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: Applied Thermodynamics, Subject Code: BME041

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. Demonstrate the supercritical steam generator system
2. Understand the basic ideas of steam power plant and to solve the steam power plant complex problems.
3. Analyze basic concept of gas dynamic problem,
4. Competent of basic engineering involve in air compressor
5. Describe of engineering basic of Rotary & axial flow air compressor.

UNIT – I

Steam generators: classification, conventional boilers, high-pressure boilers-Lamont, Benson, Loeffler and Velox steam generators, performance and rating of boilers, heat balance sheet, combustion in boilers, super critical boilers, fuel and ash handling, boiler draught, overview of boiler codes.

UNIT - II

Phase Change Cycles: Vapor Carnot cycle and its limitation, Rankin cycle, effect of boiler and Condenser pressure and superheat on end moisture and efficiency of ranking cycle, modified Rankin cycle, reheat cycle, perfect regenerative cycle, Ideal and actual regenerative cycle with single and multiple heaters, open and closed type of feed water heaters, regenerative-reheat cycle, supercritical pressure and binary-vapor cycle, work done and efficiency calculations.

UNIT - III

Gas dynamics: speed of sound, in a fluid Mach number, Mach cone, stagnation properties, one-dimensional isentropic flow of ideal gases through variable area duct-Mach number variation, area ratio as a function of Mach number, mass flow rate and critical pressure ratio, effect of friction, velocity coefficient, coefficient of discharge, diffusers, normal shock. Steam flow through nozzles.

UNIT - IV

Air compressors: working of reciprocating compressor, work input for single stage Compression, different compression processes, effect of clearance, volumetric efficiency real indicator diagram, isentropic & isothermal and mechanical efficiency, multi stage compression, inter - cooling, condition for minimum work done, classification and working of rotary compressors.

UNIT - V

Steam condensers, cooling towers: introduction, types of condensers, back pressure and its

effect on plant performance, air leakage and its effect on performance of condensers, various types of cooling towers, Fundamentals of Refrigeration, Introduction to Refrigeration Cycles, COP.

REFERENCE BOOKS:

- Nag PK; Power plant Engineering; TMH
- Thermodynamics by Gordon J. Van Wylen
- P.K.Nag; Basic and applied Thermodynamics; TMH
- Ganesan; Gas turbines; TMH
- Heat Engines by V.P. Vasandani & D. S. Kumar
- R. Yadav Steam and Gas Turbines
- R.Yadav Thermal Engineering.
- Kadambi & Manohar; An Introduction to Energy Conversion – Vol II. Energy conversion cycles

Course Outcomes:

1. Demonstrate the working principles and operation of a supercritical steam generator system.
2. Understand the fundamentals of steam power plants and apply them to solve complex problems related to steam power plant operations.
3. Analyze the basic concepts of gas dynamics and their application to practical engineering problems.
4. Demonstrate competency in the fundamental engineering principles involved in air compressors.
5. Explain the engineering basics of rotary and axial flow air compressors.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Fluid Mechanics, Subject Code: BME042

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. Recognize the type of fluid flow occurring in a particular physical system.
2. Apply appropriate simplifying assumptions and basic fluid-flow principles to produce a mathematical model of a physical fluid-flow system.
3. Recognize the particular flow regime that is present in a typical engineering system.
4. Recognize the type of loss occurring in a pipe system and be able to use the values in energy calculation.
5. Compute the magnitude of different forces acting in a flow system using CFD tool.

UNIT – I

Review of Fluid Properties: Engineering units of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and Tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

UNIT – II

Kinematics of Flow: Types of flow-ideal & real, steady & unsteady, uniform & non uniform-, one-, two- and three-dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one- and three-dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets, their utility & method of drawing flow nets.

UNIT - III

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

UNIT - IV

Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.)

UNIT – V

Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.

REFERENCE BOOKS:

- Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
- Som and Biswas; Fluid Mechanics and machinery; TMH
- Cengal; Fluid Mechanics; TMH
- White; Fluid Mechanics; TMH
- Essential of Engineering hydraulics by JNIK DAKE; African Network & Sc Inst. (ANSTI)
- A Text Book of Fluid mechanics For Engineering. Student By Fransis JRD
- R Mohanty; Fluid Mechanics; PHI
- Fluid Mechanics; Gupta & Pearson

Course Outcomes:

1. Identify the type of fluid flow occurring in various physical systems.
2. Apply appropriate simplifying assumptions and fluid-flow principles to develop a mathematical model for a physical fluid-flow system.
3. Identify the flow regime present in typical engineering systems.
4. Determine the types of losses in a pipe system and utilize these values for energy calculations.
5. Calculate the magnitude of forces acting in a fluid flow system using Computational Fluid Dynamics (CFD) tools.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Energy, Environment & Society, Subject Code: BME043

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objective:

The primary objective of this course is to introduce students to the fundamentals of energy science, including various energy systems, resources, and their environmental impacts. The course aims to provide an understanding of ecosystems, biodiversity, environmental pollution, and social issues related to sustainability.

Unit I: Introduction to Energy Science:

Introduction to energy systems and resources: Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) -past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energystorages, high efficiency batteries)

Unit II: Ecosystems:

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Biodiversity and Its Conservation:

Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit IV: Environmental Pollution:

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Unit V: Social Issues and the Environment:

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Reference Books:

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, EnvironmentalEncyclopedia, Jaico Publ. House, Mumabai,
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances andStandards', Vol I and II, Enviro Media (R)
6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems andSustainability: Power for a Sustainable Future. Oxford University Press.
7. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide toRenewable Energy Technologies and Sustainable Living, Gaiam

Course Outcomes:

1. Understand the different types of energy systems and resources, including fossil fuels and alternative energy options, and assess their environmental impacts and sustainability.
2. Analyze the structure and functioning of various ecosystems and understand the dynamics of energy flow, food chains, and ecological succession within these systems.
3. Evaluate the importance of biodiversity, recognize the threats to it, and explore methods for its conservation at global, national, and local levels.
4. Identify the causes and effects of various types of environmental pollution and propose control measures for mitigating pollution in different contexts.
5. Assess social and environmental issues such as climate change, global warming, and wasteland reclamation, while understanding environmental laws and their enforcement.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Machine Design & Drawing, Subject Code: BME044

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. To understand and design structural joints and ability to sketch machine parts as per Standards.
2. To acquaintance with the terminology and types of permanent and detachable joints.
3. To design and analyze permanent joints (riveted, welded, etc.) under concentric and eccentric loading conditions.
4. To design and analyze detachable joints (bolts, keys, pins, etc.) under various loading conditions.
5. To apply the concepts of geometric dimensioning and tolerance (GD&T) for creating and interpreting manufacturing and assembly drawings.

Note: Unit II have weightage of 40 marks, other unit have 20 marks

UNIT - I

Drawing conventions: drawing and dimensioning IS codes, sectional views and sectioning, surface finish and tolerances, representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, gears. Rivet heads and Riveted joints, types of welded joints and representation.

UNIT - II

Assembly Machine Drawing: Basic concept, plotting technique, assembly and blow up of parts, bill of materials, product data; Cotter and Knuckle joints, pedestal and footstep bearings, IC engines parts - piston and connecting rods; lath machine parts. Couplings (flange & Oldham's)

UNIT – III

Basic design concepts, design process, stages/phases in design, design considerations (strength, manufacturing, maintenance, environment, economics and safety); design for recycle and reuse, Design and safety factors for steady and variable loads, impact and fatigue considerations.

UNIT - IV

Design of components subject to static loads: riveted joints, welded joints threaded joints, pin, key knuckle, and cotter joints.

References:

- Bhat, ND; Machine Drawing; Charotar
- Singh A; Machine Drawing; TMH
- Narayana and Reddy; Machine Drawing; New age, Delhi.
- Agarwal and Agrawal; Engineering Drawing; TMH
- Shigley JE et al; Mechanical Engineering Design, TMH

- John KC; Text Book of Machine Drawing; PHI Learning
- Kulkarni SG; Machine Design; TMH
- Mubeen and Mubeen; Machine Design.
- Bhandari VB; Design of Machine elements; TMH
- Sharma PC, Agarwal DK; Machine Design; Katson
- Kannaiah P; Machine Design; SciTech Pub- Chennai
- Luzzader WJ, Duff JM; Fundamental of Engg Drawing Interactive Graphics; PHI.
- PSG Design data book
- Mahadevan and Reddy's Mechanical design data book

Course Outcomes:

1. Understand the principles of structural joints and demonstrate the ability to design and sketch machine parts in accordance with industry standards.
2. Acquire knowledge of the terminology, functions, and classifications of permanent and detachable joints in mechanical systems.
3. Design and analyse permanent joints, such as riveted and welded joints, under both concentric and eccentric loading conditions.
4. Design and analyse detachable joints, including bolts, keys, and pins, considering various loading scenarios.
5. Apply the principles of Geometric Dimensioning and Tolerancing (GD&T) for the creation, interpretation, and evaluation of manufacturing and assembly drawings.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Manufacturing Process-I Subject Code: BME045

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. Define and describe the standards of measurements. Relate the significance of various instruments with their particular practical applications.
2. Demonstrate ability of applying the theoretical knowledge of tool geometry, tool materials and cutting fluids.
3. To recognize basic theory and terminologies of pattern making and classification of molding and casting processes.
4. Explain the welding process and its classification in detail. & Describe and explain gas cutting and metal forming process.

UNIT – I

Pattern Making: Pattern and pattern making, types of patterns, Pattern materials, pattern allowances, pattern design considerations, core, core boxes.

Molding and Foundry: molding sand, core sands and their properties, gating, runners, risers, solidification, defects and elimination, molding machines, centrifugal casting, die casting, shell molding, Lost wax molding; continuous casting, cupola description and operation.

UNIT – II

Forging: Theory and application of forging processes, operations, principle of drop and horizontal forging machines, forging defects, general principle of forging design.

Press working: press tool operations, process of shearing, punching, piercing, blanking, trimming, nibbing, notching, lancing, embossing, coining, bending, forming and drawing press, tool dies, force, pressure and power requirements.

UNIT - III

Welding: Gas welding method, flames, gas cutting, Electric arc welding, A.C. and D.C. welding machines and their characteristics. Flux, Electrodes, submerged arc welding, TIG & MIG Welding, Pressure welding, electric resistance welding i.e. spot, seam and butt welding; Thermit Welding, welding defects and their remedies; brazing and soldering, Introduction of spinning.

UNIT - IV

Metal cutting: Principles of metal cutting, tool geometry, Tool life plots, Mach inability, Tool wear, cutting force analysis, cutting tool materials & Cutting fluids, Economics of metal machining.

UNIT - V

Metrology: Standards of Measurements, Linear and angular instruments; slip gauges, sine bar,

angle gauges, screw thread measurements, limit gauges, limit fits and tolerances. Introduction to surface roughness measurement, comparators, and coordinate measuring machine;
Rolling: General description of machines and process; Rolling of structural sections plates and sheets; construction of mills; hot and cold rolling techniques.

References:

- Anderson and Tetro; Shop Theory; MH
- Kaushik JP; Manufacturing Processes; PHI
- Bawa; Manufacturing Processes; TMH
- Rao PN; Manufacturing Tech- Vol 1 and 2; TMH
- Schey JA; Introduction to manufacturing processes; McGraw Hill
- Chapman; Workshop Technology
- Begeman; Manufacturing Process: John Wiley
- Raghuvanshi; Workshop Technology: Dhanpat Rai.
- Hajra Choudhary; Workshop Technology: Vol I
- Pandya & Singh; Production Engineering Science:
- Production Engineering by P.C. Sharma

Course Outcomes:

1. Define and explain the standards of measurement and identify the significance of various instruments in specific practical applications.
2. Apply theoretical knowledge of tool geometry, tool materials, and cutting fluids to machining processes.
3. Understand the basic theories and terminologies of pattern making, and classify different molding and casting processes.
4. Explain the welding process and its classifications, and describe the principles of gas cutting and metal forming processes.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Programming in C & C++ Lab, Subject Code: BME046

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. Introduce students to the basic syntax and structure of C and C++ programming languages.
2. Develop problem-solving skills using algorithmic thinking.
3. Teach fundamental programming concepts such as loops, functions, arrays, and object-oriented programming (OOP).
4. Enable students to write and execute C/C++ programs for solving mechanical engineering problems.
5. Provide hands-on experience with debugging, testing, and optimizing code.

Unit I: Introduction to C Programming

Overview of C programming language. Writing simple C programs: Basic structure, input/output, and variables. Control structures: If-else, loops (for, while, do-while), switch-case statements. Functions: Defining and calling functions, passing arguments, return types, recursion. Arrays: Single and multi-dimensional arrays, array manipulation techniques.

Unit II: Pointers and Memory Management in C

Understanding pointers and memory allocation. Pointer arithmetic and pointer to arrays. Dynamic memory allocation: malloc, calloc, free. Strings and character arrays: String manipulation functions. File handling in C: Opening, reading, writing, and closing files.

Unit III: Introduction to C++ Programming

Basics of object-oriented programming (OOP). Classes and objects: Defining classes, creating objects, and constructors/destructors. Access specifiers, member functions, and data members. Friend functions and function overloading.

Unit IV: Advanced C++ Concepts

Inheritance: Single and multiple inheritance, base and derived classes. Polymorphism: Compile-time and runtime polymorphism, virtual functions. Operator overloading in C++. Working with templates: Function and class templates. Exception handling in C++.

Unit V: Practical Applications and Problem Solving

Implementing mathematical algorithms in C/C++ (e.g., solving equations, matrix operations). Writing programs for basic mechanical engineering problems (e.g., thermodynamics, fluid mechanics calculations). Developing mini-projects related to mechanical systems simulation or automation.

List of Experiments:

1. Introduction to C programming: Writing basic programs (e.g., sum of two numbers, factorial).
2. Control structures and loops: Writing programs using if-else, switch-case, and loops (e.g., prime number checker).
3. Arrays and Functions: Implementing sorting algorithms (e.g., bubble sort, selection sort).
4. Pointers and Strings: String manipulation programs (e.g., palindrome checker, string reversal).
5. File Handling in C: Writing programs to read from and write to files.
6. Introduction to C++: Writing simple class programs (e.g., creating an object to represent a mechanical component).
7. Inheritance and Polymorphism: Implementing inheritance to model real-world relationships (e.g., a machine and its parts).
8. Operator Overloading and Templates: Writing a program that uses operator overloading for matrix operations.
9. Exception Handling: Implementing a simple program for exception handling.
10. Mini-project: Solving a mechanical engineering problem using C/C++ (e.g., calculating the efficiency of a heat engine).

Reference Books:

1. Programming in ANSI C by E. Balagurusamy, Tata McGraw Hill.
2. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie.
3. Object-Oriented Programming with C++ by E. Balagurusamy, Tata McGraw Hill.
4. C++: The Complete Reference by Herbert Schildt, McGraw Hill Education.
5. Let Us C by Yashavant Kanetkar, BPB Publications.

Course Outcomes:

1. Understand the basic syntax and structure of C and C++ programming languages.
2. Develop problem-solving skills using algorithmic thinking and structured programming techniques.
3. Apply fundamental programming concepts such as loops, functions, arrays, and object-oriented programming (OOP) to solve problems.
4. Write and execute C/C++ programs for addressing mechanical engineering problems.
5. Demonstrate proficiency in debugging, testing, and optimizing C/C++ code through hands-on programming experience.

SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Subject Name: Internship-I, Subject Code: BME058P*

Course: B.Tech. Branch: Mechanical, Semester: IV

Academic Session: 2024-25

Course Content

Course Objectives:

1. Provide students with hands-on experience in an industrial environment.
2. Help students understand the practical application of theoretical concepts learned in their coursework.
3. Expose students to the working culture, processes, and operations of industries relevant to their field of study.
4. Foster professional skills, such as communication, teamwork, problem-solving, and time management.
5. Enable students to explore and identify their areas of interest for future career development.

Week 1: Industry Orientation and Safety Training

- **Introduction to the Industry:** Overview of the company's products, services, organizational structure, and market position.
- **Workplace Safety:** Safety protocols, hazard identification, emergency procedures, and use of safety equipment.
- **Industrial Environment:** Understanding the workplace culture, communication systems, and teamwork dynamics.
- **Initial Project Assignment:** Selection of a project or task relevant to the student's specialization (e.g., design, production, quality control).

Week 2: Exposure to Industrial Processes

- **Manufacturing and Production Processes:** Introduction to key operations in manufacturing, such as machining, casting, forging, assembly, etc.
- **Quality Control:** Learning about inspection techniques, quality management systems, and standards.
- **Maintenance and Troubleshooting:** Introduction to the maintenance of machines, equipment, and tools used in the production process.
- **Data Collection and Analysis:** Gathering data related to production output, process efficiency, and product quality.

Week 3: Project Work and Problem Solving

- **Hands-On Experience:** Participation in project tasks such as CAD design, process optimization, material selection, or system diagnostics, under the supervision of industry professionals.
- **Technical Problem Solving:** Identifying issues in industrial processes and proposing practical solutions.
- **Process Improvement Techniques:** Exposure to Lean Manufacturing, Six Sigma, or other process improvement methodologies.

Week 4: Reporting and Reflection

- **Documentation of Work:** Preparing a daily/weekly log of activities performed, challenges faced, and learning outcomes.
- **Team Presentation:** Presenting findings or results of the project work to peers and supervisors.
- **Internship Report Preparation:** Preparing a detailed report that outlines the project objectives, methodology, results, and recommendations.
- **Final Evaluation:** Feedback from the industry mentor on technical skills, work ethic, and project contributions.

Internship Report:

- **Title:** A clear and concise title of the internship project.
- **Introduction:** Brief about the company, its operations, and the scope of the internship.
- **Objectives:** Outline the objectives of the project or tasks assigned during the internship.
- **Methodology:** Explain the approach and techniques used to complete the project or tasks.
- **Results:** Present findings or improvements made, including data analysis, designs, or solutions implemented.
- **Conclusion:** Summarize the overall learning and the skills developed during the internship.
- **Acknowledgments:** Recognize the guidance and support provided by industry mentors and supervisors.

Reference Materials:

- Industry-specific manuals and guidelines provided by the host company.
- ISO standards or other relevant documentation related to quality and safety.
- Technical papers and resources related to the project work.