CRITERION 2	Outcome-Based Teaching Learning	120 Marks

2.1. Describe Processes Followed to Ensure Quality of Teaching & Learning (20 Marks)

The Department of IT has institutionalized a systematic, multi-faceted process to ensure the highest quality of teaching and learning, aligned with the program's outcomes.

Implementation Details:

1. **Strict Adherence to Academic Calendar:** The department meticulously follows a semester-wise academic calendar, pre-approved by the Academic Council. This includes fixed schedules for curriculum delivery, continuous internal assessments (CIA), practical sessions, project reviews, and final examinations, ensuring a structured and timely learning journey.
2. **Pedagogical Initiatives:**
    - **Active Learning Classrooms:** Moving beyond traditional lectures, faculty employ flipped classrooms, think-pair-share, and peer instruction to foster engagement.
    - **Real-World Examples & Case Studies:** Every theoretical concept is reinforced with contemporary industry examples (e.g., explaining databases with Amazon's inventory system, networks with TCP/IP protocols). This is detailed in section 2.5.
    - **Collaborative Learning:** Group projects, assignments, and in-class problem-solving sessions are mandatory. Tools like GitHub for code collaboration and Google Workspace for documentation are extensively used.
    - **Quality of Laboratory Experience:**
        - **Pre-Lab:** Students are required to understand the aim, theory, and algorithm through pre-lab quizzes on the Learning Management System (LMS).
        - **Conducting Experiments:** Well-structured lab manuals guide students, but they are encouraged to modify code and explore alternative solutions.
        - **Recording Observations & Analysis:** Students maintain digital lab journals documenting their code, outputs, and challenges faced. The analysis section requires them to interpret results, discuss errors, and suggest improvements.
    - **Differentiated Instruction:**
        - **For Fast Learners:** They are given advanced problem statements, encouraged to undertake micro-projects (2.4), participate in hackathons (2.7), and contribute to open-source projects. They often mentor their peers.

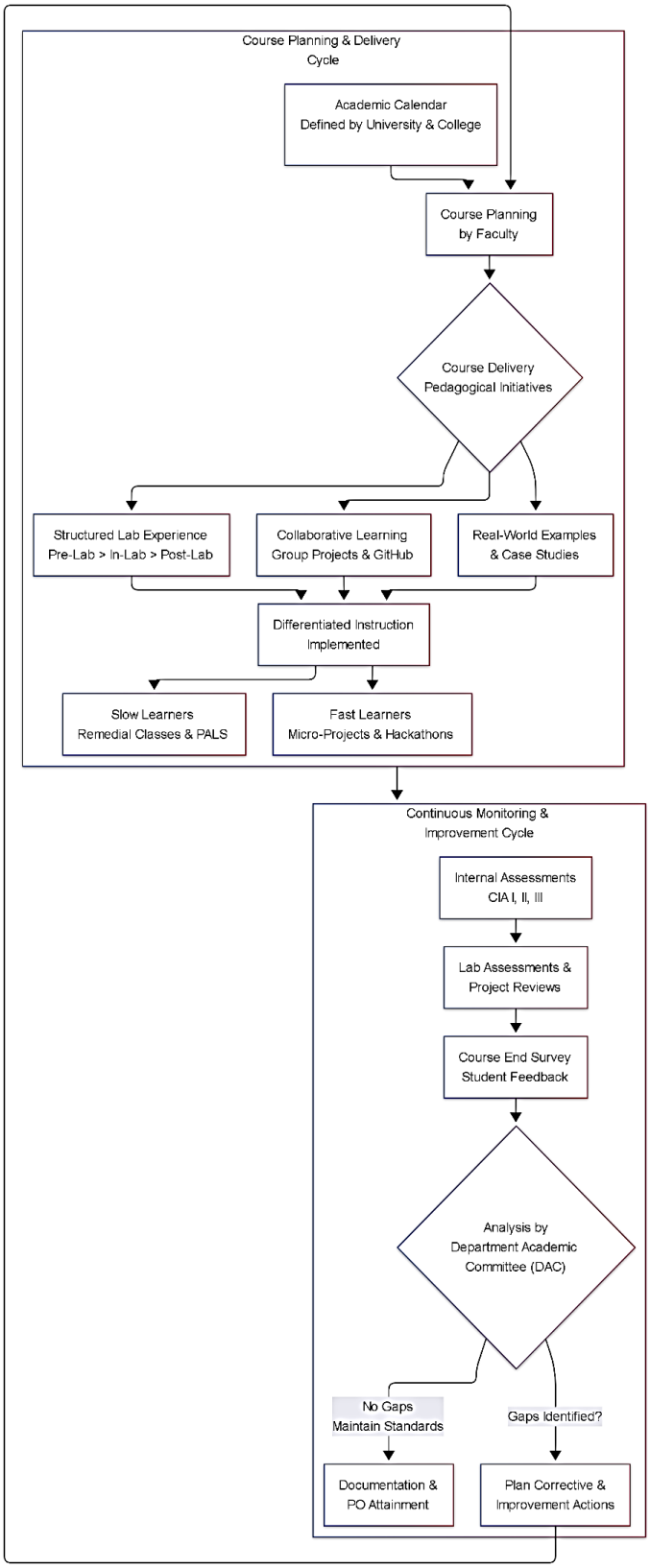

Fig 2.1 (a) Process to ensure quality of teaching and learning

- **For Slow Learners:** Additional support is provided through remedial classes, one-on-one mentoring by faculty, and peer-assisted learning sessions (PALS). Concept revision videos are shared via the LMS.

Impact Analysis:

- **Improved Results:** A consistent year-on-year improvement in End-Semester results and a reduction in fail percentages.
- **Enhanced Practical Skills:** Student performance in lab-based CIA Tests and project demonstrations shows a marked improvement in code quality and problem-solving ability.
- **Positive Feedback:** Course-end surveys indicate high student satisfaction (>85%) with the teaching methodologies and laboratory support.
- **PO Attainment:** Directly contributes to the attainment of **PO1 (Engineering knowledge), PO2 (Problem analysis), PO4 (Conduct investigations of complex problems), and PO5 (Modern tool usage)**.

2.2. Quality of Student Capstone Project (25 Marks)

The Capstone Project is the pinnacle of the undergraduate program, designed to be a holistic experience that synthesizes learning and addresses real-world challenges.

Implementation Details:

1. **Project Identification & Allotment:**
    - **Themes:** Projects are aligned with national priorities and global trends, emphasizing **Environment, Sustainability, Safety, and Ethics**. Examples include AI for precision agriculture, blockchain for secure medical records, IoT for waste management, and assistive technologies for differently-abled individuals.
    - **Sources:** Ideas are sourced from: (i) Industry-sponsored problems, (ii) Faculty research areas, (iii) NGO/Community needs, (iv) Student innovations.
    - **Allotment:** A structured process involves project idea publication, student group formation, a selection process, and final allotment by a Departmental Project Review Committee (DPRC) based on student interest and faculty expertise.
2. **Continuous Monitoring & Evaluation:**
    - **Phased Review:** The project spans two semesters with four rigorous reviews:
        - **Review 1:** Problem Definition & Literature Survey.
        - **Review 2:** System Design & Algorithm Finalization.

        - **Review 3:** Implementation & Mid-term Progress.
        - **Review 4:** Final Implementation, Testing & Demo.
    - **Evaluation Rubric:** Projects are evaluated based on:
        - **Complexity & Relevance (20%)**
        - **Design & Implementation (30%)**
        - **Testing, Results & Working Prototype (20%)**
        - **Consideration of Ethics, Safety, Sustainability & Cost (15%)**
        - **Report & Viva Voce (15%)**
3. **Enhancing Relevance:**
    - **Working Prototypes:** Demonstration of a functional software/hardware prototype is mandatory.
    - **Industry Involvement:** Industry experts are invited as external panelists for the final review, providing critical feedback.

POs/PSOs Addressed with Justification:

- **PO1 (Engineering Knowledge):** Apply knowledge of computing fundamentals. *(Justification: Core CS/IT concepts are the foundation of the project.)*
- **PO2 (Problem Analysis):** Identify, formulate, and analyze complex computing problems. *(Justification: The project begins with a well-defined problem statement and requirement analysis.)*
- **PO3 (Design/Development of Solutions):** Design and evaluate solutions for complex problems. *(Justification: The entire project lifecycle involves designing and developing a software system.)*
- **PO4 (Conduct Investigations):** Use research-based knowledge to analyze and interpret data. *(Justification: Literature survey and data analysis are integral parts.)*
- **PO5 (Modern Tool Usage):** Create, select, and apply appropriate techniques and IT tools. *(Justification: Use of modern IDEs, frameworks, databases, and deployment tools.)*
- **PO6 (The Engineer and World):** Apply reasoning to assess societal, health, safety, and cultural issues. Understand the impact of solutions in environmental contexts. *(Justification: Projects are evaluated on their societal impact and safety considerations. Explicitly evaluated in the rubric.)*
- **PO7 (Ethics):** Apply ethical principles. *(Justification: Projects involving user data must include a privacy and ethics statement.)*
- **PO8 (Individual and Team Work):** Function effectively as an individual and as a member in diverse teams. *(Justification: Project is a team-based activity.)*

- **PO9 (Communication):** Communicate effectively on complex activities. *(Justification: Through reports, presentations, and viva voce.)*
- **PO10 (Project Management):** Demonstrate knowledge of engineering and management principles. *(Justification: Students use tools like Gantt charts and follow a project timeline.)*
- **PSO1, PSO2:** (Department-specific PSOs would be mapped here based on the project's technical domain, e.g., Data Science, Networks, Software Engineering).
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2.3. Internship/Industrial Training (10 Marks)

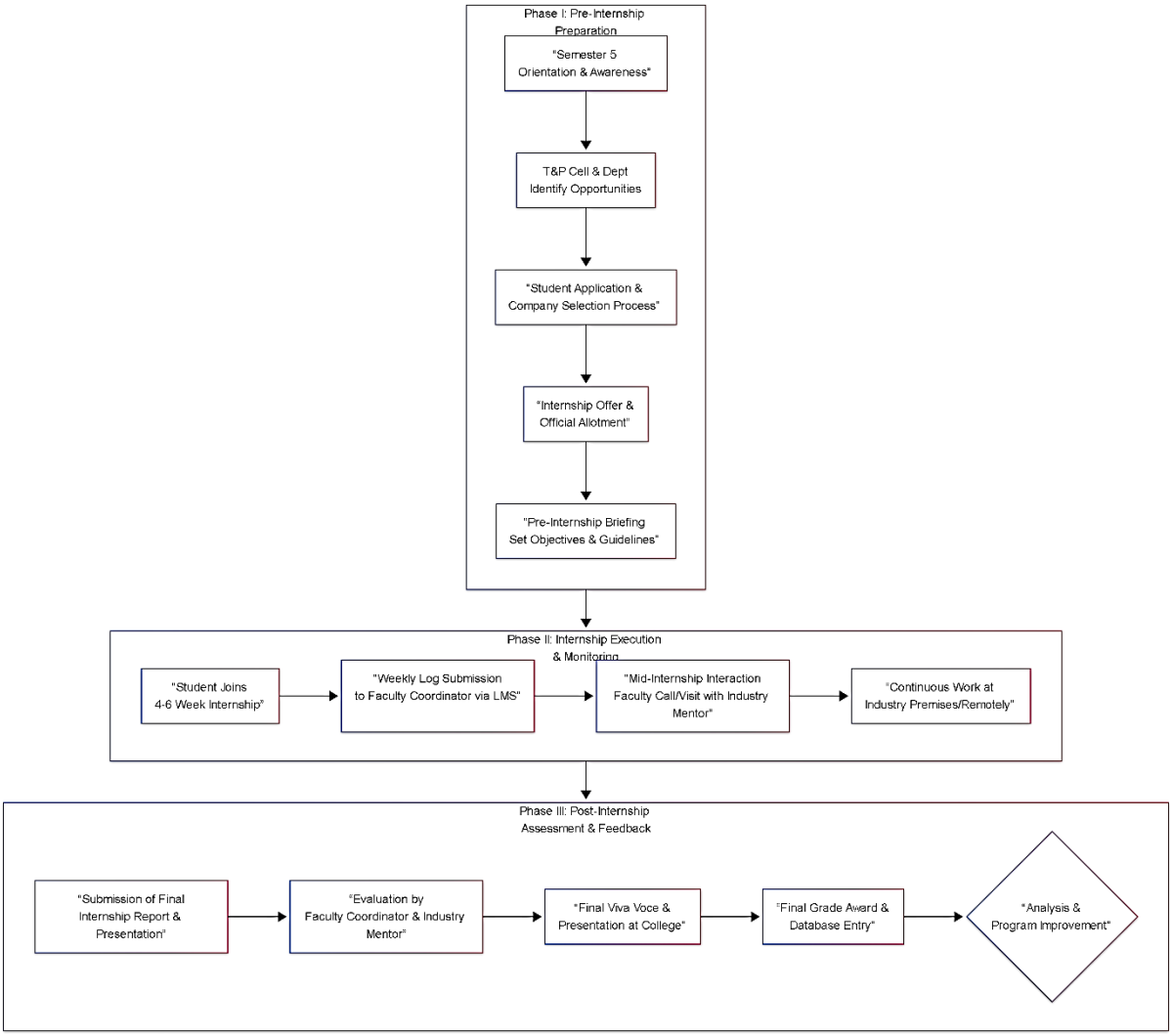

Fig 2.3 (a) Process for Internship

Process:

- **Preparation:** A dedicated placement and internship cell organizes training sessions on resume building and technical interviews.
- **Identification:** Internships are identified through our Industry Institute Partnership (IIP) cell, campus drives, and student initiatives.
- **Duration:** A mandatory 4–6-week internship during the summer after the third year.
- **Monitoring & Evaluation:** Students are monitored through weekly reports and a mid-internship visit/online meeting by a faculty coordinator. Final evaluation is based on a report, presentation, and the employer's feedback.

POs/PSOs Addressed:

- **PO1, PO2, PO3, PO5:** Applying academic knowledge to real-world industry problems.
- **PO8, PO9:** Functioning in a professional environment and communicating with colleagues.
- **PO10:** Understanding project management and business processes.
- **PO6, PO7:** Experiencing professional ethics, safety, and social responsibility in a corporate setting.

2.4. Seminar and Mini/Micro Projects (10 Marks)

Process:

- **Mini/Micro Projects:** Integrated into core courses from the 3rd semester onwards. Students work in groups on a focused problem (e.g., a web application, a data analysis script) over 4-6 weeks. Evaluation is based on functionality, code, and a brief report.
- **Seminars:** In the final year, each student delivers a technical seminar on an emerging topic (e.g., Quantum Computing, Metaverse). They are evaluated on depth of research, presentation skills, and their ability to handle queries.

A. Initiation & Planning Phase

This phase involves setting the scope and assigning topics and guides.

1. **Department Circulates Guidelines:** The department releases a formal schedule and detailed guidelines for both activities at the start of the semester, including deadlines, format, and evaluation criteria.
2. **Activity Type Branching:**
    - **For Mini/Micro Projects (A3):**
        - **Topic Source:** Faculty members propose project topics that are directly aligned with the course objectives and Program Outcomes (e.g., a "Web-based Library Management System" for a DBMS course).

        - **Focus:** Application-based, involving design, coding, and testing.
    - **For Seminars (A4):**
        - **Topic Source:** Students select from an approved list of emerging technologies (e.g., "Blockchain in Supply Chain," "Ethical AI," "Quantum Computing"). This encourages exploration beyond the curriculum.
        - **Focus:** Research, comprehension, and communication of a complex topic.

3. **Allotment:**
    - **A5 (Projects):** Students form teams (typically 2-4 members) and are allotted a project topic and a faculty guide.
    - **A6 (Seminars):** Each student is allotted a seminar topic and a faculty guide to mentor their research.

B. Execution & Monitoring Phase

This phase ensures continuous progress under faculty guidance.

4. **Execution:**
    - **B1 & B3 (Project Execution):** Teams work on the software development lifecycle: planning, design, implementation (coding), and testing.
    - **B6 & B8 (Seminar Research):** The student conducts in-depth research, prepares a structured report, and develops a presentation.
5. **Monitoring by Guide:**
    - **B2 (Project Reviews):** The faculty guide holds periodic reviews to check progress, solve technical hurdles, and ensure the project is on track.
    - **B7 (Seminar Draft Reviews):** The guide reviews the seminar report drafts and presentation slides for technical accuracy, depth, and clarity.

C. Evaluation & Closure Phase

This phase focuses on the assessment of the final output and its alignment with learning outcomes.

6. **Final Evaluation:**
    - **C1 & C2 (Project Evaluation):** The student team demonstrates a working prototype and submits the code. A departmental committee evaluates them based on a rubric (Functionality, Innovation, Code Quality, Report, Viva Voce).
    - **C3 & C4 (Seminar Evaluation):** The student delivers a 15–20-minute presentation followed by a Q&A session. The committee evaluates based on a rubric (Depth of Research, Clarity, Presentation Skills, Quality of Report).
7. **Closure:**

- **C5 & C6 (Final Submission):** Students submit the final, approved version of their project report/code or seminar report to the department via the LMS.

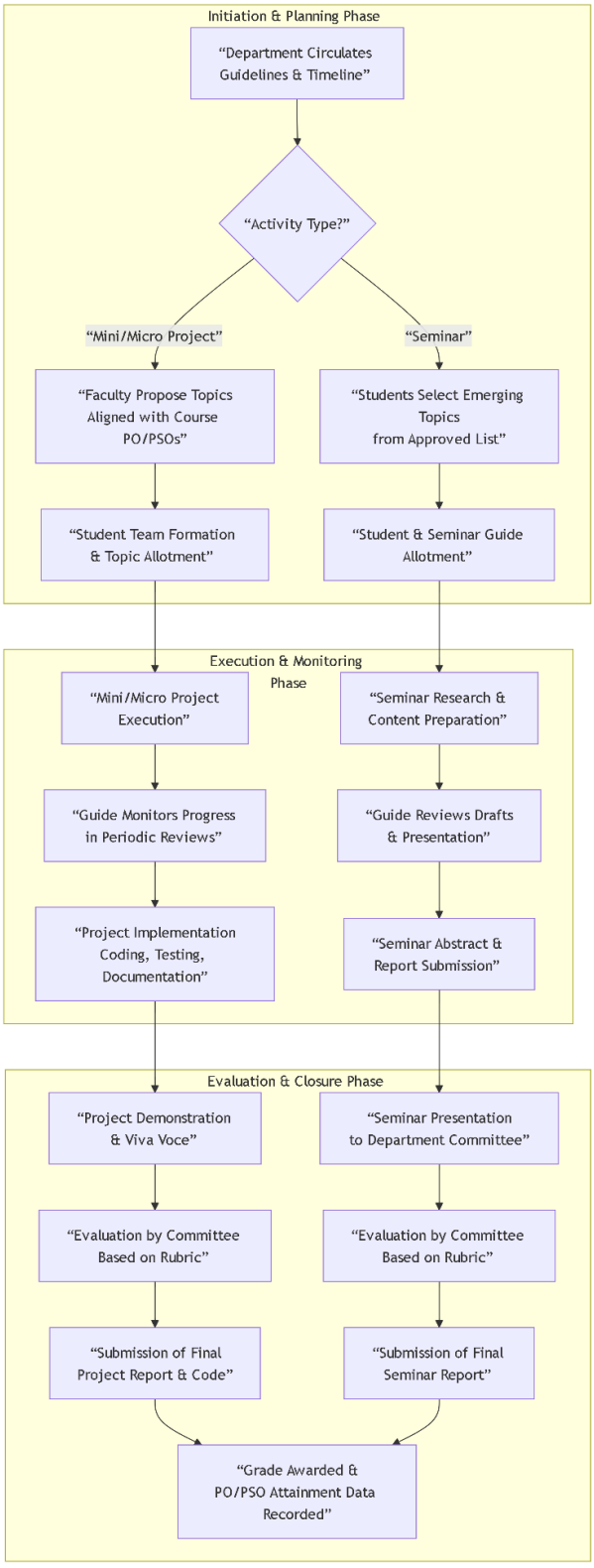

Fig 2.3 (a) Process for Seminar & Mini/Micro project

- **C7 (Grading & Documentation):** A final grade is awarded. The evaluation data is compiled and used for the attainment calculation of specific POs and PSOs.

POs/PSOs Addressed:

- **PO3, PO4, PO5:** (Mini-projects) Designing solutions and using modern tools.
- **PO8, PO9:** (Both) Teamwork for mini-projects; individual performance and communication for seminars.
- **PO1, PO2:** (Seminars) Researching and understanding a complex engineering topic.

2.5. Case Studies and Real-Life Examples (10 Marks)

Type and Complexity:

- **Foundation Courses:** Simple case studies like "Algorithmic complexity analysis of popular sorting techniques used in large-scale systems."
- **Core Courses:** Complex, multi-faceted cases like "Analysis of the 'Aadhaar' system: Database architecture, security protocols, privacy concerns, and societal impact." or "Designing a scalable microservices architecture for a ride-sharing app like Uber."
- **Professional Electives:** Domain-specific cases like "Using Convolutional Neural Networks for early detection of diabetic retinopathy from medical images."

POs/PSOs Addressed:

- **PO2:** Analyzing problems presented in the cases.
- **PO6, PO7:** Discussing societal, environmental, safety, and ethical dimensions.
- **PO1:** Relating theoretical principles to practical implementations.

2.6. SWAYAM/NPTEL/MOOC/Self Learning (10 Marks)
(Number of students registered, certification and POs/PSOs addressed.)

- **Number of Students Registered & Certified:** On average, **>60%** of our students from the 2nd year onwards are enrolled in at least one MOOC per semester. Popular courses include "Python for Data Science" (NPTEL), "Machine Learning" (Coursera), and "Cloud Computing" (edX). The department maintains a database of student certifications.

- **Process & Support:** The department identifies and recommends courses that complement the curriculum. Faculty mentors guide students and, in some cases, NPTEL courses are integrated as part of the credit transfer policy.
- **POs/PSOs Addressed:**
    - **PO1, PO2:** Deepening knowledge in specific domains.
    - **PO11 (Lifelong Learning):** This is the primary PO addressed, as it instills the habit of continuous, self-directed learning.

2.7. Solving Complex Engineering Problems Incorporating Sustainability Goals (20 Marks)

(Provide details of core courses (Project based learning, problem-based learning), mini projects, integrated design projects, capstone projects, hackathon or any other activity-based learning towards solving complex engineering problems targeting relevant SDGs.)

The department employs a project-based learning (PBL) approach across the curriculum to target complex problems aligned with UN Sustainable Development Goals (SDGs).

Core Activities:

1. **Course-Embedded PBL:**
    - **Course: Data Structures & Algorithms.** *Problem:* "Design an optimal algorithm for smart bin allocation and garbage collection routes in a smart city (SDG 11: Sustainable Cities)."
    - **Course: Database Management Systems.** *Problem:* "Design a schema for a 'Food Sharing' application to reduce food waste (SDG 12: Responsible Consumption)."
2. **Hackathons:** The department organizes an annual 24-hour hackathon "Code for Good," with themes like "Health-Tech for Rural India (SDG 3)" and "AI for Climate Action (SDG 13)."
3. **Integrated Design Projects (IDP):** In the 4th and 5th semesters, students undertake IDPs that require knowledge from multiple courses (e.g., Web Essentials + DBMS + Security) to build a system like a "Blockchain-based Land Registry" to reduce fraud (SDG 16: Peace and Justice).
4. **Capstone Projects:** As detailed in 2.2, a significant proportion of capstone projects are explicitly designed around SDGs.

POs/PSOs Addressed:

- **PO3 (Design/Development):** Central to all these activities.
- **PO4 (Investigations):** Required for understanding the problem context.
- **PO5 (Modern Tools):** Essential for building solutions.

- **PO6, PO7:** Directly mapped through the focus on societal, environmental, and ethical goals.

2.8. Steps Taken for Enhancing Industry Institute Partnerships (15 Marks)
(Provide details of partial delivery of courses, industry supported labs, industry offered short-term programs/training etc.)

The Department actively fosters strong industry relationships to bridge the gap between academia and the corporate world.

Implementation Details:

1. **Partial Delivery of Courses:** Industry experts from partner companies (e.g., CTS, TCS through Academic Interface Program) deliver specialized lectures on topics like "Cloud computing," "Virtualization," and "Full stack web development" as part of the regular curriculum.
2. **Industry-Supported Labs:**
    - **Cisco Centre of Excellence:** Lab setup for advanced networking courses and certifications.
3. **Industry-Offered Short-Term Programs:**
    - Regular workshops on emerging technologies like "RPA using UiPath" and "Full-Stack Development with MERN" are conducted by industry trainers.
    - A mandatory "Corporate Readiness Program" is offered in the pre-final year, focusing on soft skills, aptitude, and group discussions.
4. **MoUs and Collaborations:** The department has active MoUs with several IT firms for joint projects, internships, and faculty development programs.

Impact:
These initiatives ensure that the curriculum remains relevant, students are industry-ready, and they gain exposure to current tools and practices, directly enhancing their employability and aligning with **PO1, PO5, PO8, PO9, and PO10**.