**VIDYA JYOTHI INSTITUTE OF TECHNOLOGY**
An Autonomous Institution
Aziznagar Gate, C.B. Post, Hyderabad - 500 075, Telangana.

**Minutes of the Board of studies (Mech) meeting held on 14th July 2021 at 10.30 AM in Board Room**

The following members were present.

| S.No | Name of the Member | Designation | Signature |
|---|---|---|---|
| 1. | Dr. G. Sreeram Reddy | Chairman | |
| 2. | Dr. M Sreenivasa Rao | JNTUH Nominee | |
| 3. | Dr. K. Kishore | Member | |
| 4. | Dr. K. Sudhakar Reddy | Member | |
| 5. | Dr. C. Udaya Kiran | Member | |
| 6. | Mr. Ayush Nadimpalli | Member | |
| 7. | Ms. A. Swapnika | Member | |
| 8. | Dr. B.V. Reddi | Member | |
| 9. | Dr. V.V.Satyanarayana | Member | |
| 10. | Dr. L. Madan Ananda Kumar | Member | |
| 11. | Dr. B. Ravinder Reddy | Member | |

*PTO*

**Item No. 1: Approval of R20 B.Tech 2nd Year I & II Semesters Syllabi**

a) The Chairperson presented the syllabi of the following subjects of B.Tech II Year I Semester viz.

1. Materials Technology
2. Mechanics of Solids
3. Thermodynamics
4. Production Technology
5. Metallurgy and Mechanics of Solids Lab
6. Production Technology Lab

b) The Chairperson presented the syllabi of the following subjects of B.Tech II Year II Semester viz.

1. Machine Drawing & Drafting
2. Kinematics of Machinery
3. Thermal Engineering
4. Mechanics of Fluids and Hydraulic Machines
5. Mechanics of Fluids and Hydraulic Machines Lab

**Item No. 2: Approval of R20 B.Tech 3rd Year I & II Semesters Syllabi**

a) The Chairperson presented the syllabi of the following subjects of B.Tech III Year I Semester viz.

1. Metrology & Machine Tools
2. Dynamics of Machinery
3. Design of Machine Members-I
4. Applied Thermodynamics
5. Thermal Engineering/ Metrology & Machine Tools lab

b) The Chairperson also presented the syllabi of Professional Electives and Open Electives to be offered during III year I semester viz.

**Professional Elective 1:**

1. Automobile Engineering
2. Mechatronics
3. Additive Manufacturing

**Open Elective 1:**

1. Elements of Mechanical Engineering
2. Product Engineering

c) The Chairperson presented the syllabi of the following subjects of B.Tech III Year II Semester viz.

1. Design of Machine Members-II
2. Heat Transfer
3. Finite Element Method
4. Heat Transfer Lab
5. Computer Aided Engineering Lab

d). The Chairperson also presented the syllabi of Professional Electives to be offered during III year II semester viz.

**Professional Elective 2:**

1. Refrigeration and Air Conditioning
2. Industrial Management
3. Automation in Manufacturing

**Open Elective 2:**

1. Principles of Operations Research
2. Maintenance and Safety Engineering

**Item No. 3: Approval of R20 B.Tech 4th Year I & II Semesters Syllabi**

a) The Chairperson presented the syllabi of the following subjects of B.Tech IV Year I Semester viz.

1. Instrumentation and Control Systems
2. CAD/CAM
3. CAD/CAM Lab
4. Production Drawing Practice and Instrumentation Lab
5. Industry Oriented Mini Project

b). The Chairperson also presented the syllabi of Professional Electives to be offered during IV year I semester viz.

**Professional Elective 3:**

1. Robotics
2. Gas Dynamics
3. Production and Operations Management

**Professional Elective 4:**

1. Operations Research
2. Energy Conservation and Management
3. Fluid Power Systems

**Open Elective 3:**

1. Basic Automobile Engineering
2. Material Science and Engineering

c) The Chairperson presented the syllabi of the following subjects of B.Tech IV Year II Semester viz;.

1. Production Planning and Control
2. Unconventional Machining and Processes

d) Along with this the chairperson also presented the credits related to Technical seminar, Comprehensive Viva –Voce & Major Project work

**Item No.4: Approval of R20 B.Tech 3rd Year II Semesters Syllabi**

The Chairperson presented the syllabi of the following subjects of B.Tech III Year II Semester viz for fast track students

1. Design of Machine Members-II
2. Heat Transfer
3. Finite Element Method
4. Heat Transfer Lab
5. Computer Aided Engineering Lab
6. Production Planning and Control

a). The Chairperson also presented the syllabi of Professional Electives to be offered during III year II semester viz.

**Professional Elective 2:**

1. Refrigeration and Air Conditioning
2. Industrial Management
3. Automation in Manufacturing

**Open Elective 1:**

1. Principles of Operations Research
2. Maintenance and Safety Engineering

**Item No. 5: Approval of R20 B.Tech 4th Year I Semesters Syllabi**

a) The Chairperson presented the syllabi of the following subjects of B.Tech IV Year I Semester viz.for fast track students.

1. Instrumentation and Control Systems
2. CAD/CAM
3. CAD/CAM Lab
4. Production Drawing Practice and Instrumentation Lab
5. Industry Oriented Mini Project
6. Unconventional Machining and Processes

b). The Chairperson also presented the syllabi of Professional Electives to be offered during IV year I semester viz.

**Professional Elective 3:**

1. Robotics
2. Gas Dynamics
3. Production and Operations Management

**Professional Elective 4:**

1. Operations Research
2. Energy Conservation and Management
3. Fluid Power Systems

**Open Elective 3:**

1. Basic Automobile Engineering
2. Material Science and Engineering

**Item No. 6: Approval of Substitute subjects for the students with Regulation change**

The Chairperson emphasized the necessity of change of subjects for the students with Regulation change. He may take appropriate measures to offer required subjects to fulfill the number of credits.

After discussing various aspects of the syllabi the committee passed the following resolution.

**Resolution (1): To approve the Panel of examiners and adding new Courses**

The Chairman BOS is authorized to incorporate new subjects in Professional electives as per the need and he is also authorized to give panel of Examiners for setting Question papers and evaluating the Answer scripts.

**Noted and Approved.**

**Signatures of the Members Present:**

| S.No | Name of the Member | Designation | Signature |
|---|---|---|---|
| 1. | Dr. G. Sreeram Reddy | Chairman | |
| 2. | Dr. M Sreenivasa Rao | JNTUH Nominee | |
| 3. | Dr. K. Kishore | Member | |
| 4. | Dr. K. Sudhakar Reddy | Member | |
| 5. | Dr. C. Udaya Kiran | Member | |
| 6. | Mr. Ayush Nadimpalli | Member | |
| 7. | Ms. A. Swapnika | Member | |
| 8. | Dr. B.V. Reddi | Member | |
| 9. | Dr. V.V.Satyanarayana | Member | |
| 10. | Dr. L. Madan Ananda Kumar | Member | |
| 11. | Dr. B. Ravinder Reddy | Member | |

## B.TECH SECOND YEAR COURSE STRUCTURE & SYLLABUS

### B. Tech. II Year I Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | BS – 5 | Numerical Methods and Partial Differential Equations | 3 | 0 | 0 | 3 |
| 2 | ES – 5 | Materials Technology | 3 | 0 | 0 | 3 |
| 3 | PC – 1 | Mechanics of Solids | 3 | 1 | 0 | 4 |
| 4 | PC – 2 | Thermodynamics | 3 | 0 | 0 | 3 |
| 5 | PC – 3 | Production Technology | 3 | 0 | 0 | 3 |
| 6 | H&S –2 | Professional Communication | 2 | 0 | 0 | 2 |
| 7 | PC Lab – 1 | Metallurgy and Mechanics of Solids Lab | 0 | 0 | 2 | 1 |
| 8 | PC Lab – 2 | Production Technology Lab | 0 | 0 | 2 | 1 |
| 9 | MC – 1 | Environmental Sciences | 2 | 0 | 0 | 0 |
| **Total** | | | **19** | **1** | **4** | **20** |

### B. Tech. II Year II Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | BS – 6 | Probability and Statistics | 3 | 0 | 0 | 3 |
| 2 | ES – 6 | Basic Electrical Engineering | 3 | 0 | 0 | 3 |
| 3 | PC – 4 | Machine Drawing & Drafting | 3 | 0 | 0 | 3 |
| 4. | PC – 5 | Kinematics of Machinery | 3 | 0 | 0 | 3 |
| 5 | PC – 6 | Thermal Engineering | 3 | 0 | 0 | 3 |
| 6 | PC – 7 | Mechanics of Fluids and Hydraulic Machines | 3 | 0 | 0 | 3 |
| 7 | PC Lab – 3 | Mechanics of Fluids and Hydraulic Machines Lab | 0 | 0 | 2 | 1 |
| 8 | PC Lab – 4 | Basic Electrical Engineering Lab | 0 | 0 | 2 | 1 |
| 9 | MC – 2 | Gender Sensitization | 2 | 0 | 0 | 0 |
| **Total** | | | **20** | **0** | **4** | **20** |

## MATERIALS TECHNOLOGY

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:**

1. Understand the structure of metals and constitution of alloys with phases.
2. Understand the basic concepts of phase transformation during solidification and phase diagrams.
3. Understand different heat treatment processes and their influence on properties of metals and alloys.
4. Understand classifications of steels, cast irons and their alloys. Analyze the structure and properties of different non-ferrous metals.
5. Evaluating the applications of composite and ceramic materials.

**UNIT - I**

**Structure of Metals:** Crystal structures-BCC, FCC and HCP, Crystal imperfections – point, line, surface and volume imperfections. Atomic diffusion: Phenomenon, Fick's laws of diffusion, Factors affecting diffusion.

**Mechanical Behavior of Materials:** Stress-Strain diagram for ductile and brittle materials, Fatigue: Description of the phenomenon, S-N diagram. Creep: Description of the phenomenon, creep curve.

**UNIT – II**

**Phase Diagrams:** Necessity of alloying, Hume - Rothery rules, Types of solid solutions, Phase rule. Construction and interpretation of phase diagrams, Lever rule, Binary phase diagrams, Isomorphous, Eutectic, Eutectoid, Peritectic, Peritectectoid transformations with examples. Detailed study of Iron-Carbon phase diagram and different phases with microstructures. Identification of zones of steel and cast iron in the diagram.

**UNIT - III**

**Heat Treatment:** Principles of heat treatment, Annealing, Normalizing, Hardening and Tempering. TTT curves, Continuous Cooling curves, Austempering, Martempering, Hardenability, Effect of Alloying elements.

**UNIT – IV**

**Ferrous Materials:** Classification of steels: Plain, low alloy and high alloy steels including stainless steels, tool steels and die steels. Cast Iron: Properties, composition and uses of grey cast iron, malleable iron, SG iron.

**Non-Ferrous Materials:** Properties, composition and uses of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

**UNIT - V**

**Ceramic Materials and Polymers:** Crystalline ceramics, Cermets: Structure, properties and applications. Classification, Properties and Applications of Polymers.

**Composite Materials and Nanomaterials:** Classification, properties and applications of composites. Nanomaterials

**TEXT BOOK:**


1. Foundations of Materials Science and Engineering, Smith, 4th Edition, McGraw Hill, 2009.


**REFERENCES:**


1. The Science and Engineering of Materials, Donald R. Askland and Pradeep.P.Phule, Cengage Learning, 4lh Ed., 2003.
2. Material Science and Engineering and Introduction, William D. Callister, Wiley, 2006.
3. Materials Science and Engineering, V.Raghavan, PHI, 2002
4. Engineering Materials and Metallurgy, U.C. Jindal, Pearson, 2011.

# MECHANICS OF SOLIDS

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Course Outcomes:**

1. Understand the concepts of stress, strain and material properties. Derive basic stress strain equations with appropriate assumptions.
2. Appreciate the concepts of shear force and bending moments. Generate shear force and bending moment diagrams for any given beam problem.
3. Determine the stresses and strains in the members subjected to bending and shear and interpret the stress distribution across various beams like rectangular, circular, triangular, I, T and angle sections.
4. Calculate and analyze principal stresses and strains. Determine the slope and deflection of beams under different types of loadings.
5. Analyze and compute stresses and strains in thin and thick cylinders

**UNIT – I**

**Simple Stresses & Strains:**

Elasticity and plasticity Types of stresses & strains Hooke's law stress strain diagram for mild steel Working stress Factor of safety Lateral strain, Poisson's ratio & volumetric strain Elastic module & the relationship between them Bars of varying section composite bars Temperature stresses. Strain energy Resilience Gradual, Impact and shock loadings.

**UNIT – II**

**Shear Force and Bending Moment:**

Definition of beam Types of beams Concept of shear force and bending moment S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads Point of contra flexure

**UNIT – III**

**Flexural Stresses:**

Theory of simple bending Assumptions Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis –Determination bending stresses section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections.

**Shear Stresses:**

Derivation of formula Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

**UNIT – IV**

**Principal Stresses and Strains:**

Introduction-stress on an inclined section of a bar under axial loading- compound stresses-Normal and tangential stresses on an inclined plane for biaxial stresses by using Mohr's circle method

**Deflection of Beams:**

Bending into a circular arc slope, deflection and radius of curvature Differential equation for the elastic line of a beam Double integration and Macaulay's methods Determination of slope and deflection for cantilever and simply supported beams subjected to point loads and U.D.L

**UNIT – V**

**Thin Cylinders:**

Thin seamless cylindrical shells Derivation of formula for longitudinal and circumferential stresses hoop, longitudinal and volumetric strains changes in diameter, and volume of thin cylinders

**Thick Cylinders:**

Lame's equation cylinders subjected to inside & outside pressures compound cylinders.

**TEXT BOOK:**

1. Strength of Materials, S.S. Rattan, Mc Graw Hill.

**REFERENCES:**


1. Strength of Materials, R.Subramanian, Oxford University Press.
2. Fundamentals of Solid Mechanics, M.L. Gambhir, PHI.
3. Strength of Materials, R.K. Bansal, Lakshmi Publications.
4. Engineering Mechanics of Solid, Egor P, Popov, PHI New Delhi, 2001

# THERMODYNAMICS

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:**

1. Identify thermodynamic systems, understand concepts of zeroth law, first law, work and heat interactions.
2. State and illustrate second law of thermodynamics. Identify and explain concepts of entropy, enthalpy, specific energy, reversibility, availability and irreversibility.
3. Understand the concepts of phase transformation of pure substance.
4. Appreciate the concepts of perfect gas laws. Analyze mixtures of perfect gases.
5. Understand power cycles and evaluate the performance.

**UNIT – I**

**Introduction: Basic Concepts: S**ystem, Control volume, Surrounding, boundaries, Universe. Types of systems, Macroscopic and Microscopic view points, Concept of Continuum. Thermodynamic Equilibrium, state, Property, Process, Cycle – Reversibility – Quasi – static Process, irreversible process, Causes of irreversibility – Energy in state and Transition, Types , Work and heat, Point and path function. Zeroth Law of Thermodynamics – Concept of quality of temperature – Principles of Thermometry – Reference points – Constant. Volume gas thermometer – Scales of temperature, Ideal gas scale.

**First Law of Thermodynamics** – Corollaries – First law applied to a process – applied to a flow system – Steady flow energy equation.

**UNIT – II**

**Second Law of Thermodynamics** - Limitations of the first law – Thermal Reservoir, Heat pump, Parameters of performance, Second law of thermodynamics, Kelvin planck and Clausius Statements and their Equivalence/ Corollaries, PMM of second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of temperature, Clausius inequality.

**Entropy** - Principle of Entropy increase – Energy equation, Availability and irreversibility – Thermodynamic Potentials, Gibbs and Helmhoultz functions, Maxwell Relations, Tds equations – Elementary Treatment of the third law of thermodynamics.

**UNIT – III**

**Pure Substances** - P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Property tables, Mollier charts – Various thermodynamic processes, Joules Thomson co-efficient – Steam calorimetry.

**UNIT –IV**

**Perfect Gas Laws** – Equation of State, specific and universal Gas constants – various Non-flow processes, properties, end states, Heat and work Transfer, changes in internal energy – Throttling and free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander walls Equation of State – Compressibility charts – variable specific Heats – Gas tables.

**Mixtures of Perfect Gases** – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant. Molecular internal Energy, Enthalpy, specific. Heats and Entropy of Mixture of perfect Gases.

**UNIT – V**

**Power Cycles** : Otto, Diesel and Dual combustion cycles, -- comparison, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis.

**TEXT BOOK:**

1. Engineering Thermodynamics, PK Nag, TMH.

**REFERENCES:**

1. Thermodynamics, an Engineering Approach, YunusCengel& Boles, TMH
2. Thermodynamics, J.P Holman, McGrawHill
3. Engineering Thermodynamics, Jones & Dugan, PHI
4. Engineering thermodynamics, P. Chattopadhyay, Oxford University press

## PRODUCTION TECHNOLOGY

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes:**

1. Understand the basic concepts of casting processes to make different engineering components of industrial applications.
2. Differentiate the types of welding processes and decide which type of process to be selected for any given industrial application.
3. Recognize the differences between hot working and cold working processes and understand the processes of various forging operations.
4. Understand the basic principles of sheet metal operations and known the principles of drawing and extrusion processes.
5. Appreciate the process of high velocity forming and understand different types of plastics.

**UNIT I**

**Casting:** Steps involved in making a casting, Advantages of casting and its applications. Patterns and pattern making types of patterns, materials used for patterns, pattern allowances. Principles of gating gating ratio and design of gating systems, Risers types, function and design. Solidification of casting.Special casting processes centrifugal, die-casting and investment; Fettling of casting, casting defects causes and remedies.

**UNIT II**

**Welding:** classification of welding processes, types of welded joints and their characteristics.
Arc welding – types, gas welding –equipment and types of flames, Resistance welding- types, Solid -state welding – types, Thermit welding.
Heat affected zones in welding, welding defects – causes and remedies, Destructive and Non-destructive tests of welds.

**UNIT III**

**Metal Forming:** hot working and cold working, strain hardening, recovery, recrystallization and grain growth.
**Rolling** – theory of rolling, types of rolling mills and products, forces in rolling and power requirements.
**Forging** – tools and dies, types of forging – smith forging, drop forging, roll forging and rotary forging, forging defects.

**UNIT IV**

**Extrusion and Drawing :** Basic Extrusion process and it's characteristics, hot extrusion and cold extrusion, forward extrusion and backward extrusion, Impact extrusion, Hydrostatic extrusion.
**Drawing and its types** – wire drawing and tube drawing.
Sheet metal operations –spring back effect, stamping operations – blanking, piercing, coining, embossing, bending and spinning.

**UNIT V**

**High Velocity Forming:** Explosive forming, Hydraulic forming, Magnetic pulse forming high velocity forming.

**Plastics:** Types, properties, applications and their processing methods.

**TEXT BOOK:**

1. Manufacturing Technology, P N Rao Vol. 1, TMH.

**REFERENCES:**

1. Production Technology, R K Jain, Khanna.
2. Manufacturing Engineering & Technology, SeropeKalpakjian, Steven R. Schmid, Pearson
3. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems,Mikell P. Groover, Wiley.
4. Workshop Technology, HazraChowdry, Vol.1, Standard Publishers.

## METALLURGY AND MECHANICS OF SOLIDS LAB

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes:**

1. Understand and identify microstructure of metals and measure their mechanical properties.
2. Analyze the microstructure and mechanical properties of metals by applying metallurgical principles.
3. Compare the hardness and mechanical properties of treated and untreated steels tested.

**(A) Metallurgy :**

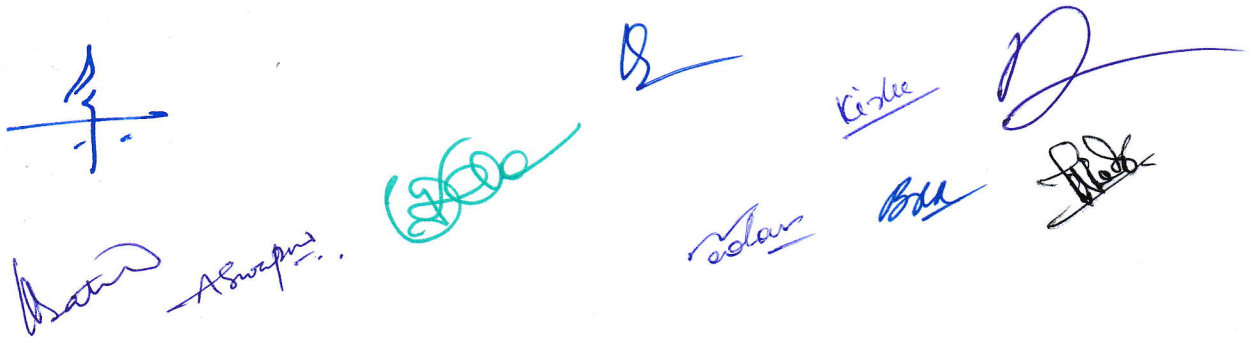
1. Preparation and study of the Microstructure of pure metals like iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steel, low carbon steels, high Carbon steels.
3. Study of the Microstructure of Cast irons.
4. Study of the Microstructure of Non-Ferrous alloys.
5. Study of the Microstructure of Heat treated steels.
6. Hardenability of steels by Jominy End Quench test.
7. To find out the hardness of various treated and untreated steels.

**(B) Mechanics of Solids :**

1. Direct tension test
2. Bending test on
   a) Simple supported b) cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test, b) Rockwell hardness test.
5. Test on springs
6. Impact test

**REFERENCES:**

1. Metallurgy and Material science, Raghavan, Prentice Hall of India (P) ltd.



## PRODUCTION TECHNOLOGY LAB

**B. Tech. II Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Understand the operating methods of welding mechanical press and moulding machines.
2. Measuring the properties of moulding sand.
3. Evaluate the quality of welded joints and products made by mechanical press.

**I. Metal Casting:**

1. Pattern Design and making – for one casting drawing.
2. Sand properties testing – Exercise for strengths and permeability
3. Moulding Melting and Casting

**II. Welding :**

1. Spot Welding
2. Gas Welding
3. Soldering and Brazing

**III. Mechanical Press Working:**

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing.
3. Bending operations.

**IV. Processing of Plastics:**

1. Injection Moulding
2. Blow Moulding

**REFERENCES:**

1. Manufacturing Technology, P.N.Rao,TMH.

# MACHINE DRAWING & DRAFTING

**B. Tech. II Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Prepare the engineering drawings by employing conventional representation.
2. Develop the assembly drawings using part drawings of machine components.
3. Applying the drawing practice using solid works software.

**PART-A:**

**Drawing of Machine Components:**

1. Conventional representation of materials, machine components and popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cotter joints and knuckle joint.
3. Riveted joints for plates : chain and Zig-Zag
4. Shaft couplings: flanged coupling, flexible coupling, universal coupling, oldham coupling
5. Journal, Bushed journal bearing and Foot step bearings.

**PART-B:**

**Assembly Drawing :**

Draw different views of assembly drawings

1. Steam engine parts – stuffing box, steam engine cross head, Eccentric.
2. Machine tool parts: Tail stock, Square Tool Post, Machine Vice.
3. Other machine parts - Screw jack, Pipe vice, Plummer block, Connecting rod.
4. Machine drawing practice using SOLIDWORKS software.

**TEXT BOOK:**

1. Machine Drawing, K.L Narayana, P.Kannaiah&K.Venkata Reddy, New Age publishers.

**REFERENCES:**

1. Machine Drawing, P.S. Gill, Kataria& Sons Publishers
2. Machine Drawing, N.D Bhatt, Charotar
3. Machine Drawing, Ajeet Singh, TMH.
4. A Textbook of Machine Drawing, R. K. Dhawan, S. Chand

## KINEMATICS OF MACHINERY

**B. Tech. II Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand working principles of different lower and higher pairs, mechanisms and their inversions.
2. Mathematical modeling of mechanisms to compute velocity and accelerations of links.
3. Understanding various steering gear mechanisms and Hooke's joint.
4. Appreciate different cams and followers used in mechanical systems.
5. Appreciate the concepts of velocity in gearing systems.

**UNIT-I**

**Mechanisms:** Elements or links Classification Rigid Link, Flexible and fluid link Types of kinematic pairs Types of constrained motion kinetic chain. Mechanism machine Structure inversions of mechanism inversions of quadric cycle chain, single and double slider crank chains, Mechanical advantage Grubler's Criterion.

**Straight-Line Motion Mechanism:** Exact and approximate copied and generated typesPeaucellier Hart Scott Russel Grasshopper Watt Tchebicheff's and Robert Mechanism Pantographs

**UNIT-II**

**Kinematics:** Velocity and acceleration Motion of link in machine Determination of Velocity and acceleration Graphical method Application of relative velocity method.

**Plane Motion of Body:** Instantaneous center of rotation centrodes and axodes ,three centers in the line theorem Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

**UNIT-III**

**Steering Gears:** Conditions for correct steering Davis Steering gear, Ackermann's Steering gear.

**Hooke's Joint:** Single and double Hooke's joint velocity ratio application problems

**UNIT-IV**

**Cams:** Definitions of cam and followers their uses Types of followers and cams Terminology Types of follower motion Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.

**UNIT-V**

**Higher Pair:** Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding.

**Gear Trains:** Introduction– Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box – Differential gear for an automobile.

**TEXT BOOK:**

1. Theory of Machines, Rattan .S.S, TMH, 2009 Edition

**REFERENCES:**

1. Mechanism and Machine Theory, JS Rao and RV Dukkipati, NewAge
2. Theory of Machines and Mechanisms, Joseph E. Shigley, Oxford.
3. Theory of Machines, Thomas Bevan, CBS
4. Theory of Machines,R S Khurmi,S K Gupta,S Chand publications

## THERMAL ENGINEERING

**B. Tech. II Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the concepts of actual cycles and their analysis.
2. Analyze the combustion phenomenon in SI engines.
3. Analyze the combustion phenomenon in CI engines.
4. Understand the testing and performance of IC engines.
5. Know about the alternative fuels and appreciate the recent trends in IC engines.

**UNIT – I**

**I.C. Engines:** Introduction- Classification- Valve and Port Timing Diagrams

**Fuel Air Cycles and Their Analysis**

Introduction- Significance- Composition of cylinder gases- Variable specific heats- Dissociation- Effect of number of moles- Comparison of Air Standard and Fuel Air Cycles- Effect of operating variables

**Actual Cycles and Their Analysis**

Introduction- Comparison between Air Standard and Actual Cycles- Time Loss Factor- Heat Loss Factor- Exhaust blow down- Loss due to Rubbing Friction- Actual and Fuel-Air Cycles of I.C. Engines.

**UNIT – II**

**Combustion in S.I. Engines**

Homogeneous mixture- Heterogeneous mixture- Stages of combustion- Flame front propagation- Factors influencing the flame speed- Rate of pressure rise- Abnormal combustion- Phenomenon of Knock- Types of Combustion chambers- Fuel requirements and fuel rating

**UNIT – III**

**Combustion in C.I Engines**

Combustion process- stages of combustion- Delay period and its importance- Factors affecting Delay period- Diesel Knock- Comparison of Knock in C.I and S.I engine- Combustion chambers in C.I. Engine- Fuel requirements and fuel rating

**UNIT – IV**

**Measurements and Testing**

Friction power- Indicated power- Brake power- Fuel consumption- Air consumption- Speed- Exhaust and Coolant temperature

**Performance Parameters and Characteristics**

Introduction- Engine power- Engine efficiencies- Engine Performance characteristics- Variables affecting Performance characteristics- Methods of improving engine performance- Heat balance

**UNIT-V**

**Fuels**

Classification of fuels- Complete combustion equation- Air fuel ratio and equivalence ratio- Flue gas analysis- Enthalpy of formation- Adiabatic flame temperature

**Alternate Fuels**

Liquid fuels: Alcohol- Methanol- Ethanol- Gaseous fuels: Hydrogen-Natural gas- CNG-LPG

**Recent trends in IC Engines:** HCCI, VTC, VVT, VCR engines

**TEXT BOOK:**

1. I.C Engines, V. Ganesan, TMH

**REFERENCES:**

1. IC Engines, Mathur & Sharma, Dhanpath Rai & Sons.
2. I.C Engines, Heywood, Mc GrawHill.
3. High Speed Combustion Engines, Heldt P.M., Oxford & IBH.
4. Internal Combustion Engines & Air Pollution, R. Yadav, Central Book Publishers

## MECHANICS OF FLUIDS AND HYDRAULIC MACHINES

**B. Tech. II Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand fluid properties and fluid statics.
2. Understand the principles of flow and energy momentum equations.
3. Analyze the losses in pipe flow, boundary layer, separation of flows, forces on different vanes. Able to quantify the flow of fluid in flow measurement instruments.
4. Understand the working of hydraulic machinery and analyze their characteristic curves.
5. Appreciate the working principles of pumps and their applications

**UNIT - I**

**Fluid Properties and Fluid Statics:** Density, Specific weight, Specific gravity, viscosity, Vapour pressure, compressibility, Surface tension Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Hydro static law, Piezometer, Simple and differential manometers.

**UNIT - II**

**Fluid Kinematics:** Stream line, path line, streak line, stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational flows, one, two and three dimensional flows.

**Fluid Dynamics:** Surface and Body forces, Euler's and Bernoulli's equation derivation, Application of Bernoulis Equation: Venturimeter, Orifice meter, Pitot tube, Navier stokes equation (explanation only), Momentum equation applications.

**UNIT - III**

**Close Conduit Flow:** Reynolds Experiment, Darcy's equation, Minor losses - pipes in series, pipes in parallel, total energy line and hydraulic gradient line, numerical problems.

**Boundary Layer Concepts:** Definition, thickness, characteristics along thin plate, laminar and turbulent layers (No Derivation) boundary layer in transition, and separation of boundary layer submerged objects drag and lift.

**UNIT - IV**

**Impact of Water Jets:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and a tip-velocity triangles at inlet and outlet expressions for work done and efficiency, Series vanes, Radial flow turbines.

**Hydraulic Turbines:** Overshot and undershot water wheels, classification of Water turbines, Pelton Wheel, work done and working proportions, Francis, Kaplan turbines, draft tubes, types & its efficiency.

**Performance of Turbines:** Performance under unit head, unit quantities, performance under specific conditions, specific speed, performance characteristic curves, model testing of turbines, cavitation, governing of turbines, surge tanks. Water hammer.

**UNIT - V**

**Centrifugal Pumps:** Types Component parts and working, work done by the impeller, Manometric head losses and efficiencies, minimum starting speed, Specific speed, Multistage Pumps, characteristics curves, NPSH, Cavitation, priming devices, pump troubles and remedies.

**Reciprocating Pumps:** Main components and working of a reciprocating pump, types of reciprocating pumps, power required driving the pump, coefficient of discharge and slipping indicator diagram.

**TEXT BOOK:**

1. Fluid mechanics and Hydraulics Machinery MODI and SETH. Rajsons Publication.

**REFERENCES:**

1. Fluid Mechanics and Fluid Power Engineering, D.S Kumar, Kotaria& Sons.
2. Fluid Mechanics and Machinery, D. Rama Durgaiah, New Age International.
3. Fluid Mechanics, John F.Douglas, Janusz M. Gasiorek, John A. Swaffield, Lynne B. Jack, Pearson
4. Hydraulic Machines, Banga & Sharma, Khanna Publishers.

## MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB

**B. Tech. II Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Test performance of different turbines.
2. Test performance of different pumps.
3. Evaluate the test results of hydraulic machinery with the standard reference values.

**List of Experiments:**

1. Impact of jets on Vanes
2. Performance test on Pelton wheel
3. Performance test on Kaplan Turbine.
4. Performance test on single stage centrifugal pump.
5. Performance test on Multi stage centrifugal pump.
6. Performance test on Reciprocating pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice meter.
9. Determination of friction factor for a given pipe line.
10. Determination of loss of head due to sudden contraction in a pipeline.
11. Verification of Bernoulli's theorems.

**NOTE:** Any 10 of the above experiments are to be performed.

**REFERENCES:**

1. Fluid Mechanics and Fluid Machinery, Modi & Seth, SBH Publication

## B.TECH THIRD YEAR COURSE STRUCTURE & SYLLABUS

### B. Tech. III Year I Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC – 8 | Metrology & Machine Tools | 3 | 0 | 0 | 3 |
| 2 | PC – 9 | Dynamics of Machinery | 3 | 0 | 0 | 3 |
| 3 | PC – 10 | Design of Machine Members-I | 3 | 0 | 0 | 3 |
| 4 | PC -11 | Applied Thermodynamics | 3 | 0 | 0 | 3 |
| 5 | PE – 1 | Automobile Engineering<br>Mechatronics<br>Additive Manufacturing | 3 | 0 | 0 | 3 |
| 6 | OE – 1 | Elements of Mechanical Engineering<br>Product Engineering | 3 | 0 | 0 | 3 |
| 7 | PC Lab - 5 | Thermal Engineering / Metrology & Machine Tools Lab | 0 | 0 | 2 | 1 |
| 8 | H & S- Lab3 | Advanced Communication Skills Lab | 0 | 0 | 2 | 1 |
| 9 | MC – 3 | Personality Development & Behavioural Skills | 2 | 0 | 0 | 1 |
| **Total** | | | **20** | **0** | **4** | **21** |

### B. Tech. III Year II Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC – 12 | Design of Machine Members-II | 3 | 0 | 0 | 3 |
| 2 | PC – 13 | Heat Transfer | 3 | 0 | 0 | 3 |
| 3 | H&S –3 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 4 | PC – 14 | Finite Element Method | 3 | 0 | 0 | 3 |
| 5 | PE – 2 | Refrigeration and Air Conditioning<br>Industrial Management<br>Automation In Manufacturing | 3 | 0 | 0 | 3 |
| 6 | OE – 2 | Principles of Operations Research<br>Maintenance and Safety Engineering | 3 | 0 | 0 | 3 |
| 7 | PC Lab – 6 | Heat Transfer Lab | 0 | 0 | 2 | 1 |
| 8 | PC Lab – 7 | Computer Aided Engineering Lab | 0 | 0 | 2 | 1 |
| 9 | MC – 4 | Quantitative Methods & Logical Reasoning | 2 | 0 | 0 | 1 |
| **Total** | | | **20** | **0** | **4** | **21** |

**B.TECH III Year II Semester (Fast Track)**

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC – 12 | Design of Machine Members-II | 3 | 0 | 0 | 3 |
| 2 | PC – 13 | Heat Transfer | 3 | 0 | 0 | 3 |
| 3 | H&S –3 | Managerial Economics and Financial Analysis | 4 | 0 | 0 | 3 |
| 4 | PC – 14 | Finite Element Method | 3 | 0 | 0 | 3 |
| 5 | PE – 2 | Refrigeration and Air Conditioning | 3 | 0 | 0 | 3 |
| | | Industrial Management | | | | |
| | | Automation In Manufacturing | | | | |
| 6 | OE – 2 | Principles of Operations Research | 3 | 0 | 0 | 3 |
| | | Maintenance and Safety Engineering | | | | |
| 7 | PC Lab – 6 | Heat Transfer Lab | 0 | 0 | 2 | 1 |
| 8 | PC Lab – 7 | Computer Aided Engineering Lab | 0 | 0 | 2 | 1 |
| 9 | MC – 4 | Quantitative Methods & Logical Reasoning | 2 | 0 | 0 | 1 |
| 10 | PC– 18 | Production Planning & Control | 3 | 0 | 0 | 3 |
| **Total** | | | **23** | **0** | **4** | **24** |

## METROLOGY & MACHINE TOOLS

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the mechanics of metal cutting and working principles of lathe machines.
2. Understand the working, classification, specifications and kinematic schemes of shaping, planing, drilling and boring machines.
3. Practicing the operations of milling, grinding, lapping, honing and broaching machines.
4. Understand the concepts of limits, fits and interchangeability. Design of GO and NO GO gauges.
5. Measuring different parameters of surface roughness and the working of Coordinate Measuring Machine.

**UNIT – I**

**Metal Cutting:** Introduction, elements of cutting process orthogonal cutting, merchant circle, oblique cutting, Geometry of single point tools. ASA system. Chip formation and types of chips.
**Engine Lathe:** Principle of working, types of lathe, specifications. Taper turning Lathe attachments. Capstan and Turret lathe Single Spindle and Multi-Spindle automatic lathes tool layouts.

**UNIT – II**

**Drilling and Boring Machines:** Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications.
**Shaping, Slotting and Planning Machines**- Principles of working machining time calculations.

**UNIT – III**

**Milling Machines:** Principles of working Types of milling machines Geometry of milling cutters methods of indexing, machining time calculations.
**Grinding:** Theory of grinding classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, Honing, comparison and Constructional features.

**UNIT – IV**

**Limits, Fits and Tolerances:** Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Limit gauges: Taylor's principle, Design of GO and NO GO gauges. Measurement of angles, Bevel protractor, Sine bar. Measurement of flat surfaces: optical flat, auto collimator.

**UNIT – V**

**Surface Roughness Measurement:** Roughness, Waviness. CLA Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.
**Coordinate Measuring Machines:** Types and Applications of CMM.

**TEXT BOOK:**

1. Manufacturing Technology Vol.2, P.N. Rao, McGraw Hill

**REFERENCES:**

1. Engineering Metrology, M. Mahajan, Danpat Rai Publishers
2. Production Technology, Hindustan Machine Tools, McGraw Hill
3. Principles of Machine Tools, Bhattacharya A and Sen.G.C. New Central Book Agency.
4. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems,Mikell P. Groover, Wiley.

# DYNAMICS OF MACHINERY

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand gyroscopic effects of rotating bodies for aero planes, naval ships, automobiles, and two wheelers. Appreciate the working of brakes and dynamometers.
2. Compute frictional torque in clutches and understand the applications of Governors in mechanical systems.
3. Perform static and dynamic force analysis of planar mechanisms. Diagrammatically represent turning moment and design flywheels.
4. Understand how to balance rotating and reciprocating masses in different planes.
5. Perform calculations pertinent to several parameters of free and forced vibrations.

**UNIT-I**

**Precession:** Gyroscopes, effect of precession, motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

**Brakes and Dynamometers:** Simple block brakes, internal expanding brake, band brake of vehicle, Dynamometers – absorption and transmission types.

**UNIT–II**

**Clutches:** Friction clutches Single Disc or plate clutch, Multiple Disc clutch, Cone clutch, Centrifugal clutch.

**Governors:** Watt, Porter and Proell governors, Sensitiveness, isochronisms and hunting.

**UNIT-III**

**Static and Dynamic Force Analysis of Planar Mechanisms:** Introduction Free Body Diagrams Conditions for equilibrium two, three and four force Members Inertia forces and D' Alembert's Principle planar rotation about a fixed center.

**Fly Wheels** Fluctuation of energy fly wheels and their design.

**UNIT-IV**

**Balancing:** Balancing of rotating masses, single and different planes. Balancing of Reciprocating Masses, Primary and secondary balancing of reciprocating masses. Analytical and graphical methods unbalanced forces and couples Multi cylinder in line and radial engines, balancing of locomotive.

**UNIT-V**

**Vibration:** Free Vibration of mass attached to vertical spring Forced damped vibration, Vibration isolation & Transmissibility Whirling of shafts, critical speeds, Torsional vibrations of two and three rotor systems.

**TEXT BOOK:**

1. Theory of Machines, S.S. Ratan, Mc Graw Hill.

**REFERENCES:**

1. Theory of Machines, Shigley, Mc Graw Hill.
2. Theory of Machines, Thomas Bevan, CBS Publishers
3. Mechanism and Machine Theory, JS Rao and RV Dukkipati ,Newage
4. Theory of Machines,R S Khurmi,S K Gupta,S Chand publications

## DESIGN OF MACHINE MEMBERS-I

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**NOTE:** Design Data books are not permitted in the Examinations.

**Course Outcomes**

1. Understand the design procedure and selection of material for a specific application. Analyze the simple stresses and strains in components.
2. Appreciate variable stresses in mechanical components, fatigue analysis and fatigue theories of failure.
3. Design fastened joints like riveted and welded joints.
4. Design various joints like bolted joints, keys, cotter joints and knuckle joint.
5. Design shafts for strength and rigidity. Design rigid and flexible shaft couplings.

**UNIT – I**

**Introduction:** General considerations in the design of engineering components Materials and their properties selection manufacturing consideration in design.

**Stresses in Machine Members:** Simple stresses Complex stresses impact stresses stress strain relations static theories of failure factor of safety Design for strength and rigidity. The concept of stiffness in tension, bending, torsion and combined situations.

**UNIT – II**

**Stresses Due to Fatigue Loading:** Stress concentration Theoretical stress Concentration factor Fatigue stress concentration factor notch sensitivity Design for fluctuating stresses Endurance limit Estimation of Endurance strength Fatigue theories of failure Goodman and Soderberg.

**UNIT – III**

**Riveted Joints:** Modes 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 bending and torsion eccentrically loaded joints.

**UNIT – IV**

**Bolted Joints:** Design of bolts with pre-stresses Design of joints under eccentric loading bolt of uniform strength, Cylinder cover joints.

**Axially Loaded Joints:** Keys, cotters and Knuckle joints: Design of keys-stresses in keys Cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

**UNIT – V**

**Design of Shafts:** Design of solid and hollow shafts for strength and rigidity Design of shafts for complex loads Shaft sizes BIS code Design of shaft for a gear and belt drives.

**Design of Shaft Couplings:** Rigid couplings Muff, split muff and flange couplings, Flexible couplings Pin Bush coupling.

**TEXT BOOK:**

1. Machine Design, V.Bhandari, TMH Publishers

**REFERENCES:**

1. Machine Design, Pandya &Shah,Charotar Publishing House Pvt. Ltd
2. Machine Design, R.L.Norton, Mc Graw Hill
2. Design of Machine Elements, Kulkarni, Mc Graw Hill.
3. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

## APPLIED THERMODYNAMICS

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Note:** Steam Table Book are Permitted in the Examinations.

**Course Outcomes**

1. Understand the working of steam power plants and boilers.
2. Perform Thermodynamic analysis of nozzles and condensers.
3. Analyze impulse and reaction steam turbines and subsequently apply to real time scenarios.
4. Understand working of different types of compressors and gas turbines.
5. Appreciate different types of propulsive engines and rockets.

**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.

**Boilers:** Classification working principles with sketches including H.P.Boilers Mountings and Accessories Working principle. Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance

**UNIT – II**

**Steam Nozzles:** Function of nozzle Applications and Types- Flow through nozzles-Thermodynamic analysis-Velocity at nozzle exit-Ideal and actual expansion in nozzle-Condition for maximum discharge- Critical pressure ratio- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson Line

**Steam Condensers:** Requirements of steam condensing plant Classification of condensers Working principle of different types-Vacuum efficiency and Condenser efficiency Air leakage, sources and its affects, Air pump- Cooling water requirement

**UNIT – III**

**Steam Turbines: 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

**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**

**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

**Gas Turbines:** Simple gas turbine plant Ideal cycle, essential components Parameters of performance Actual cycle Regeneration, Inter cooling and Reheating Closed and Semi-closed cycles.

**UNIT – V**

**Jet Propulsion:** Principle of Operation Classification of jet propulsive engines Working Principles with schematic diagrams and representation on T-S diagram Thrust, Thrust Power and Propulsion Efficiency Turbo jet engines Needs and Demands met by Turbo jet Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation Methods.

**Rockets:** Application Working Principle Classification Propellant Type Thrust, Propulsive Efficiency Specific Impulse Solid and Liquid propellant Rocket Engines.

**TEXT BOOK:**

1. Thermal Engineering, Rajput, Lakshmi Publications.

**REFERENCES:**

1. Thermodynamics and Heat Engines, R. Yadav, Central Book Depot.
2. Thermal Engineering, Ballaney, Khanna Publications.
3. Gas Turbines, V.Ganesan, TMH.
4. Thermal Engineering, Mahesh M Rathore, Mc Graw Hill

# AUTOMOBILE ENGINEERING

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the components of automobile engines and appreciate the working of lubrication and cooling systems. Know about the fuel systems in SI engine and CI engines.
2. Appreciate the functions and importance of ignition and electrical systems.
3. Elucidate the working principles, types and importance of transmission and suspension systems.
4. Appreciate the working principles, types and importance of braking and steering systems.
5. Understand the environmental implications of automobile emissions and application of various alternative fuels.

**UNIT – I**

**Introduction about Evolution of Modern Automobiles-** Components of four wheeler automobile rear wheel drive, front wheel drive, 4 wheel drivetypes of automobile engines.

**Engine Lubrication System:** Splash and pressure lubrication systems.

**Cooling System:** Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication systemRadiators- Types- Cooling fans- Water pumpThermostatEvaporating cooling- Pressure cooling.

**S.I. Engines:** Fuel supply systems, Mechanical and electrical fuel pump filters carburetor types air filters petrol injection. M.P.F.I system, GDI system

**C.I. Engines:** Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

**UNIT--II**

**Ignition System:** Function of an ignition system, battery ignition system, auto transformer, Magneto coil ignition system, electronic ignition system, spark advance and retard mechanism.

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

**UNIT – III**

**Transmission System:** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel gear boxes, types, sliding mesh, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive, torque converter. Propeller shaft Hotch- Kiss drive, Torque tube drive, universal joint, differential, gear axles types wheels and tyres.

**Suspension System:** Objects of suspension systems rigid axle suspension system, torsion bar, shock absorber, independent suspension system. Chassis-Types-Body of automobile, ergonomics and anthropometry

**UNIT – IV**

**Steering System:** Steering geometry camber, castor, King pin rake, combined angle toe-in, center point steering. Steering gears types, steering linkages.

**Braking System:** Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes- Master cylinder, wheel cylinder, Requirements of brake fluid, Pneumatic, vacuum, parking and hand brakes.

**UNIT – V**

**Pressure Changes in Engines**Super chargers and turbo chargers

**Emission from Automobiles** Pollution standards National and international Pollution control Techniques. Noise pollution and controls. Energy Alternatives, Solar, Photo-Voltaic, hybrid vehicles

**TEXT BOOK:**

1. Automobile Engineering ,Vol. 1 & Vol. 2 , KirpalSingh, Standard Publishers Distributors Delhi

**REFERENCES:**

1. Automotive Mechanics,G.B.S.Narang, Khanna Publishers
2. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication
3. Automotive Mechanics , J.Heitner, CBS Publications
4. Automobile Engineering, William Crouse, TMHILL Publishers.

# MECHATRONICS

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

On completion of the course, the student will be able to:

1. interpret the importance of mechatronics and elements involved.
2. evolve at various drives for typical applications in mechatronics
3. understand various drives and circuits
4. predict the importance and functioning of various electronic components.
5. choose various mechatronic elements to design mechatronics based systems

**UNIT – I**

Introduction to mechanization & automation. Need of interface of electrical & electronic devices with mechanical elements. The concept of Mechantronics: Flow chart of mechatronics system. Elements of mechatronics system. Drive mechanisms. Actuators. Feedback devices and control system. Application in industries and systems development.

**UNIT – II**

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems. Introduction to electrical actuators: A.C servo motors, D.C. servomotors, stepper motors.

**UNIT – III**

Introduction to fluid power systems: Industrial pneumatics and hydraulics. Merits of fluid power. Pneumatic and hydraulic elements symbols. Study of hydraulic control values, pumps & accessories. Hydraulic circuits and mechanical servo control circuits, Electro– hydraulic and Hydro – pneumatic circuits.

**UNIT – IV**

Introduction to industrial electronic devices: Diodes, Transistors, Silicon controlled Rectifiers (SCR), Integrated Circuits (IC), Digital circuits. Measurement systems & Data acquisition systems: sensors, digital to analog and analog– to– digital conversion. Signal processing using operational amplifiers. Introduction to micro processor & micro controller. Temperature measurement interface and LVDT interface. Systems Response.

**UNIT – V**

Design of Modern CNC machines and elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems. Flexible manufacturing systems. Multipurpose control machines. PLC programming

**TEXT BOOK:**

1. W. Bolton, "Mechatronics", 3rd Ed., Pearson Education India

**REFERENCES:**

1. HMT Limited, "Mechatronics, Tata Mc.Graw– Hill Publishing Company Limited; New Delhi, 1998.
2. Michael B Histand & David G. Alciatore, "Introduction to Mechatronics and Measurement systems", 4th Ed., Tata McGraw-Hill International edition, 2012
3. S.R Majumdar, Oil hydraulic systems– Principles & Maintenance, Tata McGraw–Hill Publishing CompanyLimited: New Delhi, 2006

# ADDITIVE MANUFACTURING

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the working principle and process parameters of AM processes
2. Understand data formats of additive manufacturing
3. Appreciate Liquid-Based and Solid-Based additive manufacturing systems.
4. Apply the rudiments of Powder Based additive manufacturing Systems
5. Evaluate the applications of additive manufacturing in the industry

**UNIT – I**

**Introduction to Additive Manufacturing:** Introduction to AM, Distinction between AM & CNC machining, Steps in AM, ASTM Classification of AM processes, Advantages of AM and Types of materials for AM.

**UNIT – II**

**AM Data Formats:** STL file format (Binary and ASCII), Tessellation, Anisotropy.

**STL File Problems:** Unit changing, Vertex-to-vertex rule, Leaking STL files and Degenerated facets.

**STL file printing parameters:** Top and Bottom layers, Infill types and Shell thickness.

**UNIT – III**

**Vat Photopolymerization AM Processes:** Stereolithography(SL), working principle, photopolymers,applications, Process Benefits and Drawbacks.

**Material Jetting** and **Binder Jetting AM** Processes.

**Extrusion-Based AM Processes:** Fused Deposition Modelling (FDM), working principle, Materials,Process Modelling, and Applications.

**UNIT – IV**

**Powder Bed Fusion AM Processes:** Selective laser Sintering (SLS), working principle, Materials, SLS Metal and ceramic part creation,

**Electron Beam melting (EBM)**process, Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

**Directed Energy Deposition AM Processes:** working principle and applications of Laser Engineered Net Shaping (LENS) and Direct Metal Deposition (DMD) processes.

**UNIT –V**

**AM Applications:** Application in Engineering, Aerospace Industry, Automotive Industry and Jewelry Industry. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices.

**TEXT BOOK:**


1. Additive Manufacturing Technologies - Ian Gibson, David Rosen, Brent Stucker and Mahyar Khorasani, Springer publications.


**REFERENCES:**


1. Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou L.W. and Liou F.W, CRC Press, 2007.
2. Rapid Prototyping & Engineering Applications, Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.
3. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001
4. Rapid Prototyping: Principles and Applications - Chua C.K., Leong,World Scientific Publishing Co Pvt. Ltd.

## ELEMENTS OF MECHANICAL ENGINEERING

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the basic concepts of mechanical engineering.
2. Apply principles of engineering mechanics in mechanism and machines
3. Develop manufacturing methods to produce engineering components.
4. Evaluate alternative designs for the engineering components
5. Select a suitable type of automation applicable for any industry.

**UNIT-I**

**Thermal Engineering Basic Concepts:** Zeroth Law of Thermodynamics First law of Thermodynamics- Second Law of Thermodynamics Boyles Law Charles Law Thermodynamic processes Otto cycle Diesel cycle- Four stroke petrol and diesel engines. Brake Power, Indicated Power, Mechanical efficiency, Air Refrigeration, Vapour Compression Refrigeration.

**UNIT-II**

**Theory of Machines :** Types of Gears and Geartrains Transmission of power by Belts, Ropes and Chain drives Cams and Followers. Free Vibration of mass attached to vertical spring Oscillation of pendulums Transverse loads.

**UNIT-III**

**Production Technology :** Metal Casting Sand Casting, Molten metal Pouring, Welding Arc Welding, Gas Welding, Brazing, Soldering. Metal Forming Forging, Drawing, Extrustion. Metal Cutting Lathe, Drilling, Milling operations.

**UNIT-IV**

**Introduction To Design:** Elasticity and plasticity, Types of stresses and strains, Hooke's law stress strain diagram for mildsteel, Working stress Factor of Safety, LateralStrain, Poisson's ratio and volumetric strain Temperature stresses.

**UNIT-V**

**Automation and Robotics :** Introduction to Automation in Manufacturing, CIM, CAD, CAM, CNC, Robots in industry, Robot Anatomy, Robot Configurations, Advantages, Disadvantages and Applications of robots.

**TEXT BOOKS:**

1. Fundamentals of Mechanical Engineering, Pravin Kumar, Pearson, second edition.

**REFERENCES:**

1. Elements of Mechanical Engineering, V. M. Manglik, PHI
2. Theory of Machines, Rattan .S.S, TMH, 2009 Edition.
3. Elements of Mechanical Engineering, Mathur M.L. & F.S. Mehta & Tewari, Jain Brothers Publishers.
4. Elements of Mechanical Engineering, Mathur M.L. & F.S. Mehta & Tewari, Jain Brothers Publishers

## PRODUCT ENGINEERING

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Illustrate creativity and study the techniques of innovation
2. Assess the evaluation techniques for screening ideas
3. Differentiate the IPR-Patents, Design patents, copy right and trade mark and their laws.
4. Describe the interaction between design, manufacture, quality and testing
5. Establish the machining time in various cutting operations; value engineering; GT and concepts of concurrent engineering.

**UNIT – I:** Product Design and Process Design functions. Selection of right product. Systematic procedure of product innovation. Factors contributing to successful technological innovation – need for creativity and innovation. Techniques of innovation like brain storming and Delphi techniques.

**UNIT – II:** Project selection and evaluation: Function of design – Design with Human Machine Interaction (HMI), Collection of ideas and purpose of project. Selection criteria – screening ideas for new products using evaluation techniques. Principles of ergonomics.

**UNIT – III:** New Product Development: Research and new product development. Patents, definitions, patent search, patent laws, international code for patents – Intellectual Property Rights (IPR).

**UNIT – IV:** New Product Planning: Interaction between the functions of design, manufacture, quality, testing, and marketing. Steps for introducing new products after evaluation.

**UNIT – V:** Process Planning: Process planning, process sheets, Selection of manufacturing process, estimation of machining time in various cutting operations – estimation of costs for manufacture. Value engineering in product design, group technology, concepts of concurrent engineering.

**Textbook:**

1. Chitale AK & Gupta R.C, Product Design & Manufacturing, – Prentice Hall of India, 1997.

**Reference Books:**


1. Niebel BW & Draper AB, Production Design & Process Engg., Mc Graw Hill Kogakusha, 1974.
2. Harry Nystrom, Creativity and Innovation, Jhon Wiley & Sons, 1979.
3. Brain Twiss, Managing Technological Innovation, Pittman Publ. 1992.
4. Harry, B. Waton, New Product Planning, Prentice Hall Inc., 1992.

## THERMAL ENGINEERING LAB/ METROLOGY & MACHINE TOOLS LAB

**B. Tech. III Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Understand the assembly/disassembly and their working of IC engines for performance measurement.
2. Evaluate performance parameters for consequent applications.
3. Perform the machining operations and the measurement of samples using instruments.

**List of Experiments:**

**SECTION – A**

1. Performance Test on Single Cylinder 4 Stroke Petrol Engine
2. Evaluate of Engine Friction by Conducting Morse Test on 4 Stroke Multi Cylinder Petrol Engine
3. Heat Balance Test on Single Cylinder 4 Stroke Diesel Engine
4. Evaluation of Performance and Combustion Characteristics of Duel Fuel Automotive CRDI Engine
5. Performance Test on Reciprocating Air-Compressor Unit
6. Disassembly/ Assembly of Engine

**SECTION – B**

1. Measurement of Bores by Internal Micrometers and Dial Bore Indicators
2. Angle and Taper Measurements by Bevel Protractor & Sine Bars
3. Thread Measurement by Two Wire / Three Wire Method or Tool Makers' Microscope
4. Step Turning, Taper Turning, Thread Cutting and Knurling on Lathe Machine
5. Shaping, Slotting and Planning
6. Drilling, Tapping and Surface Grinding

**REFERENCES:**


1. Automobile Engineering,Vol. 1 & Vol. 2,KirpalSingh,Standard Publishers Distributors Delhi
2. Engineering Metrology, I C Gupta, Danpath Rai

## DESIGN OF MACHINE MEMBERS – II

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**NOTE:** Design Data books are permitted in the Examinations

**Course Outcomes**

1. Understand different sliding contact and rolling contact bearings and perform design calculations
2. Analyze design considerations of IC engine parts like piston, connecting rod and cylinder
3. Appraise the design aspects of belt drives and springs
4. Design spur gear drives by calculating different parameters
5. Compute design parameters of helical gear drives

**UNIT – I**

**Sliding Contact Bearings:** Types of Journal bearings basic modes of Lubrication Bearing construction bearing design bearing materials Selection of lubricants.

**Rolling Contact Bearings:** Types of rolling contact bearings selection of bearing type selection of bearing life Design for cyclic loads and speeds Static and dynamic loading of ball & roller bearings.

**UNIT – II**

**Design of IC Engine Parts:** Design of 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, Cylinder, Cylinder liners.

**UNIT – III**

**Design of Belt and Rope Drives:** Transmission of power by Belt and Rope drives, Transmission efficiencies, Flat and VBelts

**Helical Springs:** Design of springs, Stress in springs, Deflection of Springs in series, parallel conditions, composite springs

**UNIT – IV**

**Design of Spur Gear Drives:** Spur gears Load concentration factor Dynamic load factor, Surface compressive strength Bending strength Design analysis of Spur gears check for plastic deformation, Check for dynamic and wear considerations.

**UNIT – V**

**Design of Helical Gear Drives:** Helical gears Load concentration factor Dynamic load factor, Surface compressive strength Bending strength Design analysis ofHelical gears check for plastic deformation, Check for dynamic and wear considerations.

**TEXT BOOK:**

1. Machine Design, V.Bhandari, TMH Publishers

**REFERENCES:**

1. Machine Design, Pandya& Shah, Charotar Publishing House Pvt. Ltd.
2. Machine Design, R.L.Norton, McGraw Hill
3. Mechanical Engineering Design, Bahi and Goel, Standard Publications.
4. Shigley's Mechanical Engineering Design, Richard G. Budynas, J. Keith Nisbett, Mc Graw Hill.

# HEAT TRANSFER

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the basic modes of heat transfer, steady and unsteady periodic heat transfer.
2. Solve 1-D problems of steady state and transient conduction heat transfer.
3. Appreciate concepts of convective heat transfer process and evaluate heat transfer coefficient for free and forced convection over exterior and interior surfaces with proper boundary conditions.
4. Applying the boiling and condensation principles in the heat transfer equipment design.
5. Analyze the performance of heat exchangers by LMTD and NTU methods. Appreciate radiation heat transfer scenarios.

**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's law of conduction 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 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 Chart solutions of transient conduction systems Concept of Functional body.

**UNIT – III**

**Convective Heat Transfer:** Classification of systems based on causation of flow, condition of flow, 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.

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

**Internal Flows:** Concepts of hydrodynamic and thermal entry lengths – Division of internal flow based on this – Use of empirical relations for horizontal pipe flow and annulus flow.

**UNIT – IV**

**Free Convection:** Development of hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for vertical plates and pipes

**Boiling and Condensation:** Pool boiling – Regimes Calculations on Nucleate boiling, Critical Heat flux and Film boiling. Film wise and Drop wise condensation on vertical and horizontal cylinders using empirical correlations.

**UNIT – V**

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

**Radiation Heat Transfer:** Emission characteristics and laws of black-body radiation irradiation total and monochromatic quantities laws of Planck, Wien, Kirchoff, Lambert, Stefen and Boltzmann heat exchange between two black body's concepts of shape factor Emissivity heat exchange between grey bodies radiation shields electrical analogy for radiation networks.

**TEXT BOOK:**

1. Heat and Mass Transfer, R.K.Rajput, S.Chand Publications

**REFERENCES:**

1. Heat Transfer A Practical Approach Yunus Cengel, Boles, Mc GrawHill.
2. Heat Transfer ,P.K.Nag , TMH
3. Fundamentals of Engg. Heat and Mass Transfer, R.C.Sachdeva, New Age International.
4. Heat and Mass Transfer, D. S Kumar ,S.K.Kataria& Sons

## FINITE ELEMENT METHOD

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the basics of FEM, stress-strain relations and gain knowledge of Weighted Residual Methods and Variational Methods.
2. Solve 1-D problems by applying the pertinent boundary conditions.
3. Analyze and formulate finite element equations for 1-D planar truss element and beam element.
4. Solve 2-D problems using CST element and integration using Numerical Integration method.
5. Analyze and solve 1-D and 2-D heat transfer problems using FEM. Formulate Finite element equations for a stepped bar and a beam using dynamic analysis.

**UNIT – I**

**Introduction To FEM:** Basic concepts, historical background, Steps in FEM, applications of FEM, comparison of FEM with other methods, Basic equations of elasticity, Stress Strain and strain displacement relations, Rayleigh Ritz method, Galarkin's method, Problems.

**UNIT – II**

**One Dimensional Problems:** Shape functions,Stiffness matrix for a axial bar element, Assembly of Global stiffness matrix, properties of stiffness matrix, Finite element analysis of stepped and tapered bars subjected to mechanical and thermal loads, Quadratic shape functions, Problems.

**UNIT – III**

**Analysis of Trusses:** Finite Element Analysis of Trusses, Stiffness matrix of truss element, load vector, Problems.

**Analysis of Beams:** Analysis of 2-noded beam element with 2-DOF at each node, Hermite shape functions, stiffness matrix, load vector, problems with point load and uniformly distributed load.

**UNIT – IV**

**2-D Structural Problems:** CST element, Stiffness matrix and load vector for CST element, Introduction to LST element, Problems.

Isoparametricelement representation, Shape functions, Convergence requirements,two dimensional four-nodedisoparametric elements, Numerical integration, Problems.

**UNIT – V**

**Analysis of Heat Transfer Problems:** 1-D Heat conduction with lateral and edge convection, fin and composite wall analysis, 2-D heat transfer analysis, Problems.

**Dynamic Analysis:** Dynamic equations, Lumped and consistent mass matrices, Eigen Values and Eigen Vectors, mode shapes, Problems on stepped bars and beams.

**TEXT BOOK:**

1. Introduction to Finite Elements in Engineering, Tirupathi K. Chandrupatla and Ashok D. Belagundu, Pearson .

**REFERENCES:**

1. The Finite Element Methods in Engineering, S.S.Rao, Elsevier, Pergamon
2. Finite Element Methods, Alavala, TMH
3. An Introduction to Finite Element Methods, J.N. Reddy, Mc Grawhill
4. Concepts and Applications of Finite Element Analysis – Robert Cook – Wiley

FEM – Desai

## REFRIGERATION AND AIR CONDITIONING

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the basic concepts of refrigeration and thermodynamically analyze air refrigeration systems.
2. Appreciate the working principle and thermodynamically analyze vapor compression refrigeration system.
3. Understand the working principles of vapor absorption and steam jet refrigeration systems.
4. Estimate the air conditioning load for comfort and industrial applications by applying the principles of psychrometry and design conditions.
5. Appraise Air Conditioning Systems and calculate the Cooling Load.

**UNIT – I**

**Introduction to Refrigeration:** Necessity and applications Unit of refrigeration and C.O.P. Mechanical Refrigeration, Ideal cycle of refrigeration.

**Air Refrigeration:** Bell Coleman cycle - Brayton Cycle - Open and Dense air refrigeration cycleAir craft cooling systems.

**UNIT – II**

**Vapour Compression Refrigeration:** Introduction working of simple VCR cycle - Representation of cycle on T-S and p-h charts Effect of sub cooling and super heating Actual VCR cycle Problems.

**System Components: Compressors** General classification working principles **Condensers** classification Working Principles, **Evaporators** classification Working Principles, **Expansion Devices -**Types Working Principles.

**Refrigerants:** Classification - Desirable properties commonly used refrigerants - Nomenclature.

**UNIT III:**

**Vapor Absorption System:** Introduction Description and working of $NH_3$- Water system, Calculation of Maximum COP Water - Li-Br absorption system Triple Fluid absorption system.

**Steam Jet Refrigeration System:** Introduction Working Advantages and Disadvantages.

**UNIT IV:**

**Psychometric:** Introduction Psychometric terms Psychometric processes.

**Inside and Outside Design Conditions:** Introduction Selection of inside design conditions Selection of outside design conditions.

**UNIT – V:**

**Psychrometry of Air Conditioning Systems:** Introduction- Summer Air conditioning system Winter Air conditioning system- All year air conditioning system.

Unitary refrigerant based systems.

**Cooling Load Calculations:** Introduction- Estimation of required cooling capacity.

**TEXT BOOK:**

1. A Course in Refrigeration and Air conditioning, SC Arora &Domkundwar, Dhanpatrai

**REFERENCES:**

1. Principles of Refrigeration, Dossat, Pearson Education.
2. Refrigeration and Air Conditioning, CP Arora, TMH.
3. Refrigeration and Air Conditioning , RS Khurmi and JK Gupta, S.CHAND Publication
4. Refrigeration and Air Conditioning, Manohar Prasad, New Age.

# INDUSTRIAL MANAGEMENT

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understanding the principles of management.
2. Compare various organizational structures for effective management
3. Apply the concepts of production management concepts
4. Evaluate the project in terms of time and method of execution for better quality
5. Applying the modern management concepts with scheduling techniques

**UNIT - I**

**Introduction to Management:** Entrepreneurship and organization – Nature and Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management

**UNIT - II**

**Designing Organizational Structures:** Departmentalization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.

**UNIT - III**

**Operations Management:** Objectives- product design process- Process selection-Types of production system (Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout- Line balancing (RPW method) Value analysis-Definition-types of values- Objectives- Phases of value analysis- Fast diagram

**UNIT - IV**

**Work Study:** Introduction — definition — objectives — steps in work study — Method study — definition, objectives — steps of method study. Work Measurement — purpose — types of study — stop watch methods — steps — key rating — allowances — standard time calculations — work sampling. Statistical Quality Control: variables-attributes, Shewart control charts for variables- chart, R chart, – Attributes- Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems), Acceptance Sampling- Single sampling- Double sampling plans-OC curves.

**UNIT - V**

**Job Evaluation:** Methods of job evaluation — simple routing objective systems — classification method factor comparison method, point method, benefits of job evaluation and limitations. Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review

Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems)

**TEXT BOOK:**

1 Industrial Engineering and Management/O.P. Khanna/Khanna Publishers

**REFERENCES:**


1. Industrial Engineering and Management Science/T.R. Banga and S.C. Sarma/Khanna Publishers.
2. Motion and Time Study by Ralph M Barnes! John Willey & Sons Work Study by ILO.
3. Human factors in Engineering & Design/Ernest J McCormick /TMH.
4. Production & Operation Management /Paneer Selvam/PHI

# AUTOMATION IN MANUFACTURING

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Summarize the facets of automation in a manufacturing activity.
2. Applying various elements like sensors, pneumatics, and hydraulics to append in manufacturing automation.
3. Design the assembly lines by considering the on line process analysis.
4. Evaluate the automation elements for low cost automation investment.
5. Applying the automation concepts in automobile and manufacturing sectors

**UNIT-I**

**Introduction to Automation:** Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

**UNIT-II**

**Introduction to Material Handling:** Overview of Material Handling Equipment, Considerations in Material Handling System Design, Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

**UNIT -III**

**Manual Assembly Lines:** Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

**UNIT-IV**

**Transfer Lines:** Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

**UNIT-V**

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

**TEXT BOOK:**

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover, Pearson Eduction.

**REFERENCES:**


1. Industrial Automation, W.P.David, John Wiley and Sons.
2. CAD / CAM/ CIM, Radhakrishnan,New Age International.
3. Automation, Buckinghsm W, Haper& Row Publishers, New York, 1961
4. CAD CAM: Principles, Practice and Manufacturing Management, Chris Mc Mohan, Jimmie Browne,Pearson edu. (LPE).

## PRINCIPLES OF OPERATIONS RESEARCH

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Model the real life situations with mathematical models. Understand the concept of linear programming.
2. Solve transportation and assignment problems.
3. Apply theory of games and queuing concepts for optimization.
4. Formulate the sequencing of jobs on machines. Understand the various replacement concepts. Identify and apply various inventory models.
5. Appraise dynamic programming models and simulation principles.

**UNIT – I**

**Introduction:** Definition, historic developments of operation research, Characteristics and phases, Types of operation Research models, applications. Allocation:

**Linear Programming Method:** Problem formulation, Graphical solution, Simplex method, Artificial variables Techniques, Two – phase method, Big-M method, Duality principle.

**UNIT – II**

**Transportation Problem:** Formulation, Optimal solution, unbalanced transportation problem, Degeneracy, Assignment problem, Formulation, Optimal solution, Variants of Assignment Problem, Travelling salesman problem.

**UNIT – III**

**Theory of Games:** Introduction, Minimax (maximin), Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, dominance principle, m X 2 & 2 X n games, graphical method.

**Waiting Lines:** Introduction, Single Channel, Poisson arrivals exponential service times, with infinite population and finite population models, Multichannel, Poisson arrivals, exponential service times with infinite population.

**UNIT – IV**

**Sequencing:** Introduction, Flow–Shop sequencing n jobs through two machines n jobs through three machines, Job shop sequencing, two jobs through 'm' machines.

**Inventory:** Introduction, Single item, Deterministic models, Purchase inventory models with one price break and multiple price breaks, shortages are not allowed, Stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, Single period model.

**UNIT – V**

**Replacement:** Introduction, Replacement of items that deteriorate with time, when money value is counted, Replacement of items that fail completely, group replacement

**Simulation:** Definition, Types of simulation models, phases of simulation, applications of simulation, inventory and Queuing problems, Advantages and Disadvantages, Brief introduction of simulation languages.

**TEXT BOOK:**

1. Operations Research, S.D.Sharma, Kedarnath publications

**REFERENCES:**

1. Operations Research, A.M. Natarajan, P.Balasubramani, A.Tamilarasi, Pearson
2. Operations Research, J.K. Sharma, MacMilan
3. Operations Research: Methods & Problems, Maurice Saseini, ArhurYaspan& Lawrence Friedman.
4. Operations Research, R.Pannerselvam, PHI Publications

## MAINTENANCE AND SAFETY ENGINEERING

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the need for maintenance in an industry and know about Maintenance Management and Control.
2. Appreciate and implement various types of maintenance.
3. Know the concept of inventory control in maintenance.
4. Evaluate the quality and cost of safety and maintenance.
5. Appraise the concepts of reliability and maintainability with reference to the maintenance of equipment.

**UNIT – I**

**Introduction:** Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance strategy for the 21st Century Engineering Maintenance Objectives and Maintenance in Equipment Life cycle, Terms and Definitions.

**Maintenance Management and Control:** Maintenance Manual Maintenance, Facility Evaluation Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control indices.

**UNIT – II**

**Types of Maintenance:** Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program, PM Program Evaluation and improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

**UNIT – III**

**Inventory Control in Maintenance:** Inventory Control Objectives and Basic inventory Decisions, ABC inventory Control Models Two Bin inventory Control and Safety Stock, spares Determination Factors spares calculation methods.

**UNIT – IV**

**Quality and Safety in Maintenance:** Needs for Quality Maintenance Processes, Maintenance Work Quality, Use of Quality Control Charts in Maintenance Work Sampling, Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

**Maintenance Costing:** Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

**UNIT – V**

**Reliability, Reliability Centered Maintenance, RCM:** Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement indicators, RCM Benefits and Reasons for its Failures, Reliability Versus Maintenance and Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

**Maintainability:** Maintainability importance and Objective, Maintainability in Systems Life Cycle, Maintainability Design Characteristics, Maintainability Functions and Measures, Common Maintainability Design Errors.

**TEXT BOOK:**

1. Engineering Maintenance a modern approach, B. S. Dhallon, C.R.R Publishers

**REFERENCES:**

1. Reliability, Maintenance and Safety Engineering, Dr. A.K Guptha, Laxmi Publications.
2. Reliability Engineering, Elsayed, Pearson
3. Industrial Safety Engineering, Garg, Danpathrai Publishers
4. Industrial Safety Management, L.M.Deshmukh, TMH

## HEAT TRANSFER LAB

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Understand the structural features of heat transfer equipment and their mode of working.
2. Analyze the output responses by comparing with the heat transfer governing equations.
3. Evaluate the process parameters for designing the heat transfer devices.

**LIST OF EXPERIMENTS**

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.
7. Heat Transfer in forced convection apparatus.
8. Heat Transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Study of Two Phase flow.

**REFERENCES:**

1. Fundamentals of Heat Transfer & Mass Transfer, Incropera& Dewitt, John Wiley Pub.

## COMPUTER AIDED ENGINEERING LAB

**B. Tech. III Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Build FE models of mechanical components under various loading conditions.
2. Understand conductive and convective heat transfer analysis of 1-D & 2-D components.
3. Evaluate Modal analysis of beams, plates and shells for natural frequencies and mode shapes with different elements

**List of Experiments**

1. Introduction to modeling in ANSYS workbench.
2. Analysis of bar problems to determine nodal displacements and stresses.
3. Analysis of Plane Truss to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading.
4. Analysis of Spatial Truss to determine member forces, member strains & stresses, joint deflections under static, thermal and combined loading.
5. Analysis of Beam to determine the shear force and bending moment when subjected to a point load.
6. Analysis of Beam to determine the shear force and bending moment when subjected to a UDL.
7. Determine the nodal stresses for a given axi-symmetric problem.
8. Analyzing the temperature distribution in a 2-D problem subjected to conduction & convection.
9. Determining the Natural frequencies and different modes for a bar problem.
10. Analyzing the stresses for a given 3D component.

## B.TECH FOURTH YEAR COURSE STRUCTURE & SYLLABUS

### B. Tech. IV Year I Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC - 15 | Instrumentation and Control Systems | 3 | 0 | 0 | 3 |
| 2 | PC - 16 | CAD/CAM | 3 | 0 | 0 | 3 |
| 3 | PE - 3 | Robotics | 3 | 0 | 0 | 3 |
| | | Gas Dynamics | | | | |
| | | Production And Operations Management | | | | |
| 4 | PE - 4 | Operations Research | 3 | 0 | 0 | 3 |
| | | Energy Conservation And Management | | | | |
| | | Fluid Power Systems | | | | |
| 5 | OE - 3 | Basic Automobile Engineering | 3 | 0 | 0 | 3 |
| | | Material Science and Engineering | | | | |
| 6 | PC Lab - 8 | CAD/CAM Lab | 0 | 0 | 2 | 1 |
| 7 | PC Lab - 9 | Production Drawing Practice and Instrumentation Lab | 0 | 0 | 2 | 1 |
| 8 | PC-17 | Industry Oriented Mini Project | 0 | 0 | 0 | 3 |
| **Total** | | | **15** | **0** | **4** | **20** |

### B. Tech. IV Year II Semester

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC– 18 | Production Planning & Control | 3 | 0 | 0 | 3 |
| 2 | PC – 19 | Unconventional Machining And Processes | 3 | 0 | 0 | 3 |
| 3 | PC– 20 | Technical Seminar | 3 | 1 | 0 | 2 |
| 4 | PC – 21 | Comprehensive Viva Voce | 0 | 0 | 0 | 2 |
| 5 | PC– 22 | Major Project | 0 | 0 | 0 | 10 |
| **Total** | | | **9** | **1** | **0** | **20** |

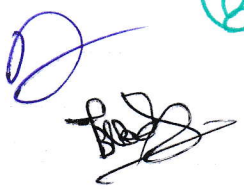
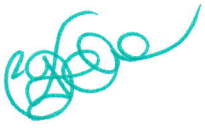
## B. Tech. IV Year I Semester (Fast Track)

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC - 15 | Instrumentation and Control Systems | 3 | 0 | 0 | 3 |
| 2 | PC - 16 | CAD/CAM | 3 | 0 | 0 | 3 |
| 3 | PE - 3 | Robotics | 3 | 0 | 0 | 3 |
| | | Gas Dynamics | | | | |
| | | Production And Operations Management | | | | |
| 4 | PE - 4 | Operations Research | 3 | 0 | 0 | 3 |
| | | Energy Conservation And Management | | | | |
| | | Fluid Power Systems | | | | |
| 5 | OE - 3 | Basic Automobile Engineering | 3 | 0 | 0 | 3 |
| | | Material Science and Engineering | | | | |
| 6 | PC Lab - 8 | CAD/CAM Lab | 0 | 0 | 2 | 1 |
| 7 | PC Lab - 9 | Production Drawing Practice and Instrumentation Control Systems Lab | 0 | 0 | 2 | 1 |
| 8 | PC-17 | Industry Oriented Mini Project | 0 | 0 | 0 | 3 |
| 9 | PC – 19 | Unconventional Machining And Processes | 3 | 0 | 0 | 3 |
| **Total** | | | **18** | **0** | **4** | **23** |

## B. Tech. IV Year II Semester (Fast Track)

| S. No. | Course Category | Course Title | L | T | P | Credits |
|---|---|---|---|---|---|---|
| 1 | PC– 20 | Technical Seminar | 3 | 1 | 0 | 2 |
| 2 | PC – 21 | Comprehensive Viva Voce | 0 | 0 | 0 | 2 |
| 3 | PC– 22 | Major Project | 0 | 0 | 0 | 10 |
| **Total** | | | **3** | **1** | **0** | **14** |




# INSTRUMENTATION AND CONTROL SYSTEMS

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Define basic terms related to measurements, understand displacement measurement techniques.
2. Understand working principles of pressure and temperature measuring instruments.
3. Appraise the working of various flow, level, and speed measurement instruments.
4. Model and analyze acceleration, vibration, stress, strain, force, torque and power measuring methods.
5. Understand control systems and their applications.

**UNIT – I**

**Definition** Basic principles of measurement systems, instrument-classifications, generalized configuration and functional descriptions of measuring instruments examples. Static and Dynamic performance characteristics input and output configuration of measuring instruments, calibration, sources of error, classification and elimination of error.

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement Piezo electric, inductive capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

**UNIT – II**

**Measurement of Temperature:** Classification ranges various principles of measurement Expansion, pressure thermometers, Electrical thermometers, Thermistors Thermocouples-laws of thermocouples Pyrometers.

**Measurement of Pressure:** Units classification different principles used. Manometers, Bourdon pressure gauges, Bellows pressure gauges Diaphragm gauges, Dead weight tester.

**Low Pressure Measurement:** Thermal conductivity gauges ionization pressure gauges, McLeod pressure gauges.

**UNIT – III**

**Measurement of Level:** Direct method indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators Bubbler level indicators.

**Flow Measurement:** Rota meter, magnetic, ultrasonic, Turbine flow meters, hot wire anemometer, Laser Doppler Anemometer (LDA).

**Measurement of Speed:** Mechanical tachometers Electrical tachometers Stroboscope, Non-contact type of tachometers.

**UNIT – IV**

**Measurement of Acceleration and Vibration:** Different simple instruments Principles of seismic instruments Vibrometer and accelerometer using this principle

**Stress Strain Measurements:** Various types of stress and strain measurements electrical strain gauges gauge factor method of usage of resistance strain gauge for bending compressive and tensile strains usage for measuring torque, strain gauge Rosettes, temperature compensation in strain gauges.

**UNIT – V**

**Control Systems:**

Open and closed loop translation and rotational elements of a mechanical system, Pneumatic control systems, Hydraulic control systems. Representation of Control Components and Systems, Mechanical Accelerometer.

**TEXT BOOK:**

1. Mechanical Measurements & Control by D.S.Kumar, Metropolitan Book Co. (P) Ltd.

**REFERENCES:**

1. Mechanical Measurement and Instrumentation by A.K.Sawhney&Dhanpat Rai Publications
2. Instrumentation & Mechanical Measurements by A.K.Tayal, Galotia Publications.
3. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
4. Instrumentation, Measurement & Analysis by B.C.Nakra&K.K.Choudhary, TMH

# CAD/CAM

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Appreciate CAD/CAM principles and know the various input and output peripherals of computers. Understand concepts of computer graphics.
2. Develop mathematical models to represent curves, surfaces and solids.
3. Understand numerical control systems and develop CNC part programs. Appraise the rudiments of Group Technology.
4. Understand Computer Aided Quality Control and Computer Integrated Manufacturing Systems.
5. Applying FMS concepts for production of engineering components.

**UNIT – I**

**Introduction:** Computers in industrial manufacturing, Product cycle, CAD/CAM hardware basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

**Computer Graphics:** Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 2D and 3D transformations, viewing transformation, mathematics of projections, windowing and clipping, hidden surface removal.

**UNIT – II**

**Geometric Modeling:** Requirements, Geometric models, Curve representation methods, Surface representation methods, modeling facilities desired.

**CAD Standards-** Graphical kernel system, standards for exchange images, open graphics library, data exchange standards- IGES, STEP, and CALS etc.

**UNIT – III**

**Numerical Control:** NC, NC modes, NC machine tools structure of CNC machine tools, features of machining center, turning center, CNC part programming: Fundamentals, manual part programming methods, computer aided part programming.

**Group Technology:** Part family, coding and classification, production flow analysis, advantages and limitations, computer aided processes panning, retrieval type and generative type.

**UNIT – IV**

**Computer Aided Quality Control:** Terminology in quality control, computer applications, contact inspection methods, noncontact inspection methods Optical, Noncontact, and inspection methods non optical, Computer aided testing, integration of CAQC with CAD/CAM.

**Computer Integrated Manufacturing Systems:** Types of manufacturing systems, Machine tools and related equipment, computer control systems, human labour in the manufacturing systems, CIMS benefits.

**UNIT – V**

**Flexible Manufacturing Systems:** Introduction, Main Objectives, FMS Equipment, Tool Management system, System layouts, FMS control

**TEXT BOOK:**

1. CAD/CAM Principles and Applications, P.N. Rao, Mc Graw Hill.

**REFERENCES:**


1. CAD/CAM: Computer- Aided Design and Manufacturing, Mikell P.Groover, Emory. W.Zimmers, Pearson Education India, 1984.
2. CAD/CAM: Theory and Practice, Ibrahim Zeid, R Sivasubramanian, Mc Graw-Hill.
3. Automation, Production Systems & Computer Integrated Manufacturing", P. Groover, Pearson Education, 2016
4. Computer Numerical Control Concepts and Programming, Warren S. Seames, Vengage Learning, 2007.

# ROBOTICS

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

After completion of the course, student will be able to:

1. Understand the basic concepts of robotics and know the components of industrial robots.
2. Derive forward and inverse kinematic models for robots.
3. Decide upon the selection of actuators and sensors for robots.
4. Appreciate different programming techniques and languages for robots.
5. Comprehend industrial applications and work cell design of robots.

**UNIT – I**

**Introduction:** Automation and Robotics, Overview of Robotics, Classification of robots by coordinate system and control systems, Components of industrial robots, Advantages, disadvantages of and applications of robots.

**End Effectors:** Classification of end effectors, Types and working principles of grippers, General considerations of gripper selection and design, Different tools used as end effectors.

**UNIT – II**

**Motion Analysis:** Basic translation and rotation matrices, Transformations, Composite transformations, Homogeneous transformation, Problems.

**Manipulator Kinematics:** Joint coordinates and world coordinates, forward and inverse kinematics of position and orientation, Problems.

**UNIT – III**

**Robot Actuators:** Introduction, Working principles, applications, advantages and limitations of Pneumatic, Hydraulic and Electric Actuators.

**Robot Sensors:** Classification of sensors, working principles of different types of sensors like position, velocity, tactile, proximity sensors etc.

**UNIT – IV**

**Robot Programming:** Methods of Robot Programming, Leadthrough Programming Methods, Motion Interpolation, Wait, Signal, and Delay Commands, Branching, Capabilities and Limitations of Leadthrough Methods.

**Robot Languages:** The Textual Robot Languages, Generations of Robot Programming Languages, Robot Language Structure, Robot Language Elements and Functions.

**UNIT – V**

**Industrial Applications of Robots:** Robot Applications in Manufacturing: Material handling, Processing, Assembly & Inspection.

**Robot Cell Design:** Robot workcells, robot-centered cell, in-line robot cell & mobile robot cell, multiple robots and machine interference, considerations in workcell design.

**TEXT BOOK:**

1. Industrial Robotics (Technology, Programming and Applications), Mikell P. Groover, Tata McGraw Hill Education Private Limited.

**REFERENCES:**

1. Introduction to Robotics: Analysis, Control and Applications, Saeed Benjamin Niku, John Wiley & Sons.

2. Robotics and Control, R.K. Mittal & I.J. Nagrath, Tata McGraw Hill Publishing Company Limited.

3. Introduction to Robotics: Mechanics and Control, John J. Craig, Pearson Education International.

4. Robotics: Control, Sensing, Vision and Intelligence, K.S.Fu, R.C.Gonzalez & C.S.G.Lee, McGraw Hill Education.

# GAS DYNAMICS

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understanding the features of different flows.
2. Comparing the flow in different cross sectional arcos.
3. Apply gas dynamics principles to Jet propulsion system.
4. Evaluate the effects with and without shocks during flow.
5. Designing the aviation components using gas dynamics principles

**UNIT-I**

**Introduction:** Concept of continuum and control volume, continuity equation, momentum equation, streamline, steady, one dimensional dynamic equation of a fluid flow with and without friction, energy equation. Basic concepts of compressible flow. Properties of atmosphere, Standard atmosphere, Relative pressure, use of air and gas tables. Condition for neglecting compressibility. Compressible flow, acoustic velocity, Mach number, Mach cone, Mach angle.

**UNIT-II**

**Isentropic Flow:** Stagnation enthalpy, density, pressure and temperature, local acoustic speed, maximum speed, variation of Compressibility with mach number.

**UNIT-III**

**Variable Area Flow:** Criteria for acceleration and deceleration, critical condition, nozzle discharge co-efficient, nozzle efficiency, operation of nozzles under varying back pressures.

**Flow in Constant Area Duct:** Adiabatic and isothermal-flow calculation of pressure, temperature, density, Mach number relationships, Limiting length of duct for adiabatic and isothermal flow, Fanno line, Diabatic flow, Flow of perfect gases in constant area duct with heat exchange, density temperature, pressure and mach number relationships, Limiting conditions, Rayleigh line.

**UNIT-IV**

**Wave Phenomenon:** Pressure disturbances in compressible fluid, type of shock waves normal, shock pressure density-velocity-temperature and Mach number relations for a plane normal shock-Shock tube-mach reflection- thin area prandtl theory.

**UNIT-V**

**Shock:** Shock intensity-Rayleigh-Pilot and Prandtl-Pitot equation for normal shock, introduction to oblique shockwaves and hypersonic flow- fenno flow.

**TEXT BOOK:**

1. Fundamentals of Compressible flow, S.M. Yahya, New Age International.

**REFERENCES:**

1. Gas Dynamics, E.Radha Krishnan, P.H.I Publication.
2. Gas Dynamics for engineers, P.Balachandran, PHI, Easterr Economy Edition.
3. Gas Dynamics and Jet propulsion, S L Somasundaram, New age International Publishers.
4. Gas Dynamics, H.W.Lipman and A.Rashkho, John Wiley.

## PRODUCTION OPERATION AND MANAGEMENT

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the importance of production and operations management for getting the competitive edge.
2. Analyze the factors effecting plant location and the volume of production to be made.
3. Apply the value engineering and work study method to standardize the manufacturing activity.
4. Evaluate the project management techniques to improve overall productivity.
5. Designing the production systems with the effective PPC principles

**UNIT-I:**

**Overview of Production & Operations Management (POM):** Introduction-Definition Importance-Historical Development of POM-POM scenario today

**Product & Process Design:** Role of product development- Product development process-Tools for efficient product development- Determination of process characteristics- Types of processes and operations systems- Continuous Intermittent-Technology issues in process design- Flexible Manufacturing Systems- Automated Material Handling Systems

**UNIT –II:**

**Value Analysis:** Definition-Objectives-Types of Values-PhasesTools -FAST diagram-Steps-Advantages-Matrix method-Steps.

**Plant Location& Plant Layout:** Factors affecting locations decisions-Location planning methods-Location factor rating -Centre of Gravity method-Load distance method. Plant layout-Definition-Objectives-Types of layouts-Design of product layout-Line balance-Terminology-RPW method.

**UNIT- III:**

**Aggregate Planning:** Definition- Objectives-Basic strategies for aggregate production planning-Aggregate production planning method-Transportation model- Master Production Scheduling. Material Requirement Planning: Terminology-Logic-Lot sizing methods-Advantages & Limitations

**UNIT – IV:**

**Work Study:** Work study: method study definition-objectives-steps-Charts used Work measurement-Time study- Definition-steps- Determination of standard time- Performance rating- Allowances. Work sampling- steps- comparison with time study.

**Quality Management:** Economics of quality assurance-Control charts for variables and for attributes Acceptance sampling plans-Total Quality Management-ISO 9000 series standards-Six sigma

**UNIT – V:**

**Scheduling:** Need-basis for scheduling- Scheduling rules- Flow shop & Job shop scheduling. Line of Balance.

**Project Management:** PERT- Critical path determination- Probability of completing project in a given time- CPM- Types of floats- Critical path determination- Crashing of simple networks- Optimum project schedule.

**TEXT BOOK:**

1. Operations Management: Theory and Practice, B.Mahadevan, Pearson.

**REFERENCES:**

1.Modern Production and Operations Management, Buffa, Wiley
2.Theory and Problems in Production and Operations Management, SN Chary, TMH.
3.Industrial Engineering and Management, Dr.Ravi Shankar, Galgotia Publications.
4.Operations Management 8e Process and Value Chains, Lee Krajewskiet,Pearson

## OPERATIONS RESEARCH

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Model the real life situations with mathematical models. Understand the concept of linear programming.
2. Solve transportation and assignment problems.
3. Understand the various waiting lines and replacement concepts.
4. Identify and apply game theory and inventory models.
5. Apply Sequencing shop floor problems and network scheduling models.

**UNIT – I**

**Development** Definition, historic developments of operation research, Characteristics and Phases Types of models Operations Research models applications.

**Allocation:** Linear Programming Problem Formulation Graphical solution Simplex method Artificial variables techniques: Two phase method, Big-M method; Duality Principle.

**UNIT – II**

**Transportation Problem:** Formulation Optimal solution, unbalanced transportation problem Degeneracy.

**Assignment Problem:** Formulation Optimal solution Variants of Assignment Problem; Traveling Salesman problem.

**UNIT – III**

**Replacement:** Introduction Replacement of items that deteriorate with time when money value is not counted and counted Replacement of items that fail completely- Group Replacement.

**Waiting Lines:** Introduction Terminology-Single Channel Poisson arrivals and Exponential Service times with infinite population and finite population models.

**UNIT – IV**

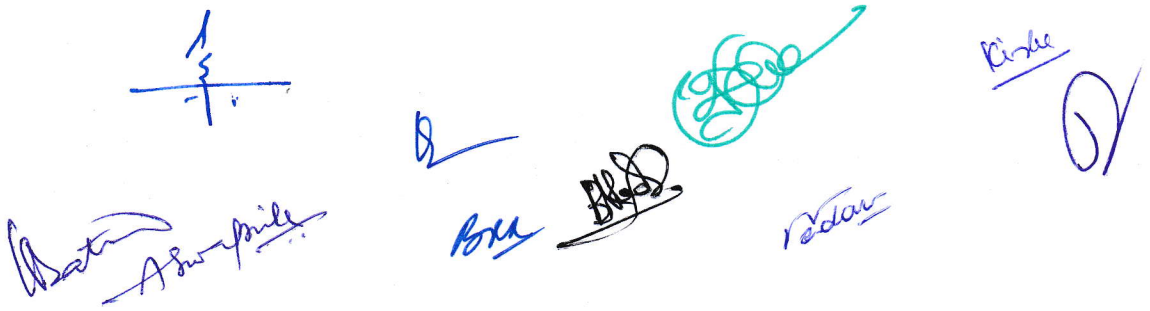
**Theory of Games:** Introduction Terminology Solution of games with saddle points and without saddle points- 2 x 2 games m x 2 & 2 x n games graphical method m x n games dominance principle.

**Inventory:** Introduction Single item, Deterministic models Types Purchase inventory models with one price break and multiple price breaks stochastic models demand discrete variable or continuous variable Single Period model with no setup cost.

**UNIT – V**

**Sequencing:** Introduction Flow Shop sequencing n jobs through two machines n jobs through three machines two jobs through 'm' machines

**Network Scheduling:** Critical path method, Programme evaluation and review technique, crashing of networks, resource leveling.



**TEXT BOOK:**

1. Operations Research, S.D.Sharma, Kedarnath

**REFERENCES:**


1. Operations Research, A.M. Natarajan, P. Balasubramaniam, A. Tamilarasi, Pearson.
2. Operations Research, Wagner, PHI Publications
3. Operations Research: Methods and Problems, Maurice Saseini, ArhurYaspan and Lawrence Friedman, Literary Licensing Publishers
4. Operations Research, ACS Kumar, Yesdee Publications

# ENERGY CONSERVATION AND MANAGEMENT

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the energy data to carry out audit.
2. Identifying the electrical, thermal and other systems with their energy consumption.
3. Perform energy audit of consumption of industries.
4. Evaluate the energy consumption of units by the economic concepts.
5. Designing the mechanical systems employing energy conservation principles

**UNIT -I**

**Introduction**

Energy Power Past & Present scenario of World; National Energy consumption Data Environmental aspects associated with energy utilization Energy Auditing: Need, Type s, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

**UNIT- II**

**Electrical Systems**

Components of EB billing HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors Motor Efficiency Computation, Energy Efficient Motors, Illumination Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

**UNIT- III**

**Thermal Systems**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters Efficiency computation and encon measures. Steam: Distribution & U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

**UNIT- IV**

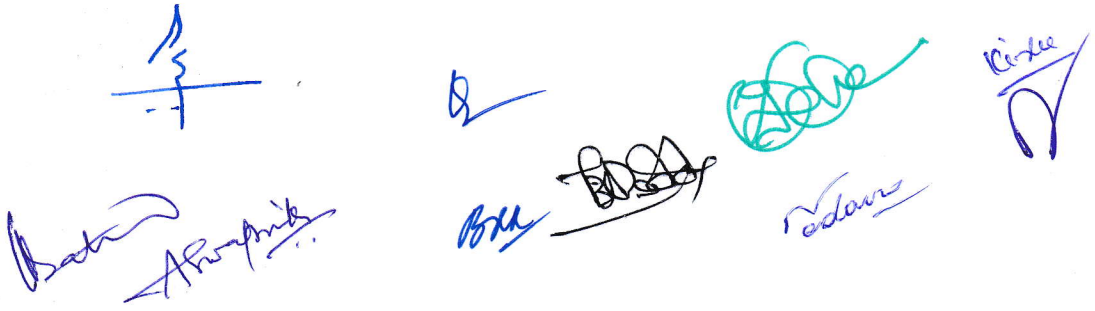
**Energy Conservation in Major Utilities**

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems Cooling Towers D.G. sets

**UNIT-V**

**Economics**

Energy Economics Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, LifeCycle Costing ESCO concept



**TEXT BOOK:**

1. Industrial Energy Management and Utilisation, Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publ, Washington, 1988.

**REFERENCES:**


1. The Efficient Use of Energy, Dryden. I.G.C., Butterworths, London, 1982
2. Energy Management Hand book, Turner. W.C., Wiley, New York, 1982.
3. Design and Management for Energy Conservation, Callaghn, P.W, Pergamon Press, Oxford, 1981.
4. Energy Management, Murphy. W.R. and G. Mc KAY, Butterworths, London 1987.

# FLUID POWER SYSTEMS

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the properties fluid and fluid power systems.
2. Apply accessories and valves in the systems for effective functioning.
3. Design and analyze typical hydraulic circuits.
4. Evaluate the systems with different control units.
5. Designing the modern fluid power systems with the hydraulic principles

**UNIT-I**

**Introduction to Oil Hydraulics and Pneumatics:** Structure, advantages and limitations. ISO symbols, energy losses in hydraulic systems. Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis. Performance curves and parameters.

**UNIT-II**

**Hydraulic Actuators:** Types and constructional details, lever systems, control elements direction, pressure and flow control valves. Valve configurations, General valve analysis, valve lap, flow forces and lateral forces on spool valves. Series and parallel pressure compensation flow control valves. Flapper valve Analysis and Design.

**UNIT-III**

**Control Valves and Servo Valves:** Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities). Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.

**UNIT-IV**

**Meter-in & Meter-out Circuits:** Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system, Filtration systems and maintenance of system. Components of pneumatic systems; Direction, flow and pressure control valves in pneumatic systems. Development of single and multiple actuator circuits. Valves for logic functions; Time delay valve; Exhaust and supply air throttling;

**UNIT-V**

**Control Systems:** Examples of typical circuits using Displacement Time and Travel-Step diagrams. Will-dependent control, Travel-dependent control and Time-dependent control, combined control, Program Control, Electro-pneumatic control and air-hydraulic control, Ladder diagrams. Applications in Assembly, Feeding, Metalworking, materials handling and plastics working.

**TEXT BOOK:**

1. Fundamentals of Fluid Power Control, John Watton, 1st Ed. Cambridge University Press,

**REFERENCES:**


1. Hydraulic Operation and Control of Machine Tools, Ian Mencal, Ronald Press.
2. Hydraulic and Pneumatic Power for Production, Sterwart, Industrial Press.
3. Fluid Power with Applications, Anthony Esposito, Pearson Education.
4. Fundamentals of Pneumatics/Electro Pneumatics ,Hasebrink J.P., and Kobler R., FESTO Didactic publication No. 7301, Esslingen Germany, 1979.

# BASIC AUTOMOBILE ENGINEERING

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understanding the basic structure of an automobile.
2. Evaluating different cooling and lubrication systems of an automobile
3. Analyzing the electrical systems in tandem with ignition systems
4. Understand various transmission and suspension systems.
5. Appraise steering and braking systems. Understand emission norms of automobiles.

**UNIT-I**

**Introduction:** Types of automobile engines.

**S.I. Engine:** Fuel supply systems, Mechanical and electrical fuel pump, filters, carburetor, types, air filters, petrol injection. M.P.F.I system

**C.I. engines:** Requirements of diesel injection systems, types of injection systems, Common Rail Diesel injection- fuel pump, nozzle, spray formation, injection timing.

**UNIT-II**

**Engine Lubrication System:** Splash and pressure lubrication systems.

**Cooling System:** Cooling requirements, Air cooling, liquid cooling, Thermo, Water and forced lubrication system, Radiators: Types, Cooling fans.

**UNIT-III**

**Ignition System:** Battery ignition system, Magneto coil ignition system, electronic ignition system. Battery, Contact breakers, Spark plugs.

**Electrical System:** Charging circuit, generator, current, voltage regulator, starting system, bendix drive mechanism solenoid switch, lighting system, Horn, Wiper, fuel gauge.

**UNIT-IV**

**Transmission System:** Clutches, types-cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches – gear boxes, types. Propeller shaft, Hotch- Kiss drive, Torque tube drive.

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

**UNIT-V**

**Steering System:** Steering geometry, camber, castor, King pin rake, combined angle toe-in, center point steering.

**Braking System:** Mechanical brake system, Hydraulic brake system, Disc and Drum type Brakes.

**Emission from Automobiles:** Pollution standards National and international, Pollution control Techniques. Noise pollution and controls.

**TEXT BOOK:**

1. Automobile Engineering ,Vol. 1 & Vol. 2,Kirpal Singh,Standard Publishers Distributors Delhi

**REFERENCES:**

1. Automotive Mechanics,G.B.S.Narang, Khanna Publishers.
2. Automotive Mechanics,J.Heitner, CBS Publications.
3. Automobile Engineering , Vol. 1 & Vol. 2 , K.M Gupta, Umesh publication
4. Automobile Engineering, William Crouse, TMHILL Publishers.

## MATERIAL SCIENCE AND ENGINEERING

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand structure of metals and constitution of alloys.
2. Appraise equilibrium diagrams of various alloys.
3. Classify steels, cast irons and their alloys.
4. Appreciate different heat treatment processes and their influence on properties of metals and alloys. Know different Non-ferrous Metals and Alloys.
5. Apply the knowledge of composite and ceramic materials to replace metals and alloys wherever applicable.

**UNIT – I**

**Structure of Metals:** Bonds in Solids Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal/ alloys determination of grain size. Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

**UNIT –II**

**Equilibrium of Diagrams:** Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-$Fe_3C$.

**UNIT –III**

**Cast Irons and Steels:** Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

**UNIT – IV**

**Heat Treatment of Alloys:** Effect of alloying elements on Fe-$Fe_3C$ system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

**UNIT – V**

**Ceramic Materials:** Crystalline ceramics, glasses, cermets, abrasive materials, Nanomaterials definition, properties and applications of the above.

**Composite Materials:** Classification of composites, various methods of component manufacture of composites, particle reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C C composites.

**TEXT BOOK:**

1. Foundations of Materials Science and Engineering, Smith, 4th Edition, McGraw Hill, 2009.

**REFERENCES:**


1. Introduction to Physical Metallurgy, Sidney H. Avener, Mc Graw Hill
2. Material Science & Engineering, V. Rahghavan, PHI
3. Science of Engineering Materials, Agarwal
4. An Introduction To Material Science, W.G.vinas & HL Mancini, Princeton University Press

## CAD/CAM LAB

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Understand the usage of relevant software and the syntax of CNC part program.
2. Develop the 2D, 3D models and conduct the analysis.
3. Evaluate the veracity between manual part program and the automated part program.

### I. PART MODELLING

a) Generate a 3D Model using Solid Works (Extrude command) as per diagram

b) Generate a 3D Model using Solid Works (Revolve, sweep command) as per diagram.

c) Generate a Surface Model using Solid Works as per diagram.

### II. ASSEMBLY MODELING

a) Generate an Assembly Model of Stuffing Box .

b) Generate an Assembly Model of Screw Jack .

### III. MANUFACTURING

a) Introduction to CNC Simulation software.

b) ) Develop a part programme for CNC turning using simulating software as per the given diagram and manufacture on CNC Lathe.

c) ) Develop a part programme for CNC milling using simulating software as per the given diagram and manufacture on CNC Mill.

**Software Packages:** SOLIDWORKS, ANSYS, CAM Software

## PRODUCTION DRAWING PRACTICE AND INSTRUMENTATION LAB

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 2 | 1 |

**Course Outcomes**

1. Understanding the symbols and their representation on drawings.
2. Calibrate the measuring devices and analyze the errors in measurement.
3. Evaluate the instruments in terms of accuracy and precision.

**PRACTICE-I**

Conventional representation of materials conventional representation of parts screw joints, Springs, Gears, Electrical, Hydraulic and Pneumatic circuits methods of indicating notes on drawings.

**PRACTICE-II**

Limits and fits: Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables.

**PRACTICE-III**

Form and positional Tolerances: introduction and indication of the tolerances of form and position on drawings, deformation of run out and total run out and their indication.

**PRACTICE-IV**

Surface roughness and its indication: Definitions, finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

**PRACTICE-V**

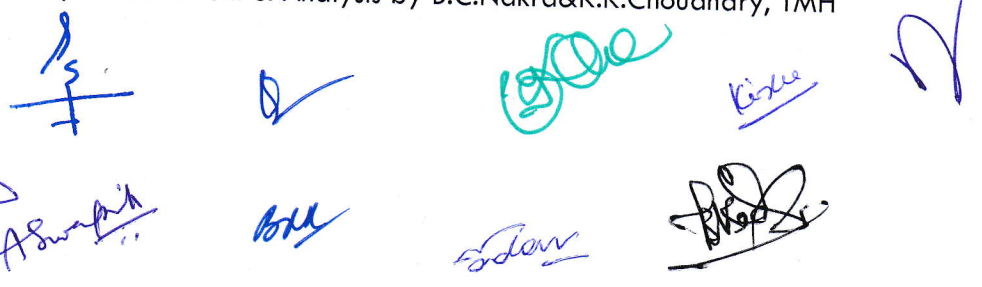
Heat treatment and surface treatment symbol used on drawings. Detailed and part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

**INSTRUMENTATION LAB:**

1. Calibration of pressure gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for load measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
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

**REFERENCES:**


1. Measurement Systems: Applications & Design, E.O.Doebelin, Mc Graw Hill
2. Instrumentation, Measurement & Analysis by B.C.Nakra&K.K.Choudhary, TMH

## INDUSTRY ORIENTED MINI PROJECT

**B. Tech. IV Year I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 0 | 3 |

**Course Outcomes**

1. Apply the engineering principles in the execution of a sub system under mechanical engineering domain.
2. Predict and solve the related issues of the sub system.
3. Evaluate the effectiveness of the sub systems the light of technical, ethical and other standards.

The students in a group of 4 to 5 works on an industry oriented topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

## PRODUCTION PLANNING & CONTROL

**B. Tech. IV Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the basic concepts of production planning and control.
2. Appreciate principles and importance of forecasting techniques.
3. Analysis of various inventory management and control systems. Plan the stock required based on various methods like MRP, ERP, LOB, JIT and other Japanese concepts.
4. Know the factors of routing and schedule. Apply standard scheduling methods and line balancing.
5. Appreciate dispatching procedure and application of computer in production planning and control.

**UNIT-I**

**Introduction-** Definitions, objectives of production planning and control- functions of production planning and control-elements of production control- types of production- organization of production planning and control, internal organizations department

**UNIT-II**

**Forecasting -** Importance of forecasting, types of forecasting, their uses- general principles of forecasting techniques- Qualitative methods and quantitative methods.

**UNIT-III**

**Inventory Management-** Functions inventory, Relevant inventory cost, ABC analysis, VED Analysis- EOQ model, Inventory control systems, P- Systems and Q-Systems Introduction to MRP and ERP, Line of balance , JIT inventory, Japanese concepts.

**UNIT- IV**

**Routing –** Definition, routing procedure, Route sheets, Bill of material, factors affecting routing procedure. Schedule: Definition, difference with loading. Scheduling polices, techniques, standard scheduling methods, job shop, flow shop. Line balancing, aggregate planning, methods for aggregate planning, Chase planning, expediting, control aspects.

**UNIT-V**

**Dispatching:** Activities of dispatcher, dispatching procedure, follow up, definition, reasons for existence of functions, types of follow up, applications of computer in production planning and control

**TEXT BOOK:**

1. Production Planning and Control: M. Mahajan, Dhanpatirai & Co.

**REFERENCES:**

1. Operations Management(Theory and Practice), Dipak- Orient Blackswan
2. Production and Operations Management R.Panneer Selvam, PHI.
3. Production Planning and Control& Industrial Management: K.C Jain,L.N.Agarwal-Khanna.
4. Production Planning and Control- Text & cases-SK Mukhopadhyaya, PHI

## UNCONVENTIONAL MACHINING AND PROCESSES

**B. Tech. IV Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 0 | 0 | 3 |

**Course Outcomes**

1. Understand the need, importance and classification of various unconventional machining processes.
2. Appreciate basic principles and process parameters of ultrasonic, water jet and abrasive jet machining processes.
3. Appreciate thermal energy based machining processes with emphasis on surface finish and accuracy.
4. Appraise different chemical material removal processes.
5. Understand electron beam machining and plasma arc machining along with applications.

**UNIT–I**

**Introduction:** Need for non-conventional machining processes, Classification of non-conventional machining processes, considerations in process selection, materials, general characteristics and applications of non-conventional machining processes, Historical development.

**UNIT–II**

**Mechanical Material Removal Processes:** Ultrasonic machining, Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining: Basic principles, components, process variables, advantages and disadvantages, applications.

**UNIT–III**

**Thermal Material Removal Processes:** Electro Discharge Machining, Wire EDM, Laser Beam Machining, Electron Beam Machining, and Ion Beam Machining: Basic principles, components, process variables, advantages, limitations and applications.

**UNIT–IV**

**Chemical Material Removal Processes:** Electro Chemical Machining, Electro Chemical Grinding, Electro Chemical Honing, and Electro Chemical Deburring: Basic principles, components, process variables, advantages, limitations and applications.

**UNIT-V**

**Electron Beam Machining:** Generation and control, Theory of electron beam machining, Comparison of thermal and non-thermal processes. General principle and application of laser beam machining – Thermal features, Cutting speed and accuracy of cut.

**Plasma Arc Machining:** Application of plasma for machining, metal removal mechanism, Process parameters, Accuracy and surface finish and other applications of plasma in manufacturing industries.

**TEXT BOOK:**

1. Advanced Machining Processes, VK Jain, Allied publishers.

**REFERENCES:**

1. Modern Machining Process, Pandey P.C. and Shah H.S., TMH
2. MEMS & Microsystems – Design and Manufacture by Tai-Ran Hsu, Tata McGrawHill
3. New Technology by Bhattacharya A, the Institution of Engineers, India 1984.
4. Non-Traditional Machining, P.K. Mishra, New Age.

## TECHNICAL SEMINAR

**B. Tech. IV Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 2 |

**Course Outcomes**

1. Synthesizing information on any one specialized topic from text books, peer revised journals, hand books and other technical resources.
2. Generation a technical seminar report comprising of all relevant information with stipulated standards.
3. Judge the veracity of the topic with various time domains

**METHOD OF EVALUATION:**

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his/ her topic of seminar and marks are given based on the report. A Faculty guide is to be allotted and he/ she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

## COMPREHENSIVE VIVA VOCE

**B. Tech. IV Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 0 | 2 |

**Course Outcomes**

1. Revise the mechanical engineering principles postulations and other technical information in order to apply in various conditions.
2. Explain the relevance of a technical note for a given application.
3. Collate and justify the design by the acquired comprehensive technical knowledge and skill.

Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department along with an external examiner. The Comprehensive Viva-Voce is intended to assess the student's understanding of the subjects he/she studied during the B. Tech. course of study. The Comprehensive VivaVoce is evaluated by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

## MAJOR PROJECT

**B. Tech. IV Year II Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 0 | 10 |

**Course Outcomes**

1. Develop a model comprising of real time application in the industry.
2. Design a system under the domain of mechanical engineering.
3. Evaluate for simulation design, analysis and manufacturing facts of the system.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.