### III-Semester (2 Year)

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| 10     | 22MC4HS07     | Constitution of India                             | 0 1 0          | 0       |
Basic Electrical & Electronics Engineering

Pre-requisite: Basic Mathematics & Physics

Course Objectives:
1) To introduce the concepts of electrical circuits and their components
2) To understand DC circuits and AC single-phase & three-phase circuits
3) To study and understand the different types of AC machines.
4) To introduce the concept of power, power facto and its improvement.
5) To introduce the concepts of diodes & transistors.

Module I: D.C. Circuits

Electrical circuit elements (R, L and C), voltage and current sources, KVL&KCL, Mesh and Nodal analysis, Voltage and current divide rule, source transformation technique and star delta conversion, analysis of simple circuits with dc excitation. Superposition, Thevenin’s, Norton’s theorems with problems.

Module II: A.C. Circuits

Representation of sinusoidal waveforms, Average and rms values, peak factor and Formfactor. Real power, Reactive power, Apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series). Resonance in series RLC circuits. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module III: Electrical Machines


Module IV: Diodes & Rectifiers


Module V: TRANSISTORS

Construction, Principle of Operation, Current amplification factor, Transistor as amplifier. MOSFET, Input – output characteristics.
TEXT BOOKS:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University

2. Basic Electrical and electronics Engineering-D P Ko

thari, I J Nagarath, McGraw Hill Education

REFERENCE BOOKS:


4. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.


Web Resources:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/117/103/117103063/

E- Books:

1. https://www.academia.edu/42933156/Basic_Electrical_Engineering.VK.Mehta

Course Outcomes:

- CO1 – To analyze the electrical circuits with DC excitation.
- CO2 – To analyze electrical circuits with AC excitation
- CO3 – To Explain the working principles of electrical machines
- CO4 – To Analyze the characteristics of Electronic devices like diodes and transistors
**CO-PO/PSO Mapping Chart**

(3/2/1 indicates strength of correlation)

3 – High; 2 – Medium; 1 – Low

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Course Objectives:
1. To learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns
2. Detailed study of engineering properties of materials is also of interest.
3. Fundamentals of applying equilibrium, compatibility, and force deformation relationships to structural elements are emphasized.
4. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis

Module I
Introduction to stresses and strains
Basic of Stress & Strain, elastic constants, Properties of material stress – strain diagram, Hooke’s law, Poisson’s ratio, shear stresses, stresses in the components subjected to multi-axial forces, principal of superposition, Stresses in Combined structure, thermal stresses, statically indeterminate systems.

Principal stresses and strains:
Transformation of plane stresses, Principal stresses, Maximum shear stresses, Mohr’s circle for plane stresses, Plain strain and its Mohr’s circle representation, Principal strains, Maximum shear strain.

Module II
Shear Force and Bending Moment:
Introduction of Beams, Various type of Beams, Various type of Supports, Reactions at supports, shear force and bending moment at any section of a beam, Methods for determination of S.F. and B.M. diagrams of beams (simply supported, overhang and cantilever) subjected to various loads, Relation between Shear Force and Bending Moment, Point of contra-flexure.

Bending of beams
Bending of beams with symmetric section, boundary conditions, pure bending, and bending equation. Problems of simple bending, Transverse Shear stress.

Module III
Deflection of beams-Relation between slope deflection and radius of curvature, solution of beam deflection, direct integration method, problem by Macaulay’s method, Castigliano’s method.
Columns-Struts and Columns, Stability of columns, Euler’s formula for different end conditions, Equivalent load, Eccentric loading, Rankine’s formula.
Module IV

**Torsion** Deformation in circular shaft due to torsion, basic assumptions, torsion equations, stresses in elastic range, angular deflection, hollow & stepped circular shaft.

**Strain Energy** Introduction, Strain energy, Proof Resilience, Elastic strain energy in tension, compression, bending and torsion. Impact loading in tension and bending.

Module V

**Combined Loading** on shafts and **failure theories**: Components subjected to bending, torsion & axial loads. Theories of failure.

**Thin Cylinders**: Thin seamless cylindrical shells – longitudinal and circumferential stresses. Thin spherical shells.

**Text Books:**

**Reference Books:**

**Online references:**
[https://nptel.ac.in/courses/112/102/112102284/](https://nptel.ac.in/courses/112/102/112102284/)
[https://www.openlearning.com/courses/mechanics-of-solids/?cl=1](https://www.openlearning.com/courses/mechanics-of-solids/?cl=1)

**Course Outcomes:** At the end of the course the student should be able to

CO1 – Apply the concept of stress and strain to analyze various types of structures.

CO2 – Determine the distribution of shear force, bending moment and transverse shear stress along the loaded beam.

CO3 – Analyze shaft under torsional load and various structural elements subjected to combine stresses/combined loads.

CO4 – Determine the deflections and slope of loaded flexural members and columns.
## CO-PO/PSO Mapping Chart

(3/2/1 indicates strength of correlation)

3 – High; 2 – Medium; 1 – Low

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<tr>
<td>CO4</td>
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</table>
Pre-requisite: Engineering Chemistry, Mathematics and Physics.

Course Objectives:
To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications.

[Tables/Codes: Steam Tables and Mollier Chart, Psychrometric chart (Permitted to use in examinations)]

Module I
Fundamental Concepts and Definitions
System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle, Quasi –static Process,

Heat and Work

Module II
First Law of Thermodynamics

Second Law of Thermodynamics
Module III

Pure Substances
Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Phase Transformations –Triple point and critical state properties during change of phase, Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour, states of pure substance with water as example. Dryness Fraction, Property tables. Mollier chart – Various Thermodynamic processes and energy Transfer –Steam Calorimetry.

Perfect Gas laws

Module IV

Ideal Gas Mixtures

Psychrometry
Atmospheric air - Psychrometric Properties – Dry bulb temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation, Carrier’s Equation – Psychrometric chart.

Module V

Gas Power Cycles

Vapour power Cycles

Text Books:
1. Fundamentals of engineering thermodynamics by E.Rathakrishnan.

Reference Books:
1. Thermodynamics for Engineers / Kenneth A. Kroos ; Merle C. Potter/ Cengage.
3. Engineering Thermodynamics / Rogers / Pearson, 2010

Online references:
https://nptel.ac.in/courses/112/105/112105123/

Course Outcomes: At the end of the course the student should be able to

CO1 – Differentiate Between different thermodynamic systems and processes.

CO2 – Perform thermodynamic analysis by applying the laws of Thermodynamics to different types of systems undergoing various processes.

CO3 – Evaluate the properties using tables & charts on concepts of pure substances. Solve the problems using Psychrometric chart on concepts of gas mixtures, Psychrometric properties.

CO4 – Analyze the Thermodynamic cycles and evaluate Performance parameters.

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B. Tech II Year–III Sem

Subject Code: 22PC3ME03

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MATERIAL SCIENCE & METALLURGY

Pre-requisite: Chemistry (Metallurgy and Atomic), Physics, Maths (Geometry)

Course Objectives:
1. This course is intended to provide basic knowledge on the metallurgical aspects of metals that are being used in our homes to various engineering applications.
2. It covers the fundamental aspects of materials, crystal structures and their representation, and various defects that are present in the materials.
3. The necessity of alloying and the corresponding changes occurring in their phase diagrams are discussed.
4. A special focus is given on the important ferrous and non-ferrous alloys which are extensively used in the industries. Tailoring of material properties through different heat treatment processes with their microstructural changes are included.
5. The course concludes with discussion on materials other than metals that includes polymers, ceramics and advanced materials such as composites.

Module I
Crystal Structure
Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Crystal Structure Mechanisms
Dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Module II
Alloys and Phase Diagram
Definition, necessity of alloying; Solid solutions: substitutional and interstitial, Hume-Rothery rules. Phase diagrams: Gibbs phase rule, unary phase diagram, cooling curves of pure metals, construction of phase diagram,

Interpretation of Binary Diagrams
Tie line, Lever rule, various invariant reactions, Microstructure development upon cooling.
Module III

Heat Treatment Processes
Annealing & their types, normalizing, spheroidizing, hardening and tempering, Surface hardening: flame and induction hardening, Case hardening: carburizing, nitriding, carburising and cyaniding,

Transformation Diagrams
Time-Temperature-Transformation (TTT) diagrams Fe-C alloys, bainite and martensite, continuous cooling curves and interpretation of final microstructures and properties. Special heat treatment processes: austempering & its limitations, martempering

Module IV

Ferrous Alloys
Introduction, Classification, Plain carbon steels: high, medium and low carbon steels, alloying of steels: stainless steels, tool steels and maraging steels; Cast irons: grey, white, malleable and spheroidal cast irons.

Non Ferrous Alloys
Copper alloys- brass, bronze and cupro-nickel; Aluminium and Aluminium alloys

Module V

Polymers and Ceramics
Introduction, classification, general characteristics, and potential applications.

Introduction to composites materials
Introduction to composites materials, classification of composite materials, fabrication methods of composites, general characteristics, and potential applications.

Text Books:

Reference Books:
Online references:
1. https://nptel.ac.in/courses/113106032/

Course Outcomes: At the end of the course the student should be able to

CO1 – Explain basic concepts of crystal structures and their imperfections
CO2 – Interpret various phases present in the binary phase diagrams of alloys and comment on the micro structural development
CO3 – Recommend a heat treatment processes for the desired changes in properties
CO4 – Differentiate ferrous and non-ferrous alloys.

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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 - Low
PRODUCTION TECHNOLOGY

Course Objectives:

1. To teach the process-level dependence of manufacturing systems through tolerances.
2. To expose the students to a variety of manufacturing processes including their suitability and capabilities.
3. To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
4. To provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances.

Module I

Casting and gating systems:

Casting process:
Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Solidification of casting – Solidification of pure metal, Directional Solidification.

Module II

Introduction to Welding:
Classification – Types of welds and welded joints; Welding Positions.

Welding processes:
Gas welding - Types, Arc welding, forge welding, and submerged arc welding, Resistance welding, Thermit welding.

Module III

Advanced welding process:

Soldering, Brazing and Welding Defects:
Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non-destructive testing of welds.

Module IV
HR22

Hot working and cold working Processes:
Hot working, cold working, strain hardening, recovery, Sheet metal Operations: Stamping, Blanking and piercing, Coining, Strip layout, Hot and cold spinning – Bending and deep drawing.

Rolling and Drawing:

Module 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, Hydrostatic extrusion.

Forging Processes:

Text Books:

Reference Books:
1. Production Technology- R.K. Jain- Khanna
2. Production Technology / G. Thirupathi Reddy / Scitech
3. Manufacturing Processes- J.P. Kaushish- PHI

Online references:
https://nptel.ac.in/courses/112/107/112107144/

Course Outcomes: At the end of the course the student should be able to

CO1 – Recognize the different types of casting process.
CO2 – Identify types of production process.
CO3 – Describe the various welding process.
CO4 – Explain the concept of forging, rolling and drawing.
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Pre-requisite: Engineering Physics, Applied maths.

Course Objectives:
1. To determine experimental data include universal testing machines and torsion equipment.
2. To determine experimental data for spring testing machine, compression testing machine, impact tester, hardness tester.
3. To determine stress analysis and design of beams subjected to bending and shearing loads using several methods
4. To determine Flexural strength of a beam.

PART-A

List of Experiments (MOS)

Note: Any eight experiments to be conducted
1. Tension test
2. Deflection test on Cantilever beam
3. Deflection test on simply supported beam
4. Torsion test
5. Spring test
6. Izod Impact test
7. Charpy impact test
8. Rockwell/Brinel hardness Test
9. Flexural strength of a beam

PART-B

List of Experiments (MMS)

Note: Any four experiments to be conducted
1. Preparation and study of crystal models for simple cubic, body centered cubic, face centered cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
5. Study of the Microstructures of Non-Ferrous alloys.
6. Hardenability of steels by Jominy End Quench Test.
**Text Books:**
Strength of Materials by R.K. Rajput

**Online references:**
https://sm-nitk.vlabs.ac.in/#

**Course Outcomes:** At the end of the course the student should be able to

CO1 – Analyze the behaviour of the solid bodies subjected to various types of loading.
CO2 – Apply knowledge of materials and structural elements to the analysis of simple structures.
CO3 – Undertake problem identification, formulation and solution using a range of analytical methods.
CO4 – 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.

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PRODUCTION TECHNOLOGY LAB

Pre-requisite: Engineering workshop

Course Objectives:
1. Know about the basic Physical, Chemical Properties of materials
2. Explain why some material(s) are better to be used in a product for given design requirements
3. Learn the basic operation of various manufacturing processes
4. Learn how various products are made using traditional, non-traditional, or Electronics manufacturing processes
5. Design simple process plans for parts and products
6. Understand how process conditions are set for optimization of production
7. Learn how CNC machines work

Note: Any 10 experiments to be performed from all trades.

I. Metal Casting Lab:
1. Pattern Design and making - for one casting drawing.
2. Sand properties testing (for strengths, and permeability).

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

III. Mechanical Press Working:
3. Bending and other operations

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


Course Outcomes: At the end of the course the student should be able to
CO1 – Understanding the properties of moulding sands and pattern making- Basic
CO2 – Fabricate joints use gas welding and arc welding and evaluate the quality of welded joints.
CO3 – Idea of press working tools and types of dies
CO4- Performs moulding studies on plastics.

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BASIC ELECTRICAL AND ELECTRONICS ENGINEERING Laboratory

**Pre-requisite:** Basic Electrical and Electronics Engineering.

**Course Objectives:**
1. To introduce the concepts of electrical circuits and its components.
2. To get the practical experience with the operation and applications of electromechanical energy conversion devices.
3. To get the knowledge of the different electronic devices like diodes, rectifiers, transistors.
4. To learn how to measure the electrical quantities with different measuring devices and with CRO

**PART A: ELECTRICAL**

*Note: All experiments are mandatory*

1. Verification of ohms law
2. Verification of KVL and KCL
3. Verification of Superposition theorem.
6. Performance Characteristics of a Three-phase Induction Motor
7. Verification of Relationship between Voltages and Currents (Star-Delta, Delta-Delta, Delta star, Star-Star) in a Three-Phase Transformer

**PART B: ELECTRONICS**

*Note: Any three experiments should be conducted*

1. Study and operation of (i) multi-meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. PN Junction diode characteristics
3. Zener diode characteristics and Zener as Voltage Regulator
4. Half Wave Rectifier Circuit
5. Full Wave Rectifier Circuit

**Text Books:**
1. Basic Electrical and Electronics Engineering – M S Sukija TK Nagasarkar Oxford University

**Reference Books:**
**Course Outcomes:**
- Analyze the electrical circuits using network laws.
- Understand the operation and applications of electromechanical energy conversion devices.
- Understand the working of various electrical and electronic components
- Analyze the characteristics of various electronics components.

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<th>Course Outcomes (COs)</th>
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**CO-PO/PSO Mapping Chart**
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 – Low
Universal Human Values (UHV)
(Common to ECE, EEE, ME, CSE, CSD, CSO, CSC, CSM branches)

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they ‘really want to be’ in their life and profession.
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Module I

Self- Exploration on UHV Basic Guidelines

Content and Process for Value Education Understanding the need, basic guidelines, Self-Exploration—what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration.

Continuous Happiness and Prosperity

A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity.

Module II

Understanding Harmony in the Human Being

Harmony in Myself Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’, Understanding the needs of Self (‘I’) and ‘Body’ - Sukh and Suvidha, Understanding the Body as an instrument of ‘I’

Understanding Harmony in self

Understanding the characteristics and activities of ‘I’ and harmony in ‘I’, Understanding the
harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail,

Module III

Understanding Harmony in the Family

Harmony and Values in Relationships in the Family- the basic unit of human interaction, Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas & Samman; Difference between intention and competence,

Understanding Harmony in the Society

Understanding the harmony in the society: Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing Undivided Society (Akhand Samaj), Universal Order (SarvabhaumVyawastha).

Module IV

Understanding Harmony in the Nature and Existence

Whole existence as Co-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

Understanding Harmony in the Existence

Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

Module V

Exploring Attitudes towards gender


Gender relationship and Culture

Gender roles and relationship matrix, sex selection and consequences, declining sex ratio, Gender Issues- Gender sensitive language, Just Relationships: Being together as equals.
Text Books:

2. Towards a World of Equals: a bilingual Textbook on Gender. A Suneetha, and others… Telugu Academy, Telangana Gov. 2015

References:


MOOC Course: NPTEL -Exploring Human Values: Visions of Happiness and Perfect Society - Web course

Course Outcome: On completion of this course, the students will be able to

CO1: Explore on the basic aspiration of Human being and its fulfilment

CO2: Distinguish the difference between the Self and the Body

CO3: Explore the value of harmony in family, society and nature

CO4: Understanding of gender related issues and gender relationship.

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STATISTICAL METHODS AND COMPLEX VARIABLES

(Mechanical)

Pre-requisite: Basic knowledge of set and relations theory, permutations, combinations, Venn diagrams, measures of central tendency and dispersion. Complex numbers.

Course Objectives: To provide the student with

1. The ideas of probability and random variables.
2. Various discrete and continuous probability distributions and their properties.
3. Point estimation and interval estimation.
4. Testing of hypothesis and making statistical inferences.
5. Differentiation and integration of complex valued functions.
7. Expansion of complex functions using Taylor’s and Laurent’s series.

MODULE I


MODULE II

Discrete Probability Distributions: Binomial Distribution, Poisson distribution and statistical constants of these distributions using moment generating function.

Continuous Probability Distributions: Uniform Distribution, Exponential Distribution, mean and variance of these distributions using moment generating function, Normal Distribution and its related applications.

MODULE III

Estimation and Tests of Significance: Introduction, Statistical Inference, Classical Methods of Estimation.: Estimating the Mean, Standard Error of a Point Estimate, Null & Alternative Hypothesis, Critical region, Type I and Type II errors, level of significance, one tail, two-tail tests. Prediction Intervals: Estimating a Mean and Proportion for single sample, Difference between Two
Means, difference between two proportions for two samples. Tests of significance for large sample: test for single mean, difference of means, single proportion, difference of proportions.

**MODULE IV**

**Complex Functions:** Limit, Continuity and Differentiation of Complex functions.

**Analytic Functions:** Analyticity, Cauchy-Riemann equations (without proof), Harmonic function and finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

**MODULE V**

**Complex Integrals:** Line integral, Cauchy’s theorem, Cauchy’s Integral formula, Zeros of analytic functions, Singularities.

**Poles and Residues:** Taylor’s series, Laurent’s series; Residues, Poles and Residues, Cauchy Residue theorem (without proof). Evaluation of Real definite integrals of the type \( \int_0^{2\pi} f(\sin\theta, \cos\theta) d\theta \), \( \int_{-\infty}^{\infty} f(x) dx \) (poles not on real axis). Conformal mapping and Mobius Transformations.

**Text Books:**

**Reference Books:**
1. Introduction to Probability, Charles M Grinsted, J Laurie Snell, American Mathematical Society.
4. Complex Analysis, A R Vasishtha, Krishna Prakash Media(P) Ltd.,

**MOOC Courses:**
1. Probability: [http://nptel.ac.in/courses/111105041/](http://nptel.ac.in/courses/111105041/)
2. Probability and Statistics: [http://nptel.ac.in/courses/111105035/](http://nptel.ac.in/courses/111105035/)
3. Complex variables: [https://nptel.ac.in/courses/111/106/111106141/](https://nptel.ac.in/courses/111/106/111106141/)

**E-Books:**
1. Probability and Statistics for Engineers by Richard A Johnson

https://1lib.in/book/2883098/927b28
Course Outcomes: After learning the contents of this paper the student must be able to

CO1: Compute probabilities using theorems in probability.

CO2: Solve problems involving random variables and probability distributions.

CO3: Apply Inferential Statistics to make predictions or judgments about the population from which the sample data is drawn for large samples.

CO4: Analyze the complex function with reference to their analyticity, integration of complex functions by Cauchy’s integral and residue theorems also Taylor’s and Laurent’s series expansions in complex function.

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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)

3 – High; 2 – Medium; 1 – Low
KINEMATICS OF MACHINES

Pre-requisite: Basic principles of Mechanics

Course Objectives:
1. To synthesis, both graphically and analytically, multilink mechanisms.
2. To perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanism.
3. To synthesis mechanism to perform certain prescribed task/motion
4. To analyze cam profiles.
5. To analyze gear trains.

Module I
Mechanisms
Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open 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.

Module 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

Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.
Module III

Straight-line motion mechanisms


Module 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 3 cases.

Analysis of motion of followers
Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

Module 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, cycloidal and involutes profiles – 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–Introduction to Helical – Bevel and worm gearing

Gear Trains

Text Books:
2. Theory of Machines by Rattan S S.
3. Theory of Machines by Thomas Bevan.

Reference Books:
1. Theory of Machines: Kinematics and Dynamics by Sadhu Singh.
2. Theory Of Mechanicsms Machines by A Ghosh.
Online references:
https://youtu.be/MJeRFzs4oRU
https://youtu.be/yDEIxEYGAos

Course Outcomes: At the end of the course the student should be able to

CO1 – Designing a suitable mechanism depending on application

CO2 – Analyze velocity and acceleration of different mechanisms using graphical methods

CO3 – Analyze displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers

CO4 – Analyze gear and gear train depending on application

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IC ENGINES & GAS TURBINES

Pre-requisites: Chemistry, Thermodynamics

Course Objectives:

The students will learn

1. Apply the laws of Thermodynamics for I.C Engines, Compressors, Gas turbines
2. Analyse air standard cycles
3. Evaluate the performance analysis of the major components and systems of IC engines
4. Performance of Heat Engines in real-time applications by applying the various testing parameters of an engine (Brake power, Torque)
5. Techniques for improving the efficiencies and performance of compressors & gas turbines

Module I

I.C Engines

Four and two stroke engine, SI and CI engines, valve and port timing diagrams, fuel properties and combustion, Stoichiometry

Assisted systems in IC Engines

Fuel injection systems for SI engines, fuel injection systems for CI engines, ignition systems, cooling and lubrication system

Module II

Combustion in SI engines

Normal combustion and abnormal combustion, importance of flame speed and effect of engine variables, type of abnormal combustion, pre-ignition and knocking, fuel requirements and fuel rating, anti-knock additives, combustion chamber, requirements, types

Combustion in CI Engines

Four stages of combustion, delay period and its importance, effect of engine variables, diesel Knock, need for air movement, open and divided combustion chambers and nozzles used, fuel requirements and fuel rating

Module 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
Compressors
Classification, of compressors, fans, blower and compressor, positive displacement and dynamic types, reciprocating and rotary types

Module IV
Rotary, dynamic and axial flow (positive displacement)
Roots blower, vane sealed compressor, mechanical details and principle of working efficiency considerations; Centrifugal compressors: mechanical details and principle of operation, velocity and Pressure variation, Energy transfer, impeller blade shape-losses, slip factor, and 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

Module V
Gas turbine and its classification, cycle analysis, introduction to Codes and Standards used in turbine design. Factors affecting design and performance of gas turbine combustion chamber, losses in turbines, estimation of turbine performance

Alternative fuels, their availability, properties, merits and demerits, requirements of fuels for IC engines, blends and other fuels used in CI engines, manufacturing, storage and performance analysis of alternative fuels, use of hydrogen, CNG, bio gas in SI engines, safety precautions, performance and emission characteristics

Text Books:

Reference Books:

Online references:
1. 1.https://nptel.ac.in/courses/112102103/16
2. 2.https://nptel.ac.in/courses/112107078/37
Course Outcomes: At the end of the course the student should be able to

CO1 – Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance.
CO2 – Evaluate the performance parameters of I.C Engines, Compressors and Gas turbines.
CO3 – Apply the laws of Thermodynamics to evaluate the performance of Gas turbine cycles.
CO4 – Describe the need of various systems to run an Engine without failure.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 – Low

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HR22

B. Tech II Year–IV Sem

Subject Code: 22PC4ME09

FLUID MECHANICS AND HYDRAULIC MACHINES

Pre-requisite: Basic Physics, Mathematics

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.

Module 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.

Pressure Measurement
Gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

Module II
Fluid Kinematics
Stream line, path line and streak lines and stream tube, classification of flows-steady & 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 streamline, momentum equation and its application on force on pipe bend.

Module 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
Module 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, work done, efficiencies, hydraulic design—draft tube theory—functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Module V

Centrifugal Pumps
Classification, working, work done—barometric head-losses and efficiencies specific speed-performance characteristic curves, NPSH.

Reciprocating Pumps
Introduction, construction details, working principle, types, Discharge, slip, indicator diagrams.

Text Books:
1. Hydraulics, Fluid mechanics and Hydraulic Machinery - MODI and SETH.
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.

Online Resources:

Course Outcomes: At the end of the course the student should be able to

CO1-Identify various types of flows and formulate their governing equations.
CO2-Analyze the losses in pipe flows with the concepts of flow through pipes.
CO3- Evaluate hydrodynamic forces of jet striking different vanes from various angles.
CO4-Design the working proportions of hydraulic turbines and pumps.
## CO-PO/PSO Mapping Chart

(3/2/1 indicates strength of correlation)

3 – High; 2 – Medium; 1 - Low

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Pre-requisite: Nil

Course Objectives:
1. Describe concepts of business economics and demand analysis to help in optimal decision making in business environment
2. Differentiate the functional relationship between Production and factors of production and able to compute breakeven point to illustrate the various uses of breakeven analysis
3. Identify various market structures and discuss their implications for resource allocation
4. Explain various accounting concepts and different types of financial ratios for knowing financial positions of business concern.
5. Demonstrate an understanding of the concept of capital budgeting and allocations of the resources through capital budgeting methods and compute simple problems for project management.

Course Outcomes:
1. Understand economics and business economic concepts
2. Differentiate different business organisations and nurture the idea of start-ups
3. Analyze operations of markets under varying competitive conditions
4. Apply accounting concepts and methods to interpret financial statements for evaluating the financial position and performance of organizations

Module I INTRODUCTION TO BUSINESS AND ECONOMICS
Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company

Module II DEMAND AND SUPPLY ANALYSIS
Elasticity of Demand: Demand, Law of Demand, Elasticity, Types of Elasticity, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand,
Demand Forecasting: Steps in Demand Forecasting, Methods of Demand Forecasting.
Supply Analysis: Determinants of Supply, Supply Function & Law of Supply

Module III PRODUCTION, COST, MARKET STRUCTURES & PRICING
Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions. Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Module IV INTRODUCTION TO FINANCIAL ACCOUNTING


Final Accounts: Elements of Financial Statements, Preparation of Final Accounts: Trading account, Profit & Loss Account, Balance sheet

Module V CAPITAL BUDGETING

Capital and its Sources: Significance, types of capital, estimation of fixed and working capital requirements, methods and sources of raising capital

Capital budgeting: Features of capital budgeting proposals; Methods of capital budgeting: Payback period, accounting rate of return (ARR), net present value method and internal rate of return method (simple problems).

Text Books:

Reference Books:

Web Resources:
1. https://books.google.co.in/books/about/Managerial_economics_and_financial_analysis.html
4. http://books.google.com/books/about/Managerial_economics_and_financial_analysis.html

CO-PO MAPPING:

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(3/2/1 indicates strength of correlation) 3 – High; 2 – Medium; 1 – Low
COMPUTER AIDED MACHINE DRAWING PRACTICE

Pre-requisite: Engineering graphics

Course Objectives:
1. To familiarize with the standard conventions for different materials and machine parts in working drawings.
2. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.
3. The student will acquire knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft.
4. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

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.

Assembly Drawings:
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions. (Any two from each topic).
1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block, Fuel Injector
4. Valves - Steam stop valve, spring loaded safety valve, feed check valve and air cock.

Reference Books:

Online references:
https://nptel.ac.in/courses/112/103/112103019/

Course Outcomes: At the end of the course the student should be able to
CO1: Analysis of complex design systems related to mechanical Engineering.
CO2: Making use of appropriate laboratory tools and design innovative methods.
CO3: To enhance the ability of students to work as teams.
CO4: Improving skills to adopt modern methods in mechanical engineering as continuous improvement.

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CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – High; 2 – Medium; 1 – Low
Course Objectives:
At the end of course students are able to

1. Develop procedure for standardization of experiments.
2. Calibrate flow discharge measuring devices used in pipes.
3. Determine the major and minor losses in a given pipe.
4. Prove that the total head at any point along the fluid flow is same.
5. Test the performance of pumps and turbines

LIST OF EXPERIMENTS:
Note: Any Ten experiments to be conducted.

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.
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.

Course Outcomes: At the end of the course the student should be able to

CO1-Describe the calibration of measuring devices
CO2-Identify various types of flows and their function
CO3-Analyze the losses in pipe flows with the concepts of flow through pipes.
CO4-Test the performance of hydraulic turbines and pumps.
## CO-PO/PSO Mapping Chart

(3/2/1 indicates strength of correlation)

3 – High; 2 – Medium; 1 - Low

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English for Employability Lab
(Common to ECE, EEE, ME, CSE, CSD, CSO, CSC, CSM branches)

Course Objectives:

1. To improve the communication skills, body language, facial expression and gesture.
2. To be able to understand the concept of employability skills (Quantum dexterity) and enhancing ones’ behavior in the personal, professional and social forum.
3. To evaluate the LSRW (listening, speaking, reading and writing) through assessment.
4. To learn the basic grammar for improving spoken and written communication.
5. To become problem solver, analyze and apply critical and analytical skills.
6. To Identify the Employability skills, assigning tasks (Group Discussion, JAM, Role play etc..) for day today evaluation.

Activity

1- Narration (Historical places, events, Picture narration, Memorable incidents of life)

Self Intro, Daily Routine, Likes & Dislikes, Vocabulary, Triangular Activity (Person based- S-P), Imperatives & JAM

Targeted Skills- Listening- Speaking- Audio-Video clips

Activity 2: Quantum of Dexterity (QOD)-- Ability (Personal, Behavioural & Professional)
Request/Permission/Order, Survival kit, Career Objective Professional, Hidden Talents (Personal), Character Traits (Behavioural)

Targeted Skills- Reading-Writing – Concluding an open-ended Story, Creative Writing.

Activity 3: Critical & Analytical Skills

SWOC- (Social & Cultural, Political, Economic, Legal Impact, Technical, Nuances of
Pronunciation, Voice Modulation, Neutralizing Mother Tongue Interference, Tongue Twisters for practice.

**Targeted Skills**- Writing SWOC, Self-Introduction, Exposure to a structured talk.

Activity 4: **Flick Flow/Extempore**


**Targeted Skills**- Speaking Skills

Activity 5: **On Job Training**

Formal & Informal communication, Resume E-mail Etiquette, Telephonic & Interview Etiquette, Situation based- Santa’s Bag, topic/case study-based Group Discussion, Kicks me! (Job Consultancy/Role Play)

**Targeted Skills**- Listening-Writing- Speaking

**Course Outcomes:** After undergoing this course, the student will be able to;

**CO1:** Understand the explicit and implicit of importance of employability skills.

**CO2:** Demonstrate life skills like team work, learning skills, problem solving, attitude, adaptability and flexibility.

**CO3:** Apply critical and analytical skills to bring out the solution on problem/case study.

**CO4:** Recognize the need of appropriate words, Phrases & functional grammar and apply them in both spoken and written communication.

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B.Tech II Year – IV Sem

Subject Code: 22PR4ME02

DOING ENGINEERING -1

Description: 3D Modeling & Drafting of a Machine/Equipment/Assembly - Lathe/Two Wheeler/Electrical Transformer/Injection Moulding Machine

Prerequisite: Engineering Drawing

Course Objectives:
1. To familiarize the assembly and Disassembly of industrial / automotive equipment
2. To familiarize the practicing engineering through a doing engineering methodology with a equipment.
3. To make 3D models of various machine elements.
4. To make part drawings including sectional views for various machine elements.
5. To prepare assembly drawings given the details of part drawings.

Assembling and Disassembling of an equipment by hands-on experience
2. Design thinking of selected assembly. (Measurement of each component, Hand Sketch of the components with dimensions. Hand sketch of the Assembly and its mechanism)
3. Solid modeling for components level
4. Presentation on components (solid modeling)
5. Presentation on manufacturing.
6. Physical Assembling of equipment.
7. Make a video & report preparation along with any other two assembly teams.

Text Books:
1. Training Manuals of SOILD WORKS/AUTOCAD/FUSION 360.

Course Outcomes: At the end of the course students able to
1. Demonstrate competency with multiple drawing and modifications.
2. Create three-dimensional solid models.
3. Create three-dimensional assemblies incorporating multiple solid models.
4. Apply industry standards in the preparation of technical drawings.
Assessment: Three hours exam:
1. 40 marks: Continuous Internal Evaluation
2. 60 Marks: External Evaluation.

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The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368; however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”.
Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21