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"Techno-Social Excellence"

MARATHWADA MITRA MANDAL'S INSTITUTE OF TECHNOLOGY

Lohgaon, Pune 411047

Department of Civil Engineering

OUTCOME-BASED EDUCATION (OBE) MANUAL

Developed and applicable for Academic Year 2024-25

Complete departmental OBE implementation manual

A practical guide for faculty and students to plan, deliver, assess, and continuously improve learning outcomes under the Savitribai Phule Pune University (SPPU) 2019 Pattern curriculum.

2019 Pattern

Savitribai Phule Pune University, Pune

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NAAC

INSTITUTE VISION

To be a premier institute of techno-social excellence for the welfare of society

INSTITUTE MISSION

- **M1: Integrating innovative pedagogy**
- **M2: Implementing entrepreneurship**
- **M3: Promoting global competency**
- **M4: Enhancing technology transfer**
- **M5: Creating excellent human resource**

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Civil Engineering

VISION

To be a leading Civil Engineering department, shaping techno-socially competent engineers for sustainable development and nation building

MISSION

- **M1- Imparting quality education in Civil Engineering through effective teaching–learning processes and modern tools**
- **M2 - Nurturing techno-social competence among students through skill development, sustainable practices, and community engagement**
- **M3 – Inculcating professional ethics, leadership skills, and preparing graduates to work in diversified domains of public and private sector**

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1. About the Department

1.1 Department Profile

- Institute: Marathwada Mitra Mandal's Institute of Technology (MMIT), Lohgaon, Pune
- Program: B.E. Civil Engineering (UG)
- Year of start of program: 2019
- Sanctioned intake: 60
- Affiliating university: Savitribai Phule Pune University (SPPU)
- Curriculum pattern covered by this manual: SPPU 2019 Pattern, applicable to all years (SE-BE) as offered in AY 2024-25.

1.2 Vision

To be a leading Civil Engineering Department, shaping techno-socially competent engineers for sustainable development and nation building.

1.3 Mission

- **M1:** Imparting quality education in Civil Engineering through effective teaching-learning processes and modern tools.
- **M2:** Nurturing techno-social competence among students through skill development, sustainable practices, and community engagement.
- **M3:** Inculcating professional ethics, leadership skills, and preparing graduates to work in diversified domains of public and private sector.

1.4 Program Offered and Intake

Program	Duration	Sanctioned Intake
Bachelors of Engineering (Civil Engineering)	4 Years	60

1.5 Faculty Profile

The department's faculty are organized across the standard AICTE/university cadre - Professor, Associate Professor, and Assistant Professor, with each course allotted a designated Course Coordinator from an appropriately qualified faculty member.

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1.6 Laboratories

Core laboratories operated for the program, with key equipment:

SN	Name of the Laboratory	Name of the major equipment
1	Material Testing Laboratory (Concrete Technology and Transportation Engineering)	⇒ Compression Testing Machine ⇒ Concrete Mixer ⇒ Compaction Factor Apparatus ⇒ Marshal Stability Apparatus ⇒ Ductility Testing Apparatus ⇒ Penetration Testing Apparatus
2	Fluid Mechanics Lab	⇒ Wind Tunnel Test Setup ⇒ Tilting Flume Test Setup
3	Environmental Lab	⇒ BOD Incubator ⇒ Spectrophotometer ⇒ Nephelometer ⇒ Jar Test Apparatus ⇒ High Volume Sample
4	Geotechnical Engineering Lab	⇒ Triaxial Test Machine ⇒ Permeability Test Machine ⇒ Lab & field density (Proctor mould & sand-replacement test) set-up ⇒ Direct Shear Test Machine ⇒ Unconfined Compressive Strength
5	Engineering Geology Lab	⇒ Mineral Specimens (50), ⇒ Rock Specimens(50)
6	Surveying Lab	⇒ DGPS rover ⇒ Total Station ⇒ 20" Theodolite ⇒ Electronic Distance Measurement

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1.7 Major Facilities

- Departmental Library - core textbooks, reference books, competitive exam material, and IS codes.
- IIT Virtual Lab Nodal Centre - online simulation-based experiments where physical resources are limited.
- IIRS-ISRO Outreach Program Centre - GIS and remote sensing courses/certifications.
- Skill-Based Learning (EduSkills) - industry-oriented training and certification programs.
- PCs with internet access and licensed design/analysis software installed in each laboratory.
- Field instrumentation: Laser Distance Meter, Digital Theodolite, Digital Altimeter, Lux Meter, IR Thermometer, Anemometer, Digital Humidity & Temperature Meter, Digital Sound Level Meter.

1.8 Department Organizational Structure

Reporting structure from the Head of Department down to committee coordinators. An organogram is maintained as follows.

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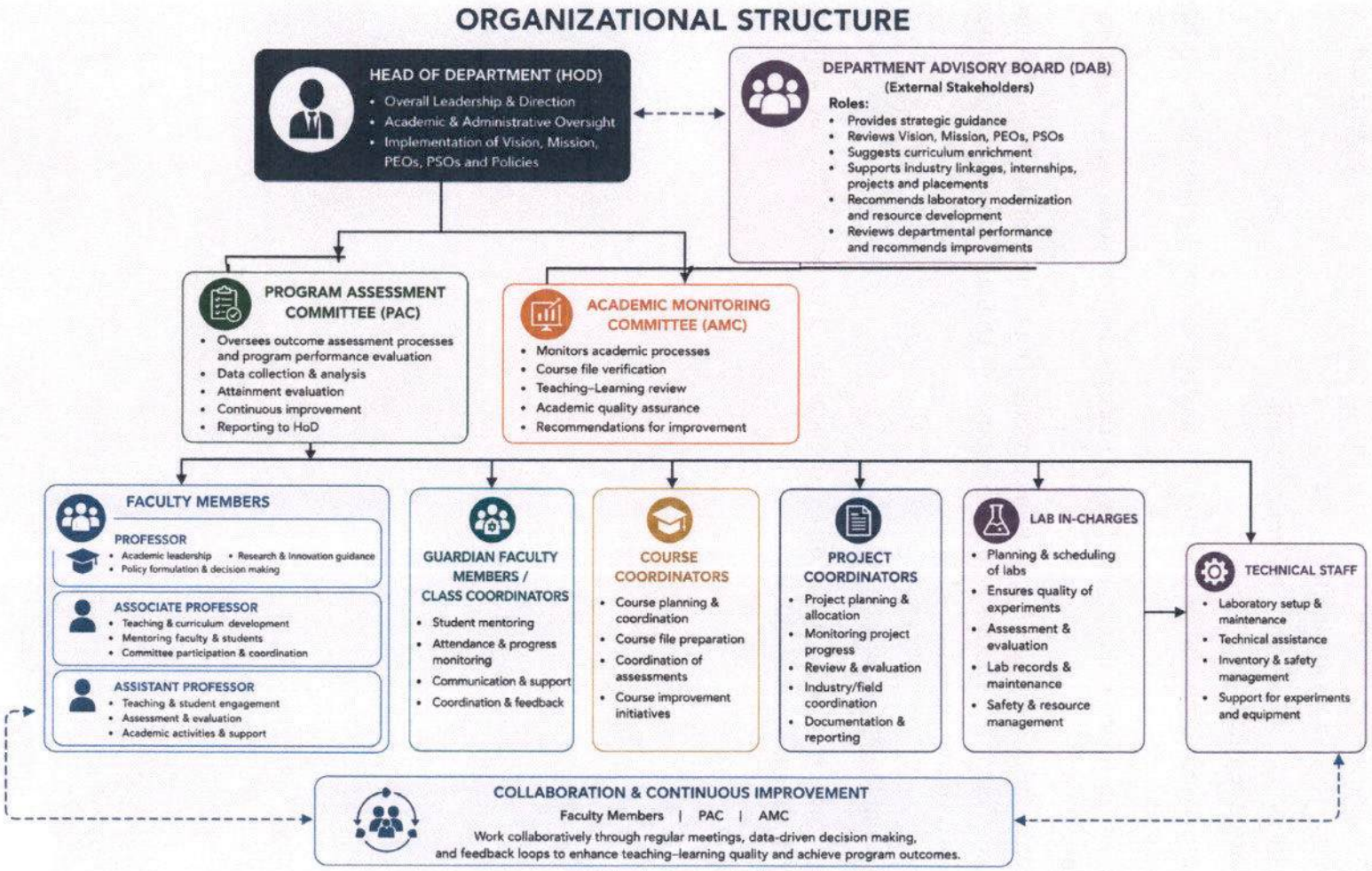


Figure 1.1 Department Organizational Structure

1.9 Scope of This Manual vs. Institute Academic Policy

This manual documents how the Department of Civil Engineering implements Outcome-Based Education - course outcomes, mapping, teaching-learning processes, assessment design, attainment, and continuous improvement - within the boundaries set by institute-level academic policy.

It does not restate institute-wide rules such as attendance requirements, examination conduct regulations, the credit and grading system, promotion/ATKT criteria, malpractice handling, or the academic calendar. Those are governed by the Institute Academic Policy / Examination Rules issued by the Savitribai Phule Pune University (SPPU), and this manual defers to them wherever a departmental process intersects with such a rule (e.g., minimum attendance for practical eligibility).

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2. Outcome-Based Education (OBE)

2.1 Introduction to OBE

Traditional Education vs OBE

Traditional (Input-Based) Education	**Outcome-Based Education**
Focus on content coverage and teaching hours delivered.	Focus on measurable learning outcomes achieved by students.
Assessment is summative and largely norm-referenced.	Assessment is continuous, criterion-referenced, and mapped to defined outcomes.
Curriculum design is largely instructor/institution driven.	Curriculum design is backward-mapped from graduate attributes (POs/PSOs).
Improvement is ad hoc and reactive.	Improvement follows a structured, evidence-based CQI cycle.

Principles of OBE

- Clarity of focus - every activity is designed around clearly defined outcomes.
- Designing down (backward design) - curriculum, delivery, and assessment are derived from the outcomes, not the reverse.
- High expectations - outcomes are set at a challenging yet achievable level for all learners.
- Expanded opportunity - multiple pathways and repeated opportunities are provided for students to demonstrate outcome attainment.

Benefits of OBE

- Provides a transparent, measurable basis for curriculum and pedagogy decisions.
- Enables early identification of learning gaps through continuous assessment.
- Creates accountability and a documented improvement trail (CQI) valued by accreditors and employers alike.
- Facilitates international mutual recognition of the qualification via Washington Accord alignment.

2.2 Why This Framework, for Students

The structures used in the rest of this manual - Program Outcomes, Course Outcomes, attainment tracking, Complex Engineering Problems/Activities - did not originate as paperwork for an external reviewer. They are a discipline for making sure teaching actually produces the competencies students need, and for catching gaps early enough to

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fix them within the same student's journey through the program, not just in a retrospective report.

- Program Outcomes (Chapter 6) give students, faculty, and employers a shared, explicit description of what a Civil Engineering graduate should be able to do - not just which courses were passed.
- Course Outcomes and CO-PO mapping (Chapters 9-10) make the link between a specific class session and a graduate competency visible, so neither students nor faculty are guessing why a topic matters.
- Attainment and CQI (Chapters 13, 14) turn assessment data into a feedback loop that changes teaching for the next cohort, rather than simply recording who passed.
- Complex Engineering Problems and Activities push students toward open-ended, judgement-requiring problems - the kind they will actually face as practicing engineers - rather than only formulaic textbook exercises.

This manual therefore keeps the OBE methodology in full, while treating it as a teaching-quality system owned by the department for its own students, rather than as an accreditation compliance exercise.

2.3 Policy Basis: AICTE Examination Reform Policy 2018

The department's assessment design (Chapters 9, 12, 13) follows the framework recommended in the AICTE Examination Reform Policy (2018), which itself set out the national push toward outcome-based assessment. Three elements of that policy are adopted directly:

- A two-step mapping process - Program Outcomes are first broken down into specific Competencies and Performance Indicators (PIs), and only then mapped to individual assessment questions - rather than mapping questions to POs directly.
- Assessment instruments are chosen by Bloom's level: Remember/Understand/Apply-level outcomes are assessed through time-limited tests and exams; Analyze/Evaluate/Create-level outcomes require extended-format instruments such as projects, mini-projects, design exercises, and internships.
- Question papers should not be dominated by recall-level questions - the department follows a working guideline of capping Remember/Understand-level questions at approximately 40% weightage in any theory question paper (Chapter 12.5).

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3. OBE Framework of the Department

This chapter establishes the logical architecture through which the department translates its institutional Vision and Mission into demonstrable graduate competencies. Every subsequent chapter of this manual operationalizes one link in this chain, and every piece of evidence collected during a course cycle should be traceable back to it.

3.1 The OBE Hierarchy

- Institute & Department Vision - the long-term aspirational identity of the department.
- Institute & Department Mission - the broad means by which the Vision is pursued.
- Program Educational Objectives (PEOs) - statements describing what graduates are expected to attain within 3-5 years of graduation.
- Program Outcomes (POs) & Program Specific Outcomes (PSOs) - the graduate attributes and specialization competencies demonstrated at the time of graduation.
- Course Outcomes (COs) - measurable, course-level statements of what a student can do on completing a course.
- Learning Activities - the teaching-learning processes through which COs are delivered.
- Assessment - direct and indirect instruments used to measure the extent to which COs, and in turn POs/PSOs, have been achieved.
- Attainment - the quantified outcome of assessment, benchmarked against pre-defined targets.
- Continuous Quality Improvement (CQI) - analysis of attainment gaps and the corrective/preventive actions that feed back into curriculum, delivery, and assessment design.

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3.2 Flow of the Framework

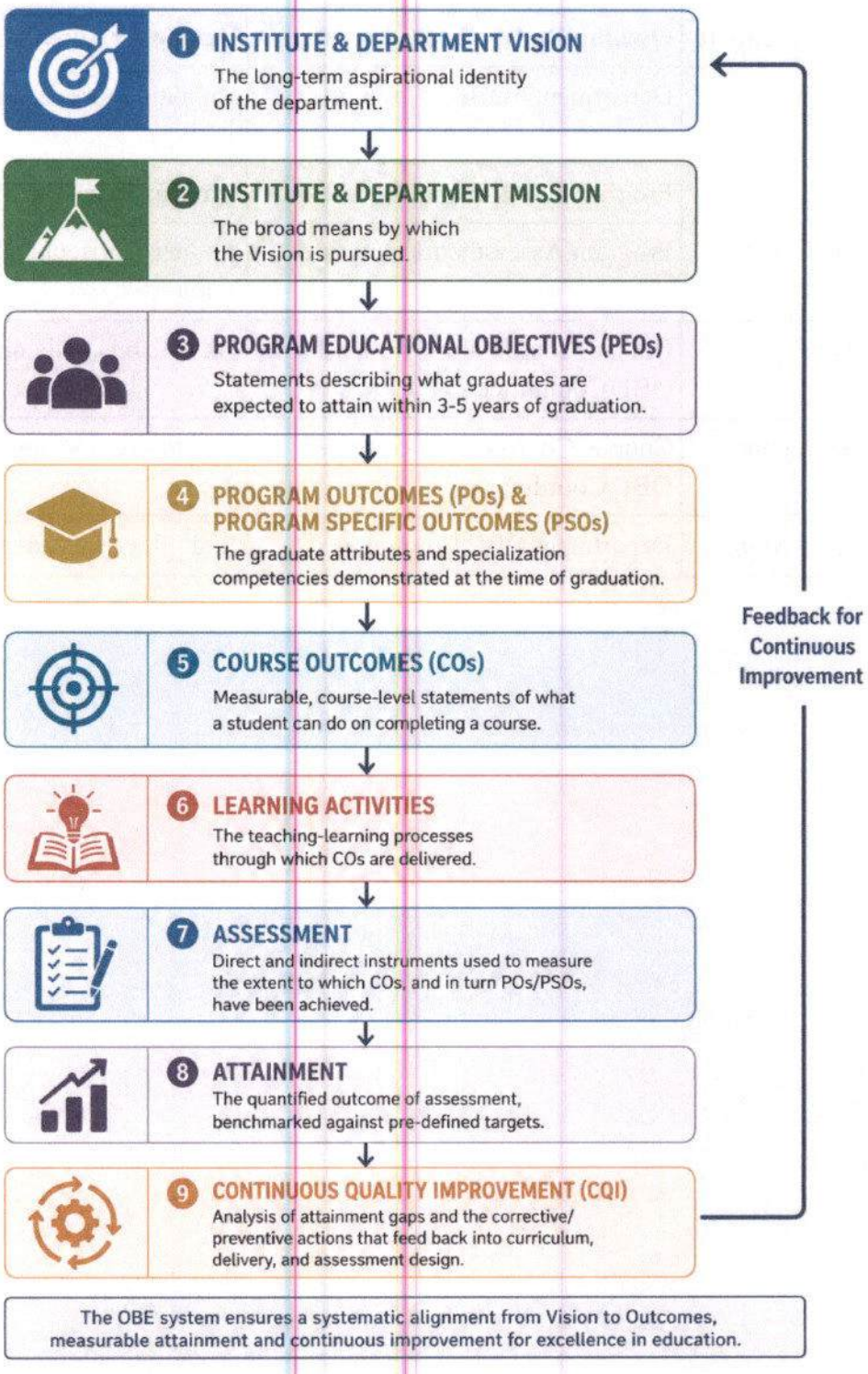


Figure 3.1 Outcome-Based Education Hierarchy

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3.3 Ownership and Periodicity

OBE Element	**Owning Body**	**Review Frequency**
Vision / Mission	Department OBE Committee + Advisory Board	On major curriculum revision
PEOs	Program Assessment Committee	Once in 3 years
POs / PSOs	Program Assessment Committee	As per curriculum revision, else static
COs	Course Coordinator + Department OBE Committee	On syllabus revision
Attainment	Course Coordinator, compiled by OBE Coordinator	End of every semester
CQI Actions	Department OBE Committee	End of every academic year

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4. Vision, Mission and Quality Policy

4.1 Institute Vision & Mission

Vision: To be a premier institute of techno-social excellence for the welfare of society.

- **M1:** Integrating Innovative Pedagogy
- **M2:** Implementing Entrepreneurship
- **M3:** Promoting Global Competency
- **M4:** Enhancing Technology Transfer
- **M5:** Creating Excellent Human Resource

4.2 Quality Policy

MMIT strives for imparting quality technical education by adopting best possible standards for continual improvement in skills with awareness of social responsibilities to meet expectations of stakeholders.

4.3 Department Vision & Mission

The department Vision and Mission (Chapter 1.2-1.3) are derived from and aligned with the institute-level statements above, contextualized to the discipline of Civil Engineering.

4.4 Core Values

- Techno-social competence and sustainable development orientation
- Professional and academic ethics
- Leadership and lifelong learning
- Community engagement and societal responsibility

4.5 Process of Formulation

The Vision and Mission are formulated through the following structured, consultative process:

- Department Vision/Mission are drafted based on the institute's Vision/Mission and benchmarking against reputed institutions.
- Faculty and staff conduct brainstorming sessions to prepare a draft, ensuring relevance and inclusiveness.
- Feedback is gathered from alumni, industry professionals, parents, and management.
- The Program Assessment Committee (PAC) reviews and prepares the final draft.
- The draft is forwarded to the Department Advisory Board (DAB) for validation and recommendations.

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- After incorporating DAB feedback, the revised statements are submitted to the Internal Quality Assurance Cell (IQAC) for approval.
- Post IQAC approval, statements are finalized and shared with all stakeholders, and displayed across the website, notice boards, and other locations.
- If revision is required due to changing scenarios or evaluator feedback, statements are referred back to the PAC for continual improvement.

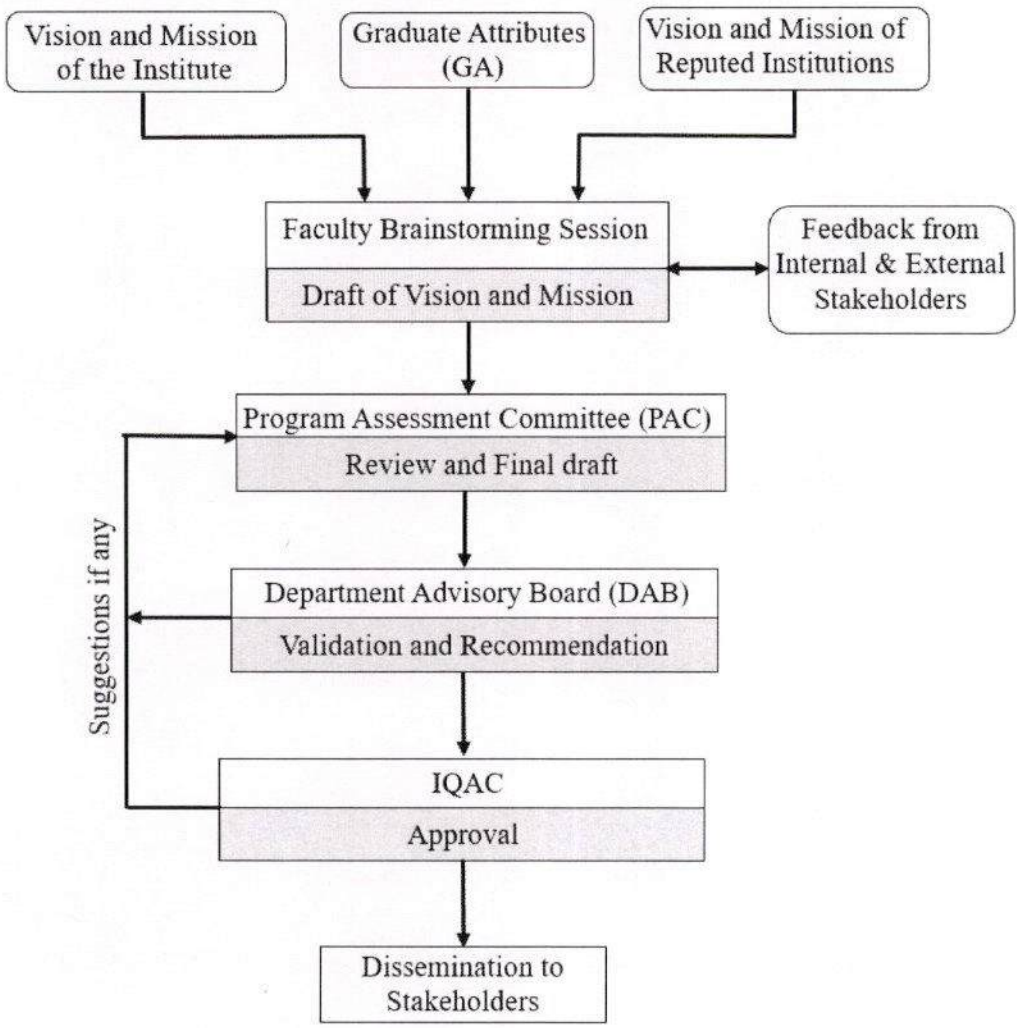


Figure 4.1 Process of Formulation of Vision and Mission

4.6 Stakeholder Participation

Formulation involves faculty, students, alumni, employers/industry professionals, parents, management, and the Department Advisory Board - consistent with the PEO process detailed in Chapter 5 and the Stakeholder Feedback System in Chapter 15.

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4.7 Dissemination Channels

Vision, Mission, and PEOs are published and displayed through: department notice board, HoD office, department board room, display at department entrance, laboratories & classrooms, department corridors, admission brochure, placement brochure, faculty course files, lab manuals, student journal, library, and department newsletter - as well as the institute and department websites.

Dissemination events: Induction programs (HoD presentation, once/year), Parent-Teacher Meetings (twice/year), IQAC and DAB meetings, Alumni Meet (once/year), student chapter activities, Industry-Institute meetings, workshops/seminars, and email signature lines.

4.8 Review Mechanism

Reviewed periodically by the Department Advisory Board to check accomplishment status; stakeholder feedback is collected during drafting/revision, and Vision/Mission is conveyed to management through Governing Body meetings.

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5. Program Educational Objectives (PEOs)

5.1 Definition

Program Educational Objectives are broad statements that describe the career and professional accomplishments the program is preparing graduates to achieve within three to five years after graduation. PEOs are aspirational, mission-linked, and evaluated through indirect assessment of alumni and employers rather than direct student assessment.

5.2 PEO Statements

On successful completion of the B.E. Civil Engineering program, graduates will:

- **PEO1:** Apply fundamental and advanced Civil Engineering knowledge using modern tools for analysis, design, and development of infrastructure systems.
- **PEO2:** Demonstrate techno-social competence by addressing engineering problems with sustainable, ethical, and societal considerations.
- **PEO3:** Pursue successful careers in public and private sectors, higher education, or entrepreneurship, demonstrating leadership and lifelong learning.

5.3 Process of Framing PEOs

- PEOs are formulated in alignment with the department's Vision and Mission and the Savitribai Phule Pune University curriculum.
- Faculty brainstorming sessions draft the PEOs; stakeholder suggestions are incorporated into a revised draft.
- The Program Assessment Committee (PAC) reviews the draft PEOs against faculty input and Program Outcomes (POs).
- The Department Advisory Board (DAB) discusses the PEO statements for further approval.
- Finalized PEOs are approved by the Internal Quality Assurance Cell (IQAC).
- Approved PEOs are disseminated to all stakeholders via website, notice boards, and other platforms.
- If revisions are required due to changing industry/academic scenarios, PEOs are referred back to the PAC for continual improvement.

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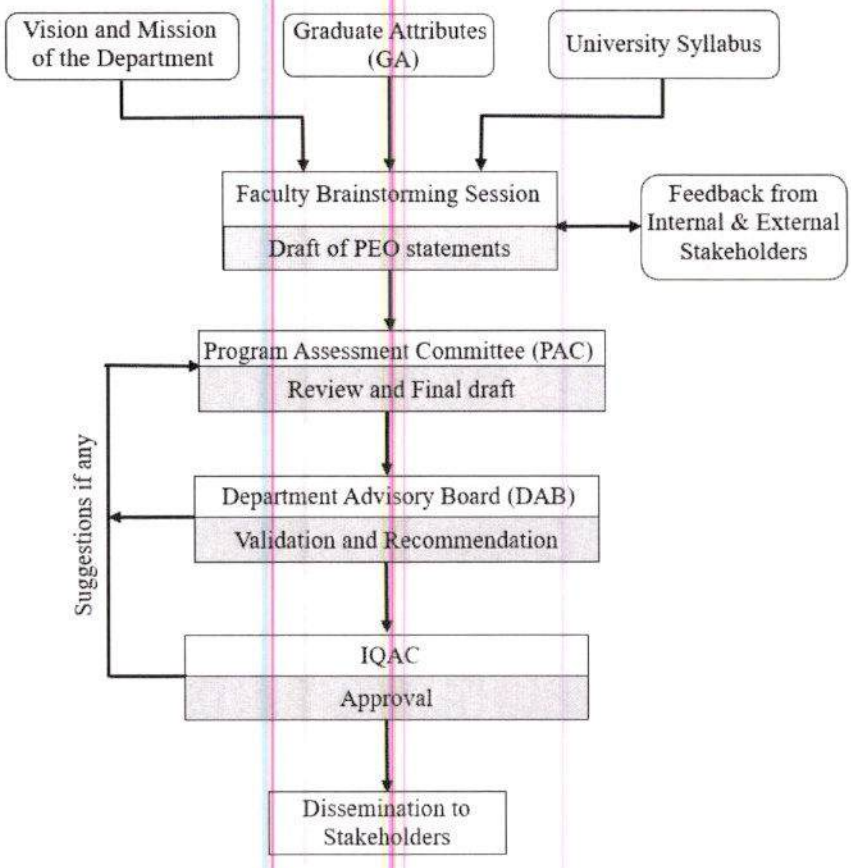


Figure 5.1 Process of Formulation of Program Educational Objectives

5.4 Stakeholders Involved

- Students, alumni, employers/industry professionals, parents, faculty, and management
- Department Advisory Board (DAB)
- Program Assessment Committee (PAC) and Internal Quality Assurance Cell (IQAC)

5.5 Mapping of PEOs with Mission

PEO	**M1**	**M2**	**M3**
PEO1 - apply CE knowledge for analysis/design	3	2	1
PEO2 - techno-social competence, sustainability, ethics	2	3	2
PEO3 - careers, higher studies, leadership, lifelong learning	2	2	3

(M1 = Imparting quality education; M2 = Nurturing techno-social competence; M3 = Inculcating professional ethics/leadership. Scale: 1=Low, 2=Medium, 3=High.)

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5.6 Review Process

PEOs are reviewed periodically by the PAC, with status of accomplishment checked at DAB meetings; revision is triggered by curriculum changes or sustained stakeholder feedback indicating misalignment.

5.7 Assessment Method (Indirect)

- Alumni Survey - administered to graduates, feeding PEO-level perception data.
- Employer Survey - administered to recruiting organizations.

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6. Program Outcomes (POs)

6.1 Definition

Program Outcomes are twelve broad graduate attributes describing what a student is expected to know and be able to do by the time of graduation, drawn from the internationally recognized Washington Accord Graduate Attributes framework. POs are directly assessed through course-level outcomes and their attainment is computed every semester.

6.2 Program Outcomes

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

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.

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.

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 information to provide valid 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.

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

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

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

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

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PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and 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.

PO11 - Project management and finance: Demonstrate knowledge and understanding of 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.

PO12 - 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.

6.3 From PO to Assessable Competencies (AICTE Two-Step Process)

Following the AICTE Examination Reform Policy approach, a PO is too broad to assess directly. Before it is mapped to a course or a question, it is broken down into specific Competencies, and each Competency into one or more observable Performance Indicators (PIs) - it is the PI, not the PO statement itself, that a question paper or rubric item actually targets.

PO	Competency (Illustrative)	Performance Indicator (Illustrative)
PO1	Apply mathematical and scientific principles to engineering problems	Selects and applies the correct governing equation/theorem for a given structural/geotechnical scenario
PO3	Design a system/component to meet specified needs	Produces a design that satisfies stated safety, serviceability, and code constraints

Department-wide Competency/PI tables per PO are maintained as a live reference document; see Chapter 26 Annexure.

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7. Program Specific Outcomes (PSOs)

7.1 Definition

Program Specific Outcomes are statements describing what graduates of the Civil Engineering program specifically are expected to know or be able to do, reflecting the specialization areas and unique strengths of the department, in addition to the twelve generic POs.

7.2 PSO Statements

- **PSO1:** Students will be able to apply civil engineering principles and analytical and problem-solving skills to solve civil infrastructural problems.
- **PSO2:** Students will be able to apply industry-relevant knowledge and current engineering practices.

7.3 Need for PSOs

- Distinguish the program's specific technical identity from the twelve generic POs.
- Reflect department strengths, laboratory infrastructure, and faculty expertise.
- Provide employers and accreditors with a precise picture of specialization-level competency.

7.4 Mapping of PSOs with Mission

PSO	**M1**	**M2**	**M3**
PSO1 - CE principles, analysis, problem-solving	3	2	1
PSO2 - industry-relevant knowledge, current practice	2	2	3

7.5 Assessment Process

PSOs are assessed directly through the CO-PSO mapping of specialization-heavy courses (design, geotechnical, environmental, transportation courses; capstone/final-year projects) and indirectly through the Graduate Exit Survey and Employer Survey, using the attainment methodology described in Chapter 13.

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8. Curriculum Mapping

8.1 Curriculum Structure

The curriculum is organized semester-wise into Basic Sciences, Engineering Sciences, Program Core, Program Electives, Open Electives, Humanities/Management, Project Work, and Mandatory/Audit courses, in line with the affiliating university's credit framework.

Category	**Approx. Credit Share**	**Representative Courses**
Basic Sciences	[~15%]	Mathematics, Physics, Chemistry
Engineering Sciences	[~10%]	Mechanics, Materials Science
Program Core	[~45%]	Structural, Geotechnical, Transportation, Environmental Engg.
Program Electives	[~10%]	Specialization electives
Project / Internship	[~10%]	Mini Project, Final Year Project, Internship
Humanities / Mandatory	[~10%]	Communication, Environmental Studies, Constitution

8.2 Curriculum Analysis

Course-wise contribution to POs/PSOs is aggregated across the curriculum to confirm balanced coverage - each PO/PSO should be addressed by an adequate number of courses at increasing Bloom's levels as students progress from first to final year.

8.3 Course Contribution

A curriculum-level PO/PSO coverage matrix (course × PO/PSO) is maintained, aggregating the individual course-level CO-PO-PSO mappings from Chapter 10, to visualize which courses carry primary responsibility for each PO/PSO.

8.4 Curriculum Gap Analysis

- Identify POs/PSOs with thin or shallow-Bloom's-level coverage.
- Identify emerging-technology gaps (e.g., BIM, GIS, sustainability, AI/automation in construction) against industry/curriculum benchmarking.
- Recommend electives, value-added courses, or content additions to close identified gaps; route through the Board of Studies / Academic Council.

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8.5 Beyond Syllabus Activities

- Value-added certificate courses (e.g., STAAD.Pro, Revit/BIM, GIS, ANSYS).
- Guest lectures, industry expert sessions, and webinars.
- Competitions, hackathons, and innovation challenges (e.g., student participation in events such as the Tata Technologies InnoVent competition).
- MOOC/NPTEL course completions credited or recorded as co-curricular attainment.

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9. Course Outcomes (COs)

9.1 Definition

A Course Outcome is a specific, measurable statement describing what a student should be able to do upon successful completion of a course. COs are the foundational unit from which PO/PSO attainment is computed (Chapter 10, 13).

9.2 Guidelines for Writing COs

- Each CO should begin with a single measurable action verb (see Bloom's Taxonomy below) - avoid vague verbs such as 'know' or 'understand' in isolation.
- Each CO should address one distinct learning outcome - avoid compound/multi-part COs.
- Typically 4-6 COs are defined per course, covering the major units/modules.
- COs must be assessable through at least one direct instrument (test, assignment, practical, project) actually used in the course.
- Higher-year/specialization courses should target higher Bloom's levels (Apply/Analyze/Evaluate/Create) compared to first-year foundational courses (Remember/Understand/Apply).
- Across a course's full set of COs, Remember/Understand-level COs should not dominate - as a working norm, no more than about 40% of total question-paper weightage should test purely recall/understanding, consistent with the AICTE Examination Reform Policy guidance (Chapter 2.3).

9.3 Bloom's Taxonomy and Action Verbs

Level	Description	Sample Action Verbs
Remember	Recall facts, terms, basic concepts	define, list, state, recall, name
Understand	Explain ideas or concepts	explain, describe, summarize, classify
Apply	Use information in new situations	apply, calculate, solve, demonstrate, use
Analyze	Draw connections among ideas	analyze, differentiate, compare, examine
Evaluate	Justify a stand or decision	evaluate, justify, critique, assess
Create	Produce new or original work	design, develop, formulate, construct

9.4 CO Numbering

COs are numbered as Course Code. CO1, CO2, … in sequence, consistent across the course plan, question papers, and attainment sheets - e.g., 201001.1, 201001.2, 301013.1.

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9.5 CO Revision Process

- CO statements are derived directly from the affiliating university's prescribed syllabus for that course. The Program Assessment Committee (PAC) reviews these against the syllabus each cycle. Module/course coordinators may suggest wording revisions to a CO statement - not to change what the syllabus covers, but to phrase it so it complies with OBE requirements (measurable, single action verb, correct Bloom's level) and with the AICTE Examination Reform Policy framework (Chapter 2.3). The PAC reviews and approves these suggested revisions; once approved, the CO statement is not further revised at individual faculty or department discretion between curriculum cycles.
- A CO's *underlying content* changes only when the affiliating university carries out a curriculum revision for that course (new pattern, syllabus restructuring, significant content change) - that's a separate, larger trigger than the PAC's wording-compliance review above.
- Where neither a PAC-approved wording revision nor a university curriculum revision has occurred, the CO remains unchanged from the previous offering; this is logged as "no change," not treated as a missed review.
- Attainment data, student feedback, and CQI findings (Chapter 14) do not by themselves revise the CO statement - they drive changes to teaching pedagogy and assessment design *for the same CO*, unless the coordinator's analysis concludes the CO itself is unmeasurable or misworded, in which case it goes to the PAC as above.
- When a university curriculum revision does occur, affected COs are freshly drafted per Chapter 9.2, re-mapped (Chapter 10), and version-logged (Chapter 23.9) before the revised syllabus is first offered.

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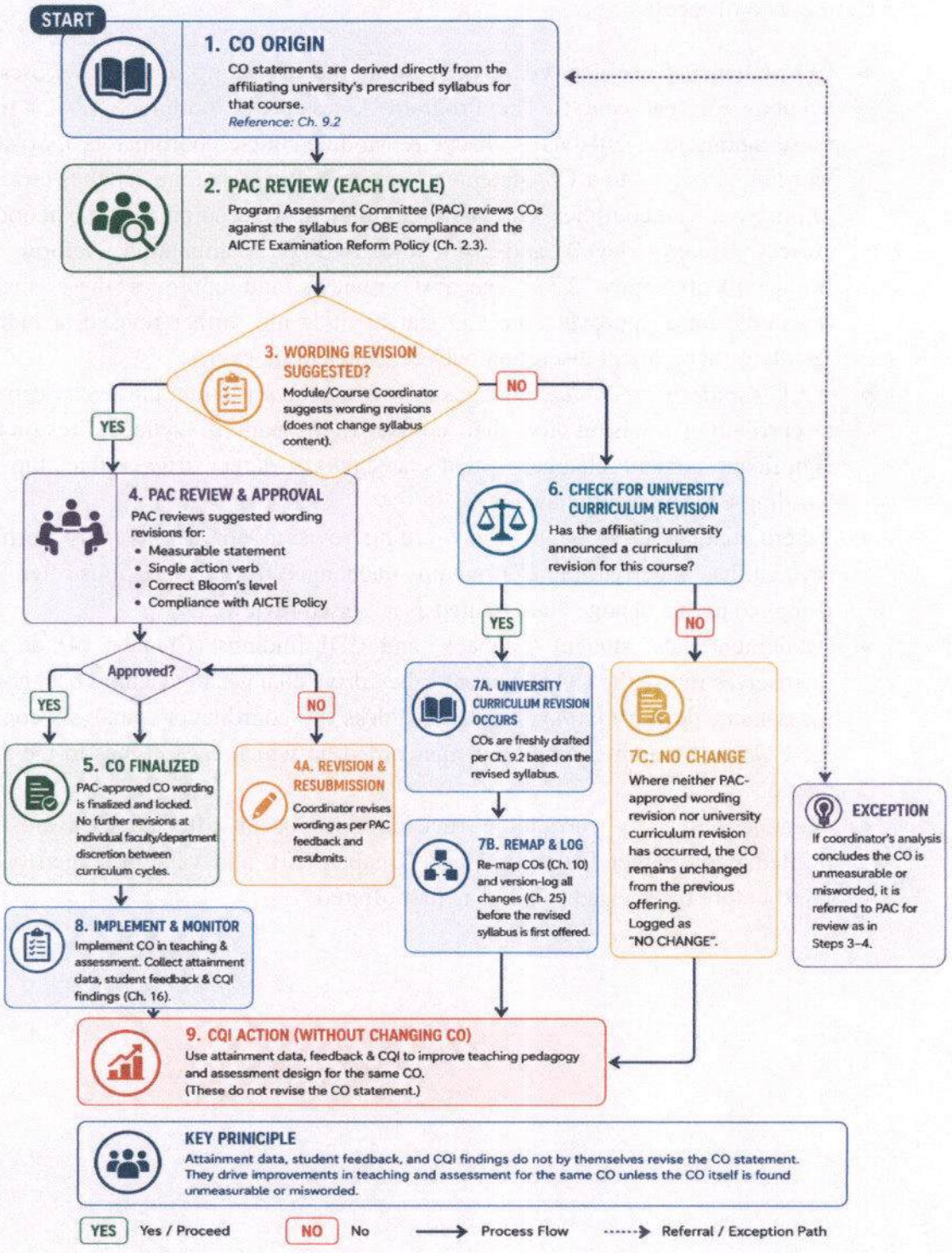


Figure 9.1 CO statement review and revision process

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9.6 Sample COs (from department course files)

Course 201001 Building Technology and Architectural Planning:

- **201001.1:** Explain types of buildings, building components, and basic requirements as per architectural principles and bye-laws.
- **201001.2:** Apply NBC provisions and bye-laws in planning residential and public buildings.
- **201001.3:** Apply town and village planning principles considering safety and zoning regulations.

Course 301013 - Design of RC Structures:

- **301013.1:** Interpret and apply relevant IS code provisions and Limit State Design philosophy to analyze behavior and ensure safety and serviceability of reinforced concrete elements.

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10. CO-PO-PSO Mapping

10.1 Mapping Philosophy

CO-PO-PSO mapping in this department is not a subjective faculty judgment call - it is computed from a documented, two-step process built on the AICTE Examination Reform Policy (2018) Competency/Performance Indicator (PI) framework introduced in Chapter 6.3. Each PO and PSO is first broken down into Competencies, and each Competency into one or more Performance Indicators. The correlation level between a CO and a PO/PSO is then derived statistically from how many of that PO's PIs are actually relevant to the CO - not assigned by inspection of the course content alone.

10.2 Three-Tier Breakdown: PO/PSO → Competency → Performance Indicator

Each PO (and PSO) is decomposed as follows, using the numbering convention PO.Competency.PI (e.g., PO1 → Competency 1.1 → PI 1.1.1, 1.1.2, 1.1.3):

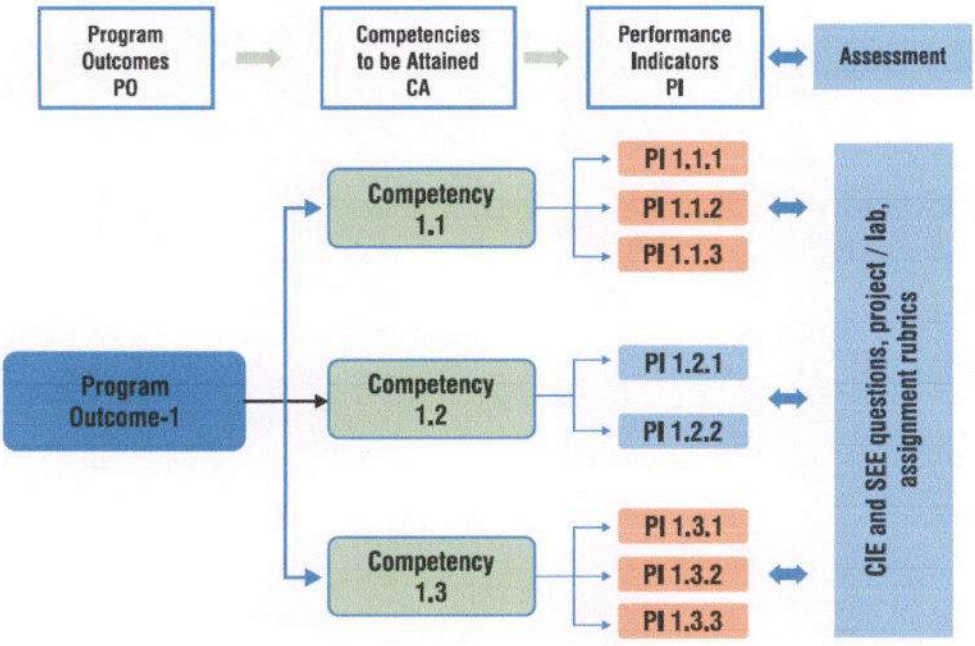


Figure 10.1 PO → Competency → PI breakdown diagram.

10.2 CO-PI Relevance Check

For every CO in a course, the course coordinator checks each Performance Indicator under every PO/PSO and marks it "Yes" (the PI is relevant to what that CO requires the student to do) or "No" (not relevant). This is done PI-by-PI, not PO-by-PO - a CO may be relevant to only some PIs under a given PO's competencies.

This relevance check is the actual justification for the mapping - it replaces the earlier draft's requirement for a separate one-line narrative justification: the completed Relevance Sheet itself is the evidence, since it shows exactly which PIs the coordinator considered and why the CO does or does not touch them.

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Marathwada Mitra Mandal's Institute of Technology (MMIT), Lohgaon, Pune - 411047
DEPARTMENT OF CIVIL ENGINEERING
Relevance of Course Outcomes (CO) with Program Outcomes (PO) and Program-Specific Outcomes (PSO)

Class	**TE Civil**	**Name of the Subject**	**Design of Steel Structures**
Semester	**III**	**Subject Code**	**301009**

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators	CO1	CO2	CO3	CO4	CO5	CO6
					Identify and classify different types of steel structures and structural components, and interpret relevant IS code provisions for their design under the Limit State Design philosophy.	Analyze and design steel tension members, including welded and bolted connections, and verify their adequacy using IS 800:2007 provisions.	Analyze and design steel compression members and columns, including built-up sections with lacing and battening, and assess their structural behavior and safety.	Evaluate the load-carrying capacity of steel columns subjected to axial load with uniaxial and biaxial bending, and design suitable column bases for axial load and bending as per IS codes.	Analyze and design laterally restrained and unrestrained steel beams, and check serviceability and strength requirements in accordance with IS code.	Analyze and design complete steel systems such as industrial trusses, gantry girders, and welded plate girders by computing load effects, member forces, and preparing structural drawings and design reports using manual and software-based methods.
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.	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	No	Yes	Yes	Yes	Yes	Yes
			3.1.2	Elicit and document, engineering requirements from stakeholders	No	No	No	No	No	Yes
			3.1.3	Synthesize engineering requirements from a review of the state-of-the-art	No	No	No	No	No	No
			3.1.4	Extract engineering requirements from relevant engineering Codes and Standards such as ASME, ASTM, BIS, ISO and ASHRAE.	Yes	Yes	Yes	Yes	Yes	Yes
			3.1.5	Explore and synthesize engineering requirements considering health, safety	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure 10.2 Sample relevance of CO-PO-PSO



10.3 Step 2 - Statistical Computation of the Mapping Grade

Once relevance is marked for every PI under a PO, the mapping level (Mapping Grade, MG) is computed, not assigned:

T.PIs (Total PIs) = the total number of Performance Indicators under that PO/PSO.

M.PIs (Mapped PIs) = the number of those PIs marked "Yes" (relevant) for that CO.

% Coverage = (M.PIs ÷ T.PIs) × 100

The Mapping Grade is then read off the fixed scale below.

10.4 Mapping Grade (Correlation Level) Scale

Level	% Coverage	Interpretation
3	71-100%	Substantial - most/all of the PO's PIs are relevant to this CO
2	51-70%	Moderate coverage of the PO's PIs
1	30-50%	Slight coverage of the PO's PIs
-	< 30%	Not mapped - coverage too low to record a correlation

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DEPARTMENT OF CIVIL ENGINEERING

Mapping of Course Outcomes (CO) with Program Outcomes (PO) and Program-Specific Outcomes (PSO)

Class TE Civil	Name of the Subject Design of Steel Structures
Semester III	Subject Code 301009

STATISTICS OF COURSE OUTCOME MAPPING WITH PROGRAM OUTCOMES AND PROGRAM SPECIOFIC OUTCOME

Course Outcomes	No.	PO1			PO2			PO3			PO4			PO5			PO6		
		T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG
	CO1	5	4	3	13	7	2	13	1	-	10	0	-	6	0	-	2	1	1
	CO2	5	5	3	13	11	3	13	6	1	10	0	-	6	4	2	2	2	3
	CO3	5	5	3	13	11	3	13	6	1	10	0	-	6	4	2	2	2	3
	CO4	5	5	3	13	12	3	13	7	2	10	0	-	6	4	2	2	2	3
	CO5	5	5	3	13	12	3	13	7	2	10	0	-	6	4	2	2	2	3
	CO6	5	5	3	13	13	3	13	8	2	10	0	-	6	4	2	2	2	3

Course Outcomes	No.	PO7			PO8			PO9			PO10			PO11			PO12		
		T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG
	CO1	4	0	-	3	0	-	7	0	-	7	1	-	5	0	-	6	1	-
	CO2	4	1	-	3	0	-	7	7	3	7	7	3	5	0	-	6	1	-
	CO3	4	1	-	3	0	-	7	7	3	7	7	3	5	0	-	6	2	1
	CO4	4	1	-	3	0	-	7	7	3	7	7	3	5	0	-	6	2	1
	CO5	4	1	-	3	0	-	7	7	3	7	7	3	5	0	-	6	2	1
	CO6	4	1	-	3	0	-	7	7	3	7	7	3	5	3	2	6	4	2

Course Outcomes	No.	PSO1			PSO2			PSO3		
		T.PIs	M.PIs	MG	T.PIs	M.PIs	MG	T.PIs	M.PIs	MG
	CO1	4	0	-	4	2	1	4		-
	CO2	4	2	1	4	4	3	4		-
	CO3	4	2	1	4	4	3	4		-
	CO4	4	2	1	4	4	3	4		-
	CO5	4	2	1	4	4	3	4		-
	CO6	4	3	3	4	4	3	4		-

Logic for the Attainment Matrix		
Level	% Coverage	Range (% Coverage)
3	70	71-100
2	50	51-70
1	30	30-50
-	29	< 30

Note: T.PIs - Total Performance Indicators M.PIs - Mapped Performance Indicators MG - Mapping Grade

Figure 10.3 Statistical Computation of the Mapping Grade and Mapping Grade (Correlation Level) Scale

10.5 Evidence and Justification

Every MG value in the final mapping table is traceable back to the specific PIs marked "Yes" for that CO under that PO - this trace is the Relevance Sheet from 10.2, retained alongside the mapping sheet in the course file (Chapter 23.1). No additional narrative justification is required beyond this, since the PI-level detail is more granular and auditable than a one-line note.

10.6 Approval Process

- The Course Coordinator prepares the Relevance Sheet (10.3) and the resulting Statistics/Mapping Sheet (10.4).
- **Module Coordinator** reviews both for correctness and consistency with the course's actual delivery.
- **The Head of Department** signs off on the finalized mapping.
- This operational sign-off (Course Coordinator → Module Coordinator → HoD) is distinct from, and feeds into, the PAC's periodic curriculum-level consistency review across all courses (Chapter 8.3, 10.4 of the earlier draft) - the PAC checks the *pattern* across courses; the three-signature process here validates each course's mapping.

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10.7 Final Consolidated CO-PO-PSO Mapping Table

Marathwada Mitra Mandal' Institute of Technology (MMIT), Lohgaon, Pune - 411047

Course Outcome (CO) - Program Outcomes (PO) - Program Specific Outcomes (PSO): Definitions, Mapping, and Justification

CO	CO. No.	CO Statement After completion of the course, the student will be able to	Unit	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO-1	301003-1	Identify and classify different types of steel structures and structural components, and interpret relevant IS code provisions for their design under the Limit State Design philosophy.	1	3	2	-	-	-	1	-	-	-	-	-	-	-	1
CO-2	301003-2	Analyze and design steel tension members, including welded and bolted connections, and verify their adequacy using IS 800:2007 provisions.	1	3	3	1	-	2	3	-	-	3	3	-	-	1	3
CO-3	301003-3	Analyze and design steel compression members and columns, including built-up sections with lacing and battening, and assess their structural behavior and safety.	2	3	3	1	-	2	3	-	-	3	3	-	1	1	3
CO-4	301003-4	Evaluate the load-carrying capacity of steel columns subjected to axial load with uniaxial and biaxial bending, and design suitable column bases for axial load and bending as per IS codes.	3	3	3	2	-	2	3	-	-	3	3	-	1	1	3
CO-5	301003-5	Analyze and design laterally restrained and unrestrained steel beams, and check serviceability and strength requirements in accordance with IS code.	4	3	3	2	-	2	3	-	-	3	3	-	1	1	3
CO-6	301003-6	Analyze and design complete steel systems such as industrial trusses, gantry girders, and welded plate girders by computing load effects, member forces, and preparing structural drawings and design reports using manual and software-based methods.	5, 6	3	3	2	-	2	3	-	-	3	3	2	2	3	3
PO Attainment Target (Average)				**3**	**2.83**	**1.6**	**-**	**2**	**2.67**	**-**	**-**	**3**	**3**	**2**	**1.25**	**1.4**	**2.67**

Attainment Levels **3 – Substantial (>70%)** **2 – Moderate (50–70%)** **1 – Slight (30–50%)** **"–" Least correlation (<30%)**

Figure 10.4 CO-PO-PSO Mapping Table

11. Teaching-Learning Process

11.1 Overview

The department ensures the quality of teaching and learning by using a diverse mix of pedagogical initiatives, assignments, seminars, ICT tools, expert sessions, industrial visits, and flipped classrooms that promote active learning, critical thinking, and practical application of knowledge. These methods are selected based on course requirements and mapped to COs to ensure effectiveness, rather than applied uniformly regardless of what a course actually needs.

The instructional approach integrates traditional teaching with innovative, student-centric methodologies, moving students from passive learning to active knowledge construction.

11.2 Academic Calendar

The Institute, affiliated with Savitribai Phule Pune University (SPPU), follows the academic calendar prescribed by the University. Based on the SPPU calendar, the Dean Academics prepares the Institute Academic Calendar in consultation with the Heads of Departments (HoDs), which the Principal approves.

The Department Academic Calendar is prepared in alignment with the Institute Academic Calendar and includes teaching-learning activities, assessments, examinations, feedback, co-curricular and extracurricular activities, project work, holidays, and other academic activities.

The HoD monitors the implementation of the Department Academic Calendar through periodic academic reviews and departmental meetings. Any deviations are identified, discussed with the concerned faculty, and appropriate corrective measures are implemented and monitored to ensure timely completion of planned academic and OBE-related activities.

11.3 Course Plan

Prepared by each course coordinator before semester commencement; includes COs, unit-wise schedule, CO-PO-PSO mapping, assessment plan and weightages, and the specific pedagogical initiatives (from 11.5 onward) selected for that course, with reasoning tied to the CO's Bloom's level (Chapter 9.3).

11.4 Lesson Plan

Session-wise breakdown of topics, teaching methodology, and CO(s) addressed per session, enabling traceability from a single lecture back to a specific CO.

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11.5 Facilities and Activities Supporting Teaching-Learning

11.5.1 Smart Classrooms & ICT Integration

Classrooms are equipped with writing boards, high-resolution interactive panels, and Bluetooth-enabled audio systems with internet-connected PCs. Faculty use digital content animations, simulations, and virtual labs to make engineering concepts easier to grasp, particularly where a physical demonstration isn't practical.

11.5.2 Assignments & Tutorials with Real-Life Problems

Students are given assignments that require them to think through, explore, and explain a problem in their own way, then present their work in class so the class learns collectively rather than each student working in isolation. Performance is evaluated using rubrics covering problem-solving, technical writing, and communication skills (Chapter 12.9, 27.7). Real-life examples, via case studies, are discussed in class alongside the assignment work.

11.5.3 Seminars & Technical Presentations (Collaborative Learning)

Students, individually or in groups, study a current engineering topic, prepare a report, and deliver a presentation/demonstration. Topic selection follows the CO-linked strategy in Chapter 12.8.

11.5.4 Guest Lectures by Industry Experts

Industry experts are invited for partial delivery of content in select courses, to connect classroom learning with industry practice. Post-session, experts interact with students to discuss the topics covered, and students provide feedback used to refine future sessions (Chapter 15).

11.5.5 Industrial Visits

Organized to expose students to real-world engineering problems and their solutions. Students prepare a report linking what they observed on-site to the concepts learned in class, helping bridge the gap between academic study and industry practice.

11.5.6 Video Lectures & Online Resources

Students use open-source platforms (NPTEL, SWAYAM, Coursera) and institute digital content via the Vmedulife ERP Learning Management System (LMS), alongside faculty-prepared videos, for self-learning. Faculty assign specific video modules as pre-class preparatory material under the flipped-classroom model (11.5.7), and check student understanding through online quizzes or discussion forums on the LMS.

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11.5.7 Innovative Teaching-Learning Methods (Course-Wise, as per Subject Requirement)

- Think-Pair-Share
- Peer learning
- Flipped Classroom
- Problem-Based Learning (PBL)
- Peer Teaching to support slow learners
- Use of research papers
- Case study method
- Use of open-source software

11.6 Choosing a Pedagogy for a Course: Reference Table

The choice among the methods in 11.5 is driven by the Bloom's level targeted by the relevant CO(s), not by convenience or habit:

Pedagogy	**Best-Suited Bloom's Level**	**Illustrative Use**
Smart classroom + digital content/simulation	Remember, Understand	Visualizing concepts not easily demonstrated physically (e.g., stress distribution animations).
Flipped classroom (11.5.6/11.5.7)	Understand, Apply	Pre-class video + in-class problem application.
Assignments with real-life problems (11.5.2)	Apply, Analyze	Design-oriented courses working through varied scenarios.
Case study method	Analyze, Evaluate	Courses with real failure/performance cases.
Think-Pair-Share / Peer learning / Peer teaching	Understand, Apply	Mixed-ability sections; supporting slow learners.
Seminar / technical presentation (11.5.3)	Understand, Evaluate	Synthesis of current practice beyond the textbook.
Guest lecture (11.5.4)	Understand, Evaluate	Current-practice context beyond the syllabus.
Industrial visit (11.5.5)	Apply, Analyze	Field-practice-heavy courses.
Problem-Based Learning	Analyze, Evaluate, Create	Design studio / capstone-adjacent courses.

This table is a starting reference, not a fixed prescription; coordinators may justify a different choice in the course plan, with reasoning recorded for OBE Committee review.

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11.7 Mini Projects

Semester-embedded mini-projects that build toward the complexity expected in the final-year project (Chapter 19), typically the point where Problem-Based Learning (11.5.7) is applied most fully.

11.8 Learner Categorization and Differentiated Support

Beyond the CO/PO-level, cohort-wide gap analysis covered in Chapter 14 (CQI), the department also runs a lighter, faster feedback loop at the level of the individual student within a running semester - identifying where a student currently stands and adjusting support accordingly, rather than waiting for end-of-semester attainment data to reveal a gap.

11.8.1 Categorization Criteria

Categorization draws on five parameters, combining a quantitative score with qualitative faculty/mentor input giving a fuller picture than test performance alone.

Quantitative component (scored, out of 30):

Parameter	**Marks**
Previous Semester Result	10
Pre-requisite Quiz	10
Unit Test 1 / Class Test / Assignment / Open-Book Test / Experiential Learning / any other	10
Total	**30**

Qualitative component (observational):

Parameter	**Basis**
Subject Teacher Observation	Class attendance and participation in extracurricular activities
GFM / Mentor Remark	Mentor's assessment from regular mentoring interactions (Chapter 21.1)

The quantitative score (out of 30, converted to a percentage) gives the initial placement into a tier. The subject teacher's observation and the GFM/Mentor remark are then considered alongside this score - particularly for borderline cases - since attendance, engagement, and a mentor's ongoing familiarity with the student can indicate a category more accurately than a composite test score alone, especially where a student's numerical performance is inconsistent with their classroom engagement.

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Category	Composite Score (% of 30), moderated by teacher/GFM input
Advanced Learner	Above 70%
Average Learner	40% – 70%
Slow Learner	Below 40%

As before, categorization is applied per cycle, not fixed for the semester - a student's tier is revisited as new data becomes available, since the purpose is to keep routing timely support, not to label a student permanently.

11.8.2 Slow Learner - Sample Actions

- Reading of extra study material
- Attending extra practice/remedial sessions
- Participation in practice quizzes
- Solving previous year questions (PYQs)
- One-to-one doubt-solving sessions

11.8.3 Average Learner - Sample Actions

- Reading of extra study material
- Participation in practice quizzes
- Solving PYQs
- Additional problem-solving exercises
- Periodic self-assessment tests

11.8.4 Advanced Learner - Sample Actions

- Reading of advanced/reference study material
- Solving higher-order/application-based problems
- Solving PYQs and competitive-level questions
- Participation in advanced quizzes
- Mini-projects/case studies and peer learning

11.8.5 Relationship to Continuous Quality Improvement

Individual-level categorization and support (11.8.1–11.8.4) is distinct from, but feeds into, the cohort-level CQI cycle (Chapter 14). Where a disproportionate share of a cohort is repeatedly categorized as Slow Learners for the same CO across consecutive offerings, this is no longer treated as an individual-support matter alone - it is escalated as a CQI-tracked gap (Chapter 14.2, Gap Analysis), since a recurring pattern at this scale points to a course-level cause (pacing, assessment difficulty, pedagogy) rather than only individual variation.



12. Assessment Process

This chapter covers the 2019 Pattern assessment structure, as applicable to SE-BE courses in AY 2024-25.

12.1 Direct Assessment Tools - Internal (CIE)

- Unit Tests - generally two per semester, questions designed per CO and Bloom's level; evaluated scripts shown to students with model solutions.
- Assignments - numerical, theoretical, and application-based; evaluated via rubrics on accuracy, approach, and presentation.
- Laboratory Work / Term Work - rubric-based, covering procedure, observations, analysis, interpretation, and understanding; term-work marks from continuous evaluation.

12.2 Direct Assessment Tools - External (SEE)

- In-Semester Examination - covers the first two units of the syllabus.
- End-Semester Examination - covers the remaining units of the syllabus.
- Oral / Practical Examination - university-conducted evaluation of laboratory work and term work.

12.3 Indirect Assessment Tool

- Course End Survey (CES) - conducted by the course teacher; CO-wise responses averaged to compute indirect attainment.

12.4 Syllabus-to-CO-to-CIE Mapping

The standard six-unit theory syllabus maps one CO per unit, with each CIE component assessing a fixed pair of units/COs at 15 marks per unit:

Syllabus Unit	**CO Coverage**	**CIE Component**	**Marks**
Unit 1	CO1	Unit Test 1	15 (of 30)
Unit 2	CO2	Unit Test 1	15 (of 30)
Unit 3	CO3	Assignment 1	15 (of 30)
Unit 4	CO4	Assignment 2	15 (of 30)
Unit 5	CO5	Unit Test 2	15 (of 30)
Unit 6	CO6	Unit Test 2	15 (of 30)

Each CIE component (Unit Test 1, Assignment, Unit Test 2) is thus set at 30 marks, split 15+15 across its two covered units/COs. This gives a direct, unit-by-unit basis for CO

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attainment computation (Chapter 13): a student's performance on a unit's 15 marks is the direct-assessment evidence for that unit's CO.

12.5 SOP: Framing Unit Test Question Papers

- Step 1: Course coordinator lists the COs due for assessment in that Unit Test and their Bloom's levels.
- Step 2: Questions are drafted so that each CO is represented by at least one question; total paper weightage keeps Remember/Understand-level questions to a maximum of approximately 40% (Chapter 2.3, 9.2).
- Step 3: Draft paper is checked for syllabus coverage, difficulty balance, and unambiguous wording.
- Step 4: Paper is moderated by a question paper quality check committee (Chapter 12.5).
- Step 5: Approved paper is tagged CO-wise and archived in the course file before the test is conducted.



Figure 12.1 Process of setting of Unit Test Question Papers

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12.6 SOP: Designing Assignment

- Define Scope and COs: Assignments are planned for Units 3 and 4 and aligned with CO3 and CO4.
- Prepare Questions: The Course Teacher prepares questions based on syllabus coverage and COs, emphasizing application, analysis, problem-solving, and conceptual understanding, with balanced difficulty levels.
- Ensure Question Quality: A suitable mix of descriptive, numerical, analytical, and application-based questions is included.
- Verify Assignment: The Module Coordinator reviews the assignment for syllabus coverage, question quality, difficulty level, and appropriate CO mapping.
- Conduct Evaluation: Assignments are evaluated using predefined rubrics/marking schemes to ensure transparency and consistency. The rubric is provided in Table 3.1.2.
- Analyse CO Attainment: Student performance is analysed CO-wise, and the assessment results are used as evidence for CO attainment.
- Provide Feedback: Evaluated assignments are discussed with students and returned. Common errors, expected answers, individual feedback, and clarification of doubts are provided to support improvement in learning and performance.

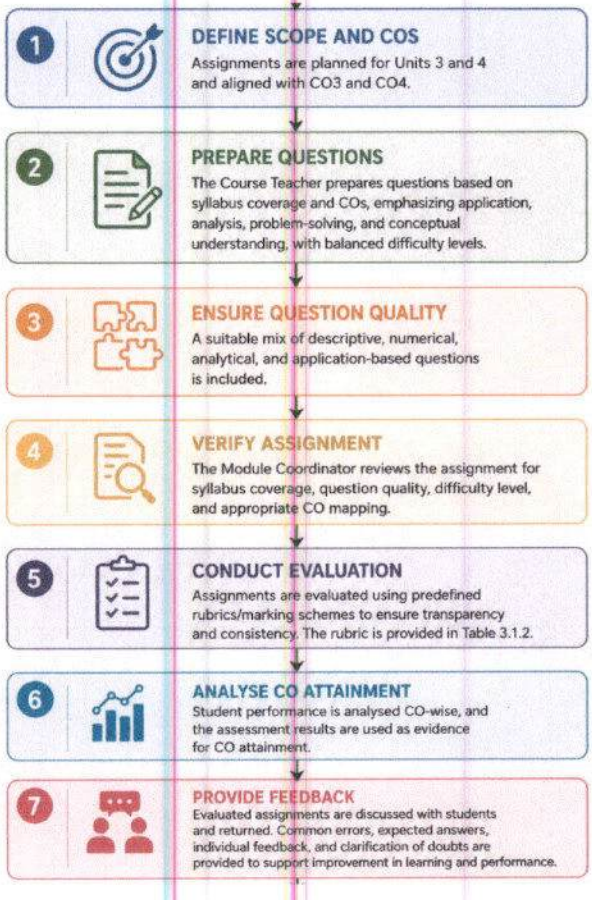


Figure 12.2 Process of setting of Assignment

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12.7 Rubrics

Standardized rubrics are used for assignments, laboratory/term work, seminars, and projects to ensure inter-evaluator consistency; sample rubric formats are provided in Chapters 17 and 19, and consolidated in Annexure F (Assessment Rubrics).

12.8 Indirect Assessment (Program-Level)

Course End Survey (CES)

Administered at the end of each course by the course teacher; CO-wise responses are averaged and used to compute indirect CO attainment.

12.9 Weightages for CO Attainment

Overall Course Outcome attainment combines direct and indirect assessment using the department's standard weightage:

CO Attainment = (0.80 × Direct Assessment) + (0.20 × Indirect Assessment)

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13. Attainment Process

13.1 Overview

Attainment is the quantitative expression of the extent to which Course Outcomes, and consequently Program Outcomes and Program Specific Outcomes, have been achieved by students, computed from direct and indirect assessment and used as the primary evidence base for CQI.

13.2 Target Setting

CO targets are decided by the module coordinator, course coordinators, and Program Coordinator (HoD) as follows:

- When a course is newly introduced, the CO target is initially set at 60% (i.e., 1.8 on a 3-point scale), based on students' entry-level performance (many are admitted through CET with comparatively lower scores).
- After each semester, calculated CO attainment is compared with the set target. If the target is fully achieved, it is increased by 5% of the current target for the next conduct; if not achieved, the same target is carried forward.

Sample A.1: CO target setting

For Batch 2019-20, for the first conduct, target was 1.80, i.e., 60% of the 3-point scale; for Batch 2019-20 conduct, the target was not attained, thus remained unchanged for the next conduct for Batch 2020-21; for Batch 2020-21, the target was attained, thus increased by 5% of the previous target (1.8+0.09 = 1.89 ≅ 1.90) for Batch 2021-22

Enrolment Year	**2019-20**		**2020-21**		**2021-22**	
CO	**Target**	**Attainment**	**Target**	**Attainment**	**Target**	**Attainment**
CO1	1.80	1.20	1.80	2.04	1.90	1.24
CO2	1.80	1.88	1.80	2.12	1.90	1.36
CO3	1.80	1.72	1.80	1.32	1.80	1.16
CO4	1.80	1.72	1.80	1.32	1.80	1.24
CO5	1.80	1.72	1.80	1.48	1.80	0.88
CO6	1.80	1.72	1.80	1.48	1.80	1.08
Average	**1.80**	1.66	**1.80**	1.63	**1.83**	1.16

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13.3 Attainment Levels and Threshold

Attainment Level	**Criteria**
Level 1	50% - 59% of students score ≥ the prescribed threshold marks
Level 2	60% - 69% of students score ≥ the prescribed threshold marks
Level 3	70% - 100% of students score ≥ the prescribed threshold marks

Threshold marks are set using a performance-based benchmark that evolves with course history:

Conduct of Course	**Threshold Calculation Method**
First Conduct	Average marks scored by the current batch (no historical data available).
Second Conduct	Average of marks scored by the first-conduct batch and the current batch.
Third & Subsequent Conducts	Average of marks scored by the current batch and the two most recent previous batches.

Sample A.2: Attainment Threshold

For the first conduct: the threshold was kept as the average marks scored by Batch 2019-20

Avg. of Marks Scored	**Threshold**
70.73	70.73

For second conduct: The average of marks scored by the first-conduct batch and the current batch, i.e., Batch 2020-21 conduct

Avg. of Marks Scored Batch 2019-20	**Avg. of Marks Scored Batch 2020-21**	**Threshold**
70.73	83.83	(70.73+83.83)/2 = 77.28

For Third & Subsequent Conducts: Average of marks scored by the current batch and the two most recent previous batches

Avg. of Marks Scored Batch 2019-20	**Avg. of Marks Scored Batch 2020-21**	**Avg. of Marks Scored Batch 2021-22**	**Threshold**
70.73	83.83	84.95	(70.73+83.83+84.95)/3 = 79.84

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Sample threshold of course 401011 Dams and Hydraulics Structures

PARAMETER		2019-20		2020-21		2021-22	
		Avg. of Marks Scored	Threshold	Avg. of Marks Scored	Threshold	Avg. of Marks Scored	Threshold
Internal Assessment	UT1-CO1	70.73	70.73	83.83	77.28	84.95	79.84
	UT1-CO2	72.60	72.60	84.26	78.43	87.74	81.53
	Asgnt 3-CO3	83.02	83.02	85.53	84.28	80.44	83.00
	Asgnt 4-CO4	81.98	81.98	84.82	83.40	81.56	82.79
	UT2-CO5	74.58	74.58	84.40	79.49	75.56	78.18
	UT2-CO6	74.69	74.69	87.38	81.03	77.11	79.72
	OR	77.56	77.56	77.40	77.48	76.60	77.19
External Assessment	Insem	51.67	51.67	74.26	62.96	66.67	64.20
	END SEM	46.70	46.70	46.17	46.43	47.65	46.84
	OR	79.94	79.94	78.77	79.35	78.44	79.05

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13.4 CO Attainment

CO attainment is computed from direct assessment (CIE + SEE, analyzed against the threshold) combined with indirect assessment (Course End Survey), using the standard formula:

CO Attainment = (0.80 × Direct Assessment) + (0.20 × Indirect Assessment)

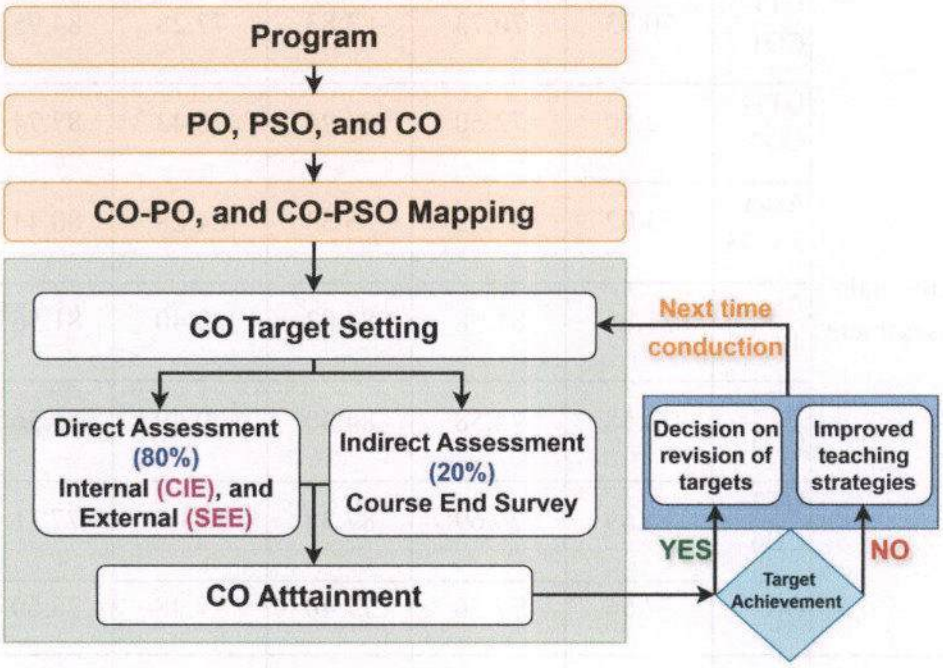


Figure 13.1 CO-level attainment framework

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Sample CO attainment calculations:

Step 1: CO-wise marks entry

										Internal Assessment					
		Maximum Marks	15.00	15.00	15.00	15.00	15.00	15.00	50.00	6.25	6.25	12.50	6.25	6.25	12.50
R N	PRN	Name of Student	CO1	CO2	CO3	CO4	CO5	CO6	OR	CO1	CO2	CO3	CO4	CO5	CO6
										1] Nos. of Assign/Exp for TW / PR / OR					
									8	1	1	2	1	1	2
BCA01	72032030F	Bambale Dinesh Sunil	13	14	13	10	15	10	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA02	72032038M	Birajdar Srushti Ajit	10	12	14	9	0	0	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA03	72032049G	Deshmukh Yash Motilal	14	12	13	13	9	10	36	4.50	4.50	9.00	4.50	4.50	9.00
BCA04	72032062D	Gaikwad Kalleshwar Dayanand	12	11	11	11	15	12	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA05	72032066G	Gawate Abhinav Madhukar	14	14	12	10	11	13	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA06	72032084E	Kadam Pranav Eknath	15	15	15	14	13	10	39	4.88	4.88	9.75	4.88	4.88	9.75
BCA07	72032086M	Kakade Rutuja Satish	14	12	10	15	14	11	40	5.00	5.00	10.00	5.00	5.00	10.00
BCA08	72032099C	Kharat Vishal Sukhadeo	10	12	10	13	14	9	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA09	72032104C	Kulkarni Vaishnavi Ramrao	12	12	11	11	12	12	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA10	72032106K	Kurhade Nilesh Dagadu	15	11	13	15	15	12	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA12	72032141H	Sancheti Harshad Dinesh	14	12	14	14	13	10	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA13	72032142F	Sapkal Abhishek Ramesh	11	14	12	13	14	13	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA14	72168990G	AHINAVE SIDHARTH MANGESH	9	12	15	15	13	13	38	4.75	4.75	9.50	4.75	4.75	9.50
BCA15	72168993M	BEHARE PRAJWAL KISHOR	15	10	11	12	9	15	42	5.25	5.25	10.50	5.25	5.25	10.50
BCA16	72168994K	BHADANE ADITYA SAHEBRAO	12	11	15	15	14	11	36	4.50	4.50	9.00	4.50	4.50	9.00
BCA17	72168997D	CHAVAN JAY RAJESH	12	11	10	11	11	10	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA18	72168999L	DODAKE ONKAR VIKAS	14	11	15	13	13	13	41	5.13	5.13	10.25	5.13	5.13	10.25
BCA19	72169000K	GAIKWAD ROHAN SIDRAM	14	13	13	9	12	11	40	5.00	5.00	10.00	5.00	5.00	10.00
BCA20	72169001H	GAIKWAD SUKANYA SUNIL	14	10	15	14	9	14	42	5.25	5.25	10.50	5.25	5.25	10.50
BCA21	72169002F	GANJALE VAISHNAVI RAVINDRA	11	15	12	14	12	13	37	4.63	4.63	9.25	4.63	4.63	9.25
BCA22	72169003D	GAYAKWAD LAKSHMI KISAN	11	13	12	13	9	14	40	5.00	5.00	10.00	5.00	5.00	10.00
BCA23	72169004B	GORE UMAJI KRISHNA	10	11	14	15	0	0	41	5.13	5.13	10.25	5.13	5.13	10.25

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Step 2: Setting of threshold

Marathwada Mitra Mandal' Institute of Technology (MMIT), Lohgaon, Pune - 411047

THRESHOLD CALCULATIONS (Based on marks scored by students in Previous THREE Examinations)

PARAMETER		2019-20		2020-21		2021-22	
		Avg. of Marks Scored	Threshold	Avg. of Marks Scored	Threshold	Avg. of Marks Scored	Threshold
Internal Assessment	UT1-CO1	70.73	70.73	83.83	77.28	84.95	79.84
	UT1-CO2	72.60	72.60	84.26	78.43	87.74	81.53
	Asgnt 3-CO3	83.02	83.02	85.53	84.28	80.44	83.00
	Asgnt 4-CO4	81.98	81.98	84.82	83.40	81.56	82.79
	UT2-CO5	74.58	74.58	84.40	79.49	75.56	78.18
	UT2-CO6	74.69	74.69	87.38	81.03	77.11	79.72
	OR	77.56	77.56	77.40	77.48	76.60	77.19
		NA	NA	NA	NA	NA	NA
Assessment	Insem	51.67	51.67	74.26	62.96	66.67	64.20
	END SEM	46.70	46.70	46.17	46.43	47.65	46.84

Step 3: Calculation of number of students crossing the threshold

			INTERNAL ASSESSMENT - CO1			INTERNAL ASSESSMENT - CO2			INTERNAL ASSESSMENT - CO3		
			CO1	Threshold	70.73	CO2	Threshold	72.60	CO3	Threshold	83.02
		Assessment Parameter	Unit Test	No. of Students	38	Unit Test	No. of Students	45	Assignment	No. of Students	32
		Maximum Marks	15.00	% Attainment	59.38	15.00	% Attainment	70.31	15.00	% Attainment	50.00
R.N.	PRN	Name of Student	Marks Obtained	% ATTAIN.	Attained (Y/N)	Marks Obtained	% ATTAIN.	Attained (Y/N)	Marks Obtained	% ATTAIN.	Attained (Y/N)
BCA01	72032030	Bambale Dinesh Sunil	13	86.67	Y	14	93.33	Y	13	86.67	Y
BCA02	72032038	Birajdar Srushti Ajit	10	66.67	N	12	80.00	Y	14	93.33	Y
BCA03	72032049	Deshmukh Yash Motilal	14	93.33	Y	12	80.00	Y	13	86.67	Y
BCA04	72032062	Gaikwad Kalleshwar Dayanand	12	80.00	Y	11	73.33	Y	11	73.33	N
BCA05	72032066	Gawate Abhinav Madhukar	14	93.33	Y	14	93.33	Y	12	80.00	N
BCA06	72032084	Kadam Pranav Eknath	15	100.00	Y	15	100.00	Y	15	100.00	Y
BCA07	72032086	Kakade Rutuja Satish	14	93.33	Y	12	80.00	Y	10	66.67	N
BCA08	72032099	Kharat Vishal Sukhadeo	10	66.67	N	12	80.00	Y	10	66.67	N
BCA09	72032104	Kulkarni Vaishnavi Ramrao	12	80.00	Y	12	80.00	Y	11	73.33	N
BCA10	72032106	Kurhade Nilesh Dagadu	15	100.00	Y	11	73.33	Y	13	86.67	Y
BCA12	72032141	Sancheti Harshad Dinesh	14	93.33	Y	12	80.00	Y	14	93.33	Y
BCA13	72032142	Sapkal Abhishek Ramesh	11	73.33	Y	14	93.33	Y	12	80.00	N
BCA14	72168990	AHINAVE SIDHARTH MANG	9	60.00	N	12	80.00	Y	15	100.00	Y
BCA15	72168993	BEHARE PRAJWAL KISHOR	15	100.00	Y	10	66.67	N	11	73.33	N
BCA16	72168994	BHADANE ADITYA SAHEBR	12	80.00	Y	11	73.33	Y	15	100.00	Y
BCA17	72168997	CHAVAN JAY RAJESH	12	80.00	Y	11	73.33	Y	10	66.67	N
BCA18	72168999	DODAKE ONKAR VIKAS	14	93.33	Y	11	73.33	Y	15	100.00	Y
BCA19	72169000	GAIKWAD ROHAN SIDRAM	14	93.33	Y	13	86.67	Y	13	86.67	Y
BCA20	72169001	GAIKWAD SUKANYA SUNIL	14	93.33	Y	10	66.67	N	15	100.00	Y

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Step 4: Determination of attainment based on the threshold expected to be crossed by the % of students for each assessment tool for each course

Marathwada Mitramandal's Institute of Technology, Lohgaon, Pune - 411047

CO-PO-PSO Attainment Report

Department: Civil Engineering
FE Enrollment Year: 2019-20
Class: BE
Academic Year: 2022-23
Name of the Subject: Dams and Hydraulics Structures
Subject Code: 401011
Name of the Faculty: Ms. Prajkta Shinde

Section 1 - Assessment Level Parameters and Weightage

ASSESSMENT	Weightage	Type	Weightage	Assessment Tools
DIRECT ASSESSMENT	80	Internal	20	Unit Tests, Assignments, and Termwork Based Assessment (TW / OR / PR)
		External	80	University Exams - Insem, End Sem, and Termwork Based Assessment (TW / OR / PR)
INDIRECT ASSESSMENT	20	Survey	20	Course end survey

Section 2 - CO Attainment - DIRECT [INTERNAL]

		CO1	CO2	CO3	CO4	CO5	CO6
INTERNAL ATTAINMENT (THEORY)	Total Number of Students	64	64	64	64	64	64
	No. of Students crossed threshold percentage	38	45	32	34	38	38
	Percentage of students crossed threshold value	59	70	50	53	59	59
	INTERNAL Attainment Level	**1**	**3**	**1**	**1**	**1**	**1**

		CO1	CO2	CO3	CO4	CO5	CO6
INTERNAL ATTAINMENT (1. Assignment Based TW/OR/PR)	Total Number of Students	64	64	64	64	64	64
	No. of Students crossed threshold percentage	36	36	36	36	36	36
	Percentage of students crossed threshold value	56	56	56	56	56	56
	INTERNAL Attainment Level	**1**	**1**	**1**	**1**	**1**	**1**

Step 5: Calculation of direct attainment by considering the contribution of 20% weightage of internal assessment tools and 80% of external assessment tools

ATTAINMENT DISTRIBUTINON WEIGHTAGE	THEORY	TERM WORK 1	TERM WORK 2	Total Weightage
INTERNAL (Unit Test, Assignments)	50	50		100
EXTERNAL (Univ Exams)	50	50		100

		CO1	CO2	CO3	CO4	CO5	CO6
DIRECT ATTAINMENT (THEORY + PRACTICAL)	INTERNAL ATTAINMENT (THEORY + TW)	1.00	2.00	1.00	1.00	1.00	1.00
	EXTERNAL ATTAINMENT (TW/PR/OR)	1.00	1.50	1.50	1.50	1.50	1.50
	DIRECT ATTAINMENT OF COURSE (THEORY+PRACTICAL)	**1.00**	**1.60**	**1.40**	**1.40**	**1.40**	**1.40**

Section 4 - CO Attainment - INDIRECT

		CO1	CO2	CO3	CO4	CO5	CO6
INDIRECT ATTAINMENT	Course End Survey						
	TOTAL INDIRECT Attainment Level	2	3	3	3	3	3

FINAL CO Attainment - DIRECT + INDIRECT [THEORY + PRACTICAL]

	CO1	CO2	CO3	CO4	CO5	CO6
FINAL ATTAINMENT (DIRECT + INDICRECT) (THEORY CO1 to CO5, PRACTICAL CO6)	**1.20**	**1.88**	**1.72**	**1.72**	**1.72**	**1.72**

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Step 6: Calculation of indirect attainment from the feedback of the course end survey

Step 6.1: CO-wise questionnaire for feedback collection

Marathwada Mitra Mandal' Institute of Technology (MMIT), Lohgaon, Pune - 411047

Indirect Attainment for CO Attainment - Course Exit Survey (20%)

Question	UNIT	CO	Question Description
1	UNIT 1	CO1	How much Course Outcome(CO) you attained? 1. Explain the types, functions, classification, site selection criteria, and instrumentation used in dams and hydraulic structures.
2	UNIT 2	CO2	How much Course Outcome(CO) you attained? 2.Analyze forces, stresses, stability conditions, seismic effects, and failure modes of gravity dams.
3	UNIT 3	CO3	How much Course Outcome(CO) you attained? 3.Evaluate the components, classification, hydraulic design principles, and energy dissipation arrangements of spillways.
4	UNIT 4	CO4	How much Course Outcome(CO) you attained? 4. Analyze seepage behavior, stability, failure mechanisms, and construction practices of earthen dams.
5	UNIT 5	CO5	How much Course Outcome(CO) you attained? 5.Analyze the components of canal falls, outlets, and cross drainage works using the design principles, and stability considerations.
6	UNIT 6	CO6	How much Course Outcome(CO) you attained? 6.Apply engineering principles to assess safety, performance, and maintenance aspects of dams and hydraulic structures.

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Step 6.2: Collection of students' feedback

Marathwada Mitra Mandal' Institute of Technology (MMIT), Lohgaon, Pune - 411047

Indirect Attainment for CO Attainment - Course Exit Survey (20%)

Responses of Course Exit Survey [3-Excellent, 2-Average, 1-Poor]								
Year	Branch	Student	Q1-CO1	Q2-CO2	Q3-CO3	Q4-CO4	Q5-CO5	Q6-CO6
2019-20	Civil Engineering	Bambale Dinesh Sı	3	3	3	3	3	2
2019-20	Civil Engineering	Birajdar Srushti Aj	2	3	3	3	3	2
2019-20	Civil Engineering	Deshmukh Yash M	2	2	3	3	3	3
2019-20	Civil Engineering	Gaikwad Kalleshw	2	3	2	2	2	3
2019-20	Civil Engineering	Gawate Abhinav M	2	3	3	2	2	3
2019-20	Civil Engineering	Kadam Pranav Ekn	2	2	3	3	3	2
2019-20	Civil Engineering	Kakade Rutuja Sati	2	3	3	3	3	3
2019-20	Civil Engineering	Kharat Vishal Sukh	2	3	2	3	3	3
2019-20	Civil Engineering	Kulkarni Vaishnavi	2	3	2	3	2	3
2019-20	Civil Engineering	Kurhade Nilesh Da	2	3	3	3	3	2
2019-20	Civil Engineering	Sancheti Harshad I	2	3	2	2	2	2
2019-20	Civil Engineering	Sapkal Abhishek R	2	3	3	2	3	3
2019-20	Civil Engineering	AHINAVE SIDHA	2	3	3	2	2	2
2019-20	Civil Engineering	BEHARE PRAJW/	2	3	2	3	2	3
2019-20	Civil Engineering	BHADANE ADIT	2	2	2	3	2	2
2019-20	Civil Engineering	CHAVAN JAY RA	2	2	2	2	3	2

Step 6.3: Determination of the number of students given feedback for the Likert scale of 3, 2, and 1

Count of Choices				
	CO	**3**	**2**	**1**
Total no. of Students given the feedback as (3, 2, 1) respectively	**CO 1**	22	42	0
	CO 2	41	23	0
	CO 3	34	30	0
	CO 4	36	28	0
	CO 5	39	25	0
	CO 6	36	28	0
	CO 7	36	28	0

Step 6.4: Determination of the % of students providing the 3, 2, and 1-scale response for each CO and calculation of attainment as follows:

Attainment = [3 x (Column 2) + 2 x (Column 4) + 1 x (Column 6)] / 3

Based on the attainment %, the attainment level is determined by considering the target expected to be attained by the % students



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Indirect Attainment for CO Attainment - Course Exit Survey (20%)

Setting of Target for Course End Survey

Level	Target expected to attained by % Students
Level 1	60
Level 2	70
Level 3	80

Column No.		1	2	3	4	5	6		
Response Scale		3		2		1		% Attainment	Attainment Level
CO	Total Responses	No. of Students	% Students	No. of Students	% Students	No. of Students	% Students		
CO1	64	22	34.38	42	65.63	0	0.00	78.13	2
CO2	64	41	64.06	23	35.94	0	0.00	88.02	3
CO3	64	34	53.13	30	46.88	0	0.00	84.38	3
CO4	64	36	56.25	28	43.75	0	0.00	85.42	3
CO5	64	39	60.94	25	39.06	0	0.00	86.98	3
CO6	64	36	56.25	28	43.75	0	0.00	85.42	3

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Step 7: Determination of the gap in the attainment levels with respect to the set target and CO-wise comment on the suggestion, and plan for actions for the next conduct, if any.

CO Attainment Summary

CO	Target	Attain	GAP	Conclusion	Observation, suggestions, remedial action
CO-1	1.80	1.20	-0.60	Not Attained	
CO-2	1.80	1.88	0.08	Attained	
CO-3	1.80	1.72	-0.08	Attained	
CO-4	1.80	1.72	-0.08	Attained	
CO-5	1.80	1.72	-0.08	Attained	
CO-6	1.80	1.72	-0.08	Attained	

Step 8: Determination of the overall CO-PO-PSO attainment using the following equation:

Overall CO-PO-PSO attainment = (CO-PO-PSO Target x Attainment) / 3

Overall CO PO Attainment

CO	Attainment	Engineering Knowledge	Problem analysis	Design / development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1.20	-	-	0.4	0.8	-	0.4	1.2	-	-	-	-	0.4	1.2	0.4
CO 2	1.88	1.9	1.3	0.6	0.6	-	-	-	-	-	1.9	-	-	-	0.6
CO 3	1.72	1.7	1.1	0.6	0.6	-	-	-	-	-	-	-	-	-	0.6
CO 4	1.72	1.7	1.1	1.1	0.6	1.1	-	-	-	-	1.7	-	-	0.6	1.7
CO 5	1.72	1.7	1.1	0.6	0.6	-	-	-	-	-	1.7	-	-	-	0.6
CO 6	1.72	1.7	1.1	1.1	-	-	-	-	-	-	-	-	0.6	-	0.6
CO Attainment		**1.75**	**1.17**	**0.74**	**0.63**	**1.15**	**0.40**	**1.20**	-	-	**1.77**	-	**0.49**	**0.89**	**0.74**

Ms. Prajkta Shinde
Course Incharge

13.5 PO / PSO Attainment

13.5.1 Attainment Flowchart (Descriptive)

- Step 1: Course coordinator collects direct assessment scores for each CO.
- Step 2: CO attainment computed per course, verified by PAC.
- Step 3: CO attainment translated to course-level PO/PSO attainment via CO-PO matrix.
- Step 4: Course-level PO/PSO attainment aggregated to program-level direct attainment.
- Step 5: Indirect attainment computed from surveys.
- Step 6: Overall PO/PSO attainment computed using the weighted formula.
- Step 7: Attainment compared against targets; gaps identified.
- Step 8: Gap analysis and CQI actions recorded (Chapter 14) and closed in the next cycle.

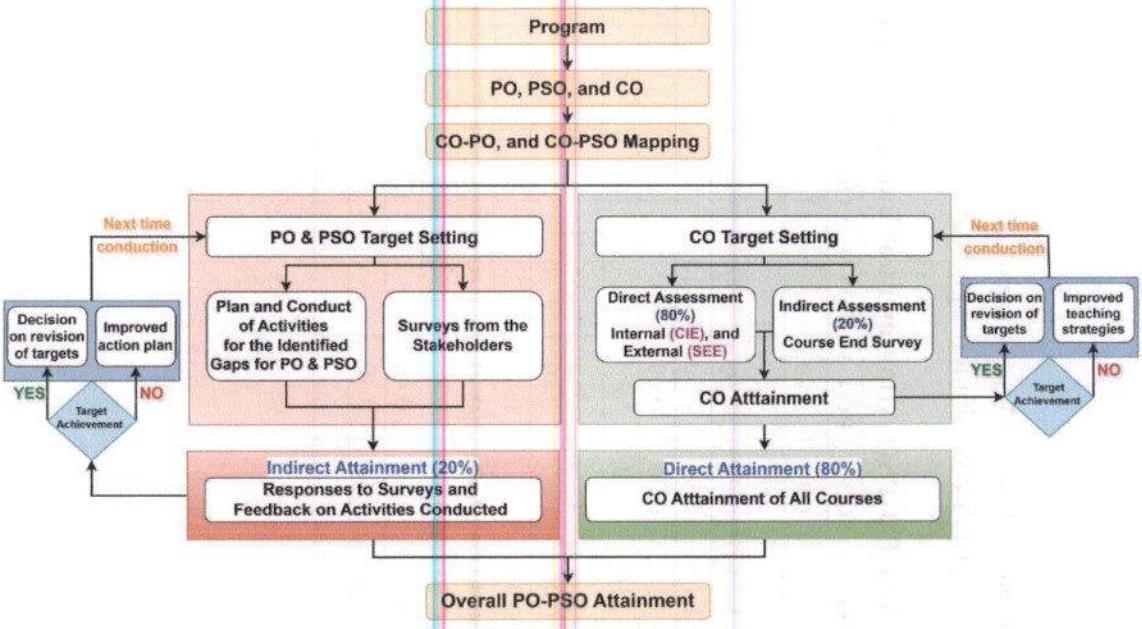


Figure 13.2 Process for Calculation of Overall Attainment

13.5.2 Direct PO/PSO Attainment

Direct attainment of POs/PSOs is computed from CO attainment using the CO-PO-PSO attainment matrix, where correlation levels (1-Slight, 2-Moderate, 3-Substantial) determine each CO's contribution, aggregated across courses.

CO-PO-PSO Attainment of Batch BE Civil 2022-23

Course	CO ID	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Dams and Hydraulics Structures	401011-1	-	-	0.40	0.80	-	0.40	1.20	-	-	-	-	0.40	1.20	0.40
	401011-2	1.90	1.30	0.60	0.60	-	-	-	-	-	1.90	-	-	-	0.60
	401011-3	1.70	1.10	0.60	0.60	-	-	-	-	-	-	-	-	-	0.60
	401011-4	1.70	1.10	1.10	0.60	1.10	-	-	-	-	1.70	-	-	0.60	1.70
	401011-5	1.70	1.10	0.60	0.60	-	-	-	-	-	1.70	-	-	-	0.60
	401011-6	1.70	1.10	1.10	-	-	-	-	-	-	-	-	0.60	-	0.60
Quantity Surveying, Contracts and Tenders	401012-1	1.10	0.40	-	0.40	1.10	-	-	-	1.10	1.10	0.40	0.40	0.40	0.40
	401012-2	1.20	0.40	-	0.40	1.20	-	-	-	1.20	1.20	-	0.40	0.40	0.40
	401012-3	1.10	0.40	0.40	0.40	1.10	-	-	-	1.10	1.10	0.40	0.40	0.40	0.40
	401012-4	1.20	0.80	0.40	0.40	1.20	-	0.40	-	1.20	1.20	0.80	0.40	0.40	0.40
	401012-5	1.20	0.80	0.40	0.40	-	1.20	-	1.20	1.20	1.20	1.20	0.40	-	-
	401012-6	1.20	0.80	0.40	0.40	-	-	-	-	1.20	1.20	1.20	0.40	-	-

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13.5.3 Indirect PO/PSO Attainment

Obtained through Program Exit, Alumni, and Employer Surveys, reflecting stakeholders' perceptions.

CO-PO-PSO Attainment of Batch BE Civil 2022-23

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Attainment of CO-PO (Direct Attainment)	**1.54**	**1.40**	**1.13**	**1.33**	**1.20**	**1.36**	**1.22**	**1.21**	**2.11**	**1.69**	**1.27**	**0.86**	**1.56**	**1.45**
Indirect Attainment														
Survey / Feedback of activity	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
Program Exit Survey (Graduate Exit Survey)	-	-	-	-	-	-	3.00	3.00	-	-	-	3.00	3.00	-
Alumni Survey	-	-	-	-	-	3.00	-	3.00	3.00	-	3.00	3.00	3.00	3.00
Employer Survey	3.00	3.00	-	-	3.00	3.00	3.00	-	3.00	3.00	3.00	2.00	3.00	3.00
Internship / Industrial Training Feedback Survey	3.00	3.00	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Technical Seminar / Student Seminar Participated	3.00	-	-	-	-	-	3.00	-	-	3.00	3.00	3.00	3.00	-
Technical Seminar / Student Seminar Participated	3.00	3.00	-	3.00	3.00	-	3.00	-	-	3.00	3.00	3.00	3.00	3.00
Student Chapter Office Bearer Roles	3.00	-	-	-	-	-	-	-	3.00	3.00	2.00	3.00	-	-
Workshops / Skill Development Programs Participation	3.00	-	-	-	-	3.00	-	3.00	-	3.00	3.00	3.00	3.00	-
Attainment of CO-PO (Indirect Attainment)	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**2.75**	**3.00**	**3.00**	**3.00**	**3.00**	**2.86**	**2.88**	**3.00**	**3.00**
Overall Attainment of CO-PO	**1.83**	**1.72**	**1.50**	**1.66**	**1.56**	**1.64**	**1.58**	**1.56**	**2.28**	**1.95**	**1.59**	**1.27**	**1.85**	**1.76**

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13.5.4 Overall Attainment Formula

Overall PO/PSO Attainment = (0.80 × Direct Attainment) + (0.20 × Indirect Attainment)

Overall Attainment of PO1 for Batch 2022-23 = (0.80 x 1.54) + (0.20 x 3.00) = 1.832

13.6 Attainment / Gap Decision Rule

- A CO/PO/PSO is considered attained if the calculated value is at least 85% of the set target - this margin accounts for normal batch-to-batch variation and avoids unfair evaluation on minor differences.
- If attained: the target is increased by 5% of the current target for the next cycle to drive continuous improvement.
- If not attained: corrective actions are proposed by the course coordinator - e.g., extra lectures, guest lectures, additional assignments/quizzes, case studies, video lectures, virtual labs/simulations, or question banks - for implementation in the next academic year (see Chapter 14 CQI).

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14. Continuous Quality Improvement (CQI)

14.1 Attainment Analysis

After the declaration of the university results in every semester year, the Program Assessment Committee (PAC) compiles CO, PO, and PSO attainment data and compares it against pre-set targets (Chapter 13).

14.2 Gap Analysis

- Outcomes falling below target are flagged, distinguishing systemic gaps (recurring across cohorts/courses) from isolated ones.
- Root-cause analysis considers curriculum content, pedagogy, assessment design, student preparedness, and infrastructure factors.

14.3 Corrective Actions

Actions addressing an already-manifested gap in the current cohort - e.g., remedial classes, additional tutorials, revised question paper difficulty calibration.

14.4 Preventive Actions

Actions addressing the root cause to prevent recurrence in future cohorts - e.g., course plan revision, pedagogy change, faculty development, lab upgrade.

14.5 Action Taken Report

Each identified gap is logged with: outcome affected, evidence, root cause, action (corrective/preventive), responsible owner, timeline, and status - consolidated into an annual Action Taken Report reviewed by the Department Advisory Board.

14.6 Evidence

Attainment sheets, minutes of PAC meetings, revised course plans/question papers, training/FDP records, before-after attainment comparison.

14.7 CO-wise Decision Record - Format

The department maintains a running decision record in the following format each semester; the current, filled record is the source of evidence and is not reproduced in this manual.

Course	CO Target	CO Attainment	Gap & Action
[Course code - title]	[target]	[attained / not attained]	[Gap description and planned action for next offering]

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14.8 Closing the Loop

The cycle is 'closed' only when the corrective/preventive action is implemented in the subsequent offering of the course, and the resulting attainment improvement is verified and documented.

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15. Stakeholder Feedback System

Institute-level feedback on the Teaching-Learning Process is coordinated by the Student Feedback and Faculty Appraisal Committee, headed by the Dean (Administration) with all HoDs and senior faculty as members.

15.1 Students

Course-end feedback and CO-level exit surveys collected each semester; feedback is also used as an input to faculty performance appraisal.

15.2 Faculty

Faculty feedback on curriculum adequacy, infrastructure, and administrative support collected annually.

15.3 Parents

Parent feedback collected during parent-teacher interactions/orientation, focusing on communication, safety, and overall satisfaction.

15.4 Alumni

Alumni surveys collected periodically (feeding PEO assessment, Chapter 5) via alumni association / LinkedIn / email outreach.

15.5 Employer

Employer feedback collected through placement cell coordination and Advisory Board industry members.

15.6 Industry

Broader industry feedback gathered through MoU partners, internship hosts, and expert lecture contributors.

15.7 Analysis

All feedback is compiled centrally by the PAC, summarized quantitatively (where scaled) and qualitatively, and presented at the annual department review meeting.

15.8 Action Taken

Feedback-driven actions are logged in the same Action Taken Report format used for CQI (Chapter 14), ensuring a single, traceable improvement record.

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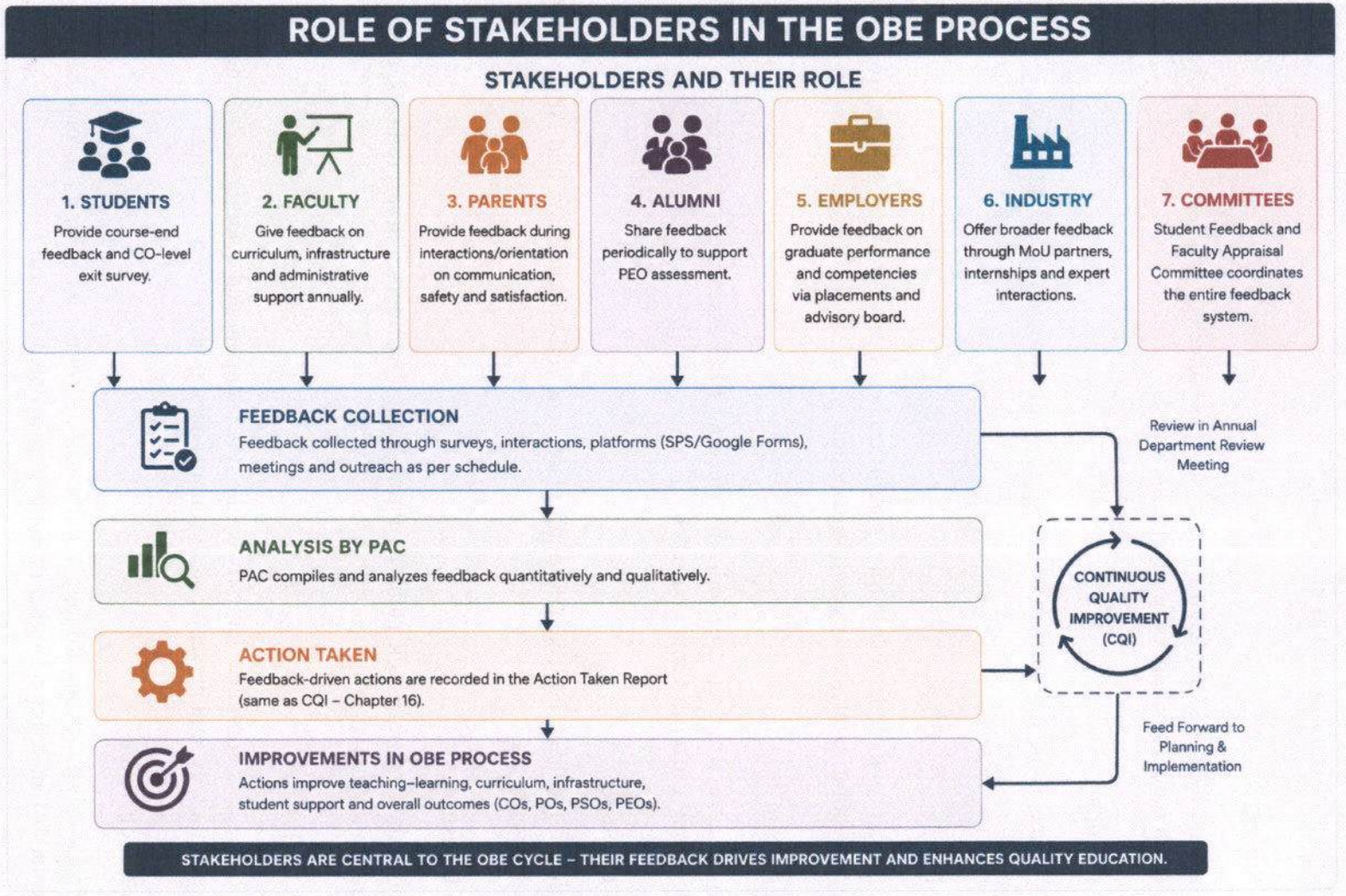


Figure 15.1 Role of stakeholders in OBE framework

16. Academic Monitoring

16.1 Course File

Consolidated per-course record: course plan, lesson plan, CO-PO-PSO mapping, question papers, assessment records, attainment sheet, sample answer scripts, and feedback.

16.2 Lab File

Per-laboratory record: list of experiments, CO mapping, manuals, safety instructions, and student performance records.

16.3 Internal Audit

Periodic internal check of course files and lab files by the PAC against a defined checklist, before semester-end.

16.4 Academic Audit

Institute-level academic audit conducted by the academic monitoring committee, cross-verifying department-level OBE implementation and documentation.

16.5 Result Analysis

Subject-wise pass percentage, class average, and distribution analysis conducted each semester, cross-referenced with CO attainment to validate assessment rigor.

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17. Laboratory Practices

17.1 Lab Manual

Each laboratory maintains a manual listing experiments, objectives, procedure, and the COs addressed, reviewed annually.

17.2 Experiment Outcomes

Each experiment is mapped to specific CO(s), consistent with the course-level CO-PO-PSO mapping (Chapter 10).

17.3 Rubrics

Standardized rubrics assess pre-lab preparation, conduct/technique, data analysis, and report quality.

17.4 Practical Assessment

Continuous assessment through the semester plus an end-semester practical/oral examination, weightages as per university scheme.

17.5 Project Work (Lab-Based)

Mini-projects conducted within laboratory courses that build experiential learnings.

17.6 Safety Practices

- Mandatory safety induction before first use of each lab.
- PPE requirements displayed and enforced (safety goggles, gloves, footwear as applicable).
- Emergency protocols and first-aid provisions displayed in each laboratory.

17.7 Equipment Maintenance

Preventive maintenance schedule and calibration records maintained for major testing equipment (e.g., UTM, CTM, CBR apparatus, total stations).

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18. Internship and Industry Interaction

18.1 Industrial Visits

Planned site/plant/project visits each semester, documented as departmental activity reports, with learning outcomes and student feedback recorded.

18.2 Internship Policy

18.2.1 Overview and Relevance

Internship / Industrial Training is a curriculum-integrated component for Third Year (TE) Civil Engineering students, undertaken after Semester V for a duration of 4-6 weeks and evaluated in Semester VI. It bridges classroom learning with practical exposure to industrial processes, tools, technologies, and organisational practices in industries, government organisations, MSMEs, research laboratories, NGOs, start-ups, and consultancy projects (Figure 3.4.1). Beyond technical application, the internship builds professional competencies in teamwork, communication, ethics, workplace safety, and industry readiness while supporting career planning and identification of final-year project themes aligned with industry needs.

18.2.2 Internship Process

Stage	**Key Activities**
Planning & Orientation	Coordinator communicates eligibility, duration, types, timelines and documentation; orientation on objectives, ethics and expected outcomes
Identification of Opportunities	Training & Placement Cell, industry MoUs, faculty/alumni networks, online platforms, student-initiated applications
Application, Approval & Selection	Company-specific selection; proposals reviewed for relevance to program outcomes; virtual/in-house/research alternatives if needed
Execution & Monitoring	Industry mentor + faculty guide; mandatory logbook; weekly progress monitoring
Post-Internship Submission	Completion certificate, internship report, and presentation, evaluated against defined rubrics

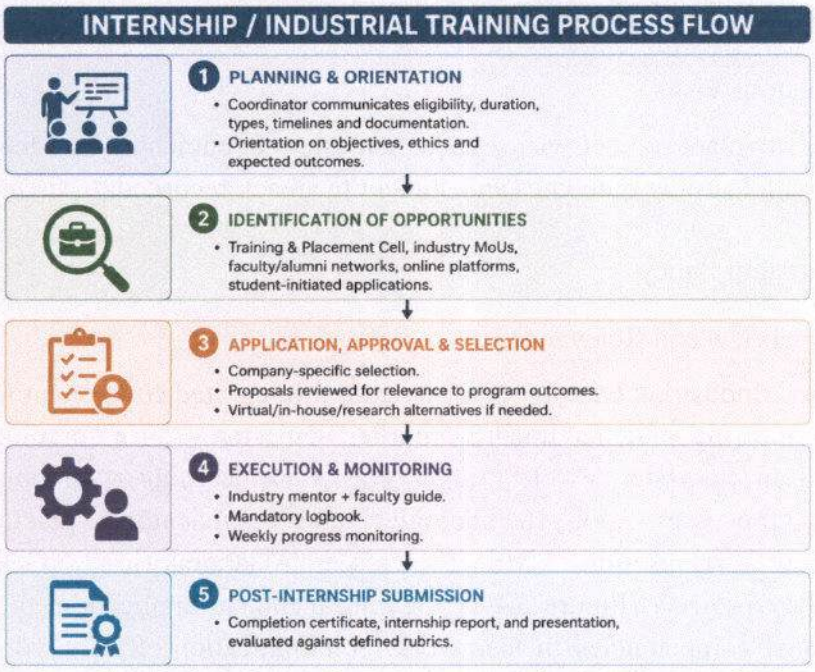


Figure 20.1 A flowchart of the internship process

18.2.3 Faculty Mentorship

- Each intern is assigned a faculty mentor responsible for periodic check-ins, reviewing the internship diary, and final evaluation.
- Mentor allotment follows the same load-balancing principle used for project guide allotment, per the department's BE Project Policy (current version).

18.2.4 Monitoring and Documentation

- Students maintain a weekly internship diary/log recording tasks performed and learning observed.
- Mid-internship check-in (where duration allows) between mentor and student/industry supervisor.

18.2.5 Assessment Scheme

(A) Continuous Evaluation - CIE (50 Marks)

Component	**Focus**
Internship Diary / Workbook	Daily record of activities, site observations, technical exposure and learning outcomes
Industry Supervisor Feedback	Technical knowledge, discipline, punctuality, professional behaviour, teamwork, work attitude
Faculty Mentor Assessment	Presentation, depth of understanding, clarity on tasks/tools/outcomes, overall learning

Mapped to CO1-CO6, contributing to PO1-PO12 and PSO1, PSO2.

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(B) Semester End Evaluation - SEE (50 Marks)

Component	Criteria	COs	POs / PSOs
Internship Diary / Workbook (20)	Regularity, quality of technical observations, accuracy of documentation, reflective thinking, organisation	CO1, CO2, CO5, CO6	PO1-PO5, PO9-PO12, PSO1
Internship Report (30)	Report structure, problem definition, methodology, results/analysis, societal-ethical-professional learning, references	CO1, CO2, CO4, CO5, CO6	PO1-PO8, PO10-PO12, PSO1, PSO2

Each criterion is graded on five performance levels (Excellent, Very Good, Good, Average, Poor/Unsatisfactory), ensuring transparent, outcome-based evaluation aligned with OBE principles.

18.2.6 Feedback and Continuous Improvement

Student feedback is collected on completion of the internship (Google Forms/questionnaires) covering organisation & logistics, learning & curriculum relevance, technical skills, professional skills, and industry guidance. Analysis (average ratings, satisfaction levels) informs improvements to industry collaboration, internship quality, and mentoring mechanisms, closing the loop for continual attainment of the mapped POs and PSOs.

18.3 MoUs

Formal Memoranda of Understanding with industry and academic partners support internships, guest lectures, and joint projects.

18.4 Expert Lectures

Industry/academic expert sessions scheduled each semester, with attendance and feedback records maintained.

18.5 Consultancy

Department/faculty consultancy engagements with industry, contributing to applied research linkages and student exposure to real-world problems.

18.6 Industry Projects

Industry-sponsored problem statements offered as final-year project topics, evaluated jointly by academic and industry mentors where feasible.

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19. Major and Minor Project Guidelines

19.1 Overview

This chapter covers two distinct project-based components of the curriculum: the Minor Project (Project-Based Learning, Second Year) and the Major Project (BE Project Stage-I & Stage-II, Final Year). The two are pedagogically related - the Minor Project builds foundational project skills that the Major Project later applies at capstone-level complexity but each is evaluated, scheduled, and governed independently, and is therefore documented here as its own self-contained section.

Group formation, topic selection, and guide allotment for both components are governed by the department's BE Project Policy (current version); this manual does not duplicate that content see Chapter 26 Annexure for the live document reference.

19.2 Minor Project (Project-Based Learning PBL, Second Year)

The Minor Project delivers experiential, collaborative learning through small-group projects addressing real-life or community-based problems. Students engage in problem identification, literature review, planning, methodology development, and basic implementation, strengthening fundamental engineering understanding and teamwork skills (cross-reference: Chapter 11, PBL as a pedagogical initiative).

19.2.1 Evaluation Structure

The Minor Project is evaluated internally through three structured reviews:

Review	Focus
PBL-I	Problem identification and topic finalization
PBL-II	Literature review, planning, and methodology development
PBL-III	Basic implementation and outcome presentation

19.2.2 Rubrics

PR-I (Max. 15 marks) assesses the project's foundational definition work: problem identification and objective formulation, literature survey and research-gap identification, and project planning/methodology (including timeline and team-role definition). This stage validates that the group has a properly scoped, justified problem before any implementation begins mirroring the same "depth before execution" principle applied at PR-I of the Major Project.

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PR-II (Max. 15 marks) assesses execution: implementation/design and analysis quality, integration of professional ethics/safety/societal consideration, teamwork and contribution balance, and presentation/communication. This stage evaluates not just whether the project works, but whether it was built and communicated responsibly and collaboratively.

Each criterion is graded across four performance bands (Excellent/Good/Average/Poor), consistent with the rubric format used throughout the manual.

Criterion-to-Outcome Alignment

The PBL rubric criteria map onto the same PO categories used for the Major Project, giving the Minor Project genuine evidentiary weight in the OBE framework rather than functioning as an isolated second-year exercise:

- Problem Identification & Objective Formulation, Literature Survey & Gap Identification → early-stage analytical competency (PO1, PO2, PO4): the same foundation PR-I of the Major Project later builds on at greater complexity.
- Project Planning & Methodology, Teamwork & Contribution → PO9, PO11: introducing project-management and teamwork discipline before it is assessed at scale in Stage-I/II.
- Implementation/Design & Analysis → PO3, PO5: an early, lower-stakes rehearsal of the design/analysis competency assessed more rigorously at PR-II-PR-IV of the Major Project.
- Professional Ethics, Safety & Societal Consideration → PO6, PO7, PO8: introduced here so students encounter this expectation before it recurs, with publication-linked weight, at PR-V of the Major Project.
- Presentation & Communication → PO10: assessed at every review stage across both the Minor and Major Project, reinforcing it as a recurring, not one-off, competency.

19.3 Major Project (BE Project Stage-I & Stage-II, Final Year)

The Major Project is executed across two semesters of the final year: Stage-I focusing on problem definition, planning, and preliminary design, and Stage-II on implementation, testing, validation, and final delivery.

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19.3.1 Project Stage-I Continuous Internal Evaluation (CIE)

Conducted through three structured project reviews:

Review	**Focus**
PR-I: Initial Review	Topic selection, environmental relevance, problem definition, literature survey, objectives, methodology, planning, work distribution
PR-II: Mid Review	Requirement analysis, preliminary investigation, analytical studies, design development, application of engineering principles
PR-III: Comprehensive Review	Initial prototype/model development, experimental setup, preliminary results, individual presentation, communication

Semester-I CIE total: **50 marks**, aggregated across PR-I, PR-II, and PR-III, ensuring balanced evaluation of technical and professional competencies.

19.3.2 Project Stage-I: Semester End Examination (SEE)

Term Work (**50 marks**) + Oral (**50 marks**), assessing problem identification, literature review, and planning.

19.3.3 Project Stage-II: Continuous Internal Evaluation (CIE)

Conducted through three structured project reviews:

Review	**Focus**
PR-IV: Technical Evaluation	System/model implementation, testing, validation, integration, result analysis
PR-V: Social, Environmental & Ethical Evaluation	Sustainability, societal relevance, ethical considerations, research dissemination (publications)
PR-VI: Individual Contribution & Report Evaluation	Teamwork, communication, documentation quality

Semester-II CIE total: **100 marks**, aggregated across PR-IV, PR-V, and PR-VI, ensuring comprehensive attainment of technical, professional, and societal competencies.

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19.3.4 Project Stage-II: Semester End Examination (SEE)

Term Work (**100 marks**) + Oral (**50 marks**), assessing project execution, analysis, and outcomes.

19.3.5 Rubrics and PO Mapping for CIE

Each of the six project reviews (PR-I to PR-VI) is assessed against a dedicated, criterion-based rubric, distinct for each review and weighted to that review's marks (PR-I: 5, PR-II: 20, PR-III: 25, PR-IV: 40, PR-V: 40, PR-VI: 20). Every rubric defines four performance bands, Excellent, Good, Average, Poor, against named criteria specific to that review's focus (e.g., PR-I assesses topic selection, problem definition, literature survey, objective justification, and scheduling; PR-V assesses identification of social/environmental/ethical issues and paper publication).

Rubric criteria are consolidated and mapped to Program Outcomes through two standing tables maintained by the department:

- Stage-I rubrics: covers complexity, cost, environmental relevance, and sustainability-related criteria; mapped to PO2, PO3, PO4, PO6, PO7, PO8, PO12.
- Stage-II: covers teamwork, communication, and project management-related criteria; mapped to PO9, PO10, PO11, PO12.

Used together across all six reviews, these tables ensure every rubric criterion - from problem definition through final report quality is traceable to a specific PO, so Stage-I and Stage-II performance feeds directly into PO attainment computation (Chapter 13.5.2) rather than producing an undifferentiated project score.

The full rubric text for PR-I through PR-VI, and the complete Table 3.5.2A/3.5.2B criterion-to-PO mapping, are maintained as live departmental documents (Annexure F and related formats) and are not reproduced in this manual consistent with the manual's practice of referencing formats rather than embedding filled/evidentiary content (Annexure F preamble).

19.3.6 PO and PSO Assessment

Project reports and oral examination performance are assessed against the rubric mapping in 21.3.5, with additional PSO assessment applied for design- and analysis-intensive topics, confirming specialization-level competency.

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20. Faculty Development

20.1 Faculty Development Programs (FDP)

Faculty are encouraged/required to attend a minimum number of FDPs/workshops each year, tracked centrally and linked to identified skill gaps from peer review.

20.2 NPTEL

Faculty enrollment in NPTEL/MOOC courses relevant to teaching or research areas, with completion certificates filed in faculty records.

20.3 Research

Ongoing faculty research activity (sponsored/unsponsored projects, PhD guidance) tracked and reported annually, contributing to the department's research profile and PEO3/PEO4-linked outcomes.

20.4 Consultancy

Faculty consultancy assignments logged with client, scope, and revenue (where applicable).

20.5 Patents

Patents filed/granted by faculty tracked and reported.

20.6 Publications

Journal and conference publications tracked per faculty member, with indexing (Scopus/SCI) and impact metrics recorded - consistent with the department's established research identity in sustainable cementitious composites and allied areas.

20.7 Professional Society Activities

Faculty memberships and active roles in professional bodies (e.g., ICI, IStructE, ASCE-affiliated chapters) tracked and encouraged.

21. Student Development

21.1 Mentoring System (Guardian Faculty Members)

The institute operates a structured mentoring system from admission through graduation. The HoD assigns Guardian Faculty Members (GFMs), typically one mentor per 15-20 students. A minimum of two formal mentoring sessions per semester are conducted, plus a Parent-Teacher Meeting once a semester. Mentors review academic performance, attendance, lab work, internships, scholarships, co-curricular participation, and career planning; records are maintained in GFM files until graduation. A professional counsellor is additionally available for personal/emotional support, and senior-junior peer mentoring supports fresher adaptation.

21.2 Academic Benefit of Student Participation

Participation in co-curricular and extra-curricular activity is linked to the OBE framework, not treated as a separate record each category of participation is recognized against specific outcomes:

Participation Type	OBE-Linked Benefit
Competitions/ hackathons	Evidence toward PO3 (Design), PO5 (Modern Tool Usage), and PO9 (Teamwork).
Value-added/ certification courses	Closes curriculum gaps identified in Chapter 8.4; recorded as evidence of PO12 (Life-Long Learning).
Internships	Assessed and credited per the Internship Policy (Chapter 18.2); mapped to PO9-PO12.
Publications/paper presentations	Evidence of PO2 (Problem Analysis) and PO4 (Investigation) at an advanced level, typically arising from final-year project work (Chapter 19).
Industrial visits	Direct input to Teaching-Learning Process (Chapter 11.5.5).

Individual student participation records (who, when, which event) are maintained in GFM files and the placement/training cell records; this manual defines only how such participation is recognized within the OBE framework, not the year-wise counts.

21.3 Institutional Recognition and Incentives (Cross-Reference)

Beyond the OBE-linked recognition in 23.0.1, participation in competitions, hackathons, and events external to the institute may also carry administrative incentives such as attendance consideration, grace marks, credit points, or certificates of merit as defined in the department's Student Participation Incentive Policy (or equivalent). This manual does

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not restate those benefit terms, since they are set and revised independently of the OBE framework.

Students are encouraged to consult their Guardian Faculty Member (Chapter 21.1) or the department notice board for the current incentive schedule before registering for external events.

21.4 Technical Clubs

Department-level technical/civil engineering club organizing peer-learning sessions, design competitions, and site-visit planning.

21.5 Professional Societies

Student chapters of professional bodies (e.g., IPA, IGS) providing exposure to technical talks and competitions.

21.6 Competitions

Participation in inter-collegiate and national competitions is tracked by the mentoring system and encouraged, including interdisciplinary innovation challenges.

21.7 Hackathons

Student participation in hackathons (including AI/automation-themed events relevant to construction and infrastructure) is tracked and encouraged.

21.8 Value Added Courses

Department-run add-on courses (e.g., STAAD.Pro, BIM/Revit, GIS, ANSYS basics) offered beyond the regular curriculum.

21.9 Certification Courses

External certification course completions (NPTEL, Coursera, vendor certifications) tracked per student for portfolio and placement purposes.

21.10 Community Engagement

NSS/community outreach activities and social responsibility projects involving civil engineering students.

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22. Governance of OBE

The three governing bodies below - Program Assessment Committee (PAC), Department Advisory Board (DAB), and Internal Quality Assurance Cell (IQAC) - are the department's actual governance structure and are used by name throughout this manual (Chapters 4-5, 13, 16).

22.1 Program Assessment Committee

Responsible for PEO/PO/PSO formulation, review, and attainment computation oversight (Chapters 5-7, 13).

22.2 Department Advisory Board

HoD, senior faculty, alumni, industry experts, and (where applicable) a parent representative; meets at least once a year to review PEOs, attainment trends, and CQI actions.

22.3 Academic Monitoring Committee

Oversees course file/lab file audits, faculty diary checks, and result analysis (Chapter 16).

22.4 IQAC Coordination

Department OBE Committee liaises with the institute's Internal Quality Assurance Cell to align department-level CQI with institute-level quality initiatives.

22.5 Roles & Responsibilities

Role / Committee	Responsibility
HoD	Overall accountability for OBE implementation, academic quality, and effective functioning of departmental quality processes.
Program Assessment Committee (PAC)	Formulation and periodic review of PEOs, POs and PSOs; oversight of CO-PO/PSO mapping and attainment computation; review of attainment trends and CQI actions.
Department Advisory Board (DAB)	External review and validation of PEOs, POs/PSOs, attainment trends, and CQI actions; provides academic, industry, and stakeholder inputs for continuous improvement.
Academic Monitoring Committee (AMC)	Monitoring of academic processes through course/lab file audits, faculty diary verification, academic performance and result analysis, and follow-up of identified gaps.

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Role / Committee	Responsibility
Course Coordinators / Course Teachers	CO definition and review, CO-PO/PSO mapping, assessment planning, attainment computation, course file maintenance, result analysis, and implementation of course-level corrective actions.
IQAC Coordination	To align departmental OBE implementation, CQI initiatives, documentation, and quality improvement activities with institute-level quality processes.

22.6 Meeting Schedule

- Program Assessment Committee: at least once per year (PEO/PO review) and as needed.
- Department Advisory Board: at least once per year.

23. Documentation System

23.1 Course File

Contains: course plan, lesson plan, CO-PO-PSO mapping, question papers with CO tagging, assignment/tutorial sheets, attainment sheet, sample best/average/weak answer scripts, and course-end feedback summary.

23.2 Lab File

Contains: lab manual, experiment-wise CO mapping, safety records, equipment maintenance log, and sample evaluated lab reports.

23.3 Faculty File

Contains: CV, qualification/experience proof, FDP/publication record, peer review reports, and appraisal records.

23.4 Attainment File

Consolidated CO/PO/PSO attainment records across all courses, semester-wise and program-wise.

23.5 Feedback File

Consolidated student, faculty, parent, alumni, and employer feedback records and analysis.

23.6 Project File

Consolidated final-year and mini-project records: proposals, review sheets, reports, and rubric-based evaluation.

23.7 Department Repository

Central digital repository (shared drive/LMS) hosting all of the above, with defined folder structure and access control.

23.8 Document Control

Each document carries a unique ID, owner, and approval authority; superseded versions are archived, not deleted.

23.9 Version Control

Document	**Version**	**Approved By**	**Date**
[Document name]	[v1.0]	[HoD / Committee]	[dd-mm-yyyy]

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24. Best Practices

24.1 AI-Assisted Learning

Use of AI tools to support personalized problem-solving practice, automated preliminary feedback on assignments, and exposure to emerging AI/automation applications in civil engineering (e.g., structural health monitoring, Edge AI-based safety systems).

24.2 Site-Based Learning

Structured site visits and field-integrated assignments that connect classroom theory to live construction/infrastructure practice.

24.3 Industry Mentoring

Pairing of student project teams with industry mentors for real-world problem framing and periodic review.

24.4 Student Consultancy

Supervised student involvement in minor departmental consultancy assignments under faculty guidance, building applied competence.

24.5 Innovation Projects

Encouraging cross-disciplinary innovation projects and competition participation (e.g., Edge AI-powered safety intelligence platforms for construction equipment) as a channel for complex, judgement-requiring project exposure.

24.6 Sustainability Initiatives

Integration of sustainable materials and practices (e.g., rubberized/self-compacting concrete, geopolymer systems, waste upcycling) into design courses and project topics, reflecting the department's active research strengths.

24.7 Community Projects

Department-supported community engagement projects addressing local infrastructure, water, or sanitation needs.

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25. Annexures

Annexure A: Program Outcomes (Graduate Attributes)

Full text of PO1-PO12 - refer Chapter 6.2.

Annexure B: Bloom's Taxonomy

Full taxonomy table with action verbs - refer Chapter 9.3.

Annexure C: AICTE Examination Reform Policy 2018 - Reference

Policy basis for the assessment framework used in Chapters 2.3, 6.4, 9.2, and 12 of this manual: AICTE Examination Reform Policy (November 2018), covering Competency/PI mapping, Bloom's-taxonomy-based question design, model question papers, and sample scoring rubrics.

Annexure D: Abbreviations and Glossary

Abbreviation	**Full form**
AICTE	All India Council for Technical Education
ASCE	American Society of Civil Engineers
ATKT	Allowed to Keep Term
AY	Academic Year
BE	Bachelor of Engineering (Final Year Engineering)
BIM	Building Information Modelling
CES	Course End Survey
CIE	Continuous Internal Evaluation
CO	Course Outcome
CQI	Continuous Quality Improvement
DAB	Department Advisory Board
FDP	Faculty Development Program
GFM	Guardian Faculty Member
GIS	Geographic Information System
HoD	Head of Department
ICT	Information and Communication Technology
IQAC	Internal Quality Assurance Cell
LMS	Learning Management System

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Abbreviation	Full form
M.PIs	Mapped Performance Indicators
MG	Mapping Grade
MMIT	Marathwada Mitra Mandal's Institute of Technology
MOOC	Massive Open Online Course
NPTEL	National Programme on Technology Enhanced Learning
OBE	Outcome-Based Education
PAC	Program Assessment Committee
PBL	Project-Based Learning
PEO	Program Educational Objective
PI	Performance Indicator
PO	Program Outcome
PR	Project Review (used as PR-I to PR-VI for Major Project review)
PSO	Program Specific Outcome
SEE	Semester End Examination
SOP	Standard Operating Procedure
SPPU	Savitribai Phule Pune University
T.PIs	Total Performance Indicators
TE	Third Year Engineering

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Annexure E: PO-Competency-PI Master Table

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.	1.1	Demonstrate competence in mathematical modelling	1.1.1	Apply mathematical techniques such as calculus, linear algebra, and statistics to solve problem
			1.1.2	Apply advanced mathematical techniques to model and solve Civil 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 Civil engineering concepts to solve engineering problems
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.	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

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Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
			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.

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
			2.3.2	Identify assumptions (mathematical and physical) necessary to allow modeling of a system at the level of accuracy required.
	2.4	Demonstrate an ability to execute a solution process and analyze 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
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	**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

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Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
cultural, societal, and environmental considerations.			3.1.4	Extract engineering requirements from relevant engineering Codes and Standards such as ASME, ASTM, BIS, ISO and ASHRAE.
			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	Demonstrate an ability to generate a diverse set of alternative design solutions	3.2.1	Apply formal idea generation tools to develop multiple engineering 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

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
			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
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.	**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

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
	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 analyze data and reach a valid conclusion	**4.3.1**	Use appropriate procedures, tools and techniques to conduct experiments and collect data
			4.3.2	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	**5.1**	Demonstrate an ability to identify/ create modern engineering tools,	**5.1.1**	Identify modern engineering tools such as computer-aided drafting, modeling and analysis;



Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.		techniques and resources		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	6.1	Demonstrate an ability to describe engineering roles in a broader context,	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

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
cultural issues and the consequent responsibilities relevant to the professional engineering practice.		e.g. pertaining to the environment, health, safety, legal and public welfare		
	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
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.	**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	**8.1**	Demonstrate an ability to recognize ethical dilemmas	**8.1.1**	Identify situations of unethical professional conduct and propose ethical alternatives

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
professional ethics and responsibilities and norms of the engineering practice.	**8.2**	Demonstrate an ability to apply the Code of Ethics	**8.2.1**	Identify tenets of the ASCE 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.	**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

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Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
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	**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	**11.1**	Demonstrate an ability to evaluate the economic and financial	**11.1.1**	Describe various economic and financial costs/benefits of an engineering activity

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Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.		performance of an engineering activity	**11.1.2**	Analyze different forms of financial statements to evaluate the financial status of an engineering project
	11.2	Demonstrate an ability to compare and contrast the costs/benefits of alternate proposals for an engineering activity	**11.2.1**	Analyze 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: 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.	**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

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
	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.
PSO 1 : Engineering graduates will be able to organize and carry out various kinds of tasks on infrastructure projects	13.1	Plan and organize infrastructure project tasks considering scope, sequence, and resources.	13.1.1	Prepare task plans, work breakdown structures, and schedules for infrastructure activities.
	13.2	Execute infrastructure tasks using drawings, specifications, and safety practices.	13.2.1	Perform field and laboratory tasks as per standard procedures, codes, and safety norms.

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Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
	13.3	Apply engineering tools for measurement, monitoring, and documentation of tasks.	**13.3.1**	Use instruments and basic software tools to collect, analyze, and report engineering data.
	13.4	Demonstrate teamwork, discipline, quality consciousness, and professional conduct during task execution.	**13.4.1**	Coordinate with team members and follow quality, ethical, and site safety practices.
PSO 2 : Engineering graduates will be capable to analyze and build Civil Engineering System components	**14.1**	Analyze civil engineering systems using engineering principles and governing parameters.	**14.1.1**	Identify loads, material properties, boundary conditions, and system behavior for analysis.
	14.2	Design and develop civil engineering system components to meet functional and safety requirements.	**14.2.1**	Analyze recent technologies, tools, and practices relevant to the civil engineering industry
	14.3	Apply modern engineering tools and construction practices for system analysis and development.	**14.3.1**	Select and use appropriate software tools and modeling techniques for engineering applications.
	14.4	Evaluate performance, sustainability, safety, and	**14.4.1**	Assess structural adequacy, serviceability, environmental impact, and feasibility of solutions.

Programme Outcomes	C.No.	Competencies	PI No.	Performance Indicators
		constructability of civil engineering systems.		

Annexure F: Assessment Rubrics

Table F.1 Practical / Task-oriented Term work

Evaluation Criteria		**Level 1**	**Level 2**	**Level 3**
		(Poor: 0 Mark)	**(Good: 1 Marks)**	**(Excellent: 2 Marks)**
EC-1	Understanding of Experiment (objective, theory, procedure, observations, analysis, results)	Poor understanding of concepts and procedures	Basic understanding with minor errors in analysis/results	Clear and complete understanding with correct analysis and interpretation
EC-2	Experiment Conduction / Performance	Unable to perform the experiment properly, requires full assistance	Performed the experiment with minor mistakes / partial guidance	Perform the experiment accurately, safely, and independently
EC-3	Journal write-up (Accuracy, Neatness, Data Presentation)	Incomplete, inaccurate, or poorly maintained journal	Mostly complete with minor errors / average neatness	Complete, accurate, neat, and well-organized journal
EC-4	Timely Submission of Journal Write-up	Submitted late without a valid reason	Submitted late with permission / partial compliance	Submitted on time regularly
EC-5	Discipline, Responsibility & Teamwork in Laboratory Work	Irregular, careless, or poor participation	Satisfactory behavior and participation	Highly disciplined, responsible, cooperative, and proactive



Table F.2 Assignment-oriented Term work

Evaluation Criteria		**Level 1**	**Level 2**	**Level 3**
		(Poor: 0 Mark)	**(Good: 1 Marks)**	**(Excellent: 2 Marks)**
EC-1	Understanding of Assignment (objective, theory, procedure, observations, analysis, results)	Poor understanding of concepts and procedures	Basic understanding with minor errors in analysis/theoretical concepts	Clear and complete understanding with correct theoretical concepts, analysis and interpretation
EC-2	Solution to Assignment	Unable to solve assignment properly, requires full assistance	Solve assignment with minor mistakes / partial guidance	Solve assignment accurately, safely, and independently
EC-3	Assignment Write-up (Accuracy, Neatness, Data Presentation)	Incomplete, inaccurate, or poorly maintained write-up	Mostly complete with minor errors / average neatness	Complete, accurate, neat, and well-organized write-up
EC-4	Timely Submission of Assignments Write-up	Submitted late without a valid reason	Submitted late with permission / partial compliance	Submitted on time regularly
EC-5	Discipline, Responsibility & Teamwork in Laboratory Work	Irregular, careless, or poor participation	Satisfactory behavior and participation	Highly disciplined, responsible, cooperative, and proactive

Table F.3(a) Rubrics for Project-Based Learning: PR-1 (Max. Marks: 15)

Criteria	**Excellent (5)**	**Good (4)**	**Average (3)**	**Poor (1–2)**
Problem Identification &	Clearly defined real-world/ interdisciplinary problem with	Problem defined with clear objectives	Problem identified, but the objectives are vague	Problem unclear / not justified

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Criteria	Excellent (5)	Good (4)	Average (3)	Poor (1–2)
Objective Formulation	well-structured aims & measurable objectives			
Literature Survey & Gap Identification	Comprehensive review from quality sources; clear research gap identified	Adequate review; partial gap identification	Limited references; weak technical linkage	No proper literature support
Project Planning & Methodology	Clear methodology, realistic timeline (Gantt chart), defined team roles	Methodology defined; minor planning gaps	Rough planning; roles unclear	No structured planning

Table F.3(b) Rubrics for Project-Based Learning: PR-II (Max. Marks: 15)

Criteria	Excellent (5)	Good (4)	Average (3)	Poor (1–2)
Implementation / Design & Analysis	Effective implementation using appropriate tools; strong analysis with valid conclusions	Proper implementation with adequate analysis	Basic implementation; limited validation	Weak execution; no proper analysis
Professional Ethics, Safety & Societal Consideration	Clearly integrates ethics, safety, sustainability & societal impact	Addresses most aspects	Minimal consideration	No consideration
Teamwork & Contribution	Excellent coordination; equal contribution & responsibility sharing	Good teamwork; minor imbalance	Uneven participation	Poor coordination
Presentation & Communication	Clear, confident, well-structured technical presentation & documentation	Good clarity; minor gaps	Average communication	Poor clarity & documentation

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Table F.4(a) Rubrics used in the CIE of internship

Criteria	Excellent (8-10)	Good (6-7)	Average (4-5)	Poor (0-3)	Marks
Technical Knowledge & Application	Demonstrates excellent understanding and application of civil engineering concepts to real problems	Good understanding with minor gaps	Basic understanding, limited application	Poor understanding, unable to relate to the theory	**10**
Depth of Internship Work & Learning	Clearly explains tasks, methods, tools, and outcomes with strong insight	Adequate explanation with clarity	Superficial description	Very limited learning is evident	**10**
Presentation & Communication Skills	Highly confident, structured, professional presentation	Clear communication with minor issues	Understandable but weak delivery	Poor communication	**8**
Analytical & Problem-Solving Skills	Excellent analysis, logical reasoning, and independent thinking	Good analysis with guidance	Limited analysis	No analytical ability	**7**
Professional Behavior & Ethics	Demonstrates high ethical standards, discipline, and responsibility	Generally ethical and professional	Needs improvement	Unprofessional attitude	**5**
Teamwork, Adaptability & Attitude	Excellent collaboration, adaptability, and initiative	Good teamwork	Limited participation	Poor teamwork	**5**
Attendance & Supervisor Feedback	Excellent feedback, punctual, and committed	Good feedback	Average feedback	Unsatisfactory feedback	**5**
				Total	**50**

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Table F.4(b) Rubrics used in the SEE of internship: An Internship Diary / Workbook - 20 Marks

Criteria	Excellent (4)	Good (3)	Average (2)	Poor (1)	Marks
Regularity & Timely Entries	Daily, properly dated and signed	Mostly regular	Irregular	Very poor	4
Quality of Observations	Clear, relevant, technical observations	Adequate details	Limited depth	Very superficial	4
Data Recording & Documentation	Accurate and structured	Mostly accurate	Partial data	Poor data	4
Thought Process & Reflection	Excellent reflection and learning	Some reflection	Minimal reflection	No reflection	4
Organization & Neatness	Very well organized	Organized	Acceptable	Poorly organized	4
				Total	**20**

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Table F.4(c) Rubrics used in the SEE of internship: Internship Report - 30 Marks

Criteria	Excellent (5)	Very Good (4)	Good (3)	Average (2)	Unsatisfactory (1)	Marks
Report Structure & Format	Fully as per guidelines, highly professional	Minor formatting issues	Generally acceptable	Several format issues	Poorly structured	5
Problem Definition & Objectives	Clear, precise, highly relevant	Well defined with minor gaps	Adequate clarity	Basic understanding	Unclear/ irrelevant	5
Methodology & Tools Used	Well justified, detailed & appropriate	Proper explanation with some justification	Basic explanation	Limited methodology	Inappropriate/ missing	5
Results, Analysis & Conclusions	Strong analysis with data-backed conclusions	Good analysis, mostly logical	Moderate analysis	Weak interpretation	No proper analysis	5
Societal, Ethical & Professional Learning	Clearly demonstrated with real impact	Well explained	Mentioned	Minimal reference	Not addressed	5
References & Documentation	Accurate citations, well documented	Minor citation errors	Limited references	A few improper references	No references	5
Total						**30**

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Table F.5(a) Rubrics used in the CIE of Major Project: PR-I: Initial Review (Maximum Marks: 05)

SN	Criteria	Excellent (5)	Good (3-4)	Average (2-1)	Poor (0)
a	**Topic Selection**	Complete, innovative, and useful for society	Somewhat innovative and useful for society	Useful for society but not innovative	Useful for a limited group and not innovative
b	**Problem Definitio n**	Exceeds expectation.	Extends beyond expectation in some manner.	Meets expectations.	Nearly meets expectations.
		The social, ethical, and environmental issues of the project problem were also identified.	The problem and its implications are well understood and described.	The problem and its implications are understood but not well described.	Steps to be followed to solve the defined problem are not specified properly.
c	**Literatur e Survey: Purpose and Need of the Project**	Outstanding investigation in all aspects.	Well-researched project, good depth and thoroughness, sensible planning of research, and well-referenced throughout.	Research is clear and structured.	Minimal research or cursory coverage.
		Detailed and extensive explanation of the purpose and need of the project.	Collects a great deal of information and good study of existing practices/systems.	Appropriate coverage is present and referenced.	Minimal referencing.
				Moderate study of existing practices/systems.	Minimal explanation of the purpose and need of the project.

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SN	Criteria	Excellent (5)	Good (3-4)	Average (2-1)	Poor (0)
d	**Justification of Project Objectives and Planning**	All objectives of the proposed work are well defined.	Good justification for the objectives.	Incomplete justification of the proposed objectives.	Limited information.
		Steps to be followed to solve the defined problem are clearly specified.	The methodology to be followed is specified, but the details are not provided.	Steps are mentioned but unclear and without justification for the objectives.	Only some objectives of the proposed work are defined.
e	**Project Scheduling & Distribution of Work among Team Members**	Detailed and extensive scheduling with timelines provided for each phase of the project.	Good scheduling of the project.	Moderate scheduling of the project.	Poor / No project scheduling done.
		The Work Breakdown Structure (WBS) is well defined.	The Work Breakdown Structure (WBS) is properly defined.	The work breakdown is insufficient.	No Work Breakdown Structure provided.

TOTAL MARKS = (a+b+c+d+e)/5

Table F.5(b) Rubrics used in the CIE of Major Project: PR-II: Mid Review (Maximum Marks: 20)

SN	Criteria	Excellent (20-15)	Good (14-10)	Average (9-5)	Poor (4-0)
a	**Quality of Project Requirements / Technical Specifications**	Outstanding clarity of thought and documentation in the development of design/model from the requirements, using and adapting engineering approaches appropriately.	Focus is on requirements/specifications, and the design follows from them, using the most appropriate elements of the chosen engineering approach.	Engineering techniques are used minimally, though correctly, in the specification.	Very minimal analysis.
		Excellent, incisive analysis leading to a well-defined model/requirements specification of high quality that is fully accurate.	Analysis is well presented and leads to a sound, well-documented model/requirements specification.	Minimal model/requirements specification is created.	A very minimal model/requirements specification is created.
b	**Quality, Appropriateness, and Accuracy of Design / Analytical Model**	Excellent design covering all aspects of the specification, fully appropriate to the project, showing clear thinking.	Appropriate design, clear and accurate, satisfactory for the implementation of the project.	Limited design, or a design not well related to the specification or analytical model.	Very minimal design.

TOTAL MARKS = (a+b)/2

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Table F.5(c) Rubrics used in the CIE of Major Project: PR-III: Comprehensive Evaluation (Maximum Marks: 25)

SN	Criteria	Excellent (25-20)	Good (19-15)	Average (14-10)	Poor (9-0)
a	**Quality and Accuracy of Prototype / Experimental Setup / Analytical Model**	Excellent design covering all aspects of the specification, fully appropriate to the project, showing clear thinking.	Appropriate design, clear and accurate, satisfactory for the implementation of the project.	Design not well related to the specification or analytical model.	Very minimal design.
		Outstanding clarity of thought and documentation in the development of the prototype/experimental setup/model from the specifications, using and adapting engineering methods appropriately.	Effective and efficient implementation with only minor limitations.	Project with some limitations, mostly technically sound.	Poor technical quality with little use of engineering skills or knowledge in evidence.
b	**Individual Presentation**	Excellently planned and executed presentation and demonstration, leaving the listeners in no doubt of the value of the project.	Quality presentation and demonstration. Clear and concise description, leaving listeners with a sound understanding of the project and its problems.	Timed and prepared a presentation and demonstration with a student describing what has been learnt.	No presentation, no demonstration, or the student is unable to articulate project development.
		The contents of the presentation are appropriate and well delivered.	The contents of the presentation are appropriate and well delivered.	The contents of the presentation are appropriate, but not well delivered.	The contents of the presentation are not appropriate and not well delivered.

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SN	Criteria	Excellent (25-20)	Good (19-15)	Average (14-10)	Poor (9-0)
		Proper eye contact with the audience and a clear voice with good spoken language.	Clear voice with good spoken language.	Eye contact with only a few people and an unclear voice.	Poor eye contact with the audience and an unclear voice.

TOTAL MARKS = (a+b)/2

SEMESTER-VII TOTAL MARKS (50) = PR-I + PR-II + PR-III

Table F.5(d) Rubrics used in the CIE of Major Project: PR-IV: Technical Evaluation (Maximum Marks: 40)

SN	Criteria	Excellent (10-9)	Good (8-6)	Average (5-3)	Poor (2-0)
a	**Quality and Accuracy of Experimental Work / Prototype / Analytical Model**	An excellent, fully operational, technically outstanding project.	Very well-engineered solution, with evidence that the student has used a proven method in transforming design into implementation.	Experimental/modeling/design facilities are effectively utilized to suggest a functional implementation.	Insufficient implementation to show competent use of engineering problem-solving methods.
b	**Quality, Appropriateness, and Accuracy of Testing / Validation**	A quality piece of work giving full coverage of the solution and a full program of testing/validation undertaken.	Extensive and well-organized implementation and testing/validation documentation.	Sufficient implementation documentation and testing/validation documentation.	Minimal implementation documentation or testing/validation documentation.
c	**Demonstration of Experimental Work / Prototype / Model Working and Functioning**	All defined objectives are achieved.	All defined objectives are achieved.	All defined objectives are achieved.	Only some of the defined objectives are achieved.
		Each component/module is working well and is properly demonstrated.	Each component/module is working well and is properly demonstrated.	Components/modules are working well in isolation and have been properly demonstrated.	Components/modules are not in proper working form, leading to failure of the integrated system.
		All components/modules of the project are well	Integration of all components/modules has not	Components/modules of the project are not properly	

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SN	Criteria	Excellent (10-9)	Good (8-6)	Average (5-3)	Poor (2-0)
		integrated, and the project performance is accurate.	been done, and project performance is not very satisfactory.	integrated.	
d	**Results, Conclusions, and Discussions**	Project work is well summarized and concluded.	The project work summary and conclusion are not very appropriate. Future extensions in the project are specified.	The project work summary and conclusion are not very appropriate. Future extensions in the project are not specified.	Project work is not summarized and concluded.

TOTAL MARKS = a+b+c+d

Table F.5(e) Rubrics used in the CIE of Major Project: PR-V: Identification of Social, Environmental and Ethical Evaluation (Maximum Marks: 40)

SN	Criteria	Excellent (20-16)	Good (15-11)	Average (10-6)	Poor (5-0)
a	**Identification of Social, Environmental, and Ethical Issues of the Project Problem (Project Participation)**	Identifying and solving social, environmental, and ethical issues.	Identifying and solving social, environmental, or ethical issues.	Identifying social, environmental, or ethical issues.	Not able to identify any issues.
b	**Paper Publication**	Paper publication in a WoS Journal, Scopus Journal, or UGC Care Journal.	Paper publication in a Scopus Conference.	Paper publication in an International Journal (Impact Factor $\geq$ 2) or an International Conference.	Not a published or submitted paper.

TOTAL MARKS = a+b

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Table F.5(f) Rubrics used in the CIE of Major Project: PR-VI: Individual Contribution and Project Report Evaluation (Maximum Marks: 20)

SN	Criteria	Excellent (10-9)	Good (8-6)	Average (5-3)	Poor (2-0)
a	**Group / Individual Presentation**	Excellently planned and executed presentation and demonstration, leaving the listeners in no doubt of the value of the project.	Quality presentation and demonstration. Clear and concise description, leaving listeners with a sound understanding of the project and its problems.	Timed and prepared a presentation and demonstration with a student describing what has been learnt.	No presentation, no demonstration, or a student unable to articulate project development.
		Proper eye contact with the audience and a clear voice with good spoken language.	Clear voice with good spoken language.	Eye contact with only a few people and an unclear voice.	Poor eye contact with the audience and an unclear voice.
b	**Style, Structure, Form, and the Perceived Clarity and Readability of the Report**	Outstanding, comprehensive, and clear report, fully referenced.	An effective report using academic language and accurately referenced.	Acceptable report structure, some referencing, no missing parts, clarity of language.	The report is unbalanced or unclear, or it is difficult to follow the ideas.

TOTAL MARKS = a+b

SEMESTER-II TOTAL MARKS (100) =PR-IV + PR-V + PR-VI

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