## B.Tech. Mechanical Engineering - R18

### Course Structure & Syllabus

#### B.Tech. V Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Code</th>
<th>Course Title</th>
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<tr>
<td>1</td>
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**Total Credits** 22.5

* MC—Mandatory course, Satisfactory/Unsatisfactory

#### B.Tech. VI Semester

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<th>S. No.</th>
<th>Code</th>
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**Total Credits** 19.5
Note: Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

PRE-REQUISITES: Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy and material science.

COURSE OBJECTIVES:
1. To understand the general design procedures and principles in the design of machine elements.
2. To study different materials of construction and their properties and factors determining the selection of material for various applications.
3. To determine stresses under different loading conditions.
4. To learn the design procedure of different fasteners, joints, shafts and couplings.

COURSE OUTCOMES:
1. The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
2. Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
3. Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.

UNIT – I:
Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Various theories of failure – Factor of
safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II:


UNIT – III:

**Riveted, Welded and Bolted Joints:** Riveted joints- methods of failure of riveted joints-strength equations-efficiency of riveted joints-eccentrically loaded riveted joints.

Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion.

Welded joints under eccentric loading.


UNIT – IV:

**Keys, Cotters and Knuckle Joints:** Design of keys-stresses in keys-cottered joints-spigot andsocket, sleeve and cotter, jib and cotter joints-Knucklejoints.

UNIT – V:

**Shafts:** Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Use of internal and external circlips, Gaskets and seals (stationary &rotary)

**Shaft Couplings:** Rigid couplings – Muff, Split muff and Flangecouplings. Flexible couplings – Flange coupling(Modified).

**TEXT BOOKS**


**REFERENCE BOOKS**

1. Design of Machine Elements / V. M. Faires /Macmillan
2. Design of Machine Elements-I / Annaiah, M.H / NewAge
PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVE: To apply the laws of Thermodynamics to analyze air standard cycles and to understand and evaluate the performance analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

COURSE OUTCOMES: At the end of the course, the student should be able

1. To evaluate the performance of IC engines and compressors under the given operating conditions.
2. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles.
3. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance.

UNIT – I:

UNIT – II:
Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types of SI engines.
Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating
UNIT - III:


**Reciprocating Compressors:** Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

UNIT – IV:

**Rotary Compressor (Positive displacement type):** Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

**Dynamic Compressors:** Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

**Axial Flow Compressors:** Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytropic efficiency.

UNIT – V:

**Refrigeration:** Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP – effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants- Vapour absorption system – mechanical details – working principle, Use of p-h charts for calculations

**Air-Conditioning:** Concepts of Psychrometry – Properties of moist air – Usage of Psychrometric Chart – Calculation of moist air properties.

Types of air – conditioning systems – Requirements - schematic layout of a typical plant.

TEXT BOOKS

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill
REFERENCE BOOKS

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson.
T K R COLLEGE OF ENGINEERING & TECHNOLOGY  
(Autonomous)  
B.TECH. MECHANICAL ENGINEERING - R18  

MACHINE TOOLS - B35PC3  

B.Tech. V Semester. L/T/P/C  
3/1/0/3  

PRE REQUISITES: Physics, Kinematics of Machines, Production Technology, Manufacturing Process  

COURSE OBJECTIVE:  

1. A source of power is always needed in various workshop processes particularly in cutting and forming of metal in a machine tool. In the metal-working industry work pieces of most different shapes and dimensions and of different materials are worked.  

2. In every industry we need shaping of materials. This shaping of materials is done by either non-cutting process or cutting process.  

3. After completion of the machine tools course, students should able to identify the utilization of different tools. Differentiate various machining operations on same and different machinery Solve industrial problems related to machine tools.  

4. Gain knowledge on various kinematics involved in machines. Design various machines & tools for various applications  

COURSE OUTCOMES:  

1. Brief exposure to various production technologies, how a product can be produced. Capable of facing challenges and requirements in industries for mechanizing the plant.  

2. Apply the principles and techniques of production and control of the production and service systems to optimize/make best use of resources.  

3. Course outcomes deliver a complete knowledge and exposure for manufacturing technologies to Control and command over production rates
UNIT - I:

UNIT - II:

UNIT - III:
Shapping, slotting and planning machines - Principles of working - principal parts - specification, classification, operations performed. Kinematic scheme of shaping, slotting and planning machines, machining time calculations.

Drilling and Boring Machines - Principles of working, specifications, types, operations performed - tool holding devices - twist drill - Boring machines - Fine boring machines - Jig boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

UNIT - IV:
Milling machine - Principles of working - specifications - classifications of milling machines - Principal features of horizontal, vertical and universal milling machines - machining operations Geometry of milling cutters - methods of indexing - Accessories to milling machines, kinematic scheme of milling machines

UNIT - V:

TEXT BOOKS
1. Production Technology / HMT / Tata Mc Graw Hill.
REFERENCE BOOKS


PRE REQUISITES: Thermal Engineering

COURSE OBJECTIVES: The student will be made to learn

1. The anatomy of the automobile in general
2. The location and importance of each part
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels
4. Suspension, frame, springs and other connections
5. Emissions, ignition, controls, electrical systems and ventilation

COURSE OUTCOMES: The student will be able to

1. Identify the different parts of the automobile.
2. Explain the working of various parts like engine, transmission, clutch, brakes.
3. Describe how the steering and the suspension systems operate.
4. Understand the environmental implications of automobile emissions.
5. Develop a strong base for understanding future developments in the automobile industry.

UNIT – I:

Introduction: Layout of automobile – introduction chassis and body components . types of Automobile engines. – power unit – Introduction to engine lubrication – engine servicing


UNIT - II:


Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT - III:


Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT - IV:

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT - V:

TEXT BOOKS

1. Automobile Engineering / William H Crouse

REFERENCES

2. Automotive Mechanics / Heitner
3. Automotive Engineering / Newton Steeds & Garrett
4. Automotive Engines / Srinivasan
5. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International
COURSE OBJECTIVE:
The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT – I:

UNIT - II:

UNIT - III:
Organization and HRM: Principles of Organization: Organizational Design&
Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.


UNIT - IV:
Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.
Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V:
Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

TEXT BOOKS

REFERENCES
FINITE ELEMENT METHODS - B35PE5A3

B.Tech. V Semester. L/T/P/C

3/1/0/3


COURSE OBJECTIVE: The aim of the course is to provide the participants an overview on Finite Element Method, Material models, and Applications in Mechanical Engineering.

COURSE OUTCOMES: At the end of the course, the student will be able to, Apply finite element method to solve problems in solid mechanics, fluid mechanics and heat transfer. Formulate and solve problems in one dimensional structures including trusses, beams and frames. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric and plate bending problems. Implement and solve the finite element formulations using MATLAB.

UNIT – I:

UNIT – II:
Analysis of Trusses: Stiffness Matrix for Plane Truss and Space Truss Elements, Stress Calculations. Analysis of Beams: Element stiffness matrix for two node, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses

UNIT – III:
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of Load Vector, Stresses. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular
elements. Two dimensional four noded Isoparametric elements and numerical integration.

UNIT – IV:

Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT – V:

Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss and beam. Finite element formulation to 3D problems in stress analysis, convergence requirements, Mesh generation. Techniques such as semi automatic and fully Automatic use of softwares such as ANSYS, NISA, NASTRAN, etc.

TEXT BOOKS
1. Finite Element Methods: Basic Concepts and applications/Alavala PHI
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu/Pearson

REFERENCE BOOKS
2. Finite Element Analysis/ SS Bhavikatti/ NewAge
3. Finite Element Method/Dixit/Cengage
ENGINEERING METROLOGY - B35PE5B

B.Tech. V Semester.  

L/T/P/C  

3/1/0/3

PRE REQUISITES: Object identification and description, material properties.

COURSE OBJECTIVE:

1. To educate students on different measurement systems and on common types of errors. And introduce measuring equipment’s used for linear and angular measurements.

2. To familiarize students with surface roughness measurements on machine components and develop an understanding of the basics of Metrology, how the principles and applications of different areas of measurement.

3. Maintenance of the accuracies of measurement. This is achieved by periodical calibration of the metrological instruments used in the plant.

4. To determine the measuring instrument capabilities and ensure that these are adequate for their respective measurements.

COURSE OUTCOMES:

1. Graduates will demonstrate an understanding of their professional and ethical responsibilities, and use technology for the benefit of mankind.

2. Understand the basics of Metrology and different methods of measurement.

3. Understand the concepts of limits, fit and tolerance and know the shaft basis system and hole basis system.

4. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)
UNIT - I:

**Systems of Limits and Fits:** Introduction, normal size, tolerance limits, deviations, allowance, fits and their types - unilateral and bilateral tolerance system, hole and shaft basis systems - interchangeability and selective assembly. Indian standard Institution system - International Standard system for plane and screwed work.

UNIT - II:

**Linear Measurement:** Length standard: line and end standard, slip gauges - calibration of slip gauges, Dial indicator, micrometers.

**Measurement of Angles and Tapers:** Different methods - Bevel protractor - angle slip gauges - spirit levels - single bar - Sine plate used to determine the tappers.

**Limit Gauges:** Taylor's principle - Design of GO and NO GO gauge, plug, ring, snap, taper, profile and position gauges.

UNIT - III:

**Optical Measuring Instruments:** Tool maker's microscope and its uses - collimators, optical projector - optical flats and their uses, interferometer.

**Flat Surface Measurement:** Measurement of flat surfaces - instruments used; straight edges, surface plates, optical flat and auto collimator.

UNIT - IV:

**Surface Roughness Measurement:** Difference between surface roughness and surface waviness - Numerical assessment of surface finish: CLA, R.M.S Values, $R_2$ Values, $R_{10}$ value - Methods of measurement of surface finish: profilograph, Talysurf - ISI symbol for indication of surface finish.

UNIT - V:

**Measurement Through Comparators:** Comparators: Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

**Screw Thread Measurement:** Element of measurement - errors in screw threads - measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.

**Machine Tool Alignment Tests:** Requirement of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools, Preparation of acceptance charts.

**Gear Measurement:** Gear measuring instruments, Gear tooth profile measurement, Measurement of diameter, pitch pressure angle and tooth thickness.
Coordinate Measuring Machines: Types of CMM, Role of CMM, and Applications of CMM.

TEXT BOOKS

2. Engineering Metrology / I C Gupta / Dhanpath Rai

REFERENCE BOOKS

2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
IC ENGINES AND GAS TURBINES - B35PE5C

B.Tech. V Semester.                      L/T/P/C

3/1/0/3

PRE-REQUISITES: Basic Thermodynamics

COURSE OBJECTIVES:

1. Acquire knowledge about the IC engine cycles, classification and working Principles.
2. Describe the testing and performance parameters along with heat balance Sheet.
3. Explain different alternate fuels, gas turbines and about jet propulsion.

COURSE OUTCOMES:

1. Explain basic concepts of actual cycles with analysis and to describe the fundamental concepts of IC engines along with its working principles.
2. Describe the combustion phenomenon in SI and CI engines.
3. Evaluate the performance of IC engines and the importance of alternate fuels.
4. Classify the essential components of gas turbine along with its performance improving methods.
5. Illustrate the working principle of different types of Jet propulsive engines and Rockets.

UNIT – I:

Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram.


UNIT – II:

Carburetors & Fuel Injection: Air Fuel Mixture Requirements, Construction and Working of Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor. Requirement of

**Combustion and Ignition Systems in SI and CI Engines:** Normal and Abnormal Combustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.

**UNIT – III:**


**UNIT – IV:**

**Gas Turbine:** Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle, and Cogeneration.

**UNIT – V:**

**Gas Turbine Cycles for Aircraft Propulsion:** Criteria of performance, Intake, and propelling nozzle efficiencies, Simple Turbojet Cycle, The turboprop engine, Thrust augmentation, Gas turbine combustion systems, Combustion chamber designs, Gas Turbine Emissions.

**TEXT BOOKS**
1. I.C. Engines/ Gas Turbines / V. Ganesan- Mc Graw Hill
2. Internal Combustion Engines /Colin R. Ferguson /Wiley

**REFERENCE BOOKS**
1. Fundamentals of Internal Combustion Engines / H.N Gupta / PHI
2. Gas Turbine Theory/ HIH Saravanamutto, Cohen, Rogers/ Pearson
THERMAL ENGINEERING LAB - B35PC7

B.Tech. V Semester.  
L/T/P/C  0/0/3/ 1.5

PRE-REQUISITE: Thermodynamics & Thermal Engineering – I

OBJECTIVE: To understand the working principles of IC Engines, Compressors.

LIST OF EXPERIMENTS:
1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
6. I.C. Engines Economical speed Test on a SI engine.
8. Performance Test on Variable Compression Ratio Engine.
9. IC engine Performance Test on a 4S CI Engine at constant speed.
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers.

Perform any 10 out of the 12 Exercises.
COURSE OBJECTIVE:

1. To import practical exposure to the machine tools.
2. To conduct experiments and understand the working of the same.

COURSE OUTCOMES:

1. Get the basic techniques of machining processes. Along with the thermal aspects of orthogonal cutting mechanics,
2. Identify lathe cutting tool materials such as high speed steel, carbide, cutting tools, shapes, and tool geometry
3. Knew the various working principles of metal cutting machines, types and uses of the vertical/horizontal milling machines.
4. Select and install proper grade of wheel for grinding material and understand the major components of a single and production type fixture or jig.

LIST OF EXPERIMENTS:

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper,
2. Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cuttergrinder.
3. Step turning and taper turning on lathe machine
4. Thread cutting and knurling on lathe machine.
5. Drilling and Tapping
6. Shaping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles.

L/T/P/ C

0/3/1.5

PRE REQUISITES: Object identification and description, material properties.

COURSE OBJECTIVE:

1. To educate students on different measurement systems and on common types of errors, and introduce measuring equipment’s used for linear and angular measurements.

2. To familiarize students with surface roughness measurements on machine components and develop an understanding of the basics of Metrology, how the principles and applications of different areas of measurement.

3. Maintenance of the accuracies of measurement. This is achieved by periodical calibration of the metrological instruments used in the plant.

4. To determine the measuring instrument capabilities and ensure that these are adequate for their respective measurements.

COURSE OUTCOMES:

1. Graduates will demonstrate an understanding of their professional and ethical responsibilities, and use technology for the benefit of mankind.

2. Understand the basics of Metrology and different methods of measurement.

3. Understand the concepts of limits, fit and tolerance and know the shaft basis system and hole basis system.

4. To be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc.)

LIST OF EXPERIMENTS:

1. Use of gear teeth vernier calipers for checking the chordal addendum and chordal height of the spur gear.


3. Tool makers microscope and its application

4. Angle and taper measurements by bevel protractor and sinebars.
5. Use of spirit level and optical flats in finding the flatness of surfaceplate.

6. Thread measurement by 2-wire and 3-wire methods.
PROFESSIONAL ETHICS AND GROUP DISCUSSION - B35MC10

B.Tech. V Semester. 

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Course Objective: To enable the students to imbibe and internalize the values and ethical behavior in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT – I:
Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT – II:

UNIT – III:
Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional
Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walkaway Collapse.

UNIT – IV:
Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.
Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

UNIT – V:

TEXT BOOKS

REFERENCES
UNIT – I:

UNIT – II:
**Phase Diagrams:** Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT – III:

UNIT – IV:

UNIT – V:
Cermets, Polymers and Composites: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties and applications of composites. Classification, Properties and applications of Polymers.
TEXT BOOKS
- Material Science and Metallurgy/ Kodgire

REFERENCE BOOKS
- Introduction to Physical Metallurgy / Sidney H. Avner.
- Materials Science and engineering / William and callister.
- Elements of Material science / V. Rahghavan
NOTE: Steam Table book Permitted.

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVE: To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

COURSE OUTCOMES: At the end of the course, the student should be able to

- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermos dynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

UNIT – I:

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.


UNIT – II:

Steam Nozzles : Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge-
Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilsonline.

UNIT – III:

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed- Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction –Velocity diagram – Parson’s reaction turbine – Condition for maximum efficiency.

UNIT – IV:


UNIT – V:


TEXT BOOKS

1. Thermal Engineering / Mahesh M Rathore/ Mc GrawHill
2. Gas Turbines – V.Ganesan /Mc GrawHill
REFERENCE BOOKS

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/Pearson
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/PHI
PRE-REQUISITES: None.

COURSE OBJECTIVE: The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include:

- Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
- A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
- Awareness of the economic, environmental, and regulatory issues related to power generation.

COURSE OUTCOMES: At the end of the course students are able to:

- Understand the concept of Rankine cycle.
- Understand working of boilers including water tube, fire tube and high pressure boilers
  and determine efficiencies.
- Analyze the flow of steam through nozzles.
- Evaluate the performance of condensers and steam turbines
- Evaluate the performance of gas turbines.

UNIT—I:

Introduction to the Sources of Energy: — Resources and Development of Power in India.
Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems. Combustion Process: Properties of coal — overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and drought system, cyclone furnace, design and

UNIT—II:
**Internal Combustion Engine Plant:** DIESEL POWER PLANT: Introduction — IC Engines, types, construction— Plant layout with auxiliaries — fuel supply system, air starting equipment,

UNIT—III:
**Hydro Electric Power Plant:** Water power — Hydro logical cycle / flow measurement — drainage area characteristics — Hydro graphs — storage and Poundage — classification of dams and spill ways.

UNIT —IV:
**Nuclear Power Station:** Nuclear fuel — breeding and fertile materials — Nuclear reactor — reactor operation. Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding radioactive waste disposal.

UNIT—V:
**Power Plant Economics And Environmental Considerations:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor — related exercises. Effluents from power plants and Impact on environment — pollutants and pollution standards — Methods of Pollution control.
TEXT BOOKS

REFERENCE BOOKS
NOTE: Design Data Book is permitted. Design of all components should include design for strength and rigidity apart from engineering performance requirements.

PRE-REQUISITES: Study of engineering mechanics, design of machine members-I and theory of machines.

COURSE OBJECTIVES:

1. To gain knowledge about designing the commonly used important machine members such as bearings, engine parts, springs, belts, gear etc.
2. To design the components using the data available in design databooks.

COURSE OUTCOMES:

1. ------------

UNIT – I:


UNIT – II:

Rolling contact bearings: Ball and roller bearings – Static load – dynamic load – equivalent radial load – design and selection of ball & roller bearings.

UNIT – III:

Engine Parts: Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – Pistons, Forces acting on piston – Construction, Design and proportions of piston.

UNIT – IV:

Mechanical Springs: Stresses and deflections of helical springs – Extension and

**Belts & Pulleys:** Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives.

**UNIT – V:**

**Gears:** Spur gears & Helical gears - Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for wear.

**TEXT BOOKS**

1. Design of Machine Elements / Spotts/Pearson

**REFERENCE BOOKS**

1. Design of Machine Elements-II / Annaiah / NewAge
2. Design of Machine Elements / Sharma and Purohit/PHI
NOTE: Heat Transfer Data Book is permitted.

PRE-REQUISITE: Thermodynamics.

COURSE OBJECTIVES: To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

COURSE OUTCOME: At the end of this course, student will be able to

1. Understand the basic modes of heat transfer
2. Compute one dimensional steady state heat transfer with and without heat generation
3. Understand and analyze heat transfer through extended surfaces
4. Understand one dimensional transient conduction heat transfer
5. Understand concepts of continuity, momentum and energy equations
6. Interpret and analyze forced and free convective heat transfer
7. Understand the principles of boiling, condensation and radiation heat transfer
8. Design of heat exchangers using LMTD and NTU methods

UNIT – I:

**Introduction:** Modes and mechanisms of heat transfer – Basic laws of heat transfer – General discussion about applications of heat transfer.

**Conduction Heat Transfer:** Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady, and periodic heat transfer – Initial and boundary conditions

**One Dimensional Steady State Conduction Heat Transfer:** Homogeneous slabs, hollow cylinders, and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation
UNIT – II:

**One Dimensional Steady State Conduction Heat Transfer:** Variable Thermal conductivity - systems with heat sources or Heat generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature

**One Dimensional Transient Conduction Heat Transfer:** Systems with negligible internal resistance – Significance of Biot and Fourier Numbers – Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

UNIT – III:

**Convective Heat Transfer:** Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham \( \Pi \) Theorem and method, application for developing semi-empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations – Integral Method as approximate method - Application of Von Karman Integral Momentum Equation for flat plate with different velocity profiles.

**Forced convection: External Flows:** Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer - Flat plates and Cylinders.

UNIT – IV:

**Internal Flows:** Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.

**Free Convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

**Heat Exchangers:** Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT – V:

**Heat Transfer with Phase Change: Boiling:** – Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling. **Condensation:** Film wise and drop wise condensation – Nusselt’s Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

**Radiation Heat Transfer:** Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchoff, Lambert,

**TEXT BOOKS**
2. Heat and Mass Transfer / Altamush Siddiqui/Cengage

**REFERENCE BOOKS**
1. Essential Heat Transfer - Christopher A Long /Pearson
COURSE OBJECTIVES: To understand the concept of world class manufacturing, dynamics of material flow, OPT and Lean manufacturing.

COURSE OUTCOMES: Students should be able to compare the existing industry with WCM companies.

UNIT - I:
**Information Age and Global Competitiveness:*** The Emergence of Information Age; Competition and Business Challenge; Operating Environment; Globalization and International Business; Global Competitiveness and Manufacturing Excellence; World Class Manufacturing and Information Age

UNIT – II:
**Cutting Edge Technology:*** Value Added Engineer in - Hall’s Framework; Schonberger’s Framework of WCM; Gunn’s Model; Maskell’s Model. Philosophy of World Class Manufacturing: Evolution of WCM; Ohno’s View on WCM; Principles and Practices; Quality in WCM; Deming’s & Shingo’s Approach to Quality Management; Culmination of WCM.

UNIT – III:
UNIT – IV:

**Competitive Indian Manufacturing:** Manufacturing Performance and Competitiveness - Indian Firms: Manufacturing Objectives and Strategy; Usage of Management Tools and Technologies; Manufacturing Management Practices; IT Infrastructure and Practices; Strategic Intent Framework; Breadth and Integration of IT Infrastructure.

Globalization and World Class Manufacturing: Generic Manufacturing Strategies for Information Age; Planning Methodology and Issues in Strategic Planning of WCM; Performance Measurement - PO-P System, TOPP System and Ambite System.

UNIT – V:


**TEXT BOOKS**

1. World Class Manufacturing- A Strategic Perspective / BS Sahay, KBS Saxena& Ashish Kumar / Macmillan

**REFERENCE BOOKS**

1. Managing Technology and Innovation for Competitive Advantage / V. K. Narayanan/ Prentice Hall
2. World Class Manufacturing - The Lesson of Simplicity / Richard J Schonberger / Free Press
COURSE OBJECTIVES:

1. Beginners will be able to acquaint themselves with the excited subject though they arenovice, whereas advanced learners will equip themselves to solve the complicatedissues further.
2. To know the importances of the synthesis method addressed in the material properties and give practical experience of nanomaterials synthesis/properties andcharacterization; investigations into the various factors influence the properties ofnanomaterials, optimizing the procedures, and implementations to the new designs.
3. To provide a sound understanding of the various concepts involved in fabrication ofdevice architectures’ and able to evaluate them in advance.

COURSE OUTCOME: The intended course covers the whole spectrum of nanomaterials ranging from introduction, classification, synthesis, properties, and characterization tools of nanophase materials to application including some new developments in various aspects.

UNIT – I:
Introduction to Nano: Importance, Definition and scope, Nano size, challenges, applications. Electrons, Other Materials, Nano magnetism as a case study; Fundamental terms (Physics & Chemistry) in nano-science and technology; Feynman’s perspective; Scaling laws pertaining to mechanics, optics, electromagnetism; Importance of Quantum mechanics, statistical mechanics and chemical kinetics in nano-science and technology;

UNIT – II:
Classification of nano materials: Scientific basis for top-down and bottom-up approaches to synthesize Nanomaterials; How to characterize Nanomaterials.
UNIT – III:
**Tools for Nanoscience and Technology:** Tools for measuring properties of Nanostructures, Tools to Make Nanostructures. Nano scale Bio-structures, modelling

UNIT – IV:
**Nano-Biotechnology:** Bio-molecules; Biosensors; Nanomaterials in drug delivery; Working in clean room environments; Safety and related aspects of Nanomaterials;

UNIT – V:
**Carbon Nanomaterials and Applications:** Carbon Nano structures and types of CarbonNano tubes, growth mechanisms of carbon nanotubes. Carbon clusters and Fullerenes, Lithium & Hydrogen adsorption & storages, Fuel cell applications and energy storage, Chemical Sensors applications of CNTs

**TEXT BOOKS**

**REFERENCES.**
2. Nanoscience and Nanotechnology in engineering – by Vijay K Varadan A Sivathanupillai Word scientific
3. Nanotechnology Applications To Telecommunications And Networking By Daniel Minoli, Wiley Interscience
COURSE OBJECTIVE: To introduce the students about the knowledge of nuclear power generation and supply, reactor design and nuclear power plant.

UNIT- I:

UNIT- II:

UNIT- III :
Reactor Design: Principles, Safety classifications, Seismic quality group, Loading considerations under normal operations, anticipated operational occurrences, design basis accidents such as earthquake, loss of coolant accident (LOCA),blackout, flood, missiles,
operator error, duel failures as applicable, Safety features for server accidents, standards, software, verifications etc.

UNIT- IV:
Nuclear power plants: Types .Thermal reactors: BWR, PWR, PHWR, GCR, APWR, AHWR etc. Fast reactors Breeders; Fusion power; Off-land NPPs:- space power unit, nuclear ships, submarines. Economics of NPPs: Various costs, ROI, Sizing, Operational characteristics.

UNIT- V:

Reactor Stages and Safety Assurances- Nuclear safety assurance.

TEXT BOOKS
2. A.K. Raja, A.P. Srivastava & M. Dwivedi, An Introduction on Nuclear Engineering,

REFERENCE BOOKS
1. Glasstone&Sesons- Nuclear Engineering
2. Arora &Domkundwar, A course in Power Plant Engg-
COURSE OBJECTIVE:

1. To learn the fundamental concepts about solar energy systems and devices.
2. To study the performance of each system in detail along with practical case studies.
3. This course provides an elaborated study about solar energy devices, their working principles, materials and theories related to the same.

COURSE OUTCOME:

1. The fundamental concepts about solar energy systems and devices are incorporated.
2. The performance of the systems along with practical case studies were done.

UNIT I:

UNIT II:

UNIT III:

UNIT IV:
UNIT V:

REFERENCES
UNIT - I:

UNIT - II:
Data, Information and Knowledge; concept of information, need of information (professional, educational, research), qualities of information, value of information, difference between data and information, properties of the needed information. Information and Management; planning, organizing, co-ordinating and controlling.

UNIT - III:
Concepts of marketing; difference between marketing selling and retailing; marketing mix, market-segmentation, marketing planning. Strategy and Approaches; modern concept of marketing.

UNIT - IV:
Community development; concept, definition, meaning, need, history, principles, objectives and scope. Community Building: Coming of Age, Regenerating Community, Community Model.

UNIT - V:
Consensus Organizing Model, What's Behind Building Healthy Communities, Participatory Democracy, The Role of various NGOs in Community Development, The Role of Business and Government in Community Development Initiatives How to Form a Non-profit Corporation Fund Raising and Grant Writing.
REFERENCE BOOKS

1. Rural Technology, (Paperback, English), by Punia Rd Roy, Publisher: Satya Prakashan (2009)
UNIT - I:

UNIT - II:
Combustion in SI Engine- Initiation of combustion, stages of combustion, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, features and design consideration of combustion chambers.- Flame structure and speed, Cycle by cycle variations, Lean burn combustion, stratified charge combustion systems. Heat release correlations. After treatment devices for SI engines.

UNIT - III:
Combustion in CI Engine- Stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl measurement, knock and engine variables, features and design considerations of combustion chambers- delay period correlations, heat release correlations, and influence of the injection system on combustion. Direct and indirect injection systems. After treatment devices for diesel engines.

UNIT - IV:
Combustion in Gas Turbines- Flame stability, re-circulation zone and requirements – Combustion chamber configuration, materials.

UNIT - V:
Emissions- Main pollutants in engines, Kinetics of NO formation, NOx formation in SI and CI engines. Unburned-hydrocarbons, sources, formation in SI and CI engines, Soot formation
and oxidation, Particulates in diesel engines, Emission control measures for SI and CI engines, Effect of emissions on Environment and human beings.

REFERENCE BOOKS
B.Tech. VI Semester. 

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVES: To enable the student to apply conduction, convection and radiation heat transfer concepts to practical applications.

COURSE OUTCOME: At the end of the lab sessions, the student will be able to

1. Perform steady state conduction experiments to estimate thermal conductivity of different materials
2. Perform transient heat conduction experiment
3. Estimate heat transfer coefficients in forced convection, free convection, condensation and correlate with theoretical values
4. Obtain variation of temperature along the length of the pin fin under forced and free convection
5. Perform radiation experiments: Determine surface emissivity of a test plate and Stefan-Boltzmann’s constant and compare with theoretical value

Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
14. Film and Drop wise condensation apparatus.
B.Tech. VI Semester. L/T/P/C 0/0/3/1.5


COURSE OBJECTIVES:
1. Understanding of conventional representations of various materials and machine components.
2. Understanding limits, fits and tolerances and their representation in drawings.
3. Understanding the process of calibration of various instruments.

COURSE OUTCOMES: After completion of this course, the average student is expected to be able to:
1. Understand and prepare the drawing used in manufacturing process.
2. Calibrate the pressure, Strain and displacement measuring instruments.
3. Use the magnetic & speed pickups for the speed measurement.
4. Calibrate of flow measurement by rotameter.
5. Calibrate different instruments used for temperature measurement.

(A) PRODUCTION DRAWING PRACTICE

UNIT – I:
CONVENTIONAL REPRESENTATION OF MATERIALS: conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

LIMITS, FITS AND TOLERANCES: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.

UNIT – II:
FORM AND POSITIONAL TOLERANCES: Introduction and indication of form and position tolerances on drawings, types of run out, total run out and their indication.
UNIT – III:
SURFACE ROUGHNESS AND ITS INDICATION: Definition, types of surface roughness indication – Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

UNIT – IV:
DETAILED AND PART DRAWINGS: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

UNIT – V:
PRODUCTION DRAWING PRACTICE: Part drawings using computer aided drafting by CAD software.

TEXT BOOKS

2. Machine Drawing with Auto CAD/ Pohit and Ghosh, PE.

REFERENCES


(B) INSTRUMENTATION LAB

2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotameter for flow measurement.

10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

11. Study and calibration of Mcleod gauge for low pressure.
COURSE OBJECTIVES: This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve students’ fluency in spoken English
2. To enable them to listen to English spoken at normal conversational speed
3. To help students develop their vocabulary
4. To read and comprehend texts in different contexts
5. To communicate their ideas relevantly and coherently in writing
6. To make students industry-ready
7. To help students acquire behavioral skills for their personal and professional life
8. To respond appropriately in different socio-cultural and professional contexts

COURSE OUTCOMES: Students will be able to:

1. Acquire vocabulary and use it contextually
2. Listen and speak effectively
3. Develop proficiency in academic reading and writing
4. Increase possibilities of job prospects
5. Communicate confidently in formal and informal contexts

Syllabus
The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. Inter-personal Communication and Building Vocabulary - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and
Collocations.

2. **Reading Comprehension** – General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.


4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments…etc.,

5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process,


**Minimum Hardware Requirement**

Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- **Spacious room with appropriate eacoustics**
- **Eight round tables with five movable chairs for each table.**
- **Audio-visual aids**
- **LCD Projector**
- **Public Address system**
- **Computer with suitable configuration**

**Suggested Software:** The software consisting of the prescribed topics elaborated above should be procured and used.

- **Oxford Advanced Learner’s Compass, 8th Edition**
- **DELTA’s key to the Next Generation TOEFL Test: AdvancedSkill Practice.**

**REFERENCES**
