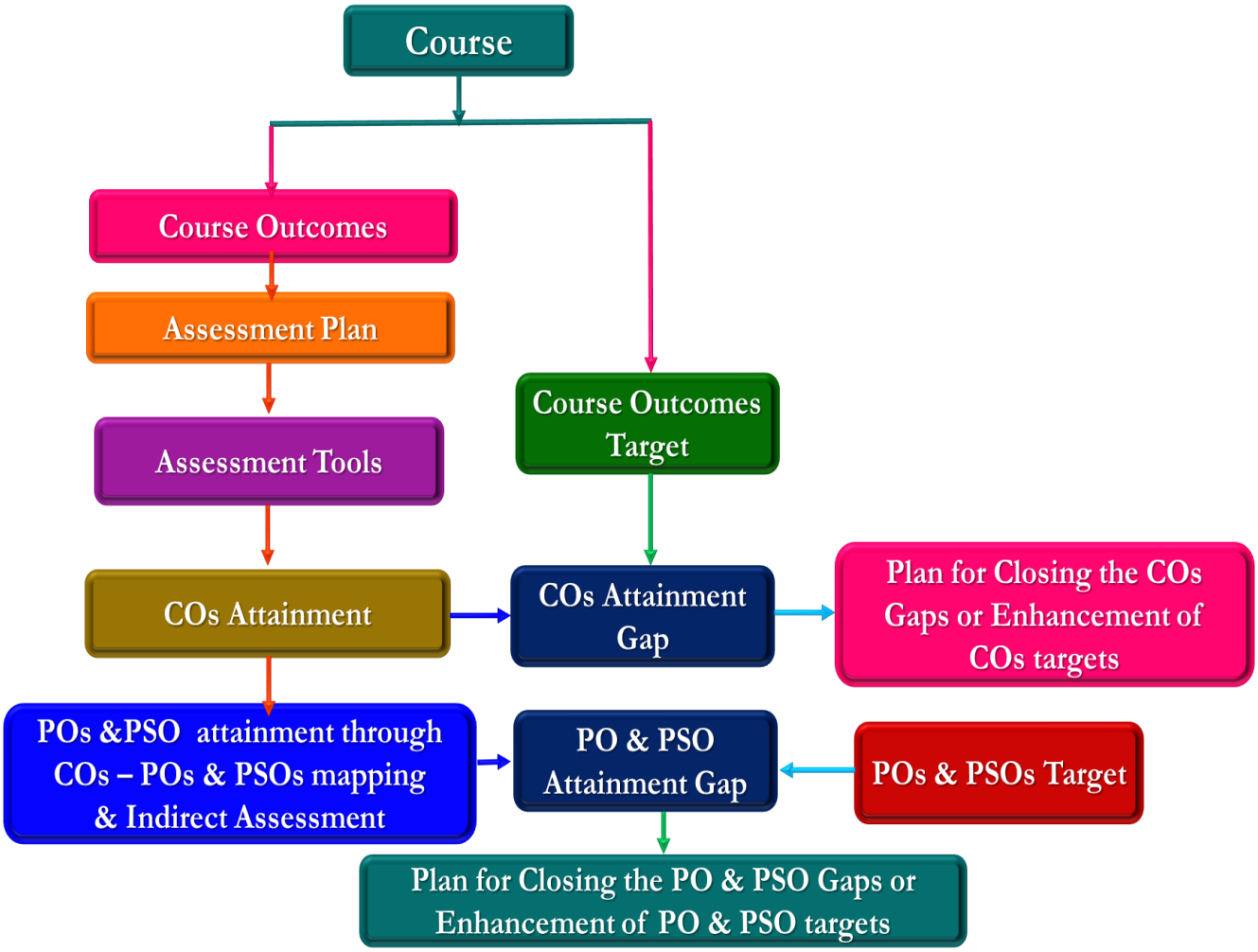
- If the average POs & PSOs attainment of two bathes is Greater than the target then increase the target
- If the average POs & PSOs attainment of two bathes is Less than the target then retain the target for further observations

Every year ATR is to be prepared to strengthen the POs and PSOs

- ✓ Adding new courses in the curriculum
- ✓ Adding relevant content in the existing courses
- ✓ Increasing the student participation in Portfolio components
- ✓ Co-Curricular activities (Workshops, Certification programs, Symposia etc.)
- ✓ Extra-curricular activities (Sports and Games, Yoga and Cultural activities)
- ✓ Extension activities (NCC & NSS)
- ✓ Placement & Higher Studies
- ✓ Addition of Equipments and Upgradation of Software tools

- **Based on ATR, prepare the department calendar of events and got approval from BoS**

CO-PO Attainment and Quality Loop



7.3. Procedure for attainment of PEOs:

PEOs will be computed after 4 to 5 years of graduation as follows.

a). Direct attainment (30%)

- POs/PSOs – PEOs articulation

$$\boldsymbol{PEO_j\ \ Attainment(Direct)}$$

$$= \frac{\sum_{i=1}^{i=k}(\boldsymbol{Level\ of}\ (\text{POs/PSOs})_{\ i} - \boldsymbol{PEO_j\ mapping} * (\text{POs/PSOs})_i\ \boldsymbol{attainment})}{\sum \boldsymbol{level\ of\ CO_i - PO_j\ mapping}}$$

Where

k is the no.of POs/PSOs tagged with the j^{th} PEO

j = 1 to no.of PEO

b). Indirect Assessment tools (70%)

- PEO attainment is based on stakeholder inputs using an online survey questionnaire

(a). Employer surveys (40%)

(b). Alumni Survey (30%)

POs Attainment = 30% of Direct Attainment + 40% of (a) + 30% of (b)

7.4. Various Committees to monitor OBE implementation

Committee	Frequency	Functions
Departmental Academic Committee (DAC)	Twice in a Semester	• To monitor feedbacks from stake holders and taking action there after on academic matters. • ATR on Results analysis • ATR on COs attainment levels • ATR on POs and PSOs attainment levels • Curriculum Overall department activities
Class Review Committee (CRC)	Twice in a Semester	• Collecting the Feedback from the students on Syllabus Coverage & Curriculum
Course Coordination Committee (CCC)	Once in a Week	• Collecting feedback to improve Teaching-Learning process • Discussion on Syllabus Coverage • Tutorial Problems
Module Coordination Committee (MCC)	Twice in a Semester	• Syllabus Coverage • Quality of the Mid-Question Papers • COs attainment of previous semester courses under the respective module • Any suggestions to improve the curriculum and syllabus
Program Assessment committee (PAC)	Twice in a Year	• Result Analysis • Direct and Indirect COs, POs and PSOs Assessment Process Document • PAC meeting minutes which address the COs attainment of courses collected form MCC along with measurements taken to improve and these minutes should be forwarded to DAC • POs and PSOs Attainment of latest graduating batch and Comparison with previous graduating batch if applicable • Measurements taken to improve POs and PSOs and forward the same to DAC
Department Advisory Board (DAB)	Once in a Year	• Calander of Events for the A.Y • Curriculum Changes • Over development of the department
Board of Studies (BoS)	Twice in a Year	• 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 • To approve the Course Outcomes (COs), Program Outcomes (POs), Program Specific Outcomes (PSOs) and program educational objectives

		(PEOs) of the programs offered by the department • Suggest methodologies for innovative teaching and evaluation techniques • Suggest panel of names to the Academic Council for appointment of examiners • Coordinate research, teaching, extension and other academic activities in the department/college.
Academic Council (AC)	Twice in a Year	• 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. • Make regulations regarding the admission of students to different programmes of study in the college keeping in view the policy of the Government. • Make regulations for sports, extra-curricular activities, and proper maintenance and functioning of the playgrounds and hostels. • Recommend to the Governing Body proposals for institution of new programmes of study. • Recommend to the Governing Body institution of scholarships, studentships, fellowships, prizes and medals, and to frame regulations for the award of the same. • Advise the Governing Body on suggestions(s) pertaining to academic affairs made by it. • Perform such other functions as may be assigned by the Governing Body. • To maintain proper standards of the examination

8. Roles and Responsibilities

Institution

- Provide infrastructure and policy support
- Ensure alignment with NBA and NEP 2020

IQAC

- Monitor implementation and quality assurance
- Review attainment and improvement actions

HoDs/BoS

- Curriculum design and revision
- Ensure CO–PO mapping

Faculty

- Deliver outcome-based teaching
- Conduct assessments and calculate attainment

Students

- Actively participate in learning
- Achieve defined outcomes

9. Expected Outcomes

Academic Outcomes

- Improved CO, PO, and PSO attainment levels
- Enhanced conceptual understanding

Student Outcomes

- Development of technical, analytical, and soft skills
- Increased participation in projects, internships, and research

Institutional Outcomes

- Strengthened compliance with NBA accreditation criteria
- Improved NAAC quality indicators

Employability Outcomes

- Higher placement rates and industry readiness
- Improved performance in competitive exams and higher education

10. Documentation and Evidence (NBA/NAAC)

- CO–PO mapping matrices
- Lesson plans and course files
- Attainment calculation sheets
- Feedback reports (students, alumni, employers)
- Action Taken Reports (ATR)

11. Policy Review

The Institute shall continuously review and update the approved policy and is committed to its implementation.

Policy History:

Version	Approved by	Implementation and Monitoring by
V1.0 (Original)	20th Meeting of GB held on 31-01-2026	IQAC and Dean (Academics)