

Academic Processes Handbook

The **Academic Processes Handbook** is a structured guide that outlines the institutional procedures, policies, and frameworks related to the planning, development, delivery, assessment, and revision of academic programs in a university. It ensures consistency, transparency, and quality in academic operations. This handbook is intended for use by university administrators, academic leaders, faculty members, curriculum designers, and statutory bodies involved in academic governance.

The handbook serves as a reference for decision-making at various academic stages—such as introducing new programs, revising curricula, seeking approvals, implementing teaching-learning processes, and conducting evaluations. It is especially useful during the academic planning phase, program reviews, and when complying with regulatory requirements.

It should be used at the end of every academic cycle, during curriculum revision periods, or when launching new programs. The handbook is essential for ensuring that all academic activities are aligned with institutional goals, national standards, and the expectations of all stakeholders.

Purpose of the Handbook

This handbook aims to document and standardize the academic processes of the university. It provides clear guidelines for planning, developing, approving, implementing, and reviewing academic programs to ensure quality, regulatory compliance, and alignment with institutional goals.

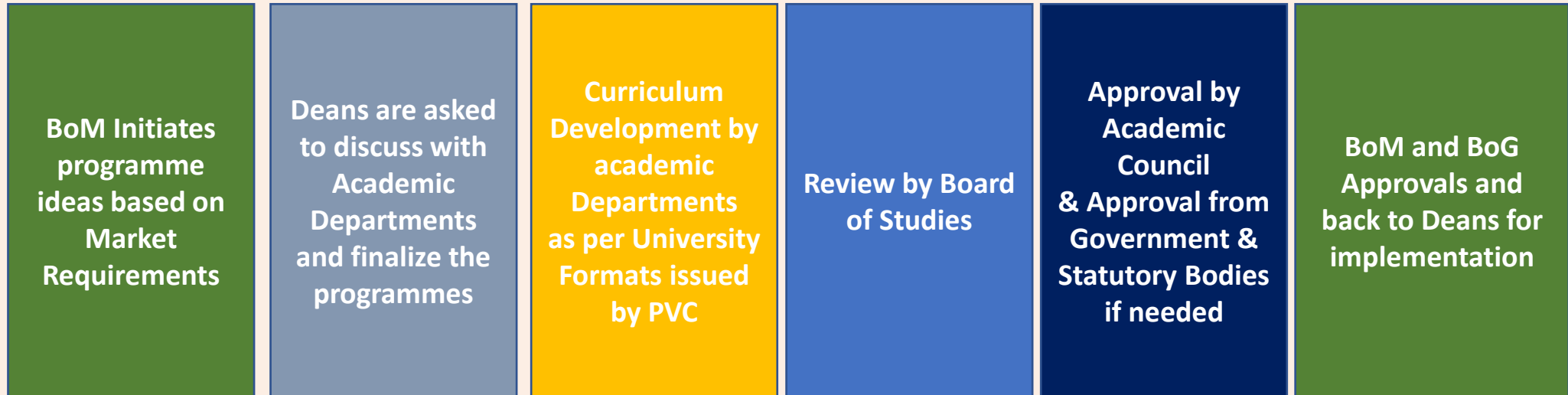
Scope and Applicability

The handbook applies to all academic programs offered by the university, including undergraduate and postgraduate courses. It covers academic governance, curriculum and course development, teaching-learning practices, assessments, and revisions, ensuring consistency across departments and schools.

Stakeholders and Users

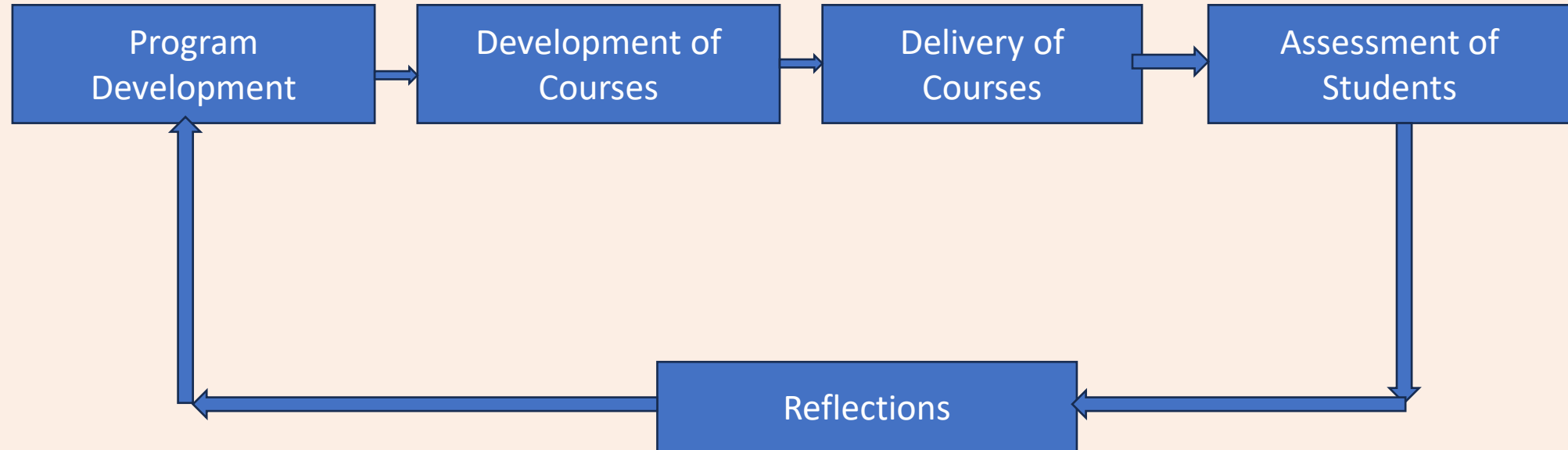
Primary users include Deans, Heads of Departments, faculty members, curriculum developers, academic administrators, and governing bodies. It also serves as a reference for regulatory agencies, external reviewers, and accreditation bodies involved in academic oversight.

Programme Development and Implementation



Responsibility: Deans, Directors, HoDs and Faculty Members

Continuous Improvement of Programs



Rationale for Instituting a Program in a University

Instituting a new program in a university is driven by the need to address emerging societal, industrial, scientific, and technological demands. Programs are designed to fill skill gaps, respond to stakeholder feedback, align with national priorities, and support institutional vision and mission. Market research, industry consultation, alumni insights, and academic benchmarking guide the relevance and viability of the program. The objective is to enhance graduate employability, promote research and innovation, and contribute to national and regional development through a competent workforce and knowledge advancement in priority or underrepresented academic and professional domains.

Program Development

Program development is a structured process involving need analysis, defining program objectives, designing curriculum structure, and identifying graduate attributes and outcomes. It includes determining the credit structure, duration, admission eligibility, and pedagogical approach. Interdisciplinary integration, regulatory compliance, industry relevance, and academic rigor are ensured. Curriculum mapping aligns each course with intended outcomes. Inputs from academia, industry experts, alumni, and regulatory bodies are incorporated. The development process concludes with the preparation of a comprehensive program document, which is then reviewed and forwarded through institutional approval channels for formal consideration and implementation readiness.

Course Development

Course development involves detailing individual courses within a program to align with curriculum objectives and graduate outcomes. Each course includes a title, code, credit structure, prerequisites, course outcomes, syllabus content, teaching-learning strategies, assessment methods, and recommended learning resources. Faculty expertise, pedagogical innovation, and outcome-based education principles guide the design. Emphasis is placed on industry relevance, skills development, and current knowledge trends. Course design should accommodate flexibility, learner diversity, and integration of experiential learning where feasible. Developed courses are reviewed by domain experts and approved by the Board of Studies before being integrated into the academic program structure.

Approval Processes – Board of Studies (BoS)

The Board of Studies (BoS) is the first academic body responsible for reviewing and recommending academic proposals such as new programs, curriculum designs, course syllabi, and revisions. Comprising internal and external subject experts, the BoS ensures academic rigor, relevance, and alignment with national education standards. It evaluates the coherence, quality, and outcome alignment of course content and teaching methodologies. Once satisfied, the BoS forwards its recommendations to the Academic Council for further approval. BoS meetings are conducted at regular intervals and are documented in minutes, forming the initial foundation for formal academic decisions and governance.

Approval Processes – Academic Council

The Academic Council is the principal academic authority in the university, responsible for maintaining academic standards and overseeing teaching, research, and evaluation. It considers recommendations from the Board of Studies regarding new programs, curriculum revisions, and academic policies. The Council ensures compliance with regulatory frameworks, institutional goals, and quality benchmarks. It may suggest modifications, seek expert reviews, or approve proposals for forwarding to higher bodies. The Council is chaired by the Vice Chancellor and includes Deans, senior faculty, and external academic experts. Approved programs proceed to the Board of Management and other statutory bodies as required.

Approval Processes – Board of Management, Finance Committee, Board of Governors

The Board of Management (BoM) reviews academic proposals approved by the Academic Council to ensure alignment with the university's strategic and operational goals. It assesses resource feasibility, infrastructure needs, and long-term implications. The Finance Committee examines financial viability, cost projections, and sustainability of the proposed programs, including staffing, labs, and facilities. Final institutional-level approval rests with the Board of Governors (BoG), which ensures that academic expansions are in harmony with the university's vision, regulatory obligations, and fiscal health. This layered approval ensures academic, administrative, and financial diligence before program launch.

Program Implementation

Once approved, program implementation involves the coordinated efforts of the Dean, School Heads, and Department Coordinators. It includes scheduling, faculty deployment, infrastructure preparation, lab setup, curriculum delivery planning, and student orientation. Teaching-learning materials are prepared, and ERP systems are updated for registration and assessments. Faculty are briefed on course plans and outcome mapping. Internal Quality Assurance Cells (IQAC) monitor implementation fidelity. Any initial feedback or operational issues are resolved through academic committees. Continuous assessment mechanisms, resource allocation, and student support systems are activated to ensure smooth, timely, and quality-driven program delivery.

Curriculum- Program-Document

Introduction

Shaping Minds, Building Futures

In the ever-evolving landscape of education, **curriculum development** is the compass that guides teaching and learning toward relevance, excellence, and societal impact. It is the foundation upon which the quality, coherence, and effectiveness of any academic program are built.

This module serves as a **gateway to understanding how educational content is crafted**, how learning outcomes are defined, and how academic experiences are structured to empower students with knowledge, skills, and values.

Whether you are a faculty member, academic planner, or educational leader, this module will help you:

Understand the **principles, processes, and frameworks** of curriculum design.

Align curriculum with **national standards, industry needs, and graduate attributes**.

Incorporate **21st-century skills, interdisciplinary integration, and student-centered learning**.

Explore **Outcome-Based Education (OBE)** and how it transforms curriculum from content-driven to results-oriented.

Curriculum is not just a collection of subjects—it is a **powerful blueprint for building thinkers, doers, and leaders**. Let us begin the journey of mastering the art and science of curriculum development!

Curriculum

Ownership Details

Faculty	Faculty of Engineering and Technology (FET)
School	School of Engineering
Department	Robotics & Automation
Program	B.Tech, Robotics & Automation
Dean of Faculty	Dr. Prakash S V
Director of School	Dr. Praveen J
Head of Department	Dr. Rajashekhar B Somasagar

Program Specifications

1	Title of the Award	
2	Modes of Study	
3	Awarding Institution /Body	
4	Joint Award	
5	Teaching Institution	
6	Date of Program Specifications	
7	Program Benchmark	
8	Program Overview	
9	Program Educational Objectives (PEOs)	
10	Program Outcomes (POs) (Graduate Attributes)	
11	Program Specific Outcomes (PSOs)	

Program Specifications

12	Program credit Structure	
13	Semester wise Courses and Credits	
14	Program Delivery-Teaching	
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16	Attendance Requirement	
17	Assessment and Grading	
18	Award of Degree	
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21	Mapping of POs with COs	

Curriculum Sample

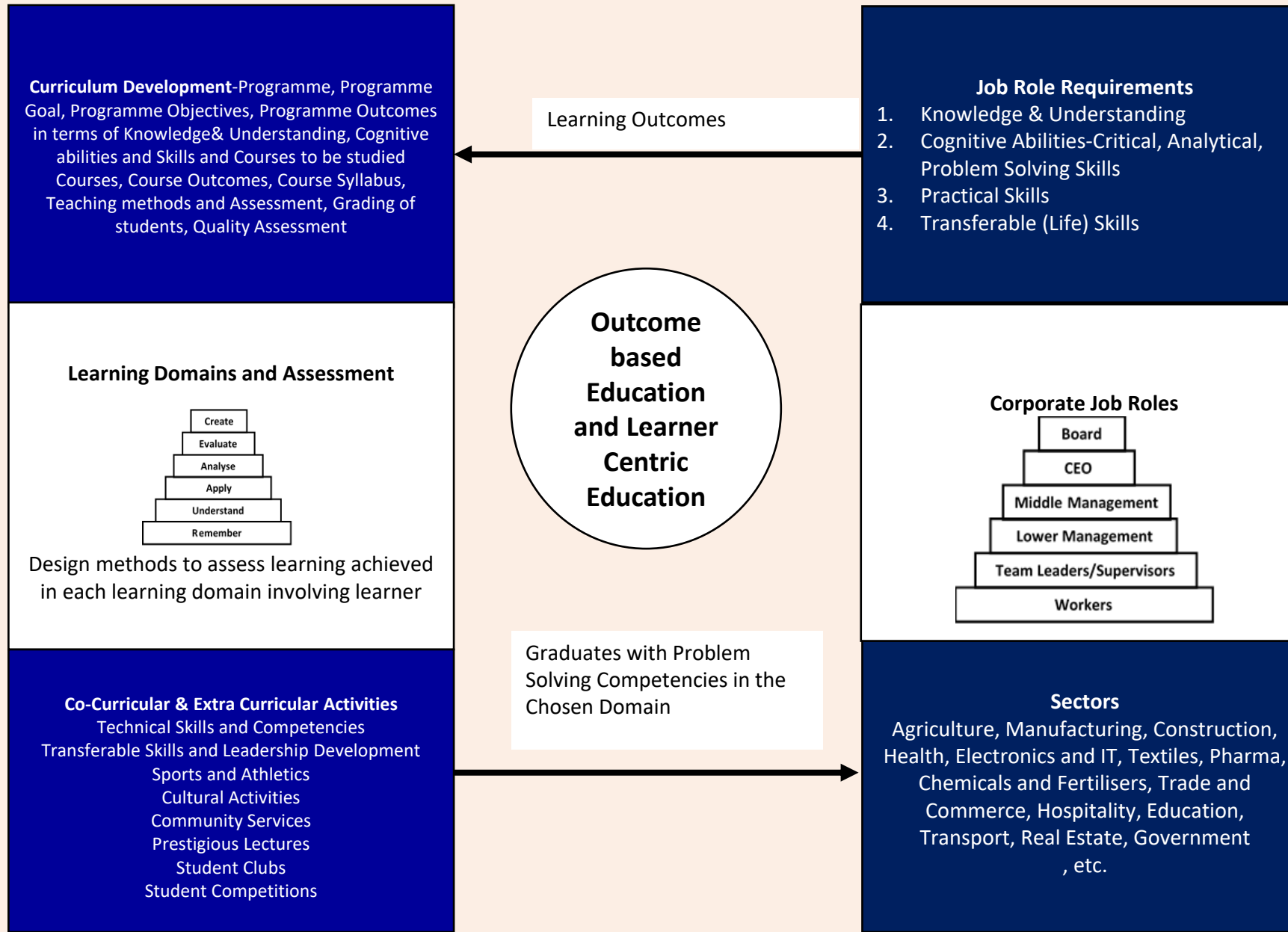
Program Document- Sample –See Annexure

Outcome Based Education (OBE)

What is Outcome-Based Education (OBE)?

Outcome-Based Education (OBE) is an educational approach that focuses on clearly defined outcomes (what students are expected to know, do, and value) by the end of a course or program. “Start with the end in mind” – In OBE, all curriculum, teaching, assessment, and evaluation are designed backward from the desired outcomes.

Outcome Based Education-Feed Back Model



Why Outcome-Based Education?

1.  **Focus on Learner-Centric Goals:**
It emphasizes **what students learn**, not just what is taught.
2.  **Clear Expectations:**
Clearly defined learning outcomes help students understand what is expected.
3.  **Accountability & Transparency:**
Teachers and institutions are accountable for students **achieving measurable learning outcomes**.
4.  **Global Standards & Accreditation:**
Required by **NBA (India), ABET (USA), and other accreditation bodies**, ensuring international equivalence.
5.  **Improved Teaching and Assessment:**
Teaching methods and evaluations are aligned with outcomes, leading to **better learning quality**.
6.  **Continuous Improvement:**
Feedback and assessment data are used to **refine curriculum and teaching methods**.

Key Terms in OBE

Term	Meaning
Program Outcomes (POs)	What students should achieve by the time they graduate
Course Outcomes (COs)	What students should achieve after completing a specific course
Program Educational Objectives (PEOs)	Broad goals to be achieved 3–5 years after graduation
Program Specific Outcomes (PSOs)	Discipline-specific outcomes aligned with the program

Other Educational Paradigms

Paradigm	Description
1. Input-Based Education	Focuses on what is taught (syllabus, teacher qualifications, resources)
2. Content-Based Education	Emphasizes content coverage , textbooks, and teacher-centered delivery
3. Process-Based Education	Focuses on the methodology (lecture, discussion, lab work)
4. Outcome-Based Education	Focuses on learning results – what students can demonstrate or do
5. Competency-Based Education	Focuses on acquiring specific skills and abilities at a mastery level
6. Experiential Education	Learning through experience (internships, fieldwork, hands-on projects)
7. Constructivist Education	Learners construct knowledge based on experience and interaction

Curriculum

1. Curriculum

Meaning:

The **curriculum** is the **overall plan** of what students will learn in an educational program. It includes all **courses, topics, learning objectives, teaching methods, and assessments** designed for a specific level or program.

Example:

An MBA curriculum includes courses in management, finance, marketing, operations, etc., spread across different semesters.

2. Program

Meaning:

A **program** is a **complete educational package** that leads to a degree or diploma. It includes a structured set of courses to be completed over a certain time period.

Example:

B.Tech in Computer Science is a 4-year **undergraduate program** with a fixed number of credits and courses.

3. Course

Meaning:

A **course** is a **single subject or unit** of study within a program. It focuses on a specific topic and is taught during a semester.

Example:

"Data Structures" is a course under the B. Tech Computer Science program.

4. Academic Credit

Meaning:

An **academic credit** is a measure of the amount of learning based on the number of **hours of teaching and study**.

Generally:

- **1 credit = 1 hour of class per week** for a semester (or 2–3 hours of practical work).

Example:

A 3-credit course usually means 3 hours of classroom instruction per week for the semester.

5. Number of Weeks in a Semester

Meaning:

A **semester** is a fixed academic term, usually half of an academic year.

Most universities have:

- **15 to 18 weeks** in a semester (including teaching, internal assessments, and exams).

Example:

A 3-credit course over a 15-week semester means 45 hours of total classroom teaching.

6. Program Specifications

Program Specifications describe the **structure, content, outcomes, and expectations** of an academic program.

They act as a **blueprint** for designing, delivering, and assessing a degree or diploma program.

7. Program Benchmark

A **Program Benchmark** refers to a **set of academic and quality standards** used to evaluate and compare the **design, delivery, and outcomes** of an educational program.

It ensures that a program meets **national or international expectations** for content, level, and learning outcomes.

(AICTE/UGC/International Expectations)

8. Program Overview

- The **Program Overview** is a **short summary** that gives a **clear, concise introduction** to an academic program. It tells the reader **what the program is about, why it matters, and what students can expect to gain.**
- It's usually the **first section** in any program document or syllabus and helps students, faculty, accreditors, and employers understand the **purpose and scope** of the program.
- **Ideal Length: 150–300 words** (1–2 short paragraphs)
- It should be **brief yet informative**, not an exhaustive description.
- It should contain-goals and relevance to society/industry/academia,
- Brief summary of what the program covers (core areas, electives, labs, projects, etc.)
- Potential job roles, industry sectors, or further study options
- Any special aspects (e.g., industry tie-ups, internships, international collaborations)

Sample Program Overview (Example):

Program Title: *B. Tech. in Artificial Intelligence and Data Science*

Duration: *4 years (8 semesters)*

Overview:

The B. Tech. in Artificial Intelligence and Data Science is a future-ready program designed to equip students with a solid foundation in machine learning, data analysis, and intelligent system design. The program integrates core computer science principles with advanced AI concepts such as deep learning, natural language processing, and robotics. It emphasizes hands-on projects, industry internships, and real-world problem-solving.

Graduates will be well-prepared to take on roles such as Data Scientist, AI Engineer, Machine Learning Specialist, and Business Analyst in leading tech companies, R&D organizations, and startups. The program also lays the groundwork for advanced studies and research in AI-related fields.

9. Program Educational Objectives

Program Educational Objectives are **broad statements** that describe what **graduates** of a program are expected to **achieve within 3–5 years** of graduation. These objectives reflect the **career and professional accomplishments** the program is preparing students for.

They are typically aligned with:

- The **mission** of the department/institution
- The **needs** of stakeholders (students, employers, society)
- **Accreditation bodies** like NBA (India) or ABET (USA)

How Many PEOs Should Be Written?

Typically, you should write **3 to 5** PEOs.

- They should be **broad, realistic, and measurable** (but not too detailed).
- Each should cover a **distinct aspect** of what the graduate is expected to achieve.

◆ Example of Program Educational Objectives

Let's consider a **B.Tech. in Computer Science and Engineering**:

1. Professional Growth:

Graduates will establish themselves as **successful professionals** in software development, IT services, or related fields, contributing to the growth of organizations.

2. Lifelong Learning and Higher Education:

Graduates will pursue **lifelong learning** through higher studies, certifications, or research in computing or allied domains.

3. Ethical and Social Responsibility:

Graduates will practice their profession with a strong sense of **ethics, teamwork, and social responsibility**, contributing to sustainable development.

4. Innovation and Problem Solving:

Graduates will apply engineering knowledge to **develop innovative solutions** for real-world problems using appropriate tools and technologies.

10. Program Outcomes (POs) (Graduate Attributes)

Program Outcomes (POs) are **narrower statements** than PEOs that describe what students are expected to know and be able to **do at the time of graduation**. They are derived from **Graduate Attributes (GAs)** defined by international accreditation bodies and focus on **knowledge, skills, and behavior**.

These outcomes form the basis for curriculum design, delivery, and assessment.

List of Program Outcomes for Engineering (As per NBA Guidelines)

PO No.	Program Outcome (Graduate Attribute)
PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, 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 modeling 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 the professional engineering practice.
PO7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the 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.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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.

11. Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are statements that describe what the **students of a specific engineering program** (like Mechanical, CSE, ECE, etc.) should be able to do **by the time of graduation**, based on the **specialized knowledge and skills** they acquire in that program.

They are derived from the **vision and mission of the department**, and are closely related to the **domain or specialization** of the program.

PSOs are more **focused** and **discipline-specific** than general Program Outcomes (POs).

How Many PSOs Should Be Written?

You should write **2 to 4** PSOs.

- They should be **precise, measurable, and distinct**.
- Should reflect what is **unique to your program**.

Example: PSOs for B. Tech in Mechanical Engineering

PSO No.	Program Specific Outcome
PSO1	Apply the principles of thermodynamics, manufacturing, and design to solve real-world mechanical engineering problems.
PSO2	Use modern engineering tools and software like CAD/CAM, FEA, and CFD for product design and analysis.
PSO3	Demonstrate understanding of industrial practices , project management, and interdisciplinary engineering to address industry and societal needs.

Example: PSOs for B. Tech in Computer Science and Engineering

PSO No.	Program Specific Outcome
PSO1	Apply knowledge of data structures, algorithms, databases, and software engineering to design efficient computing solutions.
PSO2	Design and develop web-based and mobile applications using modern programming languages, tools, and platforms.
PSO3	Apply concepts of AI, Machine Learning, and Data Science to solve domain-specific problems.

12. Program Credit Structure

Programs	Duration	Credits
UG Programs	4 years/8 Semesters	160
PG Programs	2 years/4 semesters	80
MBA Programs	2 years/4 semesters	100

UG- 4 year Program Credit Distribution

Program -Category	Credits
Program-Core courses, elective Courses, open electives, project work	130 credits
Technical Skills-School of Digital Technical Competency Development-LEAP	10
Life Skills- Career Advice and Student Placements-LEAP	3
Innovation and Entrepreneurial Skills-GMU IDEA LAB	3
Environmental Awareness and Community Services-Student Affairs	3
Athletics, Sports, Yoga, Gymnasium-Student Affairs	3
Placement Training- Career Advice and Student Placements	3
Cultural & Literary Activities-Student Affairs	3
Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition- student Proctor)-Student Clubs-Technical Clubs	2

1 credit= 15 hours of face to face interaction/30 hours of practical work

13. Semester wise Courses and Credits

Academic Year			
Program			
Semester			
List of Courses			
S. No.	Course Code	Course Title	Credits
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Total Credits			18-20

14. Program Delivery

Program Delivery refers to the **methods and strategies used to teach and facilitate learning** in a particular academic program. It involves the **implementation of curriculum** through various instructional approaches, learning resources, and technologies to ensure that students **achieve the intended learning outcomes**.

It covers:

- Teaching methodologies
- Learning environments
- Use of tools and technology
- Student engagement practices

Methods of Program Delivery

Sl. No.	Delivery Method	Explanation	Use of Videos/Materials
1	Lectures (Traditional/Chalk & Talk)	Instructor-led classroom sessions explaining key concepts.	Can be supported with video lectures , diagrams, and handouts .
2	PowerPoint-Based Lectures	Use of multimedia presentations to visually support lecture content.	Embedded images, videos, animations , and charts enhance understanding.
3	Flipped Classroom	Students learn through videos/materials before class ; classroom time is used for discussion and problem solving.	Requires pre-recorded videos , reading materials, and quiz-based apps .
4	Demonstrations	Physical or video-based demonstration of tools, techniques, or experiments.	Live or recorded demonstration videos, animations , equipment manuals.
5	Laboratory/Practical Sessions	Hands-on sessions in labs to develop practical skills.	Supported by simulation videos, lab manuals , and virtual labs .
6	Tutorials/Problem-Solving Sessions	Smaller groups solving numerical or conceptual problems.	Use of step-by-step solution videos , whiteboard recordings.
7	Case-Based Learning	Real-life scenarios/cases are used to stimulate analysis and discussion.	Case videos , documents, or interactive tools (e.g., Harvard Case Method).
8	Project-Based Learning (PBL)	Students work on real or simulated projects to apply their knowledge.	Document templates , planning tools, and video examples of similar projects.
9	Online/Blended Learning	Part or full delivery through online platforms (LMS, MOOCs).	Pre-recorded lectures, YouTube content, animations , self-paced quizzes.
10	Interactive e-Learning Modules	Structured online content with interactions, quizzes, animations.	Interactive SCORM content, click-based videos , games.

Methods of Program Delivery

Sl. No.	Delivery Method	Explanation	Use of Videos/Materials
11	Seminars/Workshops	Student- or expert-led sessions on focused topics.	Recorded guest lectures, presentation videos, and workshop manuals.
12	Industrial Visits/Field Work	Exposure to real-world environments and practices.	Pre-visit briefing videos, field manuals, and post-visit reflection videos.
13	Group Discussions & Debates	Encourages communication and critical thinking.	May use videos to present controversial topics or provoke discussion.
14	Assignments and Mini-Projects	Independent or group work to apply theoretical knowledge.	Include guideline videos, example reports, and research resources.
15	MOOCs/External Video Content	Use of third-party courses (e.g., NPTEL, Coursera, edX).	Access to high-quality video lectures, quizzes, and certification.
16	Role Play/Simulation	Students act out scenarios to learn professional behavior and decision making.	Use of scenario videos, scripts, and simulation software.
17	Peer Teaching/Peer Review	Students teach/review each other’s work to reinforce learning.	Student-recorded videos, collaborative feedback tools.
18	Mentoring and Counselling Sessions	One-on-one or small group interaction to support learning and growth.	Use of motivational videos, reflection tools, or personal learning plans.

Summary Points:

- A **blended approach** (mix of methods) is often most effective.
- Use of **videos, simulations, e-books, and LMS platforms** enhances engagement and flexibility.
- Delivery methods should be **aligned with Course Outcomes (COs) and Program Outcomes (POs)**.

15. Learning

Learning is the **process of acquiring knowledge, skills, attitudes, and values** through experience, study, or instruction.

In academic settings, learning involves understanding concepts, solving problems, applying knowledge, and developing the ability to think critically and independently.

“Learning is not the product of teaching. Learning is the product of the activity of learners.” — John Holt

Characteristics of Effective Learning

- **Active** (engaged participation)
- **Constructive** (building on prior knowledge)
- **Intentional** (goal-directed)
- **Reflective** (thinking about what and how one learns)
- **Social** (interaction with peers and instructors)

Learning Methods

Method	Explanation
1. Active Listening in Class	Paying full attention, asking questions, and taking notes during lectures.
2. Reading Textbooks & Notes	Understanding concepts through regular reading and summarizing key points.
3. Note-Making & Mind Mapping	Writing own summaries, drawing mind maps to visualize and connect ideas.
4. Self-Explanation	Teaching the concept to oneself or others to reinforce understanding.
5. Practice and Repetition	Solving problems, writing answers, or practicing skills repeatedly.
6. Group Study & Peer Learning	Learning through discussions, quizzes, and teaching peers.
7. Asking Questions	Clarifying doubts with teachers, mentors, or online forums.
8. Watching Educational Videos	Using YouTube, MOOCs (NPTEL, Coursera, Udemy, Edx), or university content to learn visually.
9. Using Flashcards & Mnemonics	Useful for remembering definitions, formulas, and terminology.
10. Applying Concepts	Doing experiments, case studies, or mini-projects to apply theoretical knowledge.
11. Practicing Past Exams & Tests	Helps in understanding the question pattern and improving time management.
12. Time Management & Scheduling	Regular, planned study times improve retention and avoid last-minute pressure.
13. Using Digital Tools	Using apps like Anki, Notion, Grammarly, Wolfram Alpha, or Google Scholar.
14. Reflection and Self-Assessment	Thinking about what was learned, what's unclear, and where improvement is needed.
15. Seeking Feedback	Learning from teacher or peer feedback on assignments, projects, or presentations.



Tips for Effective Academic Learning

- **Set Clear Goals:** Know what outcomes are expected from each subject or module.
- **Break Study into Chunks:** Use the Pomodoro technique (25 min study, 5 min break).
- **Revise Regularly:** Space repetition improves long-term memory.
- **Stay Curious:** Connect learning to real-life problems and applications.
- **Maintain Health:** Good sleep, nutrition, and physical activity boost learning ability.

16. Attendance Requirement

Attendance Requirements refer to the **minimum percentage of classes** a student must attend to be **eligible to appear for examinations** or be considered as having **satisfactorily completed** a course or program.

“A student shall maintain a **minimum of 75% attendance** in each theory and practical course. **Shortage up to 10%** may be condoned by the competent authority for valid reasons. Students failing to meet attendance requirements shall be **debarred from appearing in the semester-end examination.**”

Why is Attendance Important?

1.  **Academic Engagement** – Ensures students benefit from class interactions, discussions, and real-time feedback.
2.  **Better Learning Outcomes** – Strong correlation between attendance and academic performance.
3.  **Exam Eligibility** – Attendance shortfall may bar students from appearing in final exams.
4.  **Professional Behavior** – Instills discipline and punctuality, essential for future careers.
5.  **Institutional Compliance** – Required for accreditations (NBA, NAAC) and audits.

17. Assessment and Grading

Assessment is the process of **evaluating student performance and learning** to determine how well they meet the **Course Outcomes (COs)** and **Program Outcomes (POs)**.

There are two main types:

Type	Purpose	Timing
Formative	To improve learning during the course	During the course
Summative	To evaluate learning at the end of a course/module	End of unit/semester

◆ What is Grading?

Grading is the process of assigning **symbols (letters, numbers, GPA)** to reflect the level of **student achievement**.

◆ Methods of Student Assessment

Assessment Method	Description	Weightage (Typical)
Assignments	Individual or group tasks based on course content	10–20%
Quizzes/Tests	Short assessments to gauge immediate understanding	5–10%
Mid-Semester Exam	Formal test covering half the syllabus	20–25%
End-Semester Exam	Comprehensive evaluation of the entire syllabus	40–50%
Laboratory/Project Work	Practical implementation, experiments, mini-projects	20–30% (for lab/project)
Presentations/Seminars	Oral communication of learning, often in groups	5–10%
Viva Voce	Oral defense of understanding in labs or projects	5–10%
Peer/Group Evaluation	Assessment by fellow students in team-based work	Optional

Assessment-GMU

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weightage	15	25	20	40	100
	Quiz-1: 5	Test-1:8	Assignment-1: 10	SEE-40	
	Quiz-2: 5	Test-2: 8	Assignment-2: 10		
	Quiz: 3-5	Test-3:9			

Based on total marks scored grade is Awarded.

If marks scored is:

- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit during make-up coaching and examination period

Grading System (Example: 10-Point Scale)

Marks Range (%)	Letter Grade	Grade Point (GPA)	Meaning
90–100	O	10	Outstanding
80–89	A+	9	Excellent
70–79	A	8	Very Good
60–69	B+	7	Good
50–59	B	6	Average
40–49	C	5	Pass
<40	F	0	Fail
-	I	-	Incomplete

18. Award of Degree and Completion of Minimum of 160 Credits

In a typical **4-year undergraduate engineering program**, students are required to **successfully earn 160 academic credits** to be eligible for the **award of the degree**.

Criteria for Award of Degree

Requirement	Condition
Minimum Credits	Must earn 160 credits over 8 semesters
Minimum CGPA	Usually ≥ 5.0 on a 10-point scale
Passing all Mandatory Courses	No F (Fail) grades in core courses
Completion of Project and Internship	As per curriculum and with satisfactory grades
Fulfillment of Attendance Requirements	Typically $\geq 75\%$ per course
Clearance of Dues & Other Formalities	Library, hostel, fee payments, etc.

19. Student Support for Learning

Student Support for Learning refers to the **resources, services, and guidance** provided by an institution to help students succeed **academically, professionally, and personally**. These supports ensure students can effectively engage with the curriculum, achieve learning outcomes, and feel empowered throughout their academic journey.

Types of Student Support for Learning

Category	Support System	Explanation
 Academic Support	- Tutoring & Remedial Classes - Faculty Mentorship - Peer-Assisted Learning	Helps students struggling with course content or in need of additional clarification and practice.
 Library & Digital Resources	- Central Library Access - e-Books & Journals - MOOCs, NPTEL, SWAYAM	Ensures students have access to physical and online resources for self-paced and extended learning.
 Learning Management Systems (LMS)	- Moodle, Google Classroom, Canvas	Online platforms that host course content, assignments, videos, and discussions.
 Counseling & Guidance	- Academic Counseling - Career Counseling - Psychological Counseling	Supports mental health, stress management, academic decisions, and career planning.
 Faculty Office Hours	- Scheduled one-on-one interaction times	Allows personalized attention, doubt clarification, and mentoring from course instructors.
 Internship & Placement Support	- Placement Cell - Resume Workshops - Mock Interviews	Prepares students for the workforce through skill-building and employer interaction.
 Laboratory Access & Technical Support	- Extended lab hours - Lab assistants or facilitators	Allows deeper exploration of practical content and project development.
 Bridge and Foundation Courses	- Mathematics, Language Skills, Coding, etc.	Helps underprepared students catch up with essential knowledge and skills.
 Project & Research Support	- Mini Projects - Final Year Projects - Research Guidance	Encourages problem-solving and innovation with mentor supervision.
 Language and Communication Skills	- Language Labs - Public Speaking Workshops - English Proficiency Courses	Enhances communication skills necessary for academic and professional success.
 Student Clubs & Academic Societies	- Robotics Club, Debate Club, Coding Club - Technical & Cultural Events	Encourages peer learning, leadership, and application of classroom knowledge in co-curricular settings.
 Financial Aid & Scholarships	- Merit-based or Need-based scholarships - Fee waivers, fellowships	Ensures no student is deprived of education due to financial constraints.
 Online Learning Resources	- YouTube Lectures - Coursera, Udemy, edX, Khan Academy	Supplements academic content with global-quality teaching material.
 Induction & Orientation Programs	- Student Induction Program (SIP) - Departmental Orientation	Helps students transition smoothly into academic life with clarity of expectations and support systems.

20. Quality Control Measures

Quality Control Measures refer to the **systematic practices, checks, and procedures** implemented by academic institutions to **maintain and enhance the quality** of education, learning outcomes, and academic processes.

They ensure that the institution meets the **required standards** of teaching, learning, research, and administration as per regulatory and accreditation bodies (like **NAAC, NBA, UGC, AICTE**).

◆ **Objectives of Quality Control in Education**

- Ensure **student learning outcomes** are met
- Maintain **academic rigor** and relevance
- Enhance **teaching effectiveness**
- Provide **continuous improvement** through feedback
- Comply with **national and international standards**

Quality Control Measures in Academic Institutions

Area	Quality Control Measure	Purpose/Benefit
 Curriculum	- Periodic syllabus revision - Curriculum committee reviews	Ensures relevance to industry needs and academic standards
 Teaching–Learning Process	- Course plans & learning outcomes - Peer review of teaching	Promotes effective delivery and continuous improvement
 Faculty Quality	- Faculty recruitment policy - Performance appraisal (API scores)	Ensures qualified, competent, and updated teaching staff
 Assessment & Evaluation	- Moderation of question papers - Internal/external audits - Result analysis	Ensures fairness, transparency, and consistency in student evaluation
 Learning Resources	- Library audits - Digital resource usage tracking	Ensures resource availability and accessibility
 Laboratory & Infrastructure	- Periodic equipment maintenance - Lab manuals, safety protocols	Supports practical learning and safety compliance
 Student Feedback	- Feedback on teaching, facilities, curriculum - Action taken reports	Drives improvement through direct student input
 Internal Quality Assurance Cell (IQAC)	- Monthly/quarterly reviews - NAAC/NBA documentation	Central body for quality monitoring and enhancement
 Academic Audits	- Internal & external academic audits	Evaluate department performance and compliance
 Mentoring & Counseling	- Faculty advisors, student mentorship programs	Supports academic and personal development
 Project & Research Quality	- Plagiarism check tools (Turnitin, etc.) - Publication in reputed journals	Ensures ethical and quality research outputs
 Graduate Outcome Tracking	- Exit surveys - Alumni feedback - Placement records tracking	Measures long-term success of education and informs curriculum updates
 Administrative Quality	- ERP systems - Admission, examination process reviews	Streamlines academic administration
 Training & FDPs	- Faculty Development Programs - Industry/academic collaborations	Keeps faculty updated with latest trends and teaching innovations
 Documentation & Record Keeping	- Standard templates for CO/PO/PEO mapping - Accreditation files	Ensures traceability, accountability, and audit readiness

21. Mapping COs with POs

Mapping of POs with COs is the process of aligning **Course Outcomes (COs)**—the specific skills and knowledge a student should acquire in a course—with **Program Outcomes (POs)**—the broader abilities a graduate is expected to possess by the time of graduation.

 It ensures that **every course contributes** meaningfully to the **overall goals of the program**, making Outcome-Based Education (OBE) measurable and traceable.

Why is PO–CO Mapping Important?

Purpose	Benefit
Alignment of curriculum with program goals	Ensures curriculum coherence and relevance
Basis for assessment and evaluation	Helps in measuring attainment of POs and COs
Accreditation compliance	Essential for NBA/ABET and other quality assurance frameworks
Curriculum improvement	Identifies gaps in teaching and learning

◆ **Process of PO–CO Mapping**

1. **Define COs** for each course (usually 5–6 per course).
2. Map each CO to **relevant POs** (usually out of PO1 to PO12).
3. Assign a **correlation level**:
 1. **3 – High correlation**
 2. **2 – Medium correlation**
 3. **1 – Low correlation**
 4. **0 – No correlation**
4. Create a **matrix** showing which COs contribute to which POs.
5. Use this mapping to assess **attainment levels** at the course and program level.

Sample CO–PO Mapping Matrix

Let's say a course titled "**Engineering Mechanics**" has the following COs:

CO No.	Course Outcome Statement
CO1	Apply principles of statics and dynamics to analyze mechanical systems.
CO2	Solve problems involving forces, moments, and equilibrium in 2D and 3D systems.
CO3	Use vector and graphical methods to analyze motion and force systems.
CO4	Communicate solutions effectively using diagrams and standard notations.

Now, map these COs to POs:

COs / POs	PO1	PO2	PO3	PO4	PO10
CO1	3	3	2	1	0
CO2	3	3	2	0	0
CO3	2	3	2	1	0
CO4	1	0	0	0	3

Video Courses

<https://www.udemy.com/courses/search/?q=curriculum+development&src=sac&kw=curriculum>

Course Development

Introduction

Designing Meaningful Learning Experiences

In the ecosystem of education, **course development** is where the **vision of the curriculum** becomes a **tangible learning experience**. A well-designed course not only delivers content but also inspires curiosity, encourages critical thinking, and cultivates real-world skills.

This module explores how a course is carefully crafted—from **identifying learning outcomes** to choosing the right teaching strategies, materials, assessments, and technologies. Course development bridges the gap between **academic objectives** and **student achievement**.

 **In this module, you will learn to:**

Define clear and measurable **Course Outcomes (COs)** aligned with **Program Outcomes (POs)**

Structure the course with **relevant content**, logical sequencing, and academic rigor

Choose **effective teaching methods**, including lectures, active learning, videos, and lab work

Integrate **continuous and summative assessments** to monitor and support student learning

Ensure alignment with **Outcome-Based Education (OBE)** principles

A well-developed course is not just a set of topics—it is a journey of transformation for both teachers and learners. **Let us embark on this journey to create courses that inform, engage, and empower.**

Objectives

Sl. No.	Objective	Explanation
1	Define Clear Course Outcomes (COs)	Establish specific, measurable outcomes that students should achieve by the end of the course.
2	Ensure Alignment with Program Outcomes (POs)	Map course outcomes to broader graduate attributes and program-level expectations.
3	Design Relevant and Updated Content	Include content that reflects current knowledge, skills, technology, and industry needs.
4	Structure the Course Logically	Organize topics into modules or units with progressive complexity and coherence.
5	Select Appropriate Teaching Strategies	Use a mix of lectures, case studies, practicals, videos, and interactive methods to enhance learning.
6	Integrate Active and Experiential Learning	Incorporate real-world applications, projects, and discussions to make learning meaningful.
7	Develop Effective Assessment Tools	Include formative and summative assessments to evaluate student learning and provide feedback.
8	Promote Learner Engagement and Inclusivity	Design with student diversity in mind—accommodating different learning styles and backgrounds.
9	Embed Lifelong Learning and Soft Skills	Foster critical thinking, communication, collaboration, and ethics as part of course outcomes.
10	Facilitate Continuous Improvement	Collect feedback and use data for revising and improving course delivery and content over time.

Sample Course Document

[Sample Course Document](#)- see Annexure

Content

1	Course Ownership Details
2	Course Size
3	Course Aim and Summary
4	Course Objectives
5	Course Outcomes
6	CO-PO Map
7	Course Content
8	Course Resources
9	Course Teaching-Lesson Planning
10	Assessment Schedules
11	Assessment Weight Distribution
12	Grading Criterion
13	Setting Attainment Target
14	Academic Integrity
15	Setting Question Papers
16	Conduction of Examination and Evaluation of Answer Books
17	CAB Document and Result Analysis

1. Course Ownership Details

Course Code	EME-204
Course Title	Engineering Thermodynamics
Program Code	FET-023
Program Title	B. Tech. Mechanical Engineering
Department	Department of Mechanical Engineering
Faculty Code	01-FET
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Mechanical Engineering
Faculty Member	Dr. Basavaraju
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

2. Course Size

Course size refers to the **academic weight** or **value** assigned to a course, typically measured in terms of:

- 1. Credits
- 2. Total Instructional Hours
- 3. Course Load (per week or semester)

Example: Course Size for a 3-Credit Course

Component	Hours per Week	Total Weeks	Total Hours
Lectures	3 hours/week	15 weeks	45 hours
Labs/Tutorials	0 hours/week	—	—
Total	3 hours/week	15 weeks	45 hours

3. Course Aim and Summary

Course Aim and Summary is a concise statement that outlines:

- The **primary purpose** of the course
- The **broad knowledge and skills** students are expected to gain
- The **relevance** of the course within the program or field of study

It sets the tone for the course and provides a **quick overview** for students, faculty, and curriculum reviewers.

How Many Lines Should It Have?

- Ideally: **3 to 5 well-crafted sentences** (approximately **50–100 words**)
- It should be short enough to **scan quickly**, yet detailed enough to convey **clear meaning**

Example: Course Aim and Summary

Course Title: *Fundamentals of Electrical Engineering*

Summary:

This course introduces the foundational concepts of electrical circuits, voltage, current, resistance, and power. It aims to equip students with analytical skills using Ohm's Law, Kirchhoff's laws, and circuit theorems. The course bridges theoretical understanding and practical applications in electrical systems, forming a base for advanced topics in electrical and electronics engineering.

4. Course Objectives

Course Objectives are **broad, general statements** that describe what a course intends to cover or achieve in terms of **knowledge areas, skills, or attitudes**. They reflect the **instructor's teaching intentions**, focusing on **what will be taught**, rather than **what the student will do** with the knowledge.

They are **not meant to be measured directly**, but they help in designing the **syllabus, content, and delivery strategies** of the course.

One can add as many course objectives as possible, as it will help in lesson planning

Example: Course – “Fundamentals of Electrical Engineering”

Course Objectives:

- 1.To introduce the basic concepts and laws governing electric circuits.
- 2.To explain the operation and applications of electrical machines.
- 3.To provide knowledge on AC and DC circuit analysis techniques.
- 4.To familiarize students with the working of electrical measuring instruments.
- 5.To enable understanding of electrical safety standards and wiring practices.

5. Course Outcomes

Course Outcomes (COs) are **measurable statements** that specify what a student is expected to **know, understand, and be able to do** after successfully completing a course.

They:

- Reflect **student achievements**
- Are **aligned with Program Outcomes (POs)**
- Are based on **Bloom's Taxonomy** (action-oriented verbs)
- Provide a **basis for assessment and evaluation**



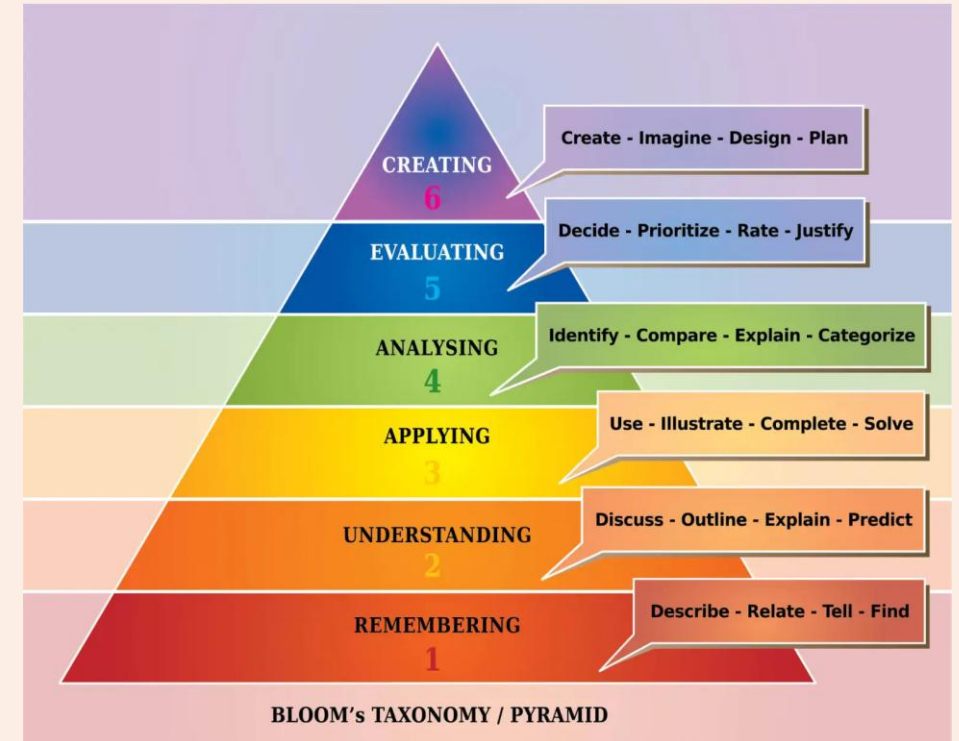
How Are Course Outcomes Written?

Each course outcome is written using:

- An **action verb** (from Bloom's Taxonomy)
- A **content/topic** area
- A **demonstrable skill/knowledge level**

Bloom's Taxonomy Action Verbs (Examples):

Level	Verbs
Remember	list, define, recall
Understand	explain, describe, summarize
Apply	use, solve, demonstrate
Analyze	distinguish, examine, compare
Evaluate	justify, critique, assess
Create	design, develop, construct



✓ **Format of a Course Outcome**

"By the end of this course, students will be able to

[action verb] + [knowledge/content] + [context or condition if applicable]."

Example: For a Course in "Basic Electrical Engineering"

CO No.	Course Outcome Statement
CO1	Define and explain basic electrical circuit concepts including current, voltage, resistance, and power.
CO2	Apply Ohm’s and Kirchhoff’s laws to analyze simple electrical circuits.
CO3	Solve numerical problems using mesh and nodal analysis techniques.
CO4	Analyze single-phase AC circuits involving resistive, inductive, and capacitive elements.
CO5	Evaluate performance of electrical systems using circuit theorems.
CO6	Demonstrate the use of basic instruments for electrical measurements in the lab.

6. Mapping COs with POs

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CO3	2	3	2	1	0
CO4	1	0	0	0	3

7. Course Content

Component	Purpose
Course Objectives	Define what you'll teach
Course Outcomes	Define what learners will be able to do
Course Content	Structured around objectives, leads to outcomes
Assessments	Verify outcomes were achieved

Example

Course Title: Basics of Electrical Engineering
Credits: 3
Contact Hours/Week: 2 Theory + 2 Practical
Duration: 15 Weeks

Course Objectives (COBJ)

By the end of the course, the learner should be able to:

1. **COBJ1:** Understand the basic concepts and laws governing electrical circuits.
2. **COBJ2:** Analyze DC and AC circuits using appropriate theorems and methods.
3. **COBJ3:** Understand the working principles of electrical machines and transformers.
4. **COBJ4:** Explore the basics of electrical power generation, transmission, and distribution.
5. **COBJ5:** Acquire hands-on skills in measuring electrical quantities and using basic instruments.

Course Content (with Objective and Outcome Mapping)

1: Fundamentals of Electrical Circuits (*3 weeks*)

- Electric charge, current, voltage, power, and energy
- Ohm's Law, Resistance and Conductance
- Types of sources: Voltage and Current
- Series and parallel resistive circuits
- Kirchhoff's Laws and simple circuit analysis

◆ **Mapped Objective:** COBJ1

◆ **Mapped Outcomes:** CO1

2: Network Theorems and DC Circuit Analysis (2 weeks)

- Node voltage and mesh current methods
- Superposition theorem
- Thevenin's and Norton's theorems
- Maximum Power Transfer theorem

◆ **Mapped Objective:** COBJ2

◆ **Mapped Outcomes:** CO1

3: AC Circuits and Power Concepts (3 weeks)

- Sinusoidal waveforms, RMS and average values
- Phasor representation
- Impedance, reactance, and admittance
- Series and parallel RLC circuits
- Power factor, real, reactive, and apparent power
- Introduction to three-phase systems

◆ **Mapped Objectives:** COBJ2

◆ **Mapped Outcomes:** CO2

4: Transformers and Electrical Machines (3 weeks)

- Principle of electromagnetic induction
- Working of ideal and practical transformers
- Introduction to DC machines: Motor and Generator
- Induction motors and synchronous machines basics

◆ **Mapped Objectives:** COBJ3

◆ **Mapped Outcomes:** CO3

5: Electrical Power Systems (2 weeks)

- Basic structure of power generation, transmission, and distribution
- Substations, switchgear, and protection elements
- Introduction to renewable energy sources (solar, wind)

◆ **Mapped Objectives:** COBJ4

◆ **Mapped Outcomes:** CO4

6: Electrical Measurements and Instruments (2 weeks)

- Working of multimeters, ammeters, voltmeters, wattmeter
- Measurement of current, voltage, power, and energy in DC and AC systems
- Safety procedures in electrical labs

◆ **Mapped Objectives:** COBJ5

◆ **Mapped Outcomes:** CO5



Lab Content

Each lab session reinforces theory through practicals.

- Verification of Ohm's and Kirchhoff's Laws
- Measurement of power in single-phase circuits
- Load test on transformers
- Use of multimeters and measuring instruments
- Simulation of AC/DC circuits using basic software (e.g., Multisim)

◆ **Supports Outcomes:** CO1, CO2, CO5

8. Course Resources

Course Resources refer to all materials that support teaching and learning in a course. These include:

-  **Textbooks** – Primary learning materials
-  **Reference Books** – For deeper understanding or alternative explanations
-  **Web Resources** – Reputed websites, online encyclopaedias, portals
-  **Video Lectures** – NPTEL, YouTube EDU, MIT OCW, etc.
-  **Software Tools/Simulators** – For circuit simulation and visualization

Example:

Course Resources for Basics of Electrical Engineering

1. Text Books (Primary Learning Material)

- **V.K. Mehta and Rohit Mehta**, *Principles of Electrical Engineering*, S. Chand Publishing
- **D.P. Kothari and I.J. Nagrath**, *Basic Electrical Engineering*, Tata McGraw-Hill Education

2. Reference Books

- **Hughes Electrical and Electronic Technology**, 11th Edition, Pearson Education
- **J.B. Gupta**, *Fundamentals of Electrical Engineering and Electronics*, S.K. Kataria & Sons
- **Mittle and Mittal**, *Basic Electrical Engineering*, Tata McGraw-Hill

3. Web Resources

- <https://nptel.ac.in> – National Programme on Technology Enhanced Learning (NPTEL)
- <https://www.electronics-tutorials.ws> – Free tutorials on basic electrical and electronics concepts
- <https://www.khanacademy.org> – Free foundational concepts and visual aids
- <https://www.allaboutcircuits.com> – Community-driven electrical engineering resource

4. Video Resources

- **NPTEL Course:** *Basic Electrical Circuits* by Prof. Sujit Kumar Biswas, IIT Kharagpur
👉 <https://nptel.ac.in/courses/108105153>
- **YouTube Channel:** *Learn Engineering* – High-quality animations on electrical machines and circuits
- **MIT OpenCourseWare:** *Introduction to Electrical Engineering and Computer Science*
👉 <https://ocw.mit.edu>

5. Software Tools / Simulators

- **Multisim** – Circuit design and simulation software
- **LTspice** – Free circuit simulator by Analog Devices
- **PSpice** – Used for analog/digital circuit simulation
- **Tinkercad Circuits** – Browser-based tool ideal for beginners
- **MATLAB/Simulink** – For modeling and simulation of electrical systems (advanced level)

9. Course Teaching-Lesson Planning

Assumptions:

- Duration: 15 Weeks
- Weekly:
 - 2 Theory classes × 1 hour
 - 1 Practical session × 2 hours

Week	Class	Topics / Subtopics	Class Learning Objectives / Outcomes	Teaching Tools / Method
1	1	Introduction to Electrical Engineering	Understand scope, applications, safety practices	Chalk-Talk, PPT
	2	Electric Charge, Current, Voltage, Power	Define and explain basic electrical quantities	PPT, Demonstrations
2	3	Ohm's Law, Resistance, Conductance	Apply Ohm's Law in simple circuits	Examples, Q&A
	4	Series and Parallel Circuits	Analyze resistance combinations	Group Activity
3	5	Kirchhoff's Laws (KVL & KCL)	Solve circuits using KVL and KCL	Board Work, Practice
	6	Mesh and Nodal Analysis	Analyze complex DC circuits	Problem Solving
4	7	Superposition Theorem	Understand and apply superposition	Numericals
	8	Thevenin & Norton Theorems	Apply network simplification techniques	Case-based examples
5	9	Maximum Power Transfer Theorem	Derive and apply condition for max power	Derivation, Examples
	10	Introduction to AC Circuits	Difference between AC and DC, waveforms	Visual Aids
6	11	Sinusoidal Sources, RMS & Average Values	Compute RMS and average of periodic waveforms	Graphs, Calculations
	12	Phasors and Impedance Concept	Represent AC quantities as phasors	Phasor Diagrams
7	13	AC Series RLC Circuits	Solve AC circuits with resistance, inductance, capacitance	Board Work, Animations
	14	Power in AC Circuits – P, Q, S, PF	Understand power triangle and power factor correction	Charts, Examples

Week	Class	Topics / Subtopics	Class Learning Objectives / Outcomes	Teaching Tools / Method
8	15	Resonance in RLC Circuits	Understand conditions and significance of resonance	Board Work
	16	Polyphase Systems – Star and Delta Connections	Identify and compute values in 3-phase systems	Diagrams, Simulations
9	17	Transformer – Construction & Working Principle	Understand EMF equation and operation	Videos, Cross-section
	18	Transformer – Losses, Efficiency, Regulation	Analyze performance parameters	Problem Solving
10	19	DC Machines – Construction, Types	Identify machine parts and types	Models, PPT
	20	DC Generator & Motor Working Principle	Explain operation and applications	Board + Animation
11	21	Induction Motors – Construction & Operation	Differentiate between types; working principle	Video + Quiz
	22	Single Phase Induction Motors	Understand usage in households	Live Demo (if possible)
12	23	Measuring Instruments – Ammeter, Voltmeter etc.	Understand function and working of analog instruments	Actual Equipment
	24	Digital Instruments & Multimeter	Use and interpret digital meters	Hands-on session
13	25	Electrical Safety, Fuses, Circuit Breakers	Learn safety measures and components	Safety Video
	26	Wiring Systems, Earthing	Understand wiring layouts and need for grounding	Diagrams, Boards
14	27	Renewable Energy Overview	Brief on solar, wind and battery systems	Web Resources
	28	Course Review and Q&A	Clarify doubts, reinforce key concepts	Open Discussion
15	29	Internal Test/Assessment	Evaluate understanding	Written Paper
	30	Feedback and Wrap-up	Gather feedback, final advice	Feedback Forms

10. Assessment

Assessment is the process of **measuring and evaluating student learning**, knowledge, skills, attitudes, and performance against predefined learning outcomes or objectives.

It helps educators:

- Understand **what students have learned**
- Improve **teaching strategies**
- Enhance **curriculum planning**
- Provide **feedback** to learners for improvement

Types of Assessment Methods and Their Purpose

Assessment Method	Type	Purpose
Written Tests (Mid/Final)	Summative	Evaluate overall understanding of course content
Quizzes	Formative/Summative	Quickly test understanding of specific topics
Assignments	Formative	Encourage application of knowledge and individual thinking
Projects/Case Studies	Formative/Summative	Assess higher-order thinking, application, and integration of concepts
Lab/Practical Work	Formative	Evaluate hands-on skills and practical understanding
Viva Voce (Oral Exam)	Summative	Assess conceptual clarity, verbal expression, and spontaneous thinking
Presentations/Seminars	Formative	Test communication skills, organization of content, and peer learning
Peer Assessment	Formative	Promote reflection, feedback, and collaborative learning
Self-Assessment	Formative	Encourage learners to reflect on their own learning and identify gaps
Portfolio Assessment	Formative/Summative	Evaluate continuous and comprehensive performance over time
Attendance and Participation	Formative	Encourage regularity, engagement, and active learning

Formative vs Summative Assessment

Formative Assessment	Summative Assessment
Ongoing throughout the course	Conducted at the end of a unit or course
Used to improve learning	Used to evaluate learning
Feedback-oriented	Grade-oriented
Examples: quizzes, discussions, assignments	Examples: final exams, term projects, viva voce

Assessment Schedules

Assessment Type	Weightage	Assessment Schedules		
Quiz	15%	End of 5 th Week	End of 10 th Week	End of 15 th Week
Test	25%	End of 5 th Week	End of 10 th Week	End of 15 th Week
Assignment	20%	Weeks 1-7 Assignment -1	Weeks 8-14 Assignment -2	
Semester End Examinations	40%	17-20 th Week		

11. Assessment Weight Distribution (AWD)

Assign weightage to each CO under various assignment methods based on your significance of outcomes

Assessment Type COs	Quizzes			Test			Assign ment		SEE	Total
	Q1	Q2	Q3	T1	T2	T3	A1	A2		
CO1										
CO2										
CO3										
CO4										
CO5										
CO6										
Total	15			25			20		40	100

12. Grading Criterion

Marks Range (%)	Letter Grade	Grade Point (GPA)	Meaning
90–100	O	10	Outstanding
80–89	A+	9	Excellent
70–79	A	8	Very Good
60–69	B+	7	Good
50–59	B	6	Average
40–49	C	5	Pass
<40	F	0	Fail
-	I	-	Incomplete

13. Setting Attainment Target

Setting attainment targets means defining **specific, measurable benchmarks** or performance levels that students should achieve in a course, module, or program. These targets help educators **evaluate** how well students are learning and whether the **Course Outcomes (COs)** and **Program Outcomes (POs)** are being met.

Purpose of Attainment Targets

- Ensure that **teaching aligns** with desired learning outcomes
- Provide a **quantifiable basis** to assess student performance
- Identify **gaps in learning** or teaching effectiveness
- Facilitate **continuous improvement** in curriculum and instruction
- Help in **NBA/NAAC accreditation processes** by evidencing outcome-based education

Example in Context

For **Course Outcome CO1**: "Understand and apply Ohm's law and Kirchhoff's laws in electrical circuits"

- If 80% of students score $\geq 70\%$ in questions related to CO1 $\rightarrow$ Attainment Level = 3
- If only 50% score that high $\rightarrow$ Attainment Level = 2

	Attainment of Course Outcomes-COs	
	Outcomes- Targeted	Outcomes Level of Attainment
CO1	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
CO2	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
CO3	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
CO4	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
CO5	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
CO6	60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	

14. Academic Integrity

Academic integrity refers to the adherence to ethical principles in all academic activities, including honesty, fairness, and responsibility. It is essential for maintaining the credibility of academic evaluations and qualifications. Students must avoid plagiarism, cheating, and data falsification, and are expected to submit original work with proper acknowledgment of sources. Upholding academic integrity ensures meaningful learning, fosters trust in the academic process, and prepares students for ethical professional conduct.

15. Setting Question Papers-Quiz, Test, Assignment and Examination

General Principles

1. **Outcome-Based Assessment:** All questions must be mapped to specific Course Outcomes (COs).
2. **Bloom's Taxonomy Alignment:** Questions should address various cognitive levels – Remember, Understand, Apply, Analyze, Evaluate, and Create.
3. **Balanced Coverage:** Ensure comprehensive coverage of the syllabus and all relevant COs.
4. **Clarity & Precision:** Questions should be unambiguous, clearly worded, and appropriate to the cognitive level targeted.

1. Quiz (Short-Form Assessment)

- **Purpose:** To test understanding and recall of core concepts.
- **Duration:** 10–30 minutes
- **Question Type:** Multiple Choice, Fill-in-the-Blank, True/False, Match-the-Following
- **Design Guidelines:**
 - Focus on **Remember** and **Understand** levels.
 - Map each question to a CO and indicate the cognitive level.
 - Cover all major topics taught since the last assessment.

2. Written Test / Internal Test

- **Purpose:** To assess conceptual clarity, analytical thinking, and application.
- **Duration:** 1–2 hours
- **Question Type:** Short Answer, Long Answer, Numerical/Problem-solving
- **Design Guidelines:**
 - Include questions at **Understand**, **Apply**, and **Analyze** levels.
 - Ensure each CO is assessed through one or more questions.
 - Maintain appropriate weightage to each CO (as per course plan).
 - Questions should test both theory and practical relevance.

3. Assignment

- **Purpose:** To evaluate students' depth of understanding, self-study, and independent learning.
- **Format:** Descriptive, case studies, problem-solving, mini-projects
- **Design Guidelines:**
 - Encourage **Analyze**, **Evaluate**, and **Create** levels.
 - Promote critical thinking, creativity, and research-based learning.
 - Link tasks to real-world applications or case scenarios.
 - Clearly state expected outcomes and assessment rubrics.

4. Semester-End Examination (SEE)

- **Purpose:** To comprehensively evaluate attainment of all Course Outcomes.
- **Duration:** Typically, 3 hours
- **Structure:**
 - Section A: Short Answer Questions (CO1, CO2)
 - Section B: Long Answer / Problem-Solving (CO3, CO4)
 - Section C: Analytical/Design/Case-based Questions (CO5+)
- **Design Guidelines:**
 - Map all questions to COs and Bloom's levels.
 - Cover the full syllabus proportionately.
 - Include a mix of direct, indirect, and scenario-based questions.
 - Ensure a balance between theoretical and application-oriented questions.
 - Use a question blueprint/table to ensure proper CO and level distribution.

Sample Question Papers –see Annexure

16. Conduction of Examination and Evaluation of Answer Books

Conduction of Examination and Evaluation of Answer Books

Semester-end examinations are conducted as per the academic calendar under strict confidentiality and invigilation protocols. Question papers are set by subject experts, ensuring alignment with course outcomes. Answer books are evaluated using predefined schemes and rubrics to ensure fairness and transparency. Double valuation or moderation is followed where applicable. Marks are recorded systematically, and performance is analyzed for outcome attainment and continuous improvement in teaching-learning processes. Revaluation provisions are available if required

17. CAB Document and Result Analysis

Course Approval Board (CAB/SAB) and Preparation of Results

The **Course Approval Board (CAB)** or **Subject Approval Board (SAB)** is responsible for reviewing the question papers, evaluation quality, and ensuring alignment with course outcomes. The board verifies internal and external assessments, moderation of marks, and consistency in evaluation practices.

After evaluation, marks from internal and semester-end assessments are compiled, verified, and processed. The CAB/SAB finalizes the results, ensures fair grading, and recommends them for declaration through the university's academic governance structure.

CAB- Document see Annexure

Based on CAB feedback, revisit your COs and Course Syllabus, Teaching methodology

Program Assessment Board (PAB)

The **Program Assessment Board (PAB)** reviews and ensures the quality of academic programs by analyzing Course and Program Outcome attainment, assessment practices, and student performance. It validates results, recommends improvements in teaching and curriculum, and ensures alignment with outcome-based education. Comprising senior faculty and coordinators, the PAB meets periodically to promote continuous improvement, maintain academic standards, and document findings for reporting and accreditation. It plays a key role in enhancing educational effectiveness and accountability.

Fostering Excellence in Higher Education: Attributes, Methods, and Responsibilities

Introduction

Fostering Excellence in Higher Education: Attributes, Methods, and Responsibilities"

Quality education is the cornerstone of national development and individual empowerment. In higher education, it encompasses not only academic excellence but also the holistic development of students, aligned with global standards, employability, ethics, and innovation. Delivering quality education depends on several critical elements — the quality of faculty, the attributes students cultivate, the effectiveness of teaching and learning methods, and the committed involvement of teachers in roles beyond classroom instruction.

Quality attributes in higher education faculty include subject expertise, effective communication, mentoring skills, research orientation, continuous learning, and ethical conduct. **Student attributes** cover curiosity, discipline, critical thinking, collaboration, and a drive for self-improvement.

Modern **teaching methods** such as interactive lectures, problem-based learning, project-based learning, simulation, and experiential learning make education engaging and outcome-oriented. Complementing this, **learning methods** like self-study, peer learning, group discussions, and online learning platforms encourage deeper understanding and active participation.

Beyond teaching, **faculty responsibilities** extend to curriculum development, student mentoring, research and publication, quality assurance, event organization, and community engagement. Together, these components foster a dynamic academic environment that nurtures capable, responsible, and innovative graduates.

Objectives

1. Understand the significance of quality education in the context of higher education and national development.
2. Identify the key quality attributes expected from higher education faculty and students.
3. Explore various effective teaching methods that enhance student engagement and learning outcomes.
4. Examine different learning methods that promote active, independent, and collaborative learning among students.
5. Recognize the additional responsibilities of faculty members beyond teaching and their role in institutional development.
6. Appreciate the integrated approach needed for holistic student development and educational excellence.

Quality In Education

Definition:

Quality in Education refers to the **systematic implementation of standards, practices, and processes** that ensure educational institutions deliver effective, consistent, and meaningful learning experiences. It encompasses **curriculum relevance, teaching effectiveness, learning outcomes, infrastructure, governance, and continuous improvement**, aimed at meeting the needs of students, industry, and society.

Methods to Ensure Quality in Education

Method	Description
Curriculum Design and Revision	Aligning curriculum with national standards, industry needs, and learner goals.
Qualified and Trained Faculty	Recruiting skilled faculty and conducting regular training and development.
Outcome-Based Education (OBE)	Focusing on student learning outcomes to guide teaching and assessment.
Student-Centered Teaching	Adopting innovative pedagogies like PBL, simulations, and ICT integration.
Robust Assessment Systems	Using formative and summative assessments aligned with course outcomes.
Accreditation and Audits	Following guidelines from NAAC, NBA, and regulatory bodies for quality assurance.
Internal Quality Assurance Cell (IQAC)	Establishing IQAC to monitor, evaluate, and improve academic processes.
Feedback Mechanisms	Gathering feedback from students, alumni, employers, and using it for improvement.
Infrastructure and Learning Resources	Ensuring well-equipped labs, libraries, and digital access.
Faculty Mentoring and Research	Encouraging mentorship, interdisciplinary research, and publication.
Industry-Institute Linkages	Collaborating with industry for internships, projects, and curriculum enrichment.
Continuous Improvement	Using data, review, and innovation to evolve and enhance educational quality.

Methods of Quality Monitoring

Method	Description
Internal Quality Assurance Cell (IQAC)	A statutory body responsible for planning, guiding, and monitoring quality initiatives in the institution.
Academic and Administrative Audits (AAA)	Periodic audits to review academic performance and administrative efficiency.
Student Feedback Systems	Collecting structured feedback from students on teaching, facilities, and support services.
Faculty Self-Appraisal Reports	Annual performance-based self-assessments by faculty to track teaching and research progress.
Peer Review and Departmental Reviews	Review of teaching practices, curriculum, and research by faculty peers and external experts.
Monitoring Learning Outcomes	Tracking and analyzing student performance aligned with Course Outcomes (COs) and Program Outcomes (POs).
Review of Lesson Plans and Attendance	Verifying delivery of syllabus as per schedule and student engagement.
Use of KPIs (Key Performance Indicators)	Measuring quality indicators like student-teacher ratio, research output, placements, etc.

Processes of Quality Control

Process	Purpose
Standard Operating Procedures (SOPs)	Establish consistent practices for academic and administrative tasks.
Benchmarking	Comparing institutional performance with national/international best practices.
Corrective and Preventive Actions (CAPA)	Implementing actions based on quality review findings to prevent future issues.
Quality Circles	Faculty/staff teams that identify problems and suggest improvements.
Documentation and Record Keeping	Maintaining detailed records for audits and continuous improvement.
Performance Appraisals	Evaluating faculty and department performance based on defined criteria.
Accreditation Reports	Preparing and submitting Self-Study Reports (SSR) for NAAC, NBA, etc.

Quality Documents to be Maintained by Teaching Faculty

Document	Purpose
Course File	Contains syllabus, lesson plan, CO-PO mapping, assignments, tests, reference materials, and question papers.
Lesson Plan	Weekly plan outlining the topics to be covered, teaching methods, and learning outcomes.
Attendance Register	Records student attendance for theory and practical classes.
Assessment Records	Includes quiz/test papers, assignment submissions, evaluation sheets, and internal marks.
CO-PO Mapping & Attainment	Documents how Course Outcomes map to Program Outcomes and their levels of attainment.
Student Feedback Records	Collected and analyzed feedback on teaching effectiveness.
Faculty Diary / Teaching Log	Daily record of classes handled, topics taught, and reflections.
Research and Publications Record	List and copies of published papers, conference presentations, and ongoing research work.
Mentoring Records	Details of student mentoring sessions, issues discussed, and actions taken.
Faculty Development Records	Participation in FDPs, workshops, seminars, and certifications.
Exam-Related Documents	Question papers, answer scripts, scheme of valuation, and mark statements.
Project/Internship Supervision Records	Guidance logs, progress reports, and evaluations of student projects or internships.

IQAC (Internal Quality Assurance Cell)

IQAC (Internal Quality Assurance Cell) is a body established in higher educational institutions to ensure continuous improvement in academic and administrative performance. It promotes a culture of quality, innovation, and accountability.

Teachers' Role in IQAC includes:

- Participating in quality enhancement initiatives
- Assisting in curriculum design and revision
- Contributing to teaching-learning reforms
- Providing data for academic audits and performance metrics
- Supporting documentation for NAAC/NBA accreditation
- Engaging in feedback collection and analysis
- Promoting best practices and innovation in pedagogy

Attributes of a Teacher

1. Personal Traits

- Passion for Teaching
- Empathy and Compassion
- Patience and Understanding
- Adaptability and Flexibility
- Positive Attitude and Enthusiasm
- Reflective and Self-Critical
- Ability to Inspire and Motivate
- High Emotional Intelligence

2. Pedagogical Skills

- Subject Mastery
- Clear Communication
- Creative and Innovative Teaching Methods
- Strong Classroom Management
- Effective Use of Technology and Tools
- Setting High Expectations with Support
- Continuous Learner
- Differentiated Instruction to Meet Diverse Needs

3. Professional Values

- Fairness and Integrity
- Respect for Students
- Commitment to Student Success
- Consistency and Discipline
- Strong Ethical Standards
- Collaborative and Team-Oriented
- Responsiveness to Feedback
- Contribution to Institutional Goals

Attributes of a Student

1. Personal Traits

- Self-Discipline
- Responsibility and Accountability
- Curiosity and Inquisitiveness
- Perseverance and Determination
- Self-Motivation
- Confidence with Humility
- Time Management
- Adaptability to Change

2. Learning Skills

- Active Listening
- Critical Thinking
- Problem-Solving Ability
- Effective Communication (Written and Oral)
- Ability to Set and Achieve Goals
- Research and Inquiry Skills
- Collaborative Learning
- Use of Technology in Learning

3. Social & Ethical Values

- Respect for Teachers and Peers
- Academic Integrity
- Team Spirit and Cooperation
- Sense of Responsibility to Society
- Empathy and Compassion
- Environmental and Civic Awareness
- Open-Mindedness and Tolerance
- Ethical and Honest Conduct

Teaching Methods

Teaching Method	Explanation	Suitable For
Lecture Method	Traditional teacher-centered approach where the instructor presents content verbally.	Large groups, theoretical subjects
Interactive Lecture	Combines lecturing with periodic interaction (e.g., Q&A, short discussions) to engage students.	Concept reinforcement, moderate class sizes
Demonstration Method	The teacher shows a process, experiment, or skill, followed by explanation.	Labs, engineering/mechanical subjects, sciences
Discussion Method	Students discuss a topic in groups or with the teacher to deepen understanding and perspectives.	Humanities, social sciences, open-ended questions
Problem-Based Learning (PBL)	Students are presented with real-life problems and work in teams to find solutions.	Medicine, engineering, management, multidisciplinary
Case-Based Teaching	Uses real or simulated case studies to develop analytical and decision-making skills.	Business, law, clinical education, policy studies
Project-Based Learning	Students complete a project over time, applying various concepts and skills.	Engineering, product development, design courses
Flipped Classroom	Students study content before class; classroom time is used for discussions, problem-solving, and activities.	All subjects, especially where deep application is required

Teaching Methods

Teaching Method	Explanation	Suitable For
Experiential Learning	Learning by doing — includes field visits, internships, labs, and practicals.	Technical, vocational, agriculture, social work
Collaborative Learning	Learning through group activities, encouraging teamwork and peer teaching.	Any course promoting communication and critical thinking
Socratic Method	Teaching through guided questioning to stimulate critical thinking and illuminate ideas.	Philosophy, ethics, leadership, law
Role Play / Simulation	Students act out roles or simulate environments to understand perspectives or scenarios.	Healthcare, psychology, training programs
Peer Teaching	Students teach parts of the syllabus to peers, reinforcing their own learning and building confidence.	Revision, leadership, teacher training
Use of ICT/Multimedia	Integration of videos, animations, simulations, and presentations to enhance visual and auditory learning.	All levels, especially STEM and distance education
Gamification	Use of game elements like scoring, competitions, or challenges to make learning engaging.	School to undergraduate level, skill-based learning
Mind Mapping & Concept Maps	Visual tools to organize and link concepts, enhancing understanding and recall.	Theory-heavy subjects, revision, integrated topics

Active Learning Methods

Aspect	Problem-Based Learning	Simulation-Based Learning	Project-Based Learning	Inquiry-Based Learning	Experiential Learning
Primary Focus	Solving real-world problems collaboratively	Practicing skills in simulated environments	Creating tangible outcomes through tasks	Investigating questions through exploration	Gaining knowledge through real experiences
Learner Role	Active problem solver	Participant in a simulated scenario	Project designer and executor	Independent or group researcher	Engaged doer and reflective thinker
Teacher Role	Facilitator	Supervisor / Trainer	Mentor and evaluator	Guide and questioner	Coach and observer
Typical Outcome	Solution or action plan	Decision-making ability, skill proficiency	Project report, model, or presentation	Insight or conclusion through inquiry	Practical understanding and reflective insights
Real-World Connection	High	Very High	High	Medium to High	Very High
Assessment Type	Analytical reports, presentations	Performance-based, scenario assessment	Final product, presentation, rubric-based	Research logs, presentations, reflection	Reflective journals, practical tests
Used In	Medicine, Business, Engineering	Medicine, Aviation, Engineering, Simulation Labs	STEM, Management, Design	Sciences, Social Sciences, Humanities	Agriculture, Technical Training, Social Work

1. Problem-Based Learning (PBL)

PBL is a student-centered approach where learners are given real-world problems and asked to research, analyze, and find solutions collaboratively. The teacher acts as a facilitator, guiding inquiry rather than delivering direct instruction. It encourages critical thinking and interdisciplinary learning.

2. Simulation-Based Learning

This method uses computer-based, physical, or role-play simulations to mimic real-life systems, processes, or environments. It helps learners practice skills, make decisions, and experience consequences in a safe, controlled setting. Common in medical, aviation, and engineering training.

3. Project-Based Learning

Students engage in extended tasks or projects that require investigation, design, problem-solving, and presentation. It combines subject knowledge with practical skills. Projects are usually interdisciplinary and culminate in a tangible output or presentation.

4. Inquiry-Based Learning

In this approach, learning starts with a question, problem, or scenario. Students investigate independently or in groups, form hypotheses, gather data, and draw conclusions. The focus is on developing curiosity, scientific thinking, and deeper understanding through exploration.

5. Experiential Learning

Experiential learning emphasizes learning through experience—learning by doing. It includes hands-on activities like fieldwork, labs, internships, and service learning. Reflection on the experience is a critical component, linking theory with practice.

Learning Methods

Learning Method	Description	Teacher Role	Student Role	Examples
Lecture-Based Learning	Traditional method where teacher delivers content verbally.	Knowledge provider	Passive listener	Classroom theory sessions, introductory topics
Discussion-Based Learning	Learning through structured dialogue and exchange of ideas.	Facilitator/moderator	Active participant	Seminars, group discussions
Problem-Based Learning	Students solve real-world problems in groups.	Facilitator/guide	Problem solver, researcher	Case studies in engineering, medical diagnostics
Project-Based Learning	Long-term projects integrating multiple skills and knowledge.	Mentor and evaluator	Planner, implementer	Mini-projects, capstone design projects
Simulation-Based Learning	Learning through computer, physical, or role-play simulations.	Operator/supervisor	Decision-maker, performer	Flight simulators, circuit simulation in labs
Inquiry-Based Learning	Students explore a question or problem through self-directed inquiry.	Guide, question poser	Investigator, analyst	Science experiments, open-ended historical inquiry
Experiential Learning	Learning by doing and reflecting on experiences.	Coach and observer	Practitioner, reflector	Internships, fieldwork, lab experiments
Cooperative Learning	Small groups work together to achieve learning goals.	Group facilitator	Collaborator, contributor	Peer learning, joint problem-solving tasks
Flipped Classroom	Students study content at home; class time is for activities and clarification.	Learning designer	Pre-learner, active in class	Video lectures + in-class problem solving
Blended Learning	Combination of online and in-person learning methods.	Content integrator	Hybrid learner	LMS + classroom activities
Gamified Learning	Applying game elements to motivate and engage learners.	Game designer, moderator	Motivated participant	Quizzes with points, badges, leaderboards in e-learning

Motivating Students To Achieve Career Goals

Career goals give students a direction and purpose for their academic journey. These may include becoming a professional in a chosen field, pursuing higher education, starting a business, or contributing to society. To achieve them, students must:

- **Identify interests and strengths**
- **Set short- and long-term goals**
- **Gain relevant knowledge and skills**
- **Participate in internships and co-curricular activities**
- **Seek guidance from mentors**
- **Continuously reflect and adapt their plans**

Contributing To All-Round Student Development

Activity	Contribution to Development
Athletics & Sports	Builds physical fitness, discipline, teamwork, leadership, and resilience.
Yoga	Enhances mental focus, emotional balance, self-awareness, and stress management.
Gymnasium	Promotes health, self-confidence, endurance, and personal discipline.
Cultural Activities	Encourages creativity, expression, appreciation of diversity, and emotional intelligence.
Student Clubs & Hackathons	Fosters teamwork, problem-solving, innovation, and hands-on skill development.
Research & Presentations	Enhances analytical thinking, academic curiosity, communication skills, and knowledge depth.
Innovation & Entrepreneurship	Cultivates initiative, design thinking, risk-taking ability, and real-world application of ideas.

Other Key Responsibilities of Teachers

Responsibility	Description
Curriculum Design & Development	Designing syllabus, lesson plans, and updating content as per academic and industry needs.
Assessment & Evaluation	Preparing question papers, evaluating answer scripts, and tracking student performance.
Mentoring & Counseling	Guiding students in academics, career choices, and personal development.
Research & Publications	Engaging in scholarly research, writing papers, and contributing to knowledge creation.
Administrative Duties	Participating in committees, documentation, and academic audits.
Faculty Development & Training	Attending and organizing workshops, FDPs, and continuous learning programs.
Community Engagement	Participating in extension activities, outreach programs, and social initiatives.
Innovation & Project Guidance	Supporting student projects, innovation activities, and startups.
Event Organization	Conducting seminars, fests, cultural events, sports, and technical competitions.
Quality Assurance & Accreditation	Contributing to IQAC, NAAC, NBA work, and institutional quality improvement.

Curriculum Revision

Need for Curriculum Revision

Curriculum revision is essential to ensure academic programs remain current, relevant, and aligned with evolving knowledge, industry needs, regulatory changes, and learner expectations. Regular updates reflect advancements in science, technology, pedagogy, and employability requirements. Feedback from stakeholders—students, alumni, industry experts, and faculty—helps identify gaps or redundancies. Revisions also incorporate new learning methodologies, interdisciplinary perspectives, and national education policies like NEP. A systematic review cycle ensures the curriculum remains outcome-oriented, flexible, and responsive to societal transformation.

Curriculum Revision at the Start of Each Batch

Revising the curriculum at the start of a new batch provides an opportunity to implement updated academic content without disrupting existing cohorts. This allows incorporation of recent trends, feedback from previous cycles, and new regulations or policies. Since the new batch is unbound by previous curricula, revisions can be more comprehensive. Approval from the Board of Studies and Academic Council is required. Revised syllabi, teaching plans, and assessment methods are implemented at the beginning of the academic year and shared with faculty and students during orientation.

Curriculum Revision for Running Programs Before Completing the Cycle – Need and Provision

Sometimes, curriculum changes become necessary for running batches due to urgent regulatory mandates, industry shifts, or correction of critical gaps. Such mid-cycle revisions are limited to non-disruptive elements such as elective replacements, minor content enhancements, or credit redistribution. Care must be taken to avoid disadvantaging enrolled students. Clear justification, minimal academic disruption, and academic body approvals are necessary. Institutions must provide academic support, bridge courses, or transition arrangements. Changes are typically reviewed by the BoS and approved by the Academic Council before implementation.

Approval Required for Curriculum Revision

Any curriculum revision—minor or major—requires structured approval to ensure academic integrity and compliance. Proposals must be submitted to the respective **Board of Studies (BoS)**, which reviews the academic merit and feasibility. Upon BoS recommendation, the **Academic Council** evaluates the alignment with institutional goals and regulatory standards. For major structural revisions or policy-related changes, **Board of Management** or **Board of Governors** approval may also be required. Documentation of revision rationale, impact analysis, and implementation strategy is essential for informed decision-making and audit trail.

Implementation of Revised Curriculum

Once approved, the revised curriculum must be implemented in a planned and systematic manner. Course files, lesson plans, learning resources, and assessment strategies must be updated. Faculty are oriented and trained, if needed. Academic schedules, ERP systems, and student records are aligned with the revised structure. Students are informed well in advance through handbooks or orientation sessions. Continuous monitoring ensures smooth adoption and feedback is gathered for further improvement. For ongoing batches, implementation may require transitional support, elective flexibility, or academic counseling to manage changes.

Planning of Revisions

All curriculum revisions, related approvals, and implementation processes shall be planned and executed during the even semester vacation at the end of each academic year. These activities must be carried out with the written approval of the University's Academic Head and duly brought to the notice of the Vice Chancellor.

Research and Innovation Council

Research Processes

The Research and Innovation Council shall define institutional research priorities, approve research proposals, and ensure ethical compliance. It should foster interdisciplinary and socially relevant research while supporting innovation, patents, and technology transfer. Processes must include proposal submission, funding facilitation, periodic progress monitoring, and final reporting. The council must promote a research culture through seminars, research cells, and collaborations. Quality assurance, plagiarism control, and adherence to ethical standards must be monitored. It must also ensure alignment with national research goals, NEP guidelines, and institutional research policy.

PhD Admissions

PhD admissions shall be governed by a transparent, merit-based process in accordance with UGC/AICTE/University norms. Candidates must meet minimum eligibility criteria (postgraduate qualification with minimum marks or equivalent CGPA). Admission shall be based on a Research Entrance Test (RET) followed by a personal interview to assess research aptitude, subject knowledge, and proposal viability. Reservations and other statutory norms must be followed. A centralized notification, clear timelines, and a well-defined process should be maintained. The Research and Innovation Council must ensure fairness, consistency, and quality of research candidates admitted to the program.

PhD Processes

PhD processes include course work, research topic finalization, guide allocation, periodic reviews, and timely progress submissions. The candidate must complete prescribed coursework in research methodology, subject-specific theory, and ethics. Research topics are finalized and approved by the Doctoral Committee. Progress is monitored through periodic seminars and reports. Ethical clearance must be obtained where applicable. A minimum residency period and regular interaction with the research supervisor are mandatory. The Research Council must ensure timely compliance, maintain records, and enforce regulations to uphold research quality and academic discipline.

PhD Thesis

The PhD thesis must represent original research work, make a significant contribution to knowledge, and follow academic integrity standards. It should be written in a clear, scholarly style, structured with chapters including introduction, literature review, methodology, results, discussion, and conclusions. The thesis must be screened for plagiarism and undergo internal review before submission. Formatting and referencing must follow university guidelines. The Research Council must ensure thesis quality, supervise timely submission, and verify that the work aligns with the approved research proposal and objectives of the doctoral program.

PhD Examinations

PhD examinations consist of thesis evaluation and the viva voce (oral defense). After submission, the thesis is sent to at least two external experts for blind review. Based on their reports, the candidate is permitted to appear for the viva. The oral examination assesses the candidate's understanding, contribution to the field, and ability to defend the work. It is conducted by an internal examiner, external expert, and the research guide. The Research Council oversees the process to ensure fairness, compliance, and proper documentation of outcomes and recommendations.

PhD Awards

A PhD degree is awarded after the candidate successfully completes the viva voce and satisfies all academic requirements. The Research and Innovation Council recommends the award based on external examiners' approval, successful defense, and plagiarism clearance. The final decision is approved by the Academic Council and endorsed by the Board of Governors. The university confers the degree during the convocation. Awards should reflect the candidate's scholarly contribution and uphold institutional standards. Honorary mentions or medals may be considered for exceptional research, subject to Council approval.

Publications

PhD scholars and faculty are encouraged to publish their research in peer-reviewed journals, conference proceedings, or as patents. Publications must be in UGC-CARE, Scopus, or equivalent indexed journals. Ethical publication practices and authorship norms should be strictly followed. All published work must acknowledge institutional affiliation and funding sources. The Research Council should facilitate publication through writing workshops, journal access, and review support. Periodic publication audits and incentives can enhance quality and quantity. Publications are considered essential for thesis submission and institutional research assessment.

Conferences

Participation in national and international conferences is vital for disseminating research, networking, and receiving expert feedback. The Research Council should encourage scholars and faculty to attend, present papers, and organize academic events. Funding support, duty leave, and travel grants should be allocated based on merit and institutional policy. Conference presentations should align with the researcher's area of study and uphold professional standards. Hosting university-level conferences enhances visibility and promotes academic dialogue. Proceedings and papers must be documented and counted as part of research output.

Research Output Dissemination

Research findings should be disseminated to both academic and non-academic audiences through journals, policy briefs, presentations, patents, technology transfers, and public forums. The Research Council should maintain a repository of research outputs and encourage open-access dissemination where possible. Institutional websites, newsletters, and media can be used to highlight achievements. Translating academic knowledge into societal solutions, entrepreneurship, or public policy is encouraged. Collaboration with industry, government, and NGOs enhances the impact. Dissemination strategies must be inclusive, ethical, and aligned with national innovation and development goals.

Thank You

GM UNIVERSITY

PROGRAM DOCUMENT

2025 - SCHEME

B. Tech.
in
Robotics & Automation



GM UNIVERSITY

Innovating Minds

School of Engineering
Faculty of Engineering & Technology



B.Tech in Robotics & Automation

PROGRAM DETAILS

Faculty	Faculty of Engineering and Technology (FET)
School	School of Engineering
Department	Robotics & Automation
Program	B.Tech, Robotics & Automation
Dean of Faculty	Dr. Prakash S V
Director of School	Dr. Praveen J
Head of Department	Dr. Rajashekhar B Somasagar

1	Title of the Award	B.Tech in Robotics & Automation
2	Modes of Study	Full Time
3	Awarding Institution /Body	GM University
4	Joint Award	Not Applicable
5	Teaching Institution	Faculty of Engineering and Technology, GM University
6	Date of Program Specifications	March -2025
7	Date of Course Approval by the Academic Council of GMU	---
8	Next Review Date:	---
9	Program Approving Regulating Body and Date of Approval	---
10	Program Accredited Body and Date of Accreditation	---
11	Grade Awarded by the Accreditation Body	---
12	Program Accreditation Validity	---
13	Program Benchmark	N/A
14	Program Overview The Bachelor's program in Robotics & Automation (B.Tech in Robotics & Automation) offers a comprehensive and innovative education for students aspiring to excel in the dynamic field of robotics, automation, and intelligent systems. This program is meticulously designed to provide students with a strong foundation in both theoretical principles and practical applications of robotics and automation, fostering a deep understanding of creative problem-solving, automation design, and emerging technologies in the robotics industry.	

	Over the course of four years, students engage in a well-structured curriculum that seamlessly integrates core engineering principles with specialized courses in robotics and automation. The program adopts a hands-on approach, incorporating robotics projects, automation system design, and internships to enable students to apply theoretical knowledge to real-world challenges in robotics and automation. Key areas of study include robotics principles, control systems, artificial intelligence, machine learning, computer vision, and mechatronics. Students also gain proficiency in using cutting-edge robotics tools, programming languages, and simulation software, preparing them for the challenges of the contemporary robotics and automation industry. The B.Tech Robotics and Automation program aim to equip graduates for diverse career opportunities across various sectors, including manufacturing, healthcare, autonomous systems, and smart technologies. Potential career paths encompass roles in robotics companies, automation industries, research and development, and entrepreneurship within the robotics domain. The interdisciplinary nature of robotics and automation opens avenues to explore diverse applications, enabling graduates to contribute to advancements in technology, automation solutions, and the development of intelligent systems. Continuous learning and staying abreast of the latest industry trends are crucial for graduates to thrive in the rapidly evolving field of robotics and automation. The program spans eight semesters, providing a holistic education that prepares students for a successful and impactful career in the dynamic realm of robotics and automation innovation.
15	Program Educational Objectives (PEOs) The Bachelor's program in Robotics and Automation is designed to provide a comprehensive education and foster key competencies in graduates, enabling them to contribute to the dynamic field of robotics and automation. The curriculum is structured to cultivate critical thinking, analytical skills, innovation, creativity, and problem-solving abilities. Continuous learning and staying abreast of the latest developments in robotics and automation further enhance graduates' professional growth. The Program Educational Objectives include: PEO-1: Knowledge and Technical Skills The program aims to provide graduates with a strong foundation in robotics and

	automation principles, control systems, artificial intelligence, and machine learning. Upon completion, graduates will possess the knowledge and technical skills necessary to conceptualize, design, analyze, and optimize robotic systems and automated processes. They will be well-equipped to address real-world challenges in various sectors, including manufacturing, healthcare, and autonomous systems. PEO-2: Professional Competence and Leadership To instill technical competencies, practical skills, and leadership abilities in graduates, preparing them for success in the field of robotics and automation. Graduates will excel in roles within robotics companies, automation industries, research and development, and entrepreneurial ventures within the robotics domain. They will be capable of assuming both technical and leadership positions, contributing to advancements in technology and innovation in the field of robotics and automation. PEO-3: Holistic Development and Adaptability The program aims to nurture critical thinking, creativity, innovation, collaboration, effective communication, information literacy, flexibility, adaptability, leadership, responsibility, and social and cross-cultural interaction skills. Graduates will demonstrate the ability to adapt to evolving professional environments, ensuring they contribute effectively to their respective fields. The interdisciplinary nature of robotics and automation prepares graduates for diverse career trajectories, fostering holistic development and lifelong learning. The overarching goal of the B.Tech in Robotics and Automation is to produce graduates who are well-prepared to meet the challenges of the dynamic robotics and automation industry, contribute to technological advancements, and make a positive impact on society.
16	Program Outcomes (POs) (Graduate Attributes) PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. 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 the public health and safety, and the cultural, societal, and environmental considerations.

	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. PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. PO-12: Lifelong 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.
17	Program Specific Outcomes (PSOs): Upon successful completion of the Bachelor's program in Robotics and Automation, graduates will possess the capability to: PSO-1: Analyze and Address Robotic Challenges Graduates will demonstrate the ability to analyze complex requirements in robotics, identify challenges, and articulate problems with necessary specifications. Leveraging their understanding of robotics and automation principles, graduates will deliver

	Innovative solutions, addressing issues in areas such as autonomous systems, machine intelligence, and robotic applications. PSO-2: Apply Robotics and Automation Concepts in System Development Graduates will be equipped to envision, model, design, simulate, develop, and test robotic systems and automation solutions. They will demonstrate proficiency in addressing technical challenges within the field of robotics and automation, utilizing their knowledge of control systems, artificial intelligence, and mechatronics to create efficient, reliable, and innovative robotic applications. PSO-3: Conduct and Lead Experimental Validation in Robotics and Automation After completing the program, graduates will showcase the capability to strategize, coordinate, and execute experiments for the validation and verification of robotic systems and automation solutions. They will adeptly use laboratory techniques and software tools for designing and simulating robotic processes, and will be prepared to assume leadership roles in research projects, effectively managing teams and resources in the context of robotics and automation. These Program Specific Objectives are tailored to ensure that graduates are not only well-versed in the theoretical aspects of robotics and automation but also possess the practical skills and leadership qualities required to make meaningful contributions in the field. The objectives emphasize the application of engineering principles in addressing real-world challenges and the development of innovative solutions in the realm of robotics and automation.
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Program Structure

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
2 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical (P) per week	1 Credit

Sl. No.	Program –Category	Credits
1	Program-Core courses, elective Courses, open electives	130
2	Technical Skills	10 (HG25TCXXX)
3	Life Skills	3(HG25TPYYYY)
4	Innovation and Entrepreneurial Skills	3(HG25CIVVVV)
5	Environmental Awareness and Community Services	3(HG25SAKKKK)
6	Athletics, Sports, Yoga, Gymnasium	3(HG25SAKKKK)
7	Cultural & Literary Activities	3(HG25SAKKKK)
8	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	2(HG25CC####)
9	Placement Training	3(HG25TPYYYY)
Total		130+30=160

18. Courses and Credits:

Semester-1			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA1101	Engineering Mathematics - I	3
2	UE25RA1102	Engineering Physics	2
3	UE25RA1103	Basics of Electrical & Electronics Engineering	3
4	UE25RA1104	Programming with C	3
5	UE25RA1105	Engineering Graphics	2
6	UE25RA1106	Analog Electronics	3
7	UE25RA1107	Project Based Learning- I	1
8	HG25TCXXXX	Technical Skills	0
9	HG25TPYYYY	Life Skills	0
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
11	HG25SAK KKK	Environmental Awareness and Community Services	0
12	HG25SAK KKK	Athletics, Sports, Yoga, Gymnasium	0
13	HG25SAK KKK	Cultural & Literary Activities	0
14	HG25CC#####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	0
Total			17

Semester-2			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA1201	Engineering Mathematics - II	3
2	UE25RA1202	Engineering Mechanics	3
3	UE25RA1203	Digital Electronics & Logic Design	3
4	UE25RA1204	Programming with Python	3
5	UE25RA1205	Basic Robotics & Mechanisms	3
6	UE25RA1206	3D Modeling of Mechanical Components and Assembly	2
7	UE25RA1207	Project Based Learning -II - 3D Modeling and Animation of a Robot	2
8	HG25TCXXXX	Technical Skills	2
9	HG25TPYYYY	Life Skills	1
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
11	HG25SAK KKK	Environmental Awareness and Community Services	1
12	HG25SAK KKK	Athletics, Sports, Yoga, Gymnasium	0
13	HG25SAK KKK	Cultural & Literary Activities	0
14	HG25CC#####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	0
Total			23

Semester-3			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA2301	Engineering Mathematics - III (Transforms & Probability)	3
2	UE25RA2302	Data Structures and Algorithms	3
3	UE25RA2303	Sensors and Instrumentation for Robotics	3
4	UE25RA2304	Microcontrollers and Embedded Systems	2
5	UE25RA2305	Kinematics of Machines and Simulation	2
6	UE25RA2306	Materials and Mechanics of Solids	2
7	UE25RA2307	Project Based Learning - III	2
8	UE25RA2308	Robotics Simulation Tools (MATLAB/Simulink)	1
9	HG25TCXXX	Technical Skills	2
10	HG25TPYYYY	Life Skills	1
11	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
12	HG25SAKXXX	Environmental Awareness and Community Services	1
13	HG25SAKXXX	Athletics, Sports, Yoga, Gymnasium	1
14	HG25SAKXXX	Cultural & Literary Activities	0
15	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
16	HG25TPYYYY	Placement Training	1
Total			24

Semester-4			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA2401	Manufacturing Processes & CNC	2
2	UE25RA2402	Dynamics of Machines and simulation	2
3	UE25RA2403	Data Visualization and Analysis	3
4	UE25RA2404	Control Systems for Robotics	3
5	UE25RA2405	Computer Vision & Image Processing	3
6	UE25RA2406	Robot Operating Systems	2
7	UE25RA2407	Project-Based Learning - IV	2
8	HG25TCXXX	Technical Skills	2
9	HG25TPYYYY	Life Skills	1
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
11	HG25SAKXXX	Environmental Awareness and Community Services	1
12	HG25SAKXXX	Athletics, Sports, Yoga, Gymnasium	1
13	HG25SAKXXX	Cultural & Literary Activities	1
14	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	1
Total			25

Semester-5			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA3501	IoT for Automation	2
2	UE25RA3502	Machine Learning for Engineers	3
3	UE25RA3503	Power Electronics and Industrial Drives	3
4	UE25RA3504	Additive Manufacturing	2
5	UE25RA3505	PCB Design and Fabrication	1
6	UE25RA3506	PLC and SCADA	2
7	UE25RA3507	Project-Based Learning - V	2
8	UE25RA3541	AI Processors	2
	UE25RA3542	ARM Cortex	
	UE25RA3543	Unmanned Aerial and Ground Vehicles	
9	HG25TCXXX	Technical Skills	2
10	HG25TPYYYY	Life Skills	0
11	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
11	HG25SAKXXX	Environmental Awareness and Community Services	0
12	HG25SAKXXX	Athletics, Sports, Yoga, Gymnasium	1
13	HG25SAKXXX	Cultural & Literary Activities	0
14	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	1
Total			21

Semester-6			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA3601	Managerial Economics for Robotics	2
2	UE25RA3602	Automation Technologies in Industry 4.0 Era	2
3	UE25RA3603	Artificial Intelligence for Robotics	3
4	UE25RA3604	Robotics System Integration	3
5	UE25RA3605	Hydraulics & Pneumatics Systems	2
6	UE25RA3606	Project-Based Learning - VI	2
7	UE25RA3641	Project Management for Robotic Systems	2
	UE25RA3642	Micro and soft Robotics	
	UE25RA3643	Simulation and Testing Tools for Robotics and Automation	
8	HG25TCXXX	Technical Skills	2
9	HG25TPYYYY	Life Skills	0
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
11	HG25SAKXXX	Environmental Awareness and Community Services	0
12	HG25SAKXXX	Athletics, Sports, Yoga, Gymnasium	0
13	HG25SAKXXX	Cultural & Literary Activities	1
14	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	0
Total			20

Semester-7			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA4701	Industrial Robotics and Human Robot Interaction	2
2	UE25RA4702	Design Optimization of Mechanical Components	2
3	UE25RA4703	Autonomous Robots & Navigation Systems	2
4	UE25RA4731	Introduction to Robotics	2
	UE25RA4732	Autonomous Systems	
	UE25RA4733	Robotics Simulation Tools (MATLAB/ROS/Simulink)	
5	UE25RA4707	Capstone Project Phase-1	4
6	HG25TCXXX	Technical Skills	0
7	HG25TPYYYY	Life Skills	0
8	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
9	HG25SAKKKK	Environmental Awareness and Community Services	0
10	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
11	HG25SAKKKK	Cultural & Literary Activities	1
12	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	1
13	HG25TPYYYY	Placement Training	0
Total			14

Semester-8			
Sl. No.	Course Code	Course Title	Credits
1	UE25RA4801	Virtual & Augmented Reality	2
2	UE25RA4831	Robots for Healthcare	2
	UE25RA4832	Agriculture Robots	
	UE25RA4833	Wearable Robotics and Prosthetics	
3	UE25RA4805	Capstone Project Phase-II	6
4	UE25RA4806	Internship	4
5	HG25TCXXX	Technical Skills	0
6	HG25TPYYYY	Life Skills	0
7	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
8	HG25SAKKKK	Environmental Awareness and Community Services	0
9	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
10	HG25SAKKKK	Cultural & Literary Activities	0
11	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	1
12	HG25TPYYYY	Placement Training	0
Total			16

List of Electives Offered

Professional Elective – I (V-Semester)

S. No.	Course Code	Course Title	Credits
1	UE25RA3541	AI Processors	2
2	UE25RA3542	ARM Cortex	2
3	UE25RA3543	Unmanned Aerial and Ground Vehicles	2

Professional Elective – II (VI-Semester)

S. No.	Course Code	Course Title	Credits
1	UE25RA3641	Project Management for Robotic Systems	2
2	UE25RA3642	Micro and soft Robotics	2
3	UE25RA3643	Simulation and Testing Tools for Robotics and Automation	2

Open Electives – I (VII-Semester)

S. No.	Course Code	Course Title	Credits
1	UE25RA4731	Introduction to Robotics	2
2	UE25RA4732	Autonomous Systems	2
3	UE25RA4733	Robotics Simulation Tools (MATLAB/ROS/Simulink)	2

Open Electives – II (VIII-Semester)

S. No.	Course Code	Course Title	Credits
1	UE25RA4831	Robots for Healthcare	2
2	UE25RA4832	Agriculture Robots	2
3	UE25RA4833	Wearable Robotics and Prosthetics	2

19	Program Delivery and Program Attainment The program comprises several courses, each delivered according to the specifications outlined in the course documents. At the conclusion of each course, both course attainments and program attainments are computed. These attainments undergo analysis during Course Assessment Board and Program Assessment Board meetings, leading to recommendations for enhancements in subsequent offerings.
20	Teaching and Learning Methods 1. Face to Face Lectures using Audio-Visuals 2. Laboratory work/Fieldwork/Workshop 3. Project Based Learning 4. Problem Based Learning 5. Group Exercises/Assignments 6. Demonstrations 7. Guest Lectures 8. Industry Visit 9. Workshops, Group Discussions, Debates, Presentations 10. Project Work 11. Project Exhibitions 12. Technical Competitions
21	Attendance A minimum of 85% attendance is essential to appear for semester end examinations. Condoning of attendance shortage is as per the Academic Regulations of B.Tech Programme.
22	Assessment and Grading 1. Every course will be assessed for a weight of 100 2. There are 4 components: a. Quiz -15% b. Class Tests: 25% c. Application Based open assignments/ Activity/project-based learning/problem-based learning and any such assessment: 20% d. Semester End Examination: 40% 3. Based on total marks scored grade is Awarded. If marks scored is:

	• 91 and above O (outstanding); 81-90: A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60: B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory) • If one scores D grade, the candidate is required to re-register for the course (for core courses only, students can exercise their choice in case of electives or open electives – means they can re-register or register for a different elective course) and earn the required credits • A minimum of overall 40% is required for completion of course by acquiring minimum grade (pass) with a minimum of 40% in each component. 4. End of each semester –grade card will be issued with SGPA displayed
23	Award of Degree Every student registering for the program need to complete a minimum of 160 credits, completing a minimum of 130 credits in academic courses (Core, elective, open elective) for the award of the degree. Award of Degree Certificate: Students will be issued consolidated grade card with CGPA displayed and GM University Degree Certificate. Award of Gold Medal: A student with highest CGPA (Not less than 9.0 on a scale of 10) in the class without getting a D grade in any course over 8 semester and completing the program within the specified period of 4 years (8 semesters) will be awarded Gold Medal.
25	Student Support for Learning 1. Course Notes 2. Reference Books in the Library 3. Magazines and Journals 4. Internet Facility 5. Computing Facility 6. Laboratory Facility 7. Workshop Facility 8. Staff Support 9. Lounges for Discussions 10. Any other support that enhances their learning

25	Quality Control Measures 1. Review of Course Notes 2. Review of Question Papers and Assignment Questions 3. Student Feedback 4. Moderation of Assessed Work 5. Opportunities for students to see their assessed work 6. Review by external examiners and external examiners reports 7. Staff Student Consultative Committee meetings 8. Student exit feedback 9. Course Assessment Board (CAB) 10. Programme Assessment Board (PAB)
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26. Mapping of POs with COs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course-1												
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												
Course-2												
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

GM UNIVERSITY

DAVANAGERE



Course Document

Course Code	EME-204
Course Title	Engineering Thermodynamics
Program Code	FET-023
Program Title	B. Tech. Mechanical Engineering
Department	Department of Mechanical Engineering
Faculty Code	01-FET
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Mechanical Engineering
Faculty Member	Dr. Basavaraju
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
2	2	0	0	2

Total Term/ Semester hours: 30

2. Course Details

2.1 Course Aims and Summary

1. The course 'Engineering Thermodynamics' aims at introducing Heat and Work interactions between a system and its surroundings and the underlying principles of energy conversion
2. The course introduces terminology associated with the study of thermodynamics; the laws of thermodynamics and their consequences. It also deals with the properties of working substances and qualitative and quantitative aspects of energy conversion including the concepts of available energy, availability and irreversibility and thus it covers concepts of Energy, Entropy and Exergy
3. The course also covers properties of ideal and real gases, mixtures of gases and Maxwell's Relations

2.2 Course Objectives

The objectives of the Course are:

- To review SI Units of various quantities used in thermodynamics
- To define thermodynamics
- To differentiate between Microscopic and Macroscopic thermodynamics
- To introduce basic concepts as applied to engineering thermodynamics- Thermodynamic system, closed system, open system, isolated system, control volume
- To define pure substance and working substance

- To define terms like property, state, change of state, equation of state, path, process, cycle, thermodynamic equilibrium, quasi-static process, point and path function
- To understand work and heat interactions
- To state Zeroth law of thermodynamics and explain international practical temperature scale
- To understand first law of thermodynamics as applied to a closed system executing a cycle and executing a process
- To explain energy, forms of energy, specific heats, enthalpy
- To introduce perpetual motion machine of first kind
- To understand first law as applied to open system
- To understand steady flow systems and to calculate work and heat interactions for various steady flow systems
- To define heat engine and efficiency of heat engine
- To define heat pump and coefficient of performance of heat pump
- To introduce the concept of thermal reservoirs
- To state second law of thermodynamics: Kelvin Planck and Clausius Statement
- To introduce the concept of perpetual motion machine of second kind
- To explain reversible and irreversible processes
- To explain Carnot cycle and reversed heat engine-heat pump or refrigerator
- To understand Carnot theorem
- To define absolute temperature scale
- To define efficiency of reversible heat engine
- To define COP of reversible heat pump
- To understand Clausius theorem
- To define entropy change
- To state third law of thermodynamics
- To prove Clausius inequality
- To explain principle of entropy increase
- To introduce the concept of availability, irreversibility and lost work
- To define thermodynamic processes
- To calculate work, heat, energy change, entropy change for different thermodynamic process for the non-flow and flow processes
- To introduce pure substance
- To explain Level change of water as a pure substance on TH, TV, PT, PVT coordinates
- To introduce table of thermodynamic properties
- To calculate heat, work, energy change, entropy change for pure substance executing thermodynamic processes
- To explain the concept of Ideal and real gases
- To express equations of state
- To explain Compressibility factor and law of corresponding states
- To explain mixture of gases and define mass fraction, mole fraction, Volume fraction and partial pressure
- To state Gibbs-Dalton Law of partial pressures
- To state Avogadro's law and Evaluation of Universal Gas Constant
- To calculate internal energy, enthalpy, specific heats, molecular weight and Gas Constant for Mixtures
- To understand Maxwell's thermodynamic relations

2.3 Course Outcomes

After undergoing this course students will be able to:

CO1	Explain basic concepts of Engineering Thermodynamics
CO2	State zeroth law of thermodynamics, first law of thermodynamics as applied closed and open systems and develop and steady flow energy equation for various flow problems
CO3	State second law and third law of thermodynamics and explain the concept of entropy, absolute entropy, principle of increase of entropy, availability and irreversibility
CO4	Calculate work, heat, change of energy, change of entropy for closed and open system executing various thermodynamic processes with and without Level change
CO5	Calculate gas constant, internal energy, enthalpy, specific heats and entropy for mixtures of ideal gases
CO6	Explain Maxwell's thermodynamic relations

Outcome Map:

COs	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															

Relevance: 1 high, 2 medium, 3 low

2.4 Course Content

- **Basic Concepts of Thermodynamics**
Thermodynamic Systems, Control Volume, Macroscopic and Microscopic points of View, Pure substance, working substance, Thermodynamic Property, state, path, process, cycle, thermodynamic equilibrium, quasi static process, point and path functions, work, PdV work, other types of work, Temperature, Zeroth law of thermodynamics, Heat
- **The First Law of Thermodynamics**
First law for a closed system undergoing a cycle, first law for a closed system undergoing a change of state, Energy a property of the system, Specific heats, Perpetual motion Machine of First Kind, First Law applied to flow process, Steady Flow Energy Equation, Application of Steady flow energy equation
- **The Second Law of Thermodynamics**
Limitations of First law, Heat Engine, Efficiency of a Heat Engine, Heat Pump, Coefficient of Performance, Thermal Reservoirs, Statements of Second Law, Perpetual Motion Machine of II kind, Reversible and Irreversible Process, Carnot Cycle, Reversed Heat Engine
- **Corollaries of II Law of Thermodynamics**
Carnot's Theorem, Absolute thermodynamic Temperature Scale, Relation between K and degree C, Efficiency of reversible Heat Engine, Clausius Theorem, Entropy –a property of the system, Third law of thermodynamics, The inequality of clausius, Entropy change of a closed system during an irreversible process, Principle of increase of entropy, Tds relations, Available energy, Unavailable energy, dead states, availability
- **Thermodynamic Processes**
- Thermodynamic processes-Isobaric, isochoric, isothermal, isentropic, polytropic, constant enthalpy-throttling; work, heat, change of energy, change of entropy for a closed system executing thermodynamic processes. Work, heat, change of energy, change of entropy for a steady flow system executing thermodynamic processes, pure substance, thermodynamic tables, calculation of work, heat, and entropy
- **Ideal and Real Gases**
- Ideal and Real Gases, equation of state, compressibility factor
- **Mixture of Gases**
- Gaseous mixtures, The Gibbs Dalton Law, Relations involving Pressure, Volume and Composition, Gas Constant, Avagadro's Law and Evaluation of Universal Gas Constant, Internal energy, enthalpy, Specific Heats and entropy of mixtures
- **Maxwell's Relations**
- Thermodynamic relations from 1st and 2nd law, Maxwell's Relations, TdS equations, Joule Thomson Coefficient, Clausius Clapeyron Equation, Thermodynamic equilibrium and Stability

2.5 Course Resources

Text Book/s:

- **Text Book:**
 - P.K. Nag (2002), Engineering Thermodynamics, Second Edition, Tata McGraw-Hill, New Delhi

- **References:**
 - Van Wylen, G.J., and Sonntag, R.E., (2002), Fundamentals of Classical Thermodynamics for Engineers, 6th Edition, Wiley
 - Francis F. Huang (1989), Engineering Thermodynamics, Maxwell Macmillan International Editions
 - D E Winterbone (1997), Advanced Thermodynamics For Engineers, Arnold
- **Other Resources**
 - Videos
 - Thermodynamic Hand Book
-

3. Teaching and Assessment

3.1 Teaching

Lecture Number	Lecture Topic	Lecture Slides	Lecture Videos
0	Physical Quantities and Their SI Units	Lecture-00	Video-00
Issue-Assignment 1 and Assignment-2 Statements			
1	Engineering Thermodynamics	Lecture-01	Video-01
2	Basic Concepts of Engineering Thermodynamics	Lecture-02	Video-02
3	Basic Concepts of Engineering Thermodynamics	Lecture-03	Video-03
4	Basic Concepts of Engineering Thermodynamics	Lecture-04	Video-04
5	Basic Concepts of Engineering Thermodynamics	Lecture-05	Video-05
6	Basic Concepts of Engineering Thermodynamics	Lecture-06	Video-06
7	The First Law of Thermodynamics	Lecture-07	Video-07
8	The First Law of Thermodynamics	Lecture-08	Video-08
9	The First Law of Thermodynamics	Lecture-09	Video-09
10	The First Law of Thermodynamics	Lecture-10	Video-10
11	The First Law of Thermodynamics	Lecture-11	Video-11
Quiz -01 and Test-1-Obtain Student Feedback			
12	The Second Law of Thermodynamics	Lecture-12	Video-12
13	The Second Law of Thermodynamics	Lecture-13	Video-13
14	The Second Law of Thermodynamics	Lecture-14	Video-14

15	The Second Law of Thermodynamics	Lecture-15	Video-15
Submission of Assignment-1			
16	The Second Law of Thermodynamics	Lecture-16	Video-16
17	Entropy	Lecture-17	Video-17
18	Entropy	Lecture-18	Video-18
19	Entropy	Lecture-19	Video-19
20	Available and Unavailable Energy	Lecture-20	Video-20
21	Availability and Irreversibility	Lecture-21	Video-21
Quiz -02 and Test -02			
22	Thermodynamic Processes	Lecture-22	Video-22
23	Thermodynamic Processes	Lecture-23	Video-23
24	Thermodynamic Processes	Lecture-24	Video-24
25	Thermodynamic Processes	Lecture-25	Video-25
26	Ideal and Real Gases	Lecture-26	Video-26
27	Ideal and Real Gases	Lecture-27	Video-27
28	Mixture of Gases	Lecture-28	Video-28
29	Mixture of Gases	Lecture-29	Video-29
30	Thermodynamic Relations	Lecture-30	Video-30
Quiz-03 and Test-03			
Submission of Assignment-2			
Obtain Student Feedback			
Examination Preparation Break			
Term/Semester End Examination			

3.2 Assessment weight Distribution

	Quiz	Test	Assignment/ PBL/PrBL	SEE	Total Marks
Weights/ Course Outcomes	15	25	20	40	100
CO1	3	5	3	5	16
CO2	3	5	3	7	18
CO3	3	5	3	7	18
CO4	2	3	3	7	15
CO5	2	3	4	7	16
CO6	2	4	4	7	17

3.3 Schedule of Assessment

Assessment Type	Dates	Marks	COs	Quiz	Test	Assignment/PBL/PrBL	SEE
Weight				15	25	20	40
Duration				30 min	60 min	6 weeks	3 hours
Quiz-1	5 th week	6	CO1/CO2				
Quiz-2	10 th week	5	CO3/CO4				
Quiz-3	15 th week	4	CO5/CO6				
Test-1	5 th week	10	CO1/CO2				
Test-2	10 th week	8	CO3/CO4				
Test-3	15 th week	7	CO5/CO6				
Assignment-1	7 th week	09	CO 1-3				
Assignment-2	14 th week	11	CO 4-6				
SEE	18 th Week	40	All				

3.4 Grading Criterion

- Based on total marks scored grade is Awarded.
If marks scored is:
- 91 and above O (outstanding); 81-90 : A+ (Excellent); 71-80: A (Very Good); 61-70: B+ (Good); 51-60 : B (Above Average); 40 -50: C (Average); below 40: D (Not satisfactory)
- If one scores D grade, the candidate is required to re-register for the course if he/she wants to earn the credit at his/her own convenience

Setting Attainment Targets:

Attainment of Course Outcomes-COs	
Outcomes- Targeted	Outcomes Level of Attainment
60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	
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60% of Students will score A grade and above-1 60% of students will score B+ grade and Above-2 60% of students will score B grade and above-3	

4. Other Details

4.1 Assignment Details or Problem Based Learning

Assignments will be given at the beginning of each block period and students can continuously work on assignment and submit at the end of the block period as per the format provided.

4.2 Academic Integrity Policy: Students are required to strictly follow academic honesty and integrity. Copying and plagiarism in any form for any of the assessment components will result in zero marks.

CAB Document

Recording Marks and Finding Eligibility for SEE (CE)

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	Eligibility for SEE	Students Eligible for SEE
1							
2							
3							
N							

SEE Examination and Awarding Grades (Pre-CAB)

S. No.	USN	Student Name	Quiz (15%)	Test (25%)	Assignment 20%	SEE 40%	Marks Scored	Grade obtained
1								
2								
3								
N								
Total							XXXXX	

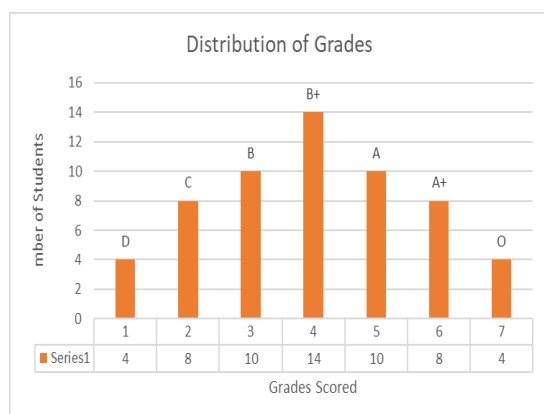
Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)

Average Grade:

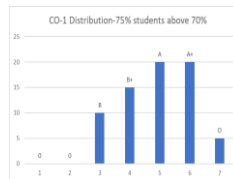
Performance Recording

Academic Year 2023-24	Program: B.Tech., in Computer Science and Engineering	Semester I	Section A	Course Code XXYYZZH11		Course Title Programming with C				
						Course Tutor/s: Tutor's ID/Department:				
Total Number of students in the Class	Number of Students appeared for all the components of Assessment	Number of Students - Passed all the components of Examination	Class Average Marks	O-Graders ≥ 91	A+ Graders 81 ≤ M ≤ 90	A Grader 71 ≤ M ≤ 80	B+ Graders 61 ≤ M ≤ 70	B Graders 51 ≤ M ≤ 60	C Graders 40 ≤ M ≤ 50	D Grades M < 40
60	58	54	58 B Grade	4	8	10	14	10	8	4
CO1- Performance										
CO2- Performance										
CO3- Performance										
CO4- Performance										
CO5- Performance										
CO6- Performance										
Students Feed Back on Teaching and Assessment:			Feedback-1				Feedback-2			

Performance Plotting and Course Assessment Board (CAB)



CO-1 Distribution



CO-4 Distribution

CO-2 Distribution

CO-3 Distribution

CO-5 Distribution

CO-6 Distribution

Finalisation of Grades and Announcement of Results (Post CAB)

Sample Question Papers

1. Quiz Question Paper (Total Marks: 15)

Format: Multiple Choice Questions (Each question carries 1 mark)

Instructions: Choose the correct answer from the given options. Each question carries 1 mark. No negative marking.

Q. No	Question	Options (A–D)
1	Ohm's Law states that	A. $V = IR$ B. $I = VR$ C. $R = VI$ D. $V = I^2R$
2	In a series circuit, the current is	A. Zero B. Same in all elements C. Different D. Maximum in resistor
3	Unit of electrical resistance is	A. Ampere B. Volt C. Ohm D. Coulomb
4	Kirchhoff's Current Law is based on conservation of	A. Energy B. Charge C. Voltage D. Power
5	Which element stores energy in magnetic field?	A. Resistor B. Inductor C. Capacitor D. Transformer
6	Voltage across a short circuit is	A. Maximum B. Zero C. Infinite D. Equal to current
7	Power in resistive circuit is given by	A. V/I B. I^2R C. VI^2 D. VR^2
8	The reciprocal of resistance is	A. Inductance B. Reactance C. Conductance D. Capacitance
9	The phase difference between voltage and current in pure resistor is	A. 90° B. 180° C. 0° D. 60°
10	Which of the following is an active element?	A. Resistor B. Diode C. Battery D. Capacitor
11	In a parallel circuit, voltage across each branch is	A. Zero B. Different C. Same D. Divided
12	Which law helps in mesh analysis?	A. KVL B. KCL C. Ohm's Law D. Maxwell's Law
13	RMS value of sinusoidal current I_m is	A. I_m B. $0.707I_m$ C. $0.5I_m$ D. $1.414I_m$
14	A capacitor stores energy in the form of	A. Light B. Sound C. Magnetic field D. Electric field
15	Frequency of AC in India is	A. 60 Hz B. 50 Hz C. 100 Hz D. 120 Hz

2. Test Paper (Total Marks: 30)

Instructions: Answer all three main questions. Each main question carries 10 marks with sub-divisions (a–c).

Q1

- (a) **Define** Ohm's Law. *(Recall – 2 Marks)*
- (b) **Explain** the difference between series and parallel circuits. *(Understand – 3 Marks)*
- (c) **Calculate** the current through a 5Ω resistor connected across a 10V supply. *(Apply – 5 Marks)*

Q2

- (a) **State** Kirchhoff's Voltage Law. *(Recall – 2 Marks)*
- (b) **Explain** the concept of node and mesh with an example. *(Understand – 3 Marks)*
- (c) **Using KCL**, find the unknown current at a node with three branches carrying 2A, 3A, and I. *(Apply – 5 Marks)*

Q3

- (a) **Write** the formula for impedance in an RLC circuit. *(Recall – 2 Marks)*
- (b) **Explain** power factor and its significance. *(Understand – 3 Marks)*
- (c) A sinusoidal voltage of 100V (rms) is applied to a pure resistor of 10Ω . **Find** the power consumed. *(Apply – 5 Marks)*

3. Assignment Question (Total Marks: 50)

Instructions: Attempt the following. Provide detailed solutions with diagrams, derivations, and real-world context.

Design a small residential wiring layout for a two-room house including:

- Power outlets, lighting circuits, and main distribution board.
- **Analyse** the load requirement and estimate total current and power demand.
- **Evaluate** the efficiency and safety of your design under different conditions.
- **Create** a wiring diagram and simulate the circuit using any free software (like Tinkercad or Multisim).

4. Semester-End Examination

Course: Basics of Electrical Engineering

Total Marks: 100

Duration: 3 Hours

Instructions:

- Answer all **five questions**.
 - Each question carries **20 marks**.
 - Each question has **three parts**:
 - (a) – Lower-order cognitive level
 - (b) – Mid-order level
 - (c) – Higher-order level
-

Q1: Electric Circuit Fundamentals and Ohm's Law

- **(a) Remember – 5 marks**
Define Ohm's Law and list its limitations.
 - **(b) Understand – 7 marks**
Explain with an example how voltage and current divide in series and parallel circuits.
 - **(c) Apply – 8 marks**
Solve a numerical: Three resistors (5Ω , 10Ω , 15Ω) are connected in series with a 60V supply. Find the total resistance, current, and voltage across each resistor.
-

Q2: Kirchhoff's Laws and Network Analysis

- **(a) Remember – 5 marks**
State Kirchhoff's Current Law and its assumptions.
 - **(b) Apply – 7 marks**
Use KVL to solve for unknown currents in a given mesh circuit (diagram to be provided).
 - **(c) Analyze – 8 marks**
Analyze a complex circuit (with two meshes and shared components) and find all branch currents using both mesh and node analysis. Comment on the differences.
-

Q3: AC Circuit Analysis and Phasors

- **(a) Understand – 5 marks**
What is a phasor? Explain phasor representation for voltage and current in RLC series circuits.

- **(b) Apply – 7 marks**

A voltage $V(t) = 100 \sin(100\pi t)$ V is applied to a circuit with $R = 10\Omega$, $L = 0.1\text{H}$. Calculate impedance and current.

- **(c) Evaluate – 8 marks**

Evaluate the effect of increasing inductance on current magnitude and power factor in the above circuit. Justify whether it improves circuit performance or not.

Q4: Power and Energy in AC Circuits

- **(a) Remember – 5 marks**

Define real power, reactive power, and apparent power with their units.

- **(b) Analyze – 7 marks**

Analyze the power triangle and derive the relationship between power factor and the three types of power.

- **(c) Create – 8 marks**

Design an AC load circuit (R-L-C) that achieves unity power factor. Specify component values and justify your design choices with calculations.

Q5: Electrical Machines and Practical Applications

- **(a) Understand – 5 marks**

Explain the working principle of a single-phase transformer.

- **(b) Apply – 7 marks**

A 1 kVA transformer has an efficiency of 90% at full load. Find input power and losses at full load.

- **(c) Create – 8 marks**

Propose a mini-project idea involving basic electrical components (resistors, inductors, transformers) to demonstrate any one real-world electrical principle. Include block diagram and objective.

CAB Document

Course Code	EME-204
Course Title	Engineering Thermodynamics
Program Code	FET-023
Program Title	B. Tech. Mechanical Engineering
Department	Department of Mechanical Engineering
Faculty Code	01-FET
Faculty Title	Faculty of Engineering and Technology
Department offering the Course	Mechanical Engineering
Faculty Member	Dr. Basavaraju
Semester Duration	Weeks (1-16) -Teaching, Learning and Continuous Assessment Weeks (17-18) -SEE Weeks (19-20)- Announcement of Results

1. Course Size

Credits	L	T	P	Hours/Week
2	2	0	0	2

Total Term/ Semester hours: 30

2. Course Outcomes

CO1	Explain basic concepts of Engineering Thermodynamics
CO2	State zeroth law of thermodynamics, first law of thermodynamics as applied closed and open systems and develop and steady flow energy equation for various flow problems
CO3	State second law and third law of thermodynamics and explain the concept of entropy, absolute entropy, principle of increase of entropy, availability and irreversibility
CO4	Calculate work, heat, change of energy, change of entropy for closed and open system executing various thermodynamic processes with and without Level change
CO5	Calculate gas constant, internal energy, enthalpy, specific heats and entropy for mixtures of ideal gases
CO6	Explain Maxwell's thermodynamic relations

3. Recording Marks and Finding Eligibility for SEE (CE)

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2							
3							
N							

4. SEE Examination and Awarding Grades (Pre-CAB)

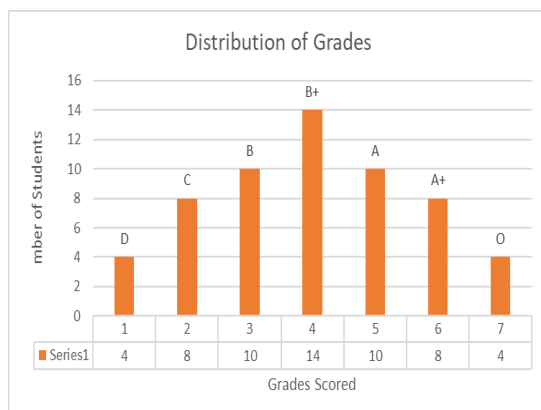
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2								
3								
N								
Total							XXXXX	

Class Average Marks: Total marks of All Students (XXXX)/ Number of students (N)
Average Grade:

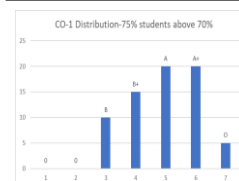
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