TKR COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
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B.TECH – MECHANICAL ENGINEERING
Course Structure R-20

SEMESTER III

S.No.	Class	Course Code	Name of the Subject	L	T	P	C
1	BS	CBSM10	Probability & Statistics and Complex Variables	3	1	0	4
2	ES	CESBE2	Basic Electrical Engineering	3	0	0	3
3	ES	CESBE1	Basic Electronics	3	0	0	3
4	PC	C33PC1	Thermodynamics	3	0	0	3
5	PC	C33PC2	Metallurgy and Material Science	3	0	0	3
6	PC	C33PC3	Mechanics of Solids	3	0	0	3
7	ES	CESEE2	Basic Electrical and Electronics Engineering lab	0	0	2	1
8	PC	C33PC4	Mechanics of Solids & MMS Lab	0	0	2	1
9	MC	MC003	Cultural Activity	0	0	0	Satisfactory
			Total Credits	**18**	**1**	**4**	**21**

Mandatory Course: CulturalActivity
The student should participate in culture activity (Music/Dance/Singing/etc.) conducted by the College, student should produce the participation certificate for clearing this course.

SEMESTER IV

S.No.	Class	Course Code	Name of the Subject	L	T	P	C
1	HS	CHSM1	Business Economics and Financial Analysis	3	0	0	3
2	PC	C34PC1	Fluid Mechanics and Hydraulic Machines	3	1	0	4
3	PC	C34PC2	Kinematics of Machinery	3	0	0	3
4	PC	C34PC4	Manufacturing Process	3	0	0	3
5	PC	C34PC5	Machine Drawing	1	0	4	3
6	PC	C34PC6	Thermal Engineering - I	3	0	0	3
7	PC	C34PC7	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
8	PC	C34PC8	Manufacturing Process Lab	0	0	2	1
9	MC	MC004	Video with Social Messages	0	0	0	Satisfactory
			Total Credits	**16**	**1**	**8**	**21**

Mandatory Course: Video with Social Messages
Student should make video with social messages. This has to be uploaded in the youtube.com, by maintaining the terms and conditions of youtube.com. Student should produce youtube.com link with screen shot for clearing this mandatory course.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
                                                                          3 /1/ 0/ 4

PROBABILITY & STATISTICS AND COMPLEX VARIABLE (CBSM10)

Course Objectives:

To learn:
1. Random variables that describe randomness or an uncertainty in certain realistic situation.
2. The study of continuous distribution predominantly describes important probability distribution.
3. Sampling distribution of mean, variance, point estimation and interval estimation and the testing of Hypothesis of Large samples.
4. Testing of Hypothesis of small samples.
5. Differentiation and integration of complex valued functions.

Course Outcomes:

After learning the contents of this paper the student must be able to learn the concept of

CO1: The ideas of probability and random variables and various discrete probability distribution and their properties.

CO2: The ideas of probability and continuous probability distribution and their properties.

CO3: Calculate mean, of sampling distributions and to make important decisions s for few samples which are taken from a large data.

CO4: Test the hypothesis and give the inference to the given data.

CO5: Test the hypothesis for small samples.

CO6: Analyse the complex functions with reference to their analyticity and integration using Cauchy's integral theorem, formula.

UNIT I
Discrete Random Variables & Distributions

Random variable –Discrete Random variable and properties - mass function of probability distributions Binomial, Poisson and related properties.

UNIT II
Continuous Random Variables & Distributions

Continuous Random variable and properties - density function of probability distributions-Normal distribution and related properties.

PROBABILITY & STATISTICS AND
COMPLEX VARIABLE (CBSM10)

UNIT III
Sampling Distributions &Hypothesis Theory

Sampling distributions of means (σknown and unknown).Tests of hypothesis- point estimations-Interval estimations . Null hypothesis-alternative hypothesis Type-1, Type-2 errors, critical region confidential interval for mean, testing of single mean and two means.

UNIT IV
Small Samples

Test for single mean- difference of two means- test for ratio of variances-Chi-square test for goodness of fit and independence of attributes.

UNIT V
Functions of a Complex Variable & Complex Integration

Introduction and definitions of Continuity, differentiability, analyticity, properties, Cauchy Riemann equations in Cartesian and polar co-ordinates(without proofs), harmonic and conjugate harmonic functions, Milne-Thompson method. Cauchy integral theorem, Cauchy integral formula, generalized Cauchy integral formula related problems (without proofs).

Text Books:

1. Probability & Statistics for Engineers by D.K.Murugesan& P.GuruSwamy, Anuradha Publications.
2. Probability & Statistics for Engineers by G.S.S. BhismaRao, SciTech Publications.
3. Complex variables and applications by James ward Brown and Ruel V.Churchill-Eighth Edition – Mc- Graw Hill Higher Education.

Reference Books:

1. Probability & Statistics for Engineers, Millers and John E.Freund, Prentice Hall of India.
2. Erwinkreyszig- Advanced Engineering Mathematics- 9th Edition- John Wiley & Sons- 2006.
3. B.S.Grewal- Higher Engineering Mathematics- Khanna Publishers- 36th Edition-2010.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
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BASIC ELECTRICAL ENGINEERING (CESBE2)

Prerequisites: Linear Algebra and Calculus

Course Objectives:

Objectives of this course are
1. To introduce the concept of DC and AC electrical circuits and its applications.
2. To determine the performance of single phase transformer.
3. To study the concepts of different types of Electrical Machines.
4. To acquire knowledge about various configurations for electrical installations and its applications.

Course Outcomes:

After this course, the student will be able to
1. Understand and analyze DC, AC circuits using basic principles
2. Analyze and evaluate electrical circuits using various theorems
3. Understand the characteristics and performance of Electrical Machines and Transformers
4. Understand the applications of various electrical installations

UNIT I
DC Circuits

Electrical circuit elements (R, L and C), dependent & Independent of voltage and current sources, Kirchhoff current and voltage laws, Analysis of Resistive circuits-Mesh, Nodal Analysis and Star-Delta Transformations, Superposition, Reciprocity, Thevenin and Norton Theorems, Maximum Transfer Theorem, Numerical problems.

UNIT II
AC Circuits

A.C. Fundamentals: Sinusoidal voltage and currents, mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, RMS values, peak factor, form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC and RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

BASIC ELECTRICAL ENGINEERING (CESBE2)

UNIT III
Transformers

Magnetic Circuits, working principle of Ideal and Practical Transformer, Equivalent Circuit, Losses in Transformers, Regulation, Efficiency, OC &SC Test on 1- Phase Transformer, Auto-Transformer and three-phase transformer connections.

UNIT IV
Electrical Machines

Construction of DC machines, Armature windings – DC Generator – Principle of operation - EMF Equation – DC Motor – Principle of operation – Back EMF - Torque Equation, Generation of rotating magnetic fields, Construction and working principle of a three-phase and Single-phase induction motor, torque-speed characteristics, Construction and working principle of synchronous generators.

UNIT V
Electrical Installations

Basic concept of wiring systems, Service Mains, Meter board and Distribution board, Concept of Earthing. Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. S.K.Bhattacharya, "Electrical installations and House Wiring", Pearson Publications

Reference Books:

1. S.K.Bhattacharya, "Basic Electrical & Electronics Engineering", Pearson Publications.
2. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill
3. Edward Hughes, " Electrical Technology,", Pearson Education.
4. Edminister.J., "Electrical Circuits" Schaum's Outline Series, Tata McGrawHill.
5. Sudhakar and Shyam Mohan, "Circuits and Networks Analysis and Synthesis, Tata McGrawHill.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
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BASIC ELECTRONICS (CESBE1)

Course Objectives:

1. To introduce the concepts of various semiconductor devices like Diodes, Transistors, and Logic gates.
2. To impart the knowledge of various configurations, characteristics and applications of electronic circuits.

Course Outcomes:

After this course, the student will be able
1. Acquires the knowledge in semiconductor materials and knows the complete internal structure of PN junction its capacitances, resistances &different types of diodes including their modes of operation, etc.
2. Acquires the Knowledge in characteristics of different types of diodes.
3. Analyzing the Application of Diode.
4. Understanding the knowledge in the structure of Transistor,(different types, operation, characteristics and applications) Analyze the dc bias circuitry of BJT.
5. Understanding the knowledge in the digital electronics.(different types logic gates operation) .

UNIT I
P-N Junction Diode

Conductors, Insulators **,** and semiconductors, formation of p-type and n-type semiconductors, principle and operation of Diode, Current components in a p-n Diode, Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.

UNIT II
Special Purpose Devices

Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With help of Energy band diagram) and Varactor Diode, Principle of Operationand Characteristics of SCR, LED, LCD and photo diode.

UNIT III
Rectifiers and Filters

P-N junction diode as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier. Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

BASIC ELECTRONICS (CESBE1)

UNIT IV
Bipolar Junction Transistor (BJT)

Principle of Operation, Transistor current components, Common Emitter, Common Base and Common Collector configurations and their Characteristics, Transistor as an Amplifier, Transistor as a switchTransistor Biasing and Stabilization - Operating point, DC load line, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias. Thermal run away, Thermal stability.

UNIT V
Digital Electronics

Introduction to digital electronics, Number system-types, conversion from one number system to other, Logic gates-NOT Gate ,AND Gate, OR Gate, Universal gates, XOR ,XNOR Gates, Half adder, Full Adder.

Text Books:

1. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
2. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabratajit, TMH, 2/e, 1998.
3. D.P. Kothari , I J.Nagarath " Basic electronics" ,Mc Graw Hill Education(India)private limited,2014.

Reference Books:

1. Electronic Devices and Circuits –S.Salivahanan,NSuresh Kumar &A.Vallavaraj.
2. Electronic Devices and Circuits – Sanjeev Gupta & Santosh Gupta,Dhanpat Rai Publications.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
3 /0/ 0/ 3

THERMODYNAMICS (C33PC1)

Course Objectives:

1. Understand the concepts of thermodynamic system, control volume, thermodynamic equilibrium, continuum, work and heat.
2. Apply the laws of thermodynamics to analyze heat pumps and heat engines
3. Evaluate properties of pure substances
4. Evaluate properties of gas mixtures
5. Analyze air standard cycles applied in prime movers.

Course Outcomes:

At the end of the course, the student should be able to
1. Understand and differentiate between different thermodynamic systems and processes.
2. Apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis.
3. Evaluate different types of substances and their properties
4. Evaluate different types of gases and their properties
5. Analyze the Thermodynamic cycles and evaluate performance parameters.

UNIT I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Macroscopic and Microscopic viewpoints, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer .

UNIT II

PMM I - Joule's Experiments **-** First law of Thermodynamics – Corollaries –Steady Flow Energy Equation. Limitations of the First Law –Second Law of Thermodynamics, Kelvin- Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations for internal energy and enthalpy Third Law of Thermodynamics statement.

THERMODYNAMICS (C33PC1)

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 and energy Transfer – Steam Calorimetric.
Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non- flow processes– Throttling and Free Expansion Processes – Flow processes

UNIT IV

Deviations from perfect Gas Model – Vader Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables, Mixtures of perfect Gases – Mole Fraction, Mass friction 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 const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases.

UNIT V

Power Cycles: Otto, Diesel, Dual Combustion cycles, 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 – comparison of Otto, diesel and dual combustion cycles.

Text Books:

1. Engg. Thermodynamics – D.S. Kumar; SK. Kataria and suns.
2. Engineering Thermodynamics by R. K. Rajput; Laxmi publishers.

Reference Books:

1. A Textbook of Engineering Thermodynamics by VM. Domakundavar; Dhanpat Rai.
2. Engineering Thermodynamics / PK Nag / Mc GrawHill.
3. Thermodynamics for Engineers / Kenneth A. Kroos; Merle C. Potter/ Cengage.
4. Engineering Thermodynamics / P. Chattopadhyay/Oxford.
5. Engineering Thermodynamics / Rogers /Pearson.
6. Thermodynamics Anup Goel, Siddu Patil, Technical publications.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
3 /0/ 0/ 3

METALLURGY AND MATERIAL SCIENCE (C33PC2)

Course Objectives:
1. To prepare students to excel their ability to identify, formulate and solve mechanical Engineering problems.
2. To prepare students, will be broadly educated and will have an understanding of the impact of engineering on society and demonstrate awareness of contemporary issues.
3. To inculcate in students, the ability to design a system to meet desired needs within environmental
4. Manufacturability and management knowledge and techniques to estimate time, resources to complete a project.
5. To prepare the students to understand the composite of elements, ceramics and Ferrous and non-Ferrous metals.

Course Outcomes:

1. Identify the properties of metals with respect to crystal structure and grain size
2. Interpret the phase diagrams of materials
3. Classify and Distinguish different types of cast irons, steels and non ferrous alloys
4. Describe the concept of heat treatment of steels & strengthening mechanisms
5. Understand the concept of different materials like Ceramics, Polymers and composites

UNIT I

Structure of Metals Crystallography, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods. Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules.

UNIT II
Phase Diagrams

Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT III
Engineering Materials –I

Steels: Iron-Carbon Phase Diagram and Heat Treatment
Study of Fe-Fe3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening, and Tempering of steels, Hardenability. Alloy steels.

METALLURGY AND MATERIAL SCIENCE (C33PC2)

UNIT IV
Engineering Materials –II

Cast Irons Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.
Engineering Materials-III
Non-ferrous Metals and Alloys Structure and properties of copper and its alloys, Aluminum and its alloys,
Al-Cu phase diagram, Titanium and its alloys. Principles of Powder metallurgy.

UNIT V
Engineering Materials –IV

Ceramics, Polymers and Composites Crystalline ceramics, glasses, cements: structure, properties and
applications. Classification, properties, and applications of composites. Classification, Properties, and
applications of Polymers. Properties and applications of FRP. Introduction of Nano Materials.

Text Books:

1. Elements of Material science / V. Rahghavan.
2. Material Science and Metallurgy/ Kodgire.

Reference Books:

1. Introduction to Physical Metallurgy / Sidney H. Avner.- TMH.
2. Materials Science and engineering / William and callister.
3. Engineering Material and Metallurgy – Er Amandeep Singh, Wadhva.
4. Materials Science for Engineering Students- Traugott Fischer 2009 Edition.
5. Mechanics of Composite materials – Robert M.Jones- Taylor and Francis- USA.
6. ASM hand book – Volume -1.
7. Material Science- S.L.Kulakarni and AmithKakani – New age Publications.
8. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

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MECHANICAL ENGINEERING

B.Tech III Semester   L/T/P/C
3 /0/ 0/ 3

MECHANICS OF SOLIDS (C33PC3)

Course Objectives:

This course will advance the students' development of the following broad capabilities:
1. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviours due to different types of loading will be discussed.
2. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
3. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations.
4. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized.
5. Students will understand how to calculate normal and shear stresses

Course Outcomes:

1. Analyze the behavior of the solid bodies subjected to various types of loading;
2. Apply knowledge of materials and structural elements to the analysis of simple structures;
3. Undertake problem identification, formulation and solution using a range of analytical methods;
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
5. Expectation and capacity to undertake lifelong learning

UNIT I
Simple Stresses & Strains

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 moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT II
Shear Force and Bending Moment

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 – Relation between S.F., B.M and rate of loading at a section of a beam.

MECHANICS OF SOLIDS (C33PC3)

UNIT III
Flexural Stresses

Theory of simple bending – Assumptions – Derivation of bending equation – Determination bending stresses – section modulus of regular sections.
Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections.

UNIT IV
Principal Stresses and Strains

Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear– Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions. Theories of Failure.

UNIT V
Torsion of Circular Shafts

Theory of pure torsion – Derivation of Torsion equations– Torsional moment of resistance – Polar section modulus –Combined bending and torsion and end thrust.
Thin Cylinders: Thin seamless cylindrical shells– Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

Text Books:

1. Strength of materials – 17th edition – Ramamrutham – Dhanpath Rai
2. Strength of materials – Bhavkati SS – Vikas publications.
3. Strength of Materials by R.K.Bansal – Laxmi Publications.
4. Strength of materials – R.S. Kurmi and J K Gupta.

Reference Books:

1. Strength of Materials -By Jindal, UmeshPublications.
2. Analysis of structures by Vaziraniand Ratwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt.Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd.

MECHANICAL ENGINEERING

B.Tech III Semester

L/T/P/C
0 /0/ 2/ 1

BASIC ELECTRICAL &
ELECTRONICS ENGINEERING LAB (CESEE2)

Prerequisites: Basic Electrical Engineering

Course Objectives:

1. Students will gain the basic knowledge of electrical circuits using various laws.
2. Identify and apply different theorems for electrical circuits.
3. Assess the performance of different types of Electrical machines and single phase transformer.
4. Apply basic electrical engineering knowledge for house wiring practice.
5. To identify various components and testing of active devices.
6. Ability to understand the characteristics of various devices.

Course Outcomes:

After the completion of this laboratory course, the student will be able to
1. Apply various laws to solve electrical networks.
2. Apply network theorems to solve complex electrical networks.
3. Evaluate the performance of different types of Electrical machines and single phase transformer by conducting various tests.
4. Understand and analyze electrical installations using different lamp controlled methods, stair case wiring and different wiring connection.
5. Understand to design different circuits.
6. Apply various devices to real time problems.

List of Experiments: (Any 10 Experiments)
1. Verification of Kirchhoff's current and voltage laws.
2. To study and verify Thevenin's and Nortons theorems.
3. To verify superposition and Reciprocity theorems.
4. Magnetization characteristics of DC shunt generator.
5. To perform open circuit and short circuit test on single phase transformer.
6. Make circuit for series and parallel connection of lamps.
7. Make a circuit for stair case wiring.
8. Forward And Reverse Bias V-I Characteristics Of PN Junction Diode.
9. Zener Diode V-I Characteristics.
10. Half Wave Rectifier With and With Out Filter.
11. Full Wave Rectifier With and With Out Filter.
12. Input and Output Characteristics of BJT in CB Configuration.
13. Input and Output Characteristics of BJT in CE Configuration.
14. Study of Logic gates.

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MECHANICAL ENGINEERING

B.Tech III Semester   **L/T/P/C**
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MECHANICS OF SOLIDS & METALLURGY AND MATERIAL SCIENCE LAB (C33PC4)

CourseObjective:
1. To know the micro structure of different materials
2. To impart the required material for products based on micro structure
3. To know the properties of materials at higher elevated temperatures
4. To know basic concepts of stress, strain and their relations
5. To know how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations

Course Outcomes:
1. Ability to relate properties to microstructure.
2. Understand various crystal structures and relationship to properties
3. Ability to select metals and alloys for industrial applications
4. Analyze the behavior of the solid bodies subjected to various types of loading.
5. Apply knowledge of materials and structural elements to the analysis of simple structures

(A)   MECHANICS OF SOLIDS LAB:
1. Direct tension test
2. Torsion test
3. Hardness test
    a) Brinells hardness test
    b) Rockwell hardness test
4. Test on springs
5. Compression test on cube
6. Impact test
7. Punch shear test

(B) METALLURGY LAB:
1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Micro-structure of Mild steels, low carbon steels, high – C steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures 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.

NOTE: Any 10 experiments from the above are to be conducted taking at least 4 from each section.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
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BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (CHSM1)

Course Objectives:

1. To learn the basic business type of the organization.
2. To aquire the knowledge and impact of the economy on business firms.
3. To analyse the business from the financial perspective.
4. To know the financial position of the company.

Course Outcomes:

1. Analyze the total structure of the business and able to identify and classify the different types of business entities.
2. Asses the demand and supply analyses with the help of various measures and types of Elasticity of demand.
3. Infer the knowledge about production and cost analysis for product and services.
4. Interpret the fundamental concepts related to financial accounting.
5. Predict the financial position by analyzing the financial statement of the company through various ratios.

UNIT I
Introduction to Business and Economics

Business:Define Business, characteristics of business, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company.
Economics: Significance of Economics, Micro and Macro Economic Concepts and Importance of National Income, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of BusinessEconomist.

UNIT II
Demand Analysis

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.

UNIT III
Production, Cost, Market Structures & Pricing

Production Analysis: Production function, Law of returns to scale, Internal and External Economies of Scale. **Cost Analysis:**Cost concepts, Types of costs, Break-Even Analysis (BEA)
Pricing: Types of pricing, product life cycle, **GST (Goods& Service Tax)**

BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (CHSM1)

Market Structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic competition, oligopoly.

UNIT IV
Financial Accounting

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of FinalAccounts.

UNIT V
Financial Analysis through Ratios

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Text Books:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications,International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata McGraw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, TataMcGraw Hill Education Pvt. Ltd. 2012.
4. Rakesh Garg, Sandeep Garg Hand book of GST in India.
5. A.R. Aryasri (2011) Managerial Economics and Financial Analysis, TMH, India.

Reference Books:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e,Vikas Publications, 2013.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
                                                                          3 /1/ 0/ 4

FLUID MECHANICS AND HYDRAULIC MACHINES (C34PC1)

Course Objectives:

The objectives of the course are to enable the student:
1. To understand the basic principles of fluid mechanics
2. To identify various types of flows
3. To understand boundary layer concepts and flow through pipes
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps

Course Outcomes:

1. Able to understand and identify the types of fluid properties and flow patterns to describe continuity equation.
2. To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
3. To select and analyze an appropriate turbine with reference to given situation in powerplants.
4. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
5. Able to demonstrate boundary layer concepts.

UNIT I
Fluid Statics

Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion-atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT II
Fluid Kinematics

Stream line, path line and streak lines and stream tube, classification of flows-steady and unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three-dimensional flows.
Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line.

FLUID MECHANICS AND HYDRAULIC MACHINES (C34PC1)

UNIT III
Boundary Layer Concepts

Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

UNIT IV
Basics of Turbo Machinery

Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.
Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions.
Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities.

UNIT V
Centrifugal Pumps

Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.
Reciprocating pumps: Working, Difference between Reciprocating and Centrifugal pumps.

Text Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH- Standard publications
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput Chand publications
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

Reference Books:

1. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
2. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
3. Fluid mechanics – Yunus A Cenegal , John Climbale – TMH.
4. Fluid mechanics and Hydraulic machines – R.K.Bansal- Laxmi publications.
5. Fluid Mechanics and HydraulicMachinary by Jagadish Lal.
6. Fluid mechanics – John F.Dauglas- Pearson.
7. Fluid mechanics – Frank M.White- TMH.

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MECHANICAL ENGINEERING

B.Tech IV Semester   L/T/P/C
                                                                  3 /0/ 0/ 3

KINEMATICS OF MACHINERY (C34PC2)

Course Objectives:

1. To understand the various mechanisms of machines
2. To draw velocity and acceleration diagrams
3. To understand various steering gear mechanisms
4. To draw cam and follower diagrams
5. To understand belts, ropes and drives with their application
6. To understand different gear trains

Course Outcomes:

1. To analyze the various mechanisms of machines
2. Able to draw velocity and acceleration diagrams
3. To design various steering gear mechanisms
4. To draw cam and follower diagrams
5. To understand different gear trains

UNIT I
Mechanisms

Elements or Links – Classification – Types of kinematics pairs, constrained motion – completely, partially or successfully and incompletely constrained.
Mechanism and Machines – Mobility of Mechanisms: Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT II
Kinematics

Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method; four bar Chain.
Plane motion of body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method. Kliens construction - Coriolis acceleration.

UNIT III
Straight-Line Motion Mechanisms

Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff's and Robert Mechanism – PantographsSteering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.
Hooke's Joint: Single Hooke's joint –velocity ratio –application –problems.

KINEMATICS OF MACHINERY (C34PC2)

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
Forms of teeth, phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements.
Gear Trains: Introduction – Types – Simple – compound and reverted gear trains –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 Books:

1. Theory of Machines – R.K.Bansal; Laxmi Publishers
2. Theory of Machines - R.S.Kurmi, J.K.Guptha- Chand Publications

Reference Books:

sKinematics of Machinery: AnupGoel ; Technical Publications
1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford
2. Theory of Machines / Sadhu Singh /Pearson.
3. Theory of Machines – V.P.Singh – DhanpathRai.
4. Kinematics and Dynamics of machinery – R.L.Norton –TMH.
5. Theory of Machines / S.S.Rattan / Mc GrawHill Publishers.
6. Theory of mechanisms and machines- Ghosh. A. and Malik A.K. – East west Publishers
7. Theory of mechanisms and machines – Jagadish Lal- Metropolyton BooksTheory of Machines / Thomas Bevan/CBS.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
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MANUFACTURING PROCESS (C34PC4)

Course Objectives:

1. To provide knowledge of various manufacturing methods of components and metal joining process to aid in appropriate manufacturing and material selection for given products.
2. To gain knowledge in metal casting process and develop understanding in design of patterns, cores, gating systems and various melting methods.
3. To expose the students to different welding processes, conducting weld tests on weld mates and modern welding process.
4. To understand cold and hot working of metals and processing of non-metals like plastics, mechanical aspects, such as force, stress, strain of the most common processes.
5. To provide a technical understanding of various extrusion methods, forging processes, presses and press tools to aid in appropriate process selection for the material and required tolerances.

Course Outcomes:

1. Select appropriate manufacturing process for a given component.
2. Apply different foundry techniques and methods of melting process.
3. Understand various hot and cold forming processes.
4. Understand various extrusion methods, forging process, presses and press tools.
5. Develop process maps for metal forming processes and identify process variables to manufacture defect free components.

UNIT I
Casting

Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands. Methods of Melting - Crucible melting – Defects in castings; Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – gating systems and its design. Solidification of casting – Solidification of pure metal – Nucleation and grain growth, casting design considerations.

UNIT II
Welding

Classification – solid state welding, fusion welding and welded joints; Gas welding- Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermite welding.

MANUFACTURING PROCESS (C34PC4)

UNIT III
Inert Gas Welding

TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT IV
Hot Working, Cold Working, Strain Hardening, Rolling Fundamentals

Theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning- Types of presses and press tools. Forces and power requirement in the above operations.
Plastic materials and processes: Types of plastics: Compression moulding; injection moulding; Blow moulding, film and sheet forming.

UNIT V
Extrusion of Metals:

Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion - Impact extrusion - Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion
Forging Processes: Forging operations and principles – types of forging methods, forging tools– forging defects – swaging, Forces in forging operations.
Introduction to powder metallurgy process, preparation of powders and types, functions of binders, sintering processes and equipment, advantages of powder metallurgy processes.

Text Books:

1. Manufacturing Science – Ghosh and Malik-TMH.
2. Production Technology –R.K. Jain – Khanna Publishers.
3. Manufacturing Technology / P.N. Rao Vol.1 &2 /McGrawHill.

Reference Books:

1. A course in work shop technology – Volume 2- S. Raghu vamsi DhanpatRai.
2. Metal Casting / T.V RamanaRao / NewAge.
3. Production Technology / G. ThirupathiReddy /SciTech.
4. Manufacturing Engineering & Technology / Serope Kalpakjian / Steven R. Schmidt / Pearson.

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MECHANICAL ENGINEERING

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MACHINE DRAWING (C34PC5)

Course Objectives:

1. To Prepare the engineering and working drawings with dimensions and bill of material during design and development.
2. To familiarize with the standard conventions for different materials and machine parts in working drawings.
3. To make part drawings including sectional views for various machine elements.
4. To prepare assembly drawings given the details of part drawings.
5. To demonstrate an ability to design and conduct experiments, analyze and interpret data and assembly and disassembly drawings knowledge will be provided.

Course Outcomes:

1. Developing assembly drawings using part drawings of machine components.
2. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
3. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
4. Types of Drawings – working drawings for machine parts.
5. Drawing of Machine Elements and simple parts Selection of Views, machine elements and parts with every drawing proportion.

Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cottered joints and knuckle joint.
3. Rivetted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

MACHINE DRAWING (C34PC5)

Assembly Drawings:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts – Screws jacks, Petrol engine connecting rod, Plummer block
4. Simple designs of steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text Books:

1. Machine Drawing by / Bhattacharyya / Oxford.
2. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson.

Reference Books:

1. Machine Drawing / Ajeet Singh / Mc Graw Hill.
2. Machine Drawing / N.D. Bhat / Charotar.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
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THERMAL ENGINEERING - I (C34PC6)

Course Objectives:

1. To apply the laws of Thermodynamics to analyze air standard cycles.
2. To understand and evaluate the perform analysis of the major components and systems of IC engines.
3. To understand and evaluate the perform analysis of the refrigeration cycles and their applications.
4. How to use fundamental principles of fluid mechanics to solve thermal problem.
5. How to use basic principles of thermodynamics to solve thermal problem.

Course Outcomes:

At the end of the course, the student should be able to
1. Understand the functionality of the major components of the IC Engines.
2. Understand effects of operating conditions of IC engines on their performance.
3. The student should be able to evaluate the performance of IC engines.
4. The student should be able to evaluate the performance of air compressors
5. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles.

UNIT I
I.C. Engines

Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburettor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system.

UNIT II
Normal Combustion and Abnormal Combustion in SI Engines

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

THERMAL ENGINEERING - I (C34PC6)

UNIT III
Testing and Performance

Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

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

UNIT IV
Rotary Compressor (Positive displacement Type)

Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

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

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

UNIT V
Refrigeration

Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP - Vapour absorption system – mechanical details – working principle.

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

Text Books:

1. I.C. Engines / V. Ganesan / Mc GrawHill.
2. Thermal Engineering / Mahesh M Rathore / Mc GrawHill.

Reference Books:

1. Applied Thermodynamics for Engineering Technologists / Eastop /Pearson.
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / WileyEastern.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
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FLUID MECHANICS AND
HYDRAULIC MACHINES LAB (C34PC7)

Course Objectives:

1. To understand the basic principles of fluid mechanics.
2. To identify various types of flows.
3. To understand boundary layer concepts and flow through pipes.
4. To evaluate the performance of hydraulic turbines.
5. To understand the functioning and characteristic curves of pumps.

Course Outcomes:

1. Able to explain the effect of fluid properties on a flow system.
2. Able to identify type of fluid flow patterns and describe continuity equation.
3. To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
4. To select and analyze an appropriate turbine with reference to given situation in powerplants.
5. To estimate performance parameters of a given Centrifugal and Reciprocating pump.
6. Able to demonstrate boundary layer concepts.

List of Experiments:

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orificemeter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems.

Note: Any 10 of the above 12 experiments are to be conducted.

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MECHANICAL ENGINEERING

B.Tech IV Semester   **L/T/P/C**
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MANUFACTURING PROCESS LAB (C34PC8)

Course Objectives:

1. To expose students to a variety of manufacturing processes, their use and capabilities.
2. To study and observe welding and brazing techniques through demonstration and practice.
3. To study and observe various stages of casting processes through demonstration of sand casting process.
4. To observe the basic principles of working presses and press tools.
5. To learn the manufacturing of sheet metal components and moulding of plastics

Course Outcomes:

1. Understand the properties of moulding sands and mould making.
2. Design and develop patterns for casting processes.
3. Fabricate the joints using arc welding, gas welding and resistance welding processes.
4. Basic idea of press working tools and moulding of plastics.
5. Identify and develop the effect of process variables to manufacture defect free products.

Minimum of 12 Exercises need to be performed

    I.   **Metal Casting Lab:**
      1. Pattern Design and making - for one casting drawing.
      2. Sand properties testing for strengths, and permeability – 1 Exercise
      3. Moulding Melting and Casting - 1 Exercise

    II.   **Welding Lab:**
      1. ARC Welding Lap & Butt Joint - 2 Exercises
      2. Spot Welding - 1Exercise
      3. TIG Welding - 1Exercise
      4. Plasma welding and Brazing - 2 Exercises
     (Water Plasma Device)

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

    IV.   **Processing of Plastics:**
      1. Injection Moulding
      2. Blow Moulding

Reference Book:

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing   House.