

# Sardar Patel University, Balaghat (M.P.)



Curriculum

For

B.Tech.

Mechanical Engineering

From Session: 2024-25



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Engineering Mathematics-III Subject Code: BME031

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. Equip students with numerical methods for solving engineering problems.
2. Introduce computational techniques for interpolation, differentiation, and integration.
3. Provide a foundation in transform calculus for solving differential equations.
4. Develop an understanding of probability theory and its engineering applications.
5. Bridge theoretical knowledge with practical engineering problem-solving.

### UNIT – I

**Numerical Methods – 1:** Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

### UNIT – II

**Numerical Methods – 2:** Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.

### UNIT – III

**Numerical Methods – 3:** Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predictor-corrector methods. Partial differential equations: Finite difference solution two-dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank Nicholson methods), Finite difference explicit method for wave equation.

### UNIT – IV

**Transform Calculus:** Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

### UNIT – V

**Concept of Probability:** Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

## Reference Books

- ❖ Engineering Mathematics by B. V. Rammana, Tata Mc Graw Hill
- ❖ Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers
- ❖ Advance Engineering Mathematics by E.Kreyszig
- ❖ Integral Transform of Schaum's Series
- ❖ Numerical Methods in Engineering and Science by B.S.Grewal, Khanna Publishers

## Course Outcomes:

1. Apply numerical methods to solve polynomial and transcendental equations.
2. Perform interpolation and approximation using finite difference techniques.
3. Execute numerical differentiation and integration effectively.
4. Solve linear systems and differential equations using numerical techniques.
5. Utilize transform calculus in engineering problem-solving.
6. Analyze and apply probability distributions in engineering contexts.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Material Science Subject Code: BME032

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. To demonstrate an ability to recognize the type of crystal systems and able to define and correlate various technological properties of the engineering materials.
2. To develop an ability to understand the mechanisms of deformation of materials.
3. To demonstrate an ability to apply appropriate assumptions and basic knowledge pertaining to the plastic and elastic behavior of elastic and brittle materials.
4. To recognize the various phases and constituents of Fe-C systems and will be able to describe the Fe-C equilibrium diagram.
5. To define and apply the type of heat treatment processes with respect to the type of the materials to describe the significance of powder metallurgy in current engineering practices

### UNIT - I

**Crystal Atoms of Solid:** Structure of atom binding in solids metallic, Vander walls, ionic and covalent, Space lattice and crystal system arrangement of atoms in BCC, FCC and HCP crystal. **Manufacture of Refractory and Ferrous Metals:** Properties uses and selection of acid, basic and natural refractory, metallurgical coke, Properties, types, uses and brief description of the manufacturing processes for iron and steel making.

### UNIT - II

**Plastic deformation of Metals:** Point and line defects in crystals, their relation to mechanical properties, deformation of metal by slip and twinning stress strain curves of poly crystalline materials viz. Mild steel cast iron and brass yield point phenomenon. Cold and hot working of metals and their effect on mechanical properties, annealing of cold worked metals, principles of re-crystallization and grain growth phenomenon, fracture in metal and alloys, ductile and brittle fracture, fatigue failure.

### UNIT - III

**Alloy Formation and Binary Diagram:** Phase in metal system solution and inter-metallic compounds. Hume-Rottery's rules, solidification of pure metals and alloy equilibrium diagrams of isomorphous, eutectic peritectic and eutectoid system, non-equilibrium cooling and coring iron, iron carbon equilibrium diagram.

### UNIT - IV

**Heat Treatment of Alloys Principles of Heat Treatment of Steel:** TTT curves heat treating processes, normalizing, annealing spheroidizing, hardening, tempering, case hardening, austempering, mar- tempering, precipitation hardening process with reference to Al, Cu alloys.

## UNIT - V

**Properties of Material:** Creep Fatigue etc., Introduction to cast iron and steel, Non-Ferrous Metals base alloys, Bronze, Brasses, Duralumin, and Bearing Metals. Plastics, Composites and ceramics: Various types of plastics, their properties and selection. Plastic molding technology, FRP, GRP resins adhesive, elastomers and their application. Powder Metallurgy: Property and Applications of Powder Metallurgy, Various process and methods of making products by powder Metallurgy techniques.

### Reference Books

- ❖ Narula GK, KS and Gupta VK; Material science; TMH
- ❖ Raghavan V; Material Science and Engineering, PHI Publication.
- ❖ Raghavan V; Physical Metallurgy Principles and Practice; PHI
- ❖ Rajendran V and Marikani; Material science; TMH
- ❖ Srinivasan R; Engineering materials and Metallurgy; TMH
- ❖ Navneet Gupta, Material Science & Engineering, Dhanpat Rai.
- ❖ B. K. Agrawal, Introduction to Engineering Materials, TMH.

### Course Outcomes:

1. Demonstrate the ability to recognize different crystal systems and correlate them with various technological properties of engineering materials.
2. Develop the ability to understand and explain the mechanisms of deformation in materials, including slip, twinning, and dislocation movement.
3. Apply fundamental knowledge to analyse and predict the elastic and plastic behaviour of ductile and brittle materials under different loading conditions.
4. Identify the various phases and constituents of the Iron-Carbon (Fe-C) system and explain the Fe-C equilibrium diagram to analyse material behaviour in ferrous alloys.
5. Define, select, and apply appropriate heat treatment processes based on material types, and understand the significance of powder metallurgy in modern engineering applications.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Fundamentals of Thermodynamics Subject Code: BME033

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. Understand the basic concept of thermodynamics and its laws. And also, able to understand Zeroth law and first law of thermodynamics with application and limitation in closed system.
2. Demonstrate and understanding of second law of thermodynamics with its application, also make understanding of Carnot theorem, reversibility, availability and entropy of a system
3. Understand the real gas and to create understanding of various laws and equation associated with these real gases.
4. Analyze the various thermodynamics properties of the pure substance with their various properties' relationship diagram and tables.
5. Describe the various ideal air standard cycle and understand properties behaviors of mixture of ideal gases also.

### UNIT – I

**Basic Concepts:** Thermodynamic, Property, Equilibrium, State, Process, Cycle, Zeroth Law of thermodynamics, statement and significance, concept of an ideal gas, Gas laws, Avogadro's hypothesis, Heat and work transfer. First law of thermodynamics- statement of first law of thermodynamics, first law applied to closed system, first law applied to a closed system undergoing a cycle, processes analysis of closed system, flow process, flow energy, steady flow process, relations for flow processes, limitations of first law of thermodynamics.

### UNIT - II

Second law of thermodynamics, heat engine, heat reservoir, refrigerator, heat pump, COP, EPR, Available energy, Carnot's theorem, Carnot's cycle, efficiency of Carnot's cycle, statement of second law reversible and irreversible processes, consequence of second law, Entropy, Entropy change for ideal gas, T-S diagrams, Availability and Irreversibility. Gibbs and Helmholtz functions.

### UNIT – III

Real Gas, Deviation with ideal gas, Vander-wall's equation, evaluation of its constants, limitations of the equation. The law of corresponding states compressibility factor, generalized compressibility chart, P-V-T surface of a real gas, Thermodynamics relations, Maxwell relations and their applications.

### UNIT - IV

Pure substances, Phase, Phase- transformations, formation of steam, properties of steam, PVT surface, HS, TS, PV, PH, TV diagram, processes of vapor measurement of dryness fraction, use of steam table and mollier chart.

## UNIT - V

Air Standard cycles, Carnot, otto, diesel, dual, cycles and there comparison, two stroke and four stroke engines, Brayton cycle, non-reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, enthalpy and specific heat of gas mixtures, enthalpy of gas mixtures.

### Suggested List of Experiment:

1. To calculate the coefficient of performance of Heat Pump and Refrigerator
2. To study of condenser efficiency.
3. To study of performance characteristics of two-stroke petrol engine
4. To conduct performance test on a variable compression ratio petrol engine
5. To conduct performance test on diesel engine
6. To study of dryness fraction of steam.
7. To determine volumetric efficiency, isothermal efficiency of multi-stage reciprocating air compressor

### Reference Books

- ❖ P. K. Nag; Engineering Thermodynamics; TMH
- ❖ Cengel Y; Thermodynamics; TMH
- ❖ Arora CP; Thermodynamics; TMH
- ❖ Omkar Singh; Engineering Thermodynamics by New Age international.
- ❖ Ratha Krishnan; Engineering Thermodynamics by PHI India Pvt. Ltd

### Course Outcomes:

1. Understand the basic concepts of thermodynamics, including the Zeroth and First Laws, and apply them to analyse closed systems while recognizing their limitations.
2. Demonstrate an understanding of the Second Law of Thermodynamics and its applications, including the Carnot theorem, concepts of reversibility, availability, and entropy in thermodynamic systems.
3. Develop a clear understanding of real gases and the associated laws and equations governing their behaviour under different conditions.
4. Analyse the thermodynamic properties of pure substances using property relationships, diagrams, and thermodynamic tables.
5. Describe various ideal air standard cycles and explain the behaviour of ideal gas mixtures in terms of thermodynamic properties.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Theory of Machines-I Subject Code: BME034

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. Systematic design and optimization of mechanisms to perform specified tasks.
2. Analyze and understand the dynamics i.e. position, velocity and acceleration characteristics, of mechanisms such as linkage and cams.
3. Understand basics of gear geometry and design procedures.
4. Develop the required analytical and practical capabilities to understand the dynamic working of mechanical machines that include most basic mechanisms.
5. Use methods of vector kinematics to analyze the translation and rotational rigid bodies and explain with appropriate visualization.

### UNIT - I

**Mechanisms and Machines:** Mechanism, machine, plane and space mechanisms, kinematic pairs, kinematic chains and their classification, degrees of freedom, Grubler's criterion, kinematic inversions of four bar mechanism and slider crank mechanism, equivalent linkages, pantograph, straight line motion mechanisms, Davis and Ackermann's steering mechanisms, Hooke's joint.

### UNIT - II

**Kinematic analysis of plane mechanisms using graphical and Cartesian vector notations:**

Planar kinematics of a rigid body, rigid body motion, translation, rotation about a fixed axis, absolute general plane motion. General case of plane motion, relative velocity method, velocity and acceleration analysis, instantaneous center and its application, Kennedy's theorem, relative motion, Coriolis component of acceleration.

### UNIT – III

**Gears:** Classification of gears, nomenclature, involutes and cycloidal tooth profile properties, synthesis of tooth profile for spur gears, tooth system, conjugate action, velocity of sliding, arc of contact, path of contact, contact ratio, interference and undercutting, helical, spiral, bevel and worm gears.

### UNIT - IV

**Cams:** Classification of followers and cams, radial cam nomenclature, analysis of follower motion (uniform, modified uniform, simple harmonic, parabolic, cycloidal), pressure angle, radius of curvature, synthesis of cam profile by graphical approach, cams with specified contours.

**Gear Trains:** Simple, compound, epicyclic gear trains; determination of gear speeds using vector, analytical and tabular method; torque calculations in simple, compound and epicyclic gear trains.

## **UNIT - V**

**Gyroscopic Action in Machines:** angular velocity and acceleration, gyroscopic torque/ couple; gyroscopic effect on naval ships; stability of two- and four-wheel vehicles, rigid disc at an angle fixed to a rotating shaft.

### **List of Experiments:**

1. To study various types of kinematics links and kinematic pair
2. To study various types of kinematics chain and Mechanisms
3. To study inversions of Single slider crank mechanisms
4. To study inversions of 4 Bar Mechanisms
5. To study inversions of double-slider-crank
6. To study different types of steering gears
7. To study different types of Gears
8. To study different types of Gears trains
9. To study different types of cams & followers

### **Reference Books:**

- ❖ Rattan SS; Theory of machines; TMH
- ❖ Ambekar AG; Mechanism and Machine Theory; PHI.
- ❖ Sharma CS; Purohit K; Theory of Mechanism and Machines; PHI.
- ❖ Thomas Bevan; Theory of Machines; Pearson/ CBS PUB Delhi.
- ❖ Rao JS and Dukkupati; Mechanism and Machine Theory; New Age Delhi.

### **Course Outcomes:**

1. Systematically design and optimize mechanisms to perform specific tasks efficiently, incorporating both theoretical and practical considerations.
2. Analyze and understand the dynamic behavior—position, velocity, and acceleration characteristics—of various mechanisms, including linkages and cams.
3. Develop an understanding of the fundamentals of gear geometry and apply standard design procedures for gears in mechanical systems.
4. Build analytical and practical skills to understand and evaluate the dynamic functioning of mechanical machines that involve basic mechanisms.
5. Utilize vector kinematics methods to analyze the translational and rotational motion of rigid bodies and explain these concepts through appropriate visualization techniques.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Strength of Materials Subject Code: BME035

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. Understand properties of materials.
2. Demonstrate the concept and laws applied to member under various loading condition.
3. Analyze and design structural members subjected to torsion, compression, bending and combined stresses using fundamental concepts of stress, strain and elastic behaviors of materials
4. Analyze beams, shaft, column and pressure vessel under various loading conditions.

### UNIT – I

**Mechanical properties of materials:** Behavior of materials under tension, compression, bending, shear; ductile and brittle materials, failure of MS and CI in tension and torsion stress and strain ; stresses in members of a structure, analysis of simple structures, stepped rods members in series and parallel; elastic and plastic behavior of materials, deformation under axial loading, statically indeterminate problems, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain relation among elastic constants, residual stress, fiber reinforced composite materials.

### UNIT – II

Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two- and three-dimensional analysis, transmission shaft under combined bending and torsion; stresses in thin-walled pressure vessel.

### UNIT - III

**Torsion in Shaft & Spring:** stresses in a shaft, deformation in circular shaft, angle of twist, stepped-hollow, thin walled-hollow transmission shafts, introduction of Leaf springs; helical springs, open and closed coil, stress in spring wire, deflection of helical spring, springs in series and parallel.

### UNIT - IV

**Bending:** Pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

### UNIT - V

**Theories of failures:** maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different

materials and loading conditions Columns: stability of structures, Euler's formula for columns with different end conditions, Rankin's formula.

### **LIST OF EXPERIMENTS:**

1. Tension Test on mild steel, Aluminum & compression test on cast iron on Universal Testing Machine.
2. Direct Shear Test of mild steel on Universal Testing Machine
3. Brinell Hardness Test of Mild Steel specimen.
4. Rockwell hardness Test of specimen.
5. Izod & Charpy - Impact tests of a standard specimen.
6. Torsion Test on Mild steel bar using tensional testing machine.
7. Drawing sheet on shear force & bending Moment diagrams for a given loading (At least four problems.).
8. Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems.).
9. Fatigue test on any given ductile material.

### **Reference Books:**

- ❖ Beer FP, Johnson ER, Dewolf JT: Mechanics of Materials; TMH
- ❖ Rattan; Strength of materials; TMH
- ❖ Nash William; Schaum's Outline Series; Strength of Materials; TMH.
- ❖ Negi; strength of materials; TMH
- ❖ Singh Arbind K; Mechanics of Solids; PHI
- ❖ Sadhu Singh; Strength of Materials; Khanna Pub.
- ❖ Kamal K and Ghai RC; Advanced Mechanics of Materials; Khanna Pub.

### **Course Outcomes:**

1. Understanding material behavior: Grasping how different materials respond to various forces.
2. Analyzing stresses and strains: Calculating internal forces and deformations in structural members.
3. Learning failure criteria: Recognizing when and why materials might fail under specific conditions.
4. Design application: Applying this knowledge to design more efficient and safe structures.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: CAD Lab Subject Code: BME036P

Course: B.Tech. Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. To provide hands-on experience with industry-standard CAD software.
2. To develop skills in 2D and 3D modeling, assembly, and simulation.
3. To enable students to create detailed engineering drawings and documentation.
4. To bridge the gap between theoretical knowledge and practical application in design and manufacturing.

### Unit-I

**Introduction to CAD Software:** Introduction to the CAD interface, navigation, and basic commands. Setting up projects: Units, grids, layers, and views. Simple 2D sketching exercises.

**2D Drafting and Documentation:** Creating detailed 2D drawings from hand sketches. Dimensioning, tolerancing, and annotations. Generating views: Orthographic, isometric, section, and auxiliary views. Introduction to GD&T (Geometric Dimensioning and Tolerancing).

### Unit-II

**3D Modeling Basics:** Basics of 3D modeling: Extrude, revolve, sweep, and loft. Parametric modeling concepts. Practice with simple 3D parts: Brackets, gears, and enclosures. Feature-based modeling: Fillets, chamfers, holes, and patterns.

**Advanced 3D Modeling:** Advanced features: Shell, rib, draft, and complex sweeps. Surface modeling: Creating and editing complex surfaces. Introduction to reverse engineering: Converting scanned data to 3D models. Exercises on complex 3D assemblies with multiple components.

### Unit-III

**Assembly Modeling:** Introduction to assembly modeling: Mates, constraints, and motion studies. Designing mechanical assemblies: Gears, couplings, and linkages. Interference and collision detection in assemblies. Generating exploded views and assembly drawings.

**Simulation and Analysis:** Basics of Finite Element Analysis (FEA): Stress, strain, and deformation. Static analysis on simple components. Motion analysis and kinematic simulations in assemblies. Introduction to Computational Fluid Dynamics (CFD) in CAD environments.

### Unit-IV

**Design Optimization and Parametric Studies:** Introduction to design optimization techniques. Parametric studies: Varying dimensions and analyzing results. Case studies on optimizing designs for weight, strength, and manufacturability. Introduction to generative design and topology optimization.

## Unit-V

**Project Work and Presentations:** Students will undertake a mini-project involving the complete design process: Concept, modeling, assembly, analysis, and documentation. Final presentation and viva on the project, demonstrating the application of CAD tools will be done before final examination.

### Reference Books:

- ❖ Engineering Design with SolidWorks by David C. Planchard Publisher: SDC Publications
- ❖ Mastering AutoCAD 2021 and AutoCAD LT 2021 by Brian C. Benton Publisher: Sybex
- ❖ Pro/ENGINEER Wildfire 5.0 by Louis Lamit Publisher: McGraw-Hill Education
- ❖ Siemens NX for Designers by Sham Tickoo Publisher: CADCIM Technologies
- ❖ Introduction to CATIA V5 Release 21 by Kirstie Plantenberg Publisher: SDC Publications
- ❖ Finite Element Analysis for Engineers by Frank L. Stasa Publisher: Butterworth-Heinemann
- ❖ ANSYS Workbench 2021 R2: A Tutorial Approach by Prof. Sham Tickoo Publisher: CADCIM Technologies
- ❖ Autodesk Fusion 360: A Power Guide for Beginners and Intermediate Users by Sandeep Dogra Publisher: CAD Artifex
- ❖ Geometric Dimensioning and Tolerancing for Mechanical Design by Gene R. Cogorno Publisher: McGraw-Hill Education
- ❖ 3D Printing and Additive Manufacturing: Principles and Applications by Chee Kai Chua and Kah Fai Leong Publisher: World Scientific Publishing.

### Course Outcomes:

1. Proficiency in using CAD tools for creating detailed 2D and 3D models.
2. Ability to design complex assemblies and perform basic simulations.
3. Competence in creating technical drawings adhering to industry standards.
4. Understanding of product lifecycle management (PLM) tools and their integration with CAD systems.



# SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Seminar, Subject Code: BME037P

Course: B.Tech., Branch: Mechanical Semester: III Sem

W.e.f. Academic Session: 2024-25

## Course Content

### Course Objectives:

1. To develop students' skills in researching, analysing, and presenting technical topics.
2. To encourage independent learning and critical thinking on contemporary issues in mechanical engineering.
3. To enhance communication skills, both verbal and written, within a technical context.
4. To foster teamwork and collaboration among students.

### Unit-I

**Introduction to Seminar Course:** Overview of seminar objectives, expectations, and evaluation criteria. Guidelines for selecting seminar topics. Introduction to research methodologies and sources of information.

**Topic Selection and Approval:** Students select seminar topics based on recent trends in mechanical engineering, industry developments, or research interests. Approval of selected topics by the faculty supervisor.

### Unit-II

**Research and Literature Review:** Conducting a literature review on the chosen topic. Identifying key papers, articles, patents, and industry reports relevant to the topic. Understanding the state-of-the-art and challenges in the selected area.

### Unit-III

**Seminar Outline and Draft Preparation:** Preparing an outline of the seminar, including key points, objectives, and structure. Developing a draft of the seminar presentation and report. Faculty feedback and revisions.

**Presentation Skills and Visual Aids:** Workshops on effective presentation techniques, including body language, voice modulation, and audience engagement. Training on creating effective visual aids (PowerPoint, posters, etc.). Practice sessions for peer and faculty feedback.

### Unit-IV

**Seminar Presentations (Part 1):** Students present their seminars in front of peers and faculty members. Each presentation followed by a Q&A session to test the depth of understanding. Peer and faculty evaluation based on content, delivery, and engagement.

**Seminar Presentations (Part 2):** Continuation of student presentations. Emphasis on improving based on feedback from earlier sessions.

## **Unit-V**

**Report Writing and Submission:** Preparing a comprehensive technical report based on the seminar topic. Guidelines for structuring the report: Abstract, introduction, methodology, findings, conclusion, and references. Submission of the final report for evaluation.

**Feedback and Reflection:** Individual feedback sessions with faculty on seminar performance. Reflection on strengths and areas for improvement in research and presentation skills. Discussion on how to apply these skills in future academic and professional settings.

### **Reference Books:**

- ❖ The Craft of Research by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams
- ❖ Engineering Communication: A Practical Guide to Workplace Communications for Engineers by David Ingre
- ❖ Technical Communication: A Practical Approach by William S. Pfeiffer
- ❖ Presentation Zen: Simple Ideas on Presentation Design and Delivery by Garr Reynolds
- ❖ How to Write and Publish a Scientific Paper by Robert A. Day and Barbara Gastel
- ❖ A Student's Guide to Presentations: Making Your Presentation Count by Barbara Chivers and Michael Shoolbred

### **Course Outcomes:**

1. Demonstrate the ability to research and understand a specific mechanical engineering topic.
2. Present technical content effectively using appropriate visual aids and communication techniques.
3. Engage in technical discussions, provide constructive feedback, and respond to questions confidently.
4. Prepare well-structured technical reports and documentation.