SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Heat and Mass Transfer Subject Code: BME071

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

Academic Session: 2025-26

Course Contents

Course Objectives:

1. Identify and understand the basic concepts of various heat transfer mechanisms that characterize a given physical system to formulate and solve heat transfer problems.
2. Formulate mathematical models for heat transfer through extended surfaces and for unsteady heat conduction processes.
3. Combine thermodynamics and fluid mechanics principles to analyze heat convection processes by incorporating empirical correlations with non dimensional numbers.
4. Analyze and design complex heat transfer applications, such as heat exchangers and will identify the various mechanisms related to mass transfer.
5. Integrate radiation aspects into real-world global heat transfer problems and understand the heat transfer mechanism during boiling and condensation.

Course Content:

UNIT-I

Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzman law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

UNIT-II

Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.

UNIT-III

Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

UNIT-IV

Heat exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, long-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method;

Mass transfer: Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

UNIT-V

Thermal radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields.

Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

LIST OF EXPERIMENTS:
1. Determination Thermal Conductivity (k) of Metallic Solid
2. Forced Convection Heat Transfer (h)analyses
3. Plot the Temperature Distribution (Radial) in Lagged pipe and determination Thermal Conductivity(k) of pipe insulation.
4. Analysis of Parallel flow and counter flow heat exchanger, effectiveness and heat transfer rat(Parallel and counter flow heat exchanger Apparatus)
5. Study of 'Twin Slab' guarded hot plate Apparatus
6. Determine Emissivity of test plate (Emissivity Apparatus)
7. Determination Thermal Conductivity (k) using Spherical Apparatus
8. Study of Composite Slab Apparatus
9. Analysis of Dropwise &Filmwise Condensation (Dropwise & Filmwise Apparatus)
10. Analysis of Critical Heat Flux (Heat Flux Apparatus)

REFERENCES BOOK:
- ❖ Sukhatme SP; Heat and mass transfer; University Press Hyderabad
- ❖ Holman JP; Heat transfer; TMH
- ❖ Dutta Binay K; Heat Transfer; PHI
- ❖ Kumar DS; Heat and mass transfer; SK Kataria and Sons Delhi
- ❖ Kreith; Heat transfer,
- ❖ Sachdeva RC; Fundamentals of engineering heat and mass transfer.
- ❖ Gupta & Prakash; Engineering heat transfer,

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name : Mechanical Estimation & Coasting Subject Code :BME072

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

Academic Session: 2025-26

Course Contents

Course Objectives:

1. Equip students with the fundamental principles of estimation and costing as applied to mechanical engineering projects and manufacturing processes.
2. Enable students to analyze and estimate material, labor, and overhead costs for mechanical components, assemblies, and systems.
3. Develop skills in preparing bills of materials (BOM), cost sheets, and quotations for engineering products and services.
4. Provide an understanding of cost control techniques, budgeting, and financial aspects of mechanical project management
5. Understand the concepts of estimation and costing, and their importance in mechanical engineering projects and manufacturing.

Course Content:

UNIT-I

Introduction to Estimation and Costing

Definition and importance of estimation and costing in mechanical engineering. Objectives and functions of estimation and costing. Types of estimates: Preliminary, detailed, supplementary, and revised estimates. Elements of cost: Material cost, labor cost, direct and indirect expenses, overheads. Costing methods: Job costing, batch costing, process costing. Role of estimation in design, manufacturing, and project management.

UNIT-II

Estimation of Material and Manufacturing Costs

Estimation of material costs: Calculation of weight, volume, and cost of raw materials for mechanical components (castings, forgings, sheet metal parts).Allowance for wastage, scrap, and shrinkage in material estimation. Estimation of manufacturing costs: Machining, welding, heat treatment, and surface finishing processes. Standard time and cost calculation for operations using time study and work measurement. Use of standard data handbooks and catalogues for cost estimation.

UNIT-III

Labor and Overhead Cost Estimation

Estimation of labor costs: Direct labor, skilled and unskilled labor rates, and productivity considerations. Overhead costs: Classification (factory, administrative, selling, and distribution overheads).Allocation and apportionment of overheads to cost centers. Depreciation: Concepts,

methods (straight line, diminishing balance), and its impact on costing. Cost estimation for assembly and installation of mechanical systems.

UNIT-IV
Cost Control, Budgeting, and Financial Analysis

Cost control: Objectives, techniques (standard costing, variance analysis), and cost reduction strategies. Budgeting: Preparation of production and project budgets, cash flow analysis. Break-even analysis: Determination of break-even point, profit-volume ratio, and margin of safety. Financial aspects: Return on investment (ROI), payback period, and net present value (NPV) for project evaluation. Tendering and bidding: Preparation of quotations, cost sheets, and contracts for mechanical projects.

UNIT-V
Software Tools and Modern Practices in Estimation

Introduction to estimation and costing software (e.g., MS Excel, ERP systems, specialized tools like Costimator).Use of CAD/CAM data for cost estimation in design and manufacturing. Value engineering and value analysis for cost optimization in mechanical systems. Case studies on estimation and costing in mechanical industries (e.g., automotive, HVAC, power plants).Emerging trends: Lean manufacturing, just-in-time (JIT) costing, and sustainability considerations in costing.

REFERENCES BOOK:
- ❖ Banga, T.R., & Sharma, S.C., "Mechanical Estimating and Costing", Khanna Publishers.
- ❖ Jain, R.K., "Mechanical and Industrial Measurements", Khanna Publishers.
- ❖ Ostwald, P.F., & Muñoz, J., "Manufacturing Processes and Systems", Wiley.
- ❖ Horngren, C.T., Datar, S.M., & Rajan, M.V., "Cost Accounting: A Managerial Emphasis", Pearson Education.
- ❖ ASHRAE Handbooks and IS Codes for standard costing data in mechanical systems.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name :Operation Research Subject Code :BME073
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents

Course Objectives:
1. formulate and solve mathematical model of linear systems by L.P. of two variables, with special cases of transportation and assignment and its solution, use Tora and Excell
2. realize the importance of Supply Chain Management (SCM) for manufacturing and business as a whole, and the roll of IT in information sharing among vendors, within the organization, and customers.
3. realize to the necessity of inventory and its management, able to estimate EOQ/EPQ and the evolution of MRP to ERP to SCM and e-business.
4. to use service mechanism by selecting suitable single /multiple server waiting line models by understanding Queue discipline and be able to estimate optimum service rate.
5. formulate pure and mixed competitive strategies using zero sum games and solve them by using algebraic, graphical, LP and other methods.

Course Content:
UNIT-I
Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT-II
Transportation Problems: Types of transportation problems, Mathematical models, transportation algorithms, methods for IBFS, Stepping Stone and MODI method. Assignment: Assignment Problem formulation, unbalanced assignment problem, Hungarian method, processing of job through machines.

UNIT-III
Network Techniques: Role of network Techniques in project Management, Basic Tools and Techniques of Project management, PERT- background and development, networking, estimating activity time, Determination of Earliest Expected and Latest allowable times, Determination of Critical Path, Applications of PERT, Critical Path Method (CPM), Numbering the events, Crashing, Resource allocation and smoothening.

UNIT-IV
Theory of Games: Rectangular games, Minimax theorem, graphical solution of 2xn or m x 2 games, game with mixed strategies, reduction to linear programming model.

Queuing theory: Elements of Queuing model, generalized Poisson queuing model, single server models and double server model.

UNIT-V
Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

REFERENCE BOOKS:

- ❖ Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
- ❖ Hamdy A. Taha, "Operations Research- An Introduction" Pearson Education, 2003.
- ❖ R. PanneerSeevam, "Operations Research" PHI Learning, 2008.
- ❖ 4.Hira and Gupta "Introduction to Operations Research", S. Chand and Co. 2002
- ❖ 5.Hira and Gupta "Problems in Operations Research", S. Chand and Co, 2002
- ❖ 6. Wagner, "Operations Research", Prentice Hall Of India, 2000.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name :Energy System and Technologies Subject Code :BME0741
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents
Course Objectives:
1. The fundamental concepts of solar cell
2. Suitable energy storage mediums for renewable energy technologies
3. The fundamental concepts of wind energy
4. Fuel cell technologies
5. To model and simulate the energy systems for performance improvement analysis

Course Content:
UNIT-I
Energy Sources: Fuels: Fossil fuels, Nuclear fuels. Direct Solar, Indirect Solar- Biomass, Ocean, Tidal, Hydro, Wind etc. Energy demand/ Growth/ economics; Fuel upgradation: gasification of coal and biomass; biogas.

UNIT-II
Energy Conversion:
Direct Conversion: Solar PV, Fuel Cells, Thermoelectric Conversion. Thermal to electric: IC Engines, gas and Steam Turbines; Electromechanical conversion; Hydraulicturbines, Chemical to Thermal: Combustion and Stoichiometry.

UNIT-III
Energy Utilization: Refrigeration, HVAC, desalination, Polygeneration; pumps and compressors.

UNIT-IV
Energy Storage: Thermal/ Mechanical/ Electric/ Chemical.

UNITV
Environmental Impact: Air/ Water/ Soil/ nuclear Waste.

REFERENCE BOOKS:
- ❖ **Energy Systems Engineering: Evaluation and Implementation** – Francis Vanek, Louis Albright, Largus Angenent
- ❖ **Sustainable Energy: Choosing Among Options** – Jefferson W. Tester et al. *(MIT Press)*
- ❖ **Energy Systems** – Thomas Ackermann
- ❖ **Renewable Energy: Power for a Sustainable Future** – Stephen Peake (Editor)

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name: Maintenance Engineering Subject Code: BME0742
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents
Course Objectives:
1. Defining failure and maintenance
2. Illustrating the importance of reliability and maintenance from a strategic business perspective
3. Highlighting the consequence of poor maintenance
4. Providing an overview of different types of maintenance strategies
5. Outlining recent trends in maintenance

Course Content:
UNIT-I
Introduction-Fundamentals of Maintenance Engineering. Maintenance Engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. Safety Regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000

UNIT-II
Maintenance Management- types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance. Their comparison, advantages & disadvantages. Limitations, computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

UNIT-III
Tribology in Maintenance: friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes. Lubricants - types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packings.

UNIT-IV
Machine Health Monitoring- Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, Instrumentation & equipment used in machine health monitoring. Instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

UNIT-V
Reliability, Availability & Maintainability (RAM) Analysis - Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non repairable systems,

REFERENCE BOOK:

- ❖ Maintenance Engineering Hand Book Higgins
- ❖ Maintenance & Spare parts Management Gopal Krishnan
- ❖ Industrial Maintenance Management S.K. Shrivastava
- ❖ Hand book of Condition Monitoring CNR Rao
- ❖ Naikan; Reliability engg and life testing; PHI
- ❖ Kapur KC and Lamberson LR; Reliability in Engineering Design; WileyIndia
- ❖ Telang AD and Telang A; Comprehensive Maintanance Management; PHI
- ❖ Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.
- ❖ Balaguruswamy; Reliability Engg; TMH
- ❖ Dhillon; Engg Maitainability- How to design for Reliability and easy maintenance; PHI
- ❖ Davidson John; The Reliability of mechanical system; Institution of Mech. Engineers, London
- ❖ Patrick D.T and O.'Connor; Practical Reliability Engineering; John Wiley and Sons

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Mechanical Vibration & Noise Engg. Subject Code: BME0743

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

Academic Session: 2025-26

Course Contents

Course Objectives:

1. Demonstrate an ability to recognize the type of vibration that is occurring in a particular physical system.
2. Demonstrate an ability to apply appropriate simplifying assumptions and basic dynamic principles to produce a mathematical model of a physical vibrating system.
3. Be able to recognize the particular Dynamic regime that is present in a typical engineering system.
4. Be able to recognize the type of vibration in a Multi DOF system and will be able to recognize the mode shape and natural frequency of the system.

Course Contents:

UNIT-I

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; elements of vibratory system; lumped and distributed parameter systems.

Undamped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration.

UNIT-II

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

UNIT-III

Harmonically excited Vibration: One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility.

Whirling Motion and Critical Speed: Whirling motion and Critical speed : Definitions and significance. Critical speed of a vertical, light flexible shaft with single rotor : with and without damping . Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

UNIT-IV

Systems With Two Degrees of Freedom : Un-damped free vibration of 2 d.o.f and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ; Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

UNIT-V
Noise Engineering Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipments; hearing conservation and damage risk criteria, daily noise doze.
Noise: Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipments and domestic appliances, industrial noise control, strategies- noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.

REFERENCE BOOK:
 ❖ MeirovitchLeonard; Element ofVibration Analysis;TMHDukkdddd
 ❖ DukikipatRV Srinivas J Text book of Mechanical Vibrations;PHI
 ❖ Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series;TMH
 ❖ 7-G.K. Grover, ' Mechanical Vibration , Nem chand and Bross , Roorkee

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name: Smart Material Subject Code: BME0751
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents

Course Objectives:
1. Familiarize the smart materials and its role in developing intelligent systems.
2. Introduce the students with HBLS and L.BHS smart materials.
3. Expose the students in smart systems development and uses.
4. Understand the working principle of smart actuators and smart sensors.

Course Contents:

UNIT-I
Overview of Smart Materials: Introduction to Smart Materials, Principles of Piezoelectricity, Piezo ceramic Materials, Magneto striction and Magneto-resistance Effect, Characteristics

UNIT-II
Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC),

UNIT-III
Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rhelological Fluids.

UNIT-IV
Smart Composites: Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam,

UNIT-V
Sensing and Actuation: Introduction, Characteristics, Applications and Principles of electro magnetic, acoustic, Chemical and Mechanical sensing Actuation.

REFERENCE BOOK:
❖ Fundamentals of Smart Materials by Mohsen Shahinpoor
❖ Adaptronics and Smart Structures: Basics, Materials, Design, and Applications *by H. Janocha*
❖ Dynamics of Smart Systems and Structures: Concepts and Applications *by multiple authors*
❖ Smart Materials for Energy Storage and Biomedical Applications *by multiple authors*
❖ Mechanical Structures and Smart Materials by Christopher Rhys Bowen

Academic Session: 2025-26

Course Contents

Course Objectives:
1. Understand concept of energy conservation and management.
2. Analyze energy cost, requirements, and substitution and system efficiencies.
3. Understand energy audit process, act, duties and responsibilities (as energy auditor).
4. To balance energy and materials in process and to plan for optimal rectification.
5. To monitor electrical and thermal energy consumption, losses and to establish efficient conservation opportunity so as to make nation energy sustainable.

Course Contents:
UNIT-I
Energy Sources and Global Scenario
Energy Basics: Definition, forms of energy (mechanical, thermal, chemical, etc.), and energy units, broad classification **Energy Sources**: Renewable (solar, wind, hydro, biomass) vs. Non-renewable (coal, oil, natural gas, nuclear).**Energy Conversion**: Overview of energy conversion processes (e.g., mechanical to electrical).**Energy Demand and Consumption**: Global and national energy consumption patterns.

UNIT-II
Energy Systems Application and Governing Bodies
Solar Energy: Photovoltaic systems, solar thermal systems (Solar Water heater, Solar Dryer) **Wind Energy**: Wind turbines, power generation, repowering and applications. **Hydroelectric Power**: Types of hydroelectric plants, benefits, and limitations. **Biomass and Bioenergy**: Sources of biomass, biofuels, and their role in energy generation. Biomass Gaisfier, Central governing body: Roles & responsibilities, **Bureau of Energy Efficiency:** Schemes of BEE (Star Labeling, ECBC, DSM, Ag-DSM, PAT etc.)

UNIT-III
Energy Conservation and Sustainable development
Energy Conservation Act: EC Act 2001 and its salient features**, Energy Efficiency**: Importance, methods to improve energy efficiency in industries and homes. **Sustainable Practices**: Concepts of sustainable development, **Government Policies and Regulations**: Overview of energy policies, environmental regulations, and international agreements (e.g.,

Kyoto Protocol, Paris Agreement).**Future of Energy**: Emerging technologies, smart grids, and the role of innovation in energy sustainability.

UNIT-IV
Energy Conservation for Industries
Energy Efficiency in Thermal Utilities: Boilers, Steam System, Furnaces, Insulation, Waste heat recovery **Energy Efficiency in Electrical Utilities:** Electricity Distribution System, Motors, Drives, Fans, Blowers, Pumps, Compressors, HVAC (Heating / Ventilation / Air Conditioning), Refrigeration, Cooling towers , Lighting, DG Sets, Buildings

UNIT-V
Energy Audit and its Management
Definition and Objectives of Energy Management: Energy Audit definition, Need for Energy Audit, Types of Energy Audit and Approach, Benchmarking, Energy Audit Instruments and its performance, Ten steps methodology for conducting detailed energy audit. **Material and Energy Balance**: Purpose, Components, and basic principles, Energy Analysis and the Sankey Diagram, Duties and responsibilities of energy manager and auditors.

REFERENCE BOOK:
- ❖ General Aspects of Energy management and Energy Audit: Bureau of Energy Efficiency
- ❖ Non-Conventional Energy Sources, Fourth Edition, Khanna Publishers, G.D. Rai. (2011).
- ❖ Energy Technology-Nonconventional, Renewable & Conventional, S. Rao and Dr. B. B. Parulekar, Khanna Publishers.
- ❖ Renewable Energy: Power for a Sustainable Future, Sept 2012, Oxford Press

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Reliability Engineering and TPM Subject Code :BME0753

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

Academic Session: 2025-26

Course Contents

Course Objectives:
1. Recognize the basic reliability principles of engineering systems (probabilistic analysis, simulation)
2. Combine numerical methods of reliability calculation during the operation of complex engineering systems.
3. Apply the modeling principles and calculation techniques of reliability in power systems and electronic systems.
4. Assess human reliability

Course Contents:
UNIT-I
Basic Concepts of Reliability: Probability distributions used in maintenance engineering-Binomial, Poisson, Exponential, Normal, Log-normal, Gamma and Weibull distribution; failure rate, hazard rate, failure modes, MTTR, MTBF, MTTF

UNIT-II
System Reliability Models: System reliability–n-component series systems, m-component parallel systems and combined system; standby systems; K-out-of-m systems; redundancy techniques in system design; event space, decomposition (Key Stone), cut and tie sets, Markov analysis, reliability and quality, unreliability, maintainability, availability

UNIT-III
Reliability Testing: Introduction, testing requirements, testing methods: Marginal Testing, Non- destructive testing, reliability tester, acceleration models, SWOT analysis.

UNIT-IV
Total Productive Maintenance: Evolution of TPM, TPM objectives, concept, pillars of TPM, Terro technology, Six Big Losses autonomous Maintenance.
Reliability centered maintenance: concept, methodology, benefits.

UNIT-V
Failure Modes and Effects Analysis (FMEA): Failure Modes and Effects Analysis (FMEA) Failure Modes, Effects and Criticality Analysis (FMECA):Overview, elements of FMECA, applications and benefits, risk evaluation, risk priority numbers, criticality analysis, process FMEA, qualitative and quantitative approach to FMECA; design FMEA and steps for carrying out design FMEA.

REFERENCE BOOK:

- ❖ Ebeling CE; An Introduction To Reliability & Maintainability Engg; TMH
- ❖ Srinath L.S; Reliability Engineering; East West Press.
- ❖ Naikan; Reliability engg and life testing; PHI
- ❖ Kapur KC and Lamberson LR; Reliability in Engineering Design; Wiley India
- ❖ Telang AD and Telang A; Comprehensive Maintanance Management; PHI
- ❖ Mishra R.C; Reliability and Maintenance Engineering; New age International publisher.
- ❖ Balaguruswamy; Reliability Engg; TMH
- ❖ Dhillon; EnggMaitainability- How to design for Reliability and easy maintenance; PHI
- ❖ Davidson John; The Reliability of mechanical system; Institution of Mech. Engineers, London
- ❖ Patrick D.T and O.'Connor; Practical Reliability Engineerin; John Wiley and Sons
- ❖ Modarre M; Reliability and Risk Analysis, Marcel Dekker Inc CRC Press

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name :Major Project I Subject Code :BME076P
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents

Course Objectives:
1. To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
2. To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
3. To give students an opportunity to do something creative and to assimilate real life work situation in institution.
4. To adapt students for latest development and to handle independently new situations.
5. To develop good expressions power and presentation abilities in students.

Course Contents:
The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan,a nalysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working schedule: The faculty and student should work according to following schedule:
Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

Action plan for Major Project work and its evaluation scheme #(Suggestive)

Task/Process	Week	Evaluation	Marks For Term Work#
Orientation of students by HOD/Project Guide	1st	-	-
Literature survey and resource collection	2nd	-	-
Selection and finalization of topic before a committee*	3rd	Seminar-I	5
Detailing and preparation of Project (Modeling, Analysis and Design of Project work	4th to 5th	0	5
Development stage	-	-	-
Testing, improvements, quality control of project	6th to 10th 11th		10
Acceptance testing	12th	-	5
Report Writing	13th to 15th	-	5
Presentation before a committee (including user manual, if any)	16th	- Seminar-II	30

* Committee comprises of HOD, all project supervisions including external guide from industry (if any) # The above marking scheme is suggestive, it can be changed to alternative scheme depending on the type of project, but the alternative scheme should be prepared in advance while finalizing the topic of project before a committee and explained to the concerned student as well. NOTE: At every stage of action plan, students must submit a write up to the concerned guide:

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name: MATLAB Lab Subject Code: BME077P
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents

Course Objectives:
This lab course aims to provide students with hands-on experience using MATLAB for solving mechanical engineering problems. The focus will be on numerical analysis, simulation, and data visualization relevant to mechanical systems.

UNIT-I
Introduction to MATLAB Environment: Overview of MATLAB Interface, Basic commands and operations, working with matrices and arrays, Plotting and visualization

Basic Programming in MATLAB: Script files and functions, Conditional statements (if-else, switch-case) Loops (for, while), User-defined functions

UNIT-II
Matrix Operations & Linear Algebra Applications: Matrix manipulations (addition, multiplication, inversion), Solving systems of linear equations, Eigenvalues and Eigenvectors, Application in mechanical vibrations and structural analysis

Numerical Methods in MATLAB: Root-finding methods (bisection, Newton-Raphson), Numerical differentiation and integration, Curve fitting and interpolation, Application to mechanical system modelling

Solving Ordinary Differential Equations (ODEs): Solving first-order and higher-order ODEs using MATLAB (ode45, ode23), Mechanical applications: Vibration analysis, spring-mass-damper systems

UNIT-III
Data Visualization and Plotting Techniques: 2D and 3D plots, subplots, Surface plots, contour plots, and mesh plots, Real-time data visualization, Application in mechanical analysis

Optimization Techniques: Introduction to optimization and f_{min} search function, Constrained and unconstrained optimization, Application to mechanical design optimization problems

UNIT-IV
Finite Element Method (FEM) in MATLAB: Introduction to FEM in MATLAB, Developing 1D and 2D FEM codes, Application to structural analysis problems.

Introduction to Simulink: Overview of Simulink, Building mechanical system models, Simulation of dynamic systems (spring-mass systems, control systems).

UNIT-V
Case Study: Mechanical Engineering Problem: Students will work on a mechanical engineering problem using MATLAB. Application areas may include heat transfer, fluid mechanics, or mechanical vibrations.
Project Work: Students will apply MATLAB to a project of their choice related to their specialization, such as robotics, automotive systems, or material science.

Project Presentation & Evaluation: Students will present their MATLAB projects. Evaluation based on code quality, problem-solving approach, and results.

Reference Books:
- ❖ MATLAB for Engineers by Holly Moore
- ❖ MATLAB: A Practical Introduction to Programming and Problem Solving by Stormy Attaway
- ❖ Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra
- ❖ Introduction to MATLAB for Engineers by William J. Palm
- ❖ MATLAB Programming Fundamentals by MathWorks
- ❖ MATLAB An Introduction with Applications by Amos Gilat

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology
Syllabus
Subject Name: Assessment of Internship 2 Subject Code: BME079P
Course: B.Tech. Branch: Mechanical Semester: VII Sem

Academic Session: 2025-26

Course Contents

Course Objectives:
The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester.

Scheme of Studies: Duration: Minimum 4 weeks in winter break after VI semester, assessment to be done in VII semester

Scheme of Examination: For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry	Marks Allotted
Attendance and General Discipline	10
Daily diary Maintenance	10
Initiative and participative attitude during training	05
Assessment of training by Industrial Supervisor	05
Total	30

(b) Practical/Oral Examination (Viva-Voce) in Institution	Marks Allotted
1. Training Report	10
2. Seminar and cross questioning (defense)	10
Total	20

Marks of various components in industry should be awarded by the I/c of training in Industry but in special circumstances if not awarded by the industry then faculty in charge /T.P.O. will give the marks.

During training students will prepare a first draft of training report in consultation with section in charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.

Learning through Industrial Training:

During industrial training students must observe following to enrich their learning: Industrial environment and work culture.

- Organizational structure and inter personal communication.
- Machines/equipment/instrument-their working and specifications.
- Product development procedure and phases.
- Project Planning, monitoring and control.
- Quality control and assurance.
- Maintenance system.
- Costing system.
- Stores and purchase systems.
- Layout of Computer/EDP/MIS centers.
- Roles and responsibilities of different categories of personnel.
- Customer services.
- Problems related to various areas of work etc.

Students are supposed to acquire the knowledge on above by-

- Direct Observations without disturbing personnel at work.
- Interaction with officials at the workplace in free/ tea time.
- Study of Literature at the workplace (e.g. User Manual, standards, processes schedules, etc.)
- "Hand's on" experience
- Undertaking/assisting project work.
- Solving problems at the work place.
- Presenting a seminar.
- Participating in group meeting/discussion.
- Gathering primary and secondary data/information through various sources, storage,retrieval and analysis of the gathered data.
- Assisting official and managers in their working.
- Undertaking a short action research work.
- Consulting current technical journals and periodicals in the library.
- Discussion with peers.

Daily Diary- Industrial Training:

Name of the Trainee-------------------------------- College --------------------------------- Industry / work place --- Week No-------------------- Department /Section -- Date ---------------------------- ----------------------
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Dates   Brief of observations made, work done, problem/project undertaken, discussion held, literature consulted etc.

Signature of Supervisor   Signature of Trainee   Signature of Official in (TPO/Faculty)   charge for Trg. In Indutry. --
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Supervision of Industrial Training:

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above area in the field. One faculty member or TPO will plan

industrial training of students in consultation with training manager of the industry (work place) as per the predefined objectives of training. Monitoring visits will be made by training and placement officer/faculty in-charge for the group of students, of the college during training.

Guidance to the faculty / TPO for Planning and implementing the Industrial Training:
Keeping in view the need of the contents, the industrial training program, which is spread to minimum 4 weeks duration, has to be designed in consultation with the authorities of the work place; Following are some of the salient points:
- Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) authorities of the work place and 3) supervising faculty members.
- Discussing and preparing students for the training for which meetings with the students has to be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the program.
- Correspondence with the authorities of the work place.
- Orientation classes for students on how to make the training most beneficial- monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information form the workplace, ethics etc.
- Guiding students to make individual plans (week wise/ day wise) to undertake industrial training.
- Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
- Inviting industrial personnel to deliver lectures on some aspects of training.

Action plan for planning stages at the Institutional Level

S.No.	Activity	Commencing Week	Finishing week	Remark
1.	Meeting with Principal			
2.	Meeting with colleagues			
3.	Correspondence with work place (Industry concerned)			
4.	Meeting with authorities of work place			
5.	Orientation of students for industry training			
6.	Scrutinizing individual training plan of students.			
7.	Commencement of individual training			
8.	First monitoring of industrial training			
9.	Second monitoring of industrial training			
10.	Finalization of Training report			
11.	Evaluation of performance at industry level			
12.	Evaluation of Industry Program in the Institutions.			