

## 21BS2112:PROBABILITY AND STATISTICS &COMPLEX VARIABLES

B.Tech. II Year - I Sem

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**Pre-requisites:** Mathematical Knowledge at pre-university level

### Course Objectives:

- Understand the basic concepts of probability and random variables.
- Gain knowledge about various discrete and continuous probability distributions.
- Examine statistical hypothesis for large and small data samples.
- Understand analyticity of complex valued functions.
- Evaluate integrals using Cauchy's integral formula and Cauchy's residue theorem, expansion of complex functions using Taylor's and Laurent's series, mapping the functions and Transform the functions by Mobius transformation.

**Course outcomes:** At the end of the course, student would be able to:

- Solve problems involving discrete and continuous random variables for finding measures of central tendency.
- Evaluate of statistical parameters for some of the discrete and continuous distributions.
- Apply the hypothesis procedure for experimental data to test means and proportions using large and small sample tests.
- Analyze the complex function with reference to the analyticity and understand the harmonic and conjugate harmonic functions.
- Analyze the Taylor's and Laurent's series expansions and Mobius transformation for the complex function.

### UNIT - I

**Basic Probability:** Introduction to Probability, Random variables: Discrete and continuous random variables and their properties, distribution functions and density functions. Expectation of random variables, Moments, Variance of random variables.

### UNIT – II

**Probability distributions:** Binomial, Poisson, evaluation of statistical parameters for these distributions, Poisson approximation to the binomial distribution. Normal and exponential, evaluation of statistical parameters for these distributions.

### UNIT – III

**Testing of Hypothesis:** Test of significance - Basic of testing of Hypothesis. Null and Alternate Hypothesis, types of errors, level of significance, critical region. Large sample test for single proportion, difference of proportions, single mean, difference of means; small sample tests: Test for single mean, difference of means and test for ratio of variances

### UNIT – IV

**Complex Variables (Differentiation):** Limit, Continuity and Differentiation of Complex functions, Analyticity, Cauchy-Riemann equations (without proof), finding harmonic conjugate.

## **UNIT – V**

**Complex Variables(Integration):**Line integral, Cauchy's theorem, Cauchy's Integral formula, Zeros of analytic functions, Singularities, Taylor's series, Laurent's series;Residues, Cauchy Residue theorem, Conformal mappings, Mobius transformations and their properties.

### **TEXT BOOKS:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2016.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, Khanna Publications.
3. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9<sup>th</sup> Edition, PearsonPublications.
4. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 8th Ed., Mc-Graw Hill, 2004.

### **REFERENCE BOOKS:**

1. T.K.V.Iyengar, B. Krishna Gandhi and others,Probability and Statistics & Complex Variables,S.Chand publishing.
2. Miller and Freund's, Probability and Statistics for Engineers, 8<sup>th</sup> Edition, PearsonEducations.
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India,2002.
4. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

## 21ME2111: THERMODYNAMICS

B.Tech. II Year - I Sem

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**Pre-requisite:** Engineering Chemistry and Physics

### Course Objectives:

- To teach basic principles of classical thermodynamics
- To apply basic conversion principles of mass and energy to closed and open systems.
- To enable the students to understand second law of thermodynamics and apply it to various systems, note the significance of the results and to know about availability, entropy and second law aspects of daily life.
- To teach students about properties of pure substances and Using of mollier charts.
- To help the students understand various gas laws and equations of state and apply them to solve problems of gas mixtures in estimating enthalpy, entropy, specific heat and internal energy.

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

- Demonstrate an understanding of the concepts such as conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.
- Identify closed and open systems and analyze related problems.
- Apply the concept of second law to design simple systems.
- Demonstrate the importance of phase change diagrams of various pure substances.
- Apply gas laws to mixtures.

### UNIT I

**Basic concepts of Thermodynamics:** Introduction, System, Surroundings, universe, macroscopic and microscopic views, property, Path and Point functions, temperature and International Temperature Scale, Zeroth law of thermodynamics and application, Thermodynamics state and equilibrium, process and cycle, work, heat and other forms of energy.

**First Law of Thermodynamics:** First law of thermodynamics, applications to closed and open systems, uniform and non-uniform processes, steady state and unsteady state processes, general energy equation and applications to thermal equipment.

### UNIT II

**Second Law of Thermodynamics:** Kelvin-Planck and Clausius statements-heat engines and heat pump, reversibility, Carnot cycle, Carnot theorem, Thermodynamic temperature scale, Deduction of the third law of thermodynamics, Types of Irreversibility.

### UNIT III

**Entropy & Available Energy, Availability and Irreversibility:** Clausius theorem, Property of Entropy, Clausius inequality, Entropy Principle, Applications of entropy principle, Maximum work obtainable from finite heat reservoirs, Entropy Generation in Closed and Open Systems, Isentropic Work in a Steady Flow Open System. Availability Basics, Available energy referred to a cycle, Maximum work in a reversible process, Reversible work-open cycle and closed system, Availability and Irreversibility.

### UNIT IV

**Properties Of Pure Substances, Ideal Gases and Properties of Steam:** Ideal gas equation, Properties of Ideal Gases, Equations of State, Law of Corresponding States, Properties of Mixtures, compressibility, universal compressibility chart, Pure Substances, P-V-T Surfaces, P-V, T-V, and P-T diagrams of water and other substances and differences of the same, phase change processes, Concept of Vapor Pressure, Properties of steam, Saturation Temperature and Pressure, Use of property tables, T-S diagrams, Mollier Chart, Rankine Cycle.

## UNIT V

**Thermodynamic Relations:** Thermodynamic Relations, Maxwell's Equations, Gibbs and Helmholtz Functions, Joule Kelvin Effect, Clausius-Clapeyron Equation, Conditions of Thermodynamic Equilibrium and Stability.

### TEXT BOOKS:

1. P K Nag, 6th Edition, Basic Engineering Thermodynamics, Tata McGraw-Hill Publishing Company Ltd.
2. Yunus A. Cengel Michael A. Boles, (2005), Thermodynamics: An Engineering Approach, McGraw-Hill Science.
3. Engineering Thermodynamics – R.K. Rajput Laxmi Publications 3rd Edition.
4. A Text Book of Engineering Thermodynamics - BB Ghosh, Sanis. Ghosh / Vikas.
5. Applications of Thermodynamics – V. Kadambi / Wiles.

### REFERENCES:

1. Cengel Y A and Boles M A "Thermodynamics, An Engineering Approach" Tata McGraw Hill, 2003.
2. Michael J Moran, —Fundamentals of Engineering Thermodynamics, Wiley India Pvt. Ltd., 2010.
3. Holman J P, —Thermodynamics, Tata McGraw Hill, 1998.
4. Thermodynamics / S.C.Gupta / Pearson.
5. Applied Thermodynamics for Engineering Technologist-Y.D.Estop/Pearson 5<sup>th</sup> Edition.

**Pre-requisites:** Basic principles of mechanics.

**Course Objectives:**

- Study different link, pairs of a mechanism and also to different mechanisms and their inversions.
- Analyze displacement, velocity and acceleration of various links in a mechanism using instantaneous centre method and relative velocity method.
- Understand different straight line motion mechanisms and to analyze Hooke's joint.
- Study different CAMS and Followers and to Analyze the motion of the follower w.r.t CAM using CAM profiles.
- Study toothed gears, Types of gears and to analyze different types gear trains.

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

- Identify different links, pairs of a mechanism and also different mechanisms and their inversions.
- Analyze displacement, velocity and acceleration of links in different mechanisms using instantaneous center and relative velocity method.
- Differentiate different straight line motion mechanisms and to explain Universal coupling or Hooke's joint.
- Develop cam profiles for the required motion of follower.
- Design gears and gear trains to avoid interference and to get exact velocity ratio.

**UNIT – I**

**Simple Mechanisms :** Elements or Links, types of links, 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 constrained and incompletely constrained . Kinematics chain, inversion of mechanism, type of kinematic chains, four bar or quadric cycle chain, single and double slider crank chains and their inversions.

**UNIT – II**

**Plane motion of body:** Instantaneous center of rotation, centrodes and axodes, relative motion between two bodies. Three centers in line theorem – Graphical determination of instantaneous center, analysis of simple mechanisms and determination of linear velocity and angular velocity of links.

**Kinematics:** Velocity and acceleration – Motion of link in machine – construction of Velocity and acceleration – Graphical method – Application of relative velocity method- four bar chain.

**Analysis of Mechanisms:** Analysis of slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for a given mechanism. Kliensconstruction ,Coriolis acceleration , determination of Coriolis component of acceleration.

**UNIT – III**

**Hooke's Joint:** Hooke's joint –universal coupling – application – problems.

**Straight line motion mechanisms:** Exact and approximate copied and generated types – Peaucellier , Hart , Scott Russel – Grasshopper – Watt ,Tchebicheff's and Robert Mechanism and straight line motion, Pantographs.

**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. Maximum velocity and maximum acceleration during outward and return strokes in the above three cases. Over view

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

#### **UNIT – V**

**Gears-Gear trains: 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, Path of contact.

**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. Expressions for arc of contact.

#### **TEXT BOOKS:**

1. S.S.Rattan, Theory of Machines, 3rd edition, McGraw-Hill Publications, New Delhi (2011).
2. Amitabha Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines, 3rd edition, East West Press Pvt. Ltd., New Delhi (Reprint 2017).
3. R.K. Bansal, J.S. Brar. A Textbook of Theory of Machines; L.P January 2016.
4. Shigley J. E. and John Joseph Uicker, Theory of Machines and Mechanisms, 2<sup>nd</sup> edition McGraw-Hill international edition (2003)
5. Norton, R.L., Design of Machinery - An introduction to Synthesis and Analysis of Mechanisms and Machines, McGraw Hill International Editions, 2000.

#### **REFERENCES:**

1. Thomas Bevan, “Theory of Machines”, College Book Store (CBS) Publishers Ltd., 3rd Edn., 1985.
2. Theory of Machines and Mechanisms Prof. PL BALLANEY; Kanna Publications 25 edition.
3. J.S. Rao and R.V. Dukkipati, “Mechanisms and Machine Theory”, Wiley Eastern Limited, 1992.
4. “Theory of Machines: Kinematics and Dynamics” by Sadhu Singh. Pearson, 3rd Edition.
5. Theory of Machines by RS Kurmi & JK Gupta; S CHAND New Addition.

## 21ME2113: INDUSTRIAL METALLURGY AND MATERIAL SCIENCE

B.Tech. II Year - I Sem

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**Pre-requisites:** Mathematics, Physics and Chemistry.

### Course Objectives:

- Understand the microstructures of different types of metal and alloys – cast iron, steels, non-ferrous metal and alloys.
- Understand the heat treatment principles – annealing, normalizing and hardening.
- Understand the different types of tool steels and non-ferrous alloys.
- Able to understand the importance of Titanium and its alloys.

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

- Distinguish different types of metals and alloys.
- Design a heat treatment process to change the properties – hardness, ductility, etc.
- Analyze the microstructures of various metals and alloys.
- Explain and justify the usage of Non-ferrous alloys specially Titanium and its alloys.
- Understand the concepts of composites.

### UNIT-I

**Crystal Structures:** Unit cells, Crystal systems, Crystallographic directions and planes, FCC, BCC and HCP structures, linear and planar densities, Close packed structures, Imperfections in crystal structures, Point defects, Dislocations, Grain boundaries, Grain size determination, Slip and deformation.

### UNIT-II

**Phase Diagrams And Phase Transformations:** Phase, Gibbs phase rule, Microstructure, Binary phase diagrams, Isomorphous systems, Conditions of unlimited solubility, Eutectic systems, Intermediate phases, Eutectoid and peritectic reactions, Iron-Carbon diagram, Microstructures in Iron-Carbon alloys, Phase transformations, Isothermal transformation diagrams, Pearlite, Martensite and Bainite transformations, Tempered martensite, Continuous cooling transformation diagrams.

### UNIT-III

**Heat Treatment And Strengthening Methods:** Heat treatment of steels, Annealing, Normalizing, Quench hardening, Tempering, Austempering, hardenability and hardenability test, Surface heat treatment / Case hardening, Carburising, Cyaniding, Nitriding, Flame hardening, Induction hardening, Strain hardening / Cold working and annealing, Three stages of annealing, Solid solution strengthening, Dispersion hardening, Precipitation / Age hardening, Strengthening by grain refinement.

### UNIT-IV

**Steels And Cast Irons:** Carbon steels and Low alloy steels, Effects of alloying elements, Important low alloy steels, Stainless steels, Ferritic, Martensitic and Austenitic stainless steels, Maraging steels, Tool steels, Types, Cast irons, White iron, Malleable iron, Grey iron, Ductile iron.

### UNIT-V

**Non Ferrous Metals, Ceramics And Composites:** Copper and copper alloys, Brasses, Bronzes, Aluminum alloys, Temper designations for aluminium alloys, Heat treatable and non-heat treatable aluminium alloys, Nickel and Nickel alloys, Monel, Super alloys, Titanium and Titanium alloys, Alpha Ti alloys, Beta Ti alloys, Alpha-Beta Ti alloys, Nickel and nickel alloys, Ceramics, Glasses, Refractories, Types of refractories, Composites, Types of composites.

**TEXT BOOKS:**

1. Sydney H Avner, —Introduction to Physical Metallurgy| McGraw Hill Book Company, 1997.
2. Raghavan V, —Physical Metallurgy: Principles and Practicel, Prentice-Hall of India Pvt.Ltd,2006.
3. V.D. Kodgire, “Material Science and Metallurgy”, Everest Publishing House - 25th Edition – 2009.
4. Metallurgy and Material Science – PakirappaDurga publishing house Hyderabad.
5. Material Science for Engineers – J.C.Anderson Nelson Thomas U.K.

**REFERENCES:**

1. William D CallisterJr, —Materials Science and Engineering-An Introduction|, John Wiley and Sons Inc., New York, 2009.
2. Kenneth G. Budinski and Michael K. Budinski, —Engineering Materials: Properties and Selection|, Prentice Hall, 2010.
3. B.K.Agarwal, “Introduction to Engineering Materials”, Tata McGraw Hill - 1 stEdition.
4. M.Mukhopadhyay, “Mechanics of Composite Materials and Structures” Universities Press - 2004.
5. Mechanics of Composite Materials – Tailor & Francis Publishing Co.



## 21ME2114: MECHANICS OF SOLIDS

B.Tech. II Year - I Sem

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**Pre Requisite:** Engineering Mechanics.

### Course Objectives:

- This course will advance the students' development of the following broad capabilities:
- Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
- 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.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations.
- Students will understand how to calculate normal and shear stresses.

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

- Model and analyze the behavior of structural and machine components subject to various loadings and support conditions based on principles of equilibrium and material constitutional relationships.
- Understand and apply the concept of stress and strain to analyze and design structural members and machine parts under axial loads, shear load, bending moment and Torsional moment.
- Solve practical problems through evaluating the relationship between stress and strain.
- Analyze of composite bars and shafts and deflections and deformations of loaded flexural members.
- Determine stresses in both thin and thick cylinders.

### UNIT – I

**Simple Stresses And Strains:** Elasticity and plasticity – Types of stresses and strains- Hook's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and 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:** Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, uniformly varying loads and combination of these loads – Point of contraflexure – Relation between S.F, B.M and rate of loading at a section of a beam.

### UNIT – III

**Flexural Stresses:** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$  Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections (solid and hollow), I, T Angle and channel sections – Design of simple beam sections.

**Shear Stresses:** Derivation of formula – shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

### UNIT – IV

**Deflection Of Beams:** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L, uniformly varying load, Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

## **UNIT – V**

**Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Riveted boiler shells – Thin spherical shells.

**Thick cylinders** – lame’s equation – cylinders subjected to inside and outside pressures – compound cylinders.

### **TEXT BOOKS:**

1. S. Ramamrutham, Strength of Materials, DhanpatRai& Sons, 1993.
2. Strength of Materials by SS Rattan, McGraw Hill; Third Edition.
3. B.C. Punmia, Strength of Materials, Laxmi Publishers, 2012.
4. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, 2011.
5. E.P.Popov, Engineering Mechanics of Solids, PHI, 2009.

### **REFERENCES :**

1. R.K. Rajput, Strength of Materials, S. Chand & Co., 2003.
2. D.S. Prakash Rao, Strength of Materials - A Practical Approach, Universities Press, 1999.
3. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan Indian Limited, Delhi, 2002.
4. S. B. Junarkar, Mechanics of Structures, Charotar Publishers, 2010.
5. Ferdinand P Beer [et.al.](#), Mechanics of Materials, Tata McGraw-Hill, 2004.

## 21ME2151: THERMODYNAMICS LABORATORY

B.Tech. II Year - I Sem

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**Pre-requisites:** Basic Principles of Thermodynamics.

**Course Objective:** To understand the fuels and lubricants properties.

**Course outcomes:**

- Understand the Flash and Fire points of different Liquids.
- Compare the viscosity of different fluids by using Viscometers.
- Understand the Drop point and Penetration test based on applied loads.
- Identify the calorific value of Gas fuel using Junkers calorimeters.
- Identify the calorific value of Solid fuel using Bomb calorimeters.

**List of Experiments:**

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using Pensky Martens Apparatus.
3. Carbon residue test on Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using Saybolt Viscometer.
5. Determination of Viscosity of Liquid lubricants and Fuels using Redwood Viscometer.
6. Determination of Viscosity of Liquid lubricants and Fuels using Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using Bomb Calorimeter.
9. Determination Drop point and Penetration test on Grease.
10. Fractional distillation experiment as per ASTM standard.
11. Cloud and Pour point test on oils.

## 21ME2152: MATERIAL SCIENCE& MECHANICS OF SOLIDS LABORATORY

B.Tech. II Year - I Sem

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**Pre-requisites:** Fundamental knowledge on metallurgy, material science Engineering Mechanics.

### Course Objectives:

- Students will be able to experimentally learn the microstructure, compositions and various mechanical properties of the metals and alloys.
- Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
- 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.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
- Students will understand how to calculate normal and shear stresses on any cross-section of a beam.

**Course Outcomes:** After completion of this course the students will be able to:

- The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application.
- Upon graduation, students would have acquired and developed the necessary background and skills for successful careers in the materials-related industries.
- Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree.
- Analyze the behavior of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.

### List of Experiments:

1. Preparation and study of the microstructure of steels.
2. Study of microstructures of cast irons.
3. Preparation and study of the microstructure of non -ferrous alloys.
4. Preparation and study of the microstructure of heat treated steels.
5. Hardenability of steels by Jomney end quench test.
6. To find out the hardness of various treated and untreated steels.
7. To investigate the behavior of given specimen under a Tensile Test.
8. To conduct the compression test on the given test specimen.
9. To perform the Bending test on the given test specimen.
10. To find out the Brinell Hardness and Rockwell hardness of the given material.
11. To organize the Bending test of a Simply Supported Beam of steel and wooden specimen.
12. To organize the Bending test of a Cantilever Beam of steel and wooden specimen.
13. To determine the Stiffness of the Spring under Compressive loads.
14. To determine the Stiffness of the Spring under Tensile loads.
15. To conduct the Punch Shear test on the given rod.
16. To organize the Charpy test on the given specimen.
17. To organize the Izod Impact Test on the given specimen.

**NOTE:** Perform any 12 experiments as mentioned above.

## 21ME2153:MACHINE DRAWING

B.Tech. II Year - I Sem

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**Pre-requisites:** Engineering graphics

**Course objectives:** To learn

- To familiarize with the standard conventions for different materials and machine parts in working drawings.
- To make part drawings including sectional views for various machine elements.
- To prepare assembly drawings given the details of part drawings.

**Course Outcomes:** After completion of this course the students would be able to:

- Understand the different conventional representations of materials related to machine members.
- Preparation of engineering and working drawings with dimensions and bill of material during design and development.
- Understand the Drawing of Machine Elements for simple parts.
- Develop Assembly of machine drawings using part drawings.
- Understand the sectional views of assembled components for analysis.

### **Introduction:**

1. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
2. Types of sections, sectional views.
3. Methods of dimensioning, general rules.
4. Title boxes and details – common abbreviations and their liberal usage.
5. Types of Drawings – working drawings for machine parts.

**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.

**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, Eccentrics.
2. Machine tool parts: Tail stock, Machine Vices.
3. Other machine parts – Screws jacks, Petrol engine connecting rod.
4. Simple designs of spring loaded safety 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 N D Bhatt Revise Edition 2016. Charotar Publishing.
2. Textbook of Computer Aided Machine Drawing S. Trymbaka Murthy 2017 – e EDITION.
3. A Textbook of Machine Drawing by Dhawan R K CHAND & CO – 2016 EDITION

4. Text book of Machine Drawing - P.S.Gill. S.K. Kataria& Sons - 2013 Edition - Reprint 2019.

**REFERENCES :**

1. Machine Drawing / Ajeet Singh / Mc Graw Hill.
2. Machine Drawing by / Bhattacharyya / Oxford.
3. Machine Drawing - III edition K/L Narayana / KannaiahVenkat Reddy New Age Publishing.
4. Machine Drawing with Auto CAD / GouthamPohit, Goutam Ghosh / Pearson.

## 21HS2117:UNIVERSAL HUMAN VALUES-II

B. Tech II Year I Semester

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**Pre-requisites:** Universal Human Values 1 (desirable)

**Course Objective:** The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

**Course Outcomes:** By the end of the course, students

1. Are expected to become more aware of themselves, and their surroundings (family, society, nature).
2. Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
3. Would have better critical ability.
4. Would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
5. Would be able to apply, what they have learnt, to their own self in different day-to-day settings.

### UNIT - I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

*Include practice sessions to discuss natural acceptance in human being as their innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking*

### UNIT - 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’ - happiness and physical facility
- Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

*Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease*

### **UNIT - III: Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

*Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives*

### **UNIT - IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

*Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.*

### **UNIT - V: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
  - a. Ability to utilize the professional competence for augmenting universal human order
  - b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order:
  - a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  - b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

*Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.*

### **TEXT BOOKS**

1. RR Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. RR Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values



## REFERENCE BOOKS

1. JeevanVidya: E k Parichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. A.N.Tripathi,“HumanValues”,New Age Intl.Publishers,NewDelhi,2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”
5. E. F Schumacher. “Small is Beautiful”
6. “Slow is Beautiful”–Cecile Andrews
7. J C Kumarappa “Economy of Permanence”
8. PanditSunderlal“Bharat Mein Angreji Raj”
9. Dharampal,“Rediscovering India”
10. Mohandas K. Gandhi, “Hind Swarajor Indian Home Rule”
11. “India Wins Freedom”-Maulana Abdul Kalam Azad
12. Vivekananda-Romain Rolland(English)
13. Gandhi-Romain Rolland(English)

## 21MC0003: ENVIRONMENTAL SCIENCE

**B. Tech. II Year- I Sem**

**LT P C**  
**3 0 0 0**

**Course Objectives:** To learn

- Identify the importance of ecosystem and its functions.
- Understand the natural resources and their usage in day to day life.
- Understand the concept of bio-diversity, its values and conservation.
- Be aware of the causes of different types of pollution and its control.
- Understand various environmental impacts, requirement of various policies and legislations towards environmental sustainability.

**Course Outcomes:** After the completion of the course, the student would be able to –

- Explain ecosystem and its functions namely, food chain, ecological pyramids etc.
- Acquire knowledge about different types of natural resources such as land, water, minerals, non-renewable energy and their excessive usage leading to detrimental effects on environment.
- Comprehend ecosystem diversity, its values and importance of hot spots to preserve the same.
- Explain different types of pollution, its control and impact on global environment.
- Recognize various environmental impacts and the importance of various acts and policies towards environmental sustainability.

### **UNIT-I**

**ECOSYSTEMS:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnifications, Field visits.

### **UNIT-II**

**NATURAL RESOURCES:** Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy Resources-renewable and non-renewable.

### **UNIT-III**

**BIODIVERSITY AND BIOTIC RESOURCES:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

### **UNIT-IV**

**ENVIRONMENTAL POLLUTION AND CONTROL TECHNOLOGIES:** Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies. Global Environmental Issues and Global Efforts: Green House Gases And its effect, Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

## **UNIT-V**

**ENVIRONMENTAL POLICY, LEGISLATION & EIA:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economic aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

### **TEXT BOOKS:**

1. ErachBharucha, Textbook of Environmental Studies for Undergraduate Courses, University Grants Commission.
2. R. Rajagopalan, Environmental Studies, Oxford University Press.

### **REFERENCES:**

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHLLearning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin& Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by AnubhaKaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications. 6. Introduction to Environmental Science by Y. Anjaneyulu, BS.Publications.

## 21ME2211:THERMAL ENGINEERING- I

B.Tech. II Year -IISem

L T P C

3 0 0 3

Pre-Requisites: Thermodynamics.

### Course Objectives:

- Apply the laws of Thermodynamics to analyze Steam cycles.
- Perform analysis of the major components of steam turbine plants and their applications. Understand the working of different types of Boilers and nozzles and its applications.
- Understand the working of steam turbines and their performance analysis.
- Understand the working of different types of Steam condensers and jet propulsions.

### Course Outcomes: At the end of the course Student would be able to

- Demonstrate the working and performance of IC Engines on Thermodynamic Cycle.
- Understand the working of vapor power cycle and various heat addition concepts for improving its vapour quality and efficiency.
- Apply the fundamentals of thermodynamics on Nozzle performance and its analyses.
- Estimate the various performance parameters of steam turbines in different fields of energy transfer equipment's.
- Demonstrate the concepts of steam condensers within realistic constraints and power plant measuring instruments.

### UNIT I

**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 Cycles.

**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 – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition. – Fuels, Fuel properties and Combustion Stoichiometry.

### UNIT II

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

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

**Draught-** Classification – Height of chimney for given draught and discharge- Condition for Maximum discharge- Efficiency of chimney.

### UNIT III

**Steam Nozzles:** Stagnation Properties- Function of nozzle – Applications and Types Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge Critical pressure ratio- Criteria to decide nozzle

shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

#### **UNIT IV**

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

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

#### **UNIT V**

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

**Power plant instrumentation and measurements:** Classification of instruments in thermal power plant and working – pressure, temperature, level, flow, expansion, vibration measurements– Analysis of water, steam, flue gases.

#### **TEXT BOOKS:**

1. V. Ganesan “Gas Turbines” Mc Graw Hill, 2nd Edition, 2017.
2. Mahesh M Rathore “Thermal Engineering” Mc Graw Hill, 2nd Edition, 2010.

#### **REFERENCES:**

1. Saravanamuttoo, Cohen, Rogers “Gas Turbine Theory” Pearson, 5th Edition, 2001.
2. Rathakrishnan “Fundamentals of Engineering Thermodynamics” PHI, 2nd Edition, 2006.
3. R.K. Rajput “Thermal Engineering” McGraw Hill Ed.6th Edition, 2006.
4. Thermal Engineering, R. Rudramurthy, Tata McGraw-Hill Education.

## 21ME2212: DYNAMICS OF MACHINES

B.Tech. II Year - II Sem

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3 0 0 3

**Pre-requisite:** Kinematics of machines.

**Course Objectives:** To learn

- Explain the gyroscopic effect of dynamic bodies such as aero plane, ship and four wheeler and static and dynamic force analysis of different mechanisms.
- Analyze inertia forces in different parts of reciprocating engine and fluctuation of energy and to design a flywheel.
- Understand the effect of friction on clutches and brakes and determine the frictional torque, power loss due to friction.
- Study different types of governors and balancing of rotating and reciprocating masses.
- Interpret the types of vibrations and analyze whirling of shafts.

**Course Outcome:** After completion of this course the students will be able to:

- Determine the effect of gyroscopic couple in a dynamic body such as aero planes, ships etc.,
- Analyze the forces in a single and multi-cylinder IC engines.
- Interpret the frictional torque and power in clutches, brakes and dynamometers.
- Determine the unbalanced forces in a single cylinder and multi cylinder engines containing rotating and reciprocating masses.
- Apply natural frequency of free and forced vibrations with and without damping.

### UNIT – I

**Precession:** Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aero planes and ships.

**Static and Dynamic Force Analysis:** Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

### UNIT – II

**Turning Moment Diagram and Flywheels:** Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod-inertia force in reciprocating engines – crank effort and torque diagrams.

### UNIT – III

**Friction:** pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.

**Brakes and Dynamometers:** Types of brakes: Simple block brake, band and block brake-internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

### UNIT – IV

**Governors:** Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

**Balancing:** Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of “V” and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

#### **UNIT – V**

**Vibrations:** Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly’s method – Rayleigh’s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

#### **TEXT BOOKS:**

1. Theory of Machines /S.S. Rattan / Mc Graw Hill. - 5th Edition
2. Theory of Machines /Sadhu Singh/ Pearson- 3rd Edition
3. Theory of Machines and Mechanisms / P.L Ballaney / Khanna Publishers- Twenty FifthEdition.
4. Theory of Mechanisms & Machines Amitabha Ghosh Asok Kumar Mallik / East West Press Pvt.ltd
5. Theory of Machines by J. S Rao / New Age International Publishers.
6. Mechanical Vibrations / S.S Rao – 5th Edition / PEASON.

#### **REFERENCES:**

1. The Theory of Machines / Thomas Bevan / CBS Publications- Third Edition
2. Theory of Machines and Mechanisms/ John J. Uicker. Jr -Gordon R. Pennock–JosephE. Shigley / Oxford – Fourth edition
3. Theory of Mechanisms and Machines 1st Edition, Reprint by JagdishLal-MetropolitanBook Company Pvt.Ltd
4. Fundamentals of Machine theory and Mechanisms / Springer Publisher / Alex BatallerTorrás, Juan Antonio Cabrera Carrillo, Francisco EzquerroJuancAntonioJesús GuerraFernández.
5. Mechanical Vibrations by Dr. V. P Singh / DhanpatRai and Co (P) Ltd.

## 21ME2213: FLUID MECHANICS AND HYDRAULIC MACHINES

B. Tech. II Year - II Sem

L T P C  
3 0 0 3

**Course Objectives:** To learn

- Understand the basic fluid properties and different types of fluid flows.
- Understand various Forces acting on fluid flow and to derive Bernoulli's equation and also to study different discharge measuring devices.
- Study the impact of jet on vanes i.e Force exerted by jet of water on Fixed and moving blades of different types of vanes and to study hydro electric power plants and its components.
- Analyze different hydraulic turbines,hydraulic pumps and to evaluate their performance characteristics.

**Course Outcomes:** After completion of this course the students will be able to:

- Explain the effect of fluid properties on a flow system and to identify different types of fluid flows.
- Apply Bernoulli's principle to find discharge of fluid flowing through Orifice and Venturimeter and to find losses in pipes.
- Determine impact of jet on different types of blades or vanes of stationary and moving type and to study hydroelectric power plants.
- Analyze different hydraulic turbines for power generation and study performance parameters and characteristic curves of hydraulic turbines.
- Analyze different hydraulic Pumps and study performance parameters and characteristic curves of Hydraulic Pumps

### UNIT I

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

**Fluid kinematics :** Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, irrotational one, two and three dimensional flow, equation of continuity for one dimensional flow.

### UNIT II

**Fluid dynamics :** Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

**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.

**Measurement of flow:** pitot tube, venturimeter, and orifice meter, Flow nozzle Boundary Layer theory.

### UNIT III

**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, Layout of hydroelectric power plant.

**Hydroelectric power stations:** Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.



#### **UNIT IV**

**Hydraulic Turbines** : Classification of turbines, 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, cavitation, surge tank, water hammer, Hydraulic Ram.

#### **UNIT V**

**Centrifugal pumps** : Classification, working principle, work done – manometric head- losses and efficiencies, specific speed- pumps in series and parallel-performance characteristic curves, NPSH.

**Reciprocating pumps** :Working principle and workdone, Discharge, slip, indicator diagrams.

#### **TEXT BOOKS :**

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.
3. Fluid Mechanics and Hydraulic Machines by R.K.Bansal Lakshmi Publications.
4. Fluid Mechanics and Hydraulic Machines by R.S.KhurmiS.chand& Co. Ltd,
5. Fluid Mechanics and Hydraulic Machines by S.C.Gupta - PERSON Educations.

#### **REFERENCES:**

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiyah, New Age International.
3. Hydraulic Machines by Banga& Sharma, Khanna Publishers.
- 4..Hydraulic Machines Including Fluidics PB by JagdishLal Metropolitan Book Co. Pvt. Ltd.
5. Industrial Pneumatic Control by Z.J.Lanksy – Marcel Dekker, Inc.

## 21ME2214: PRODUCTION TECHNOLOGY

B.Tech. II Year - II Sem

L T P C  
3 0 0 3

**Pre-requisites:** Material science and metallurgy.

### Course Objectives:

- Various manufacturing processes like casting, joining and metal forming.
- Fundamentals of casting process and provide insight into the different casting methods.
- Fundamentals of various joining processes and their applications.
- Various metal forming processes such as cold and hot working processes.
- Different extrusion and forging operations.

**Course Outcomes:** After completion of the course the student is able to:

- Explain foundry process like casting, pattern making, mould making and casting defects.
- Choose appropriate joining process and classify different welding process.
- Classify various metal forming processes such as hot working and cold working process.
- Explain the methods involved in sheet metal works, rolling process and forging process.
- Know the various manufacturing methods in processing of plastics.

### UNIT-I

**Metal Casting Process:** Patterns- Pattern materials, types of pattern, Pattern allowances-types of molding sand and its properties, mold sand composition- Core making-Methods of sand testing- gating and risering System- Melting Practices: cupola, Induction furnaces construction and operations- Casting cleaning and casting defects-Inspection methods. Special casting processes: Investment casting process, Die casting process, shell molding process-centrifugal casting process-CO<sub>2</sub> Process.

### UNIT-II

**Joining Processes:** Fusion welding processes-Types of Gas Welding-Fuel Gases, Oxy-Acetylene Welding Equipment-Flame characteristics- Filler and Flux materials, Electric-Arc Welding, Electrodes, Coated electrode designation for manual metal arc welding, Carbon Arc Welding, Inert-Gas Shielded Arc Welding, Tungsten Inert-Gas Welding (TIG), Gas Metal-Arc Welding (GMAW), Submerged Arc-Welding (SAW), Other Arc-Welding Processes, Resistance Welding-Welding Defects. Basic principles of Thermit Welding, Laser Beam welding, Electron Beam Welding, Friction welding, Friction stir welding and Ultrasonic welding.

### UNIT-III.

**Bulk Deformation Processes:** Hot working and cold working of metals-Forging processes-Open, impression and closed die forging-types of Forging machines-Typical forging operations-Swaging-Rolling of metals-Types of rolling mills-Flat strip rolling-Shape rolling operations-Defects in rolled parts-principle of rod and wire drawing-Tube drawing-Principles of extrusion-Types of Extrusion-hot and cold extrusion-Equipment used.

### UNIT-IV

**Sheet Metal Processes:** Sheet metal characteristics-Typical shearing operations, bending and drawing operations, blanking, piercing, punching, trimming, etc. -formability of sheet metal-test methods of formability-Presses for sheet metal working, Elements of a simple die; punch and die clearances;

Progressive, compound and combination dies and Blanking force Calculations. Special forming methods: Explosive forming, electromagnetic forming, electro hydraulic forming, composite moldings.

#### **UNIT-V**

**Powder Metallurgy:** Definition-Advantages, Disadvantages/Limitations of powder metallurgy-Applications of powder metallurgy-Manufacture of parts by powder metallurgy-Production of metal powders-Blending of metal powders-pressing or compaction of metal powders-sintering-finishing operations.

**Plastic Processing:** Processing of plastics: General aspects-Plastic processing methods-compression moulding-Transfer moulding-Injection moulding-Expandable bead moulding-blow moulding-Extrusion.

#### **TEXT BOOKS:**

1. Production Technology: Manufacturing processes, Technology and Automation/R. K.Jain/Khanna Publications Pvt. Ltd, 2014, New edition.
2. Manufacturing processes for Engineering Materials/Kalpakjin S/ Pearson, 5th edition,2007.
3. Principles of Metal Castings / Richard W. Heine, Carl R. Loper, Philip C. Rosenthal/ McGraw-Hill, 1967.
4. Welding Process and Technology/ R.S.Paramar/Khanna publisher, 3 edi, 2003.
- 5.Principles of Foundry *Technology*/P.L Jain/ Tata McGraw Hill Pub., Co. Ltd., 4th Edition.

#### **REFERENCES:**

1. A text book of Production Engineering / Dr. P.C.Sarma/S.Chand Publications, New edition.
2. Process and materials of manufacturing/Lindberg/ Pearson India/ 4 edi, 2015.
3. Production Engineering – Suresh Dalela& Ravi Shankar / Galgotia Publications Pvt. Ltd.
4. Production Technology / R.K. Jain/Khanna Publications Pvt. Ltd, 2010, edition.
5. Production Technology/ K L Narayana/ I K International Pvt Ltd, 2010 edition.

## 21EE2218: ELECTRICAL TECHNOLOGY

B.Tech. II Year - II Sem

L T P C  
2 0 0 2

**Prerequisites:** Mathematics, Applied Physics

### Course Objectives:

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To study the concepts of control system

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

- **Analyze** and solve electrical circuits using network laws and theorems.
- **Understand** and **analyze** basic Electric and Magnetic circuits
- **Study** the working principles of Electrical Machines
- **Demonstrate** the concepts of control systems
- **Analyze** the Time Response of Control systems

### UNIT - I: ELECTRICAL CIRCUITS

**D.C. CIRCUITS:** Electrical circuit elements, Ohm's law, voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation.

**A.C. CIRCUITS:** Representation of sinusoidal waveforms, Peak and Rms values, Phasor representation, Real power, Reactive power, apparent power, Power factor, Three-phase balanced circuits, Star-Delta connections.

### UNIT – II

**DC MACHINES:** Working principle of DC Generator, constructional features, Types and EMF equation of generator, DC motor working principle, Back EMF and its significance, torque equation, Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor, Brake Test, Swinburne's test.

### UNIT - III: AC MACHINES:

**SINGLE PHASE TRANSFORMERS:** Principle of operation and construction of single phase transformers (core and shell types), EMF equation, Equivalent circuit, losses, efficiency, open circuit test and short circuit test

**THREE PHASE INDUCTION MOTORS:** Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Torque equation, Torque –slip characteristics, Applications of squirrel cage and slip ring motors.

**SYNCHRONOUS GENERATORS:** Working Principle-Construction.

**UNIT - IV: INTRODUCTION TO CONTROL SYSTEMS:** Open Loop and closed loop control systems and their differences, Mathematical Modelling of physical Systems-Mechanical, electrical, thermal and hydraulic systems, Block diagram and signal flow graph analysis, transfer function

**UNIT – V: TIME RESPONSE ANALYSIS:** Time response of first and second-order systems, Characteristic Equation of Feedback control systems, and Transient response of second order systems - Time domain specifications.

**TEXT BOOKS:**

1. Basic Electrical and Electronics Engineering –M S Sukija TK Nagasarkar Oxford University
2. Basic Electrical and Electronics Engineering-D P Kothari. I J Nagarath, McGraw Hill Education
3. “I. J. Nagrath and M. Gopal”, “Control Systems Engineering”, New Age International (P) Limited, Publishers, 5th edition, 2009

**REFERENCES:**

1. Basic Electrical and electronics Engineering-Dr.Ramanapilla, Dr.M.Suryakalavathi & G.T. Chandrashekar-S Chand Publications.
  2. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6<sup>th</sup> edition.
  3. Network Theory by N. C. Jagan & C. Lakshminarayana, B.S. Publications.
  4. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
  5. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
  6. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
  7. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
- “A.K. Jairath” Problems and solutions of control systems with essential theory 5th Edition.

## 21ME2251: DYNAMICS OF MACHINES LABORATORY

B.Tech. II Year - II Sem

L T P C  
0 0 3 1.5

**Pre-requisites:** Kinematics of machines and dynamics of machines.

### Course Objective:

The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.

**Course Outcomes:** After completion of the laboratory, the students will be able to:

- Understand types of motion.
- Analyze forces and torques of components in linkages.
- Understand static and dynamic balance.
- Understand forward and inverse kinematics of open-loop mechanisms.

**Experiments:** (A Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces.
2. To determine the frequency of torsional vibration of a given rod.
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor.
4. The balance masses statically and dynamically for single rotating mass systems.
5. Determine the critical speed of a given shaft for different n-conditions.
6. For a simple pendulum determine time period and its natural frequency.
7. For a compound pendulum determine time period and its natural frequency.
8. Determine the effect of gyroscope for different motions.
9. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
10. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
11. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems.

## 21ME2252: PRODUCTION TECHNOLOGY LABORATORY

**B.Tech. II Year – II Sem**

**L T P C**  
**0 0 3 1.5**

**Pre-requisites:** Manufacturing Technology.

### **Course Objective:**

Student will be able to learn and practice the various production processes like casting, melting, welding, forming and processing of plastics.

**Course Outcomes:** After completion of the laboratory ,the students will be able to:

- Understanding the properties of molding sands and pattern making.
- Fabricate joints using gas welding and arc welding.
- Evaluate the quality of welded joints.
- Basic idea of press working tools and performs molding studies on plastics.

### **List of Exercises**

#### **I. Metal Casting Lab:**

1. Pattern making - for one casting drawing.
2. Sand properties testing - Exercise -for strength and permeability.
3. Mould making.
4. Melting and Casting – demonstration.

#### **II. Welding Lab:**

1. Arc Welding.
2. Spot Welding.
3. TIG Welding.
4. Gas Welding.
5. Plasma Welding.

#### **III. Mechanical Press Working:**

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

#### **IV. Processing Of Plastics:**

1. Injection Moulding.
2. Blow Moulding.

### **REFERENCES:**

Dictionary of Mechanical Engineering – G.H.F. Naylor, Jaico Publishing Ho.

## 21ME2253:FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

**B.Tech. II Year -II Sem.**

**L T P C**  
**0 0 3 1.5**

**Pre- requisites:** Fluid Mechanics Theory.

### **Course Objectives:**

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

### **Course Outcomes:**

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

### **List of Experiments:**

1. Calibration of Venturi-meter.
2. Calibration of Orifice meter.
3. Determination of friction factor for a given pipe line.
4. Determination of loss of head due to sudden contraction in a pipeline.
5. Determination of loss of head due to sudden enlargement in a pipeline.
6. Verification of Bernoulli's Theorems.
7. Impact of jets on Vanes.
8. Performance Test on Pelton Wheel Turbine.
9. Performance Test on Francis Turbine.
10. Performance Test on Kaplan Turbine.
11. Performance Test on Single Stage Centrifugal Pump.
12. Performance Test on Multi Stage Centrifugal Pump.
13. Performance Test on Reciprocating Pump.
- 14 Calibration of contracted Rectangular Notch and /or Triangular Notch.
- 15 Determination of Coefficient of discharge for an external mouth piece by variable head method.
- 16 Study of Hydraulic jump.
- 17 Determination of Coefficient of discharge for a small orifice by a constant head method.

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



## 21HS2254: SOFT SKILL FOR PROFESSIONAL SUCCESS

<b>Course category:</b>	<b>Engineering Sciences</b>	<b>Credits</b>	<b>1</b>
<b>Course type:</b>	<b>Practical</b>	<b>Lecture-Tutorial-practice</b>	<b>0-0-2</b>
<b>Pre requisites:</b>	-	<b>Continuous evaluation:</b>	<b>30</b>
		<b>Semester end evaluation:</b>	<b>70</b>
		<b>Total Marks:</b>	<b>100</b>

### Objectives of the Course

1. To enable students understand the nature and the scope of communication, and overcome the barriers for effective communication.
2. To empower students understand the correlation between communication and building social relations.
3. To enhance the team building and leadership qualities.
4. To make the students realize the significance of goal setting.
5. To impart interpersonal communication skills and life skills required for students' professional success.

**Course Outcomes:** By the end of the course, the students will be able to:

1. Communicate effectively in academic and social contexts.
2. Understand about themselves with reference to self-discovery and self-awareness.
3. Nurture social behavior, responsibility and accountability leading to the ability to work in teams with diverse groups of people.
4. Apply their creative and critical thinking skills for problem solving and decision making.
5. Identify their short-term and long-term goals; apply emotional intelligence to enhance leadership skills and professionalism.

### UNIT 1

Art of Communication – Communication Cycle – Barriers to Communication – Effective Communication - Assertiveness - Reading a Story/Passage loudly with more focus on meaningful pauses and Accent Neutralization - Inter-Personal Communication - Social and Professional Networking.

**Activity/ies:** Role Plays/Telephonic Conversations - Introducing Oneself and Others – Greetings – Making Requisitions and Apologies.

### UNIT 2

Self-Discovery - Self-Awareness – SWOT - Self Esteem - Self and Professional Discipline –Procrastination - Time Management – Professional Behavior and Attitude.

Activity/ies: Situations/Case Studies related to Self-Awareness, Self Esteem, Time Management, Behavior and Attitude.

### UNIT 3

Motivation – Cooperation and Coordination – Team Building – Creative Thinking – Problem Solving - Decision Making – Accountability and Social Responsibility.

Activity/ies: Situations/Case Studies related to Motivation, Cooperation and Coordination, Team Building and Decision Making

### UNIT 4

Emotional Intelligence (EQ) – Critical Thinking - Bonding – Trust Building - Etiquette (Social, Professional and Email)

Activity/ies: Situations/Case Studies related to Trust Building/Etiquette/Film Critiquing

## **UNIT 5**

Leadership - Organizational Skills - Entrepreneurial Skills - Goal Setting - Long-term and Short-term Goals.

Activity/ies: Situations/Case Studies related to Leadership, Organizational Skills, and Goal Setting.

### **TEXT BOOKS/REFERENCES**

1. Raju, Yadava B, B T Sujatha & C. Murali Krishna. *English for Better Performance*. Orient Blackswan, Pvt., Ltd, 2014.
2. Rajan. *I Love Living*. Mumbai: Jaico Publishers, 2013.
3. Sundararajan, Francis. *Basics of Communication in English: Soft Skills for Listening, Speaking, Reading and Writing*. New Delhi: Macmillan Publishers India Ltd., 2021.
4. Tulgan, Bruce. *Bridging the Soft Skills Gap - How to Teach the Missing Basics to Today's Young Talent*. Jossey-Bass; 1 edition. September 15, 2015.

## 21MC0004: GENDER SENSITIZATION

<b>Course category:</b>	<b>Mandatory Course</b>	<b>Credits</b>	<b>0</b>
<b>Course type:</b>	-	<b>Lecture-Tutorial-practice</b>	<b>3-0-0</b>

### Course Objectives

1. To develop students sensibility with regard to issues of gender in contemporary India.
2. To provide a critical perspective on the socialization of men and women.
3. To introduce students to information about some key biological aspects of genders.
4. To expose the students to debates on the politics and economics of work and help them reflect critically on gender violence.
5. To expose students to more egalitarian interactions between men and women.

### Course Outcomes

#### By the end of the course, students

1. Will have developed a better understanding of important issues related to gender such as gender discrimination in our society and how to counter it.
2. Will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Will acquire insight into the gendered division of labour and its relation to politics and economics enabling students and professionals to work and live together as equals.
4. Will develop a sense of appreciation of women in all walks of life.
5. Will be empowered to understand and respond to gender violence by familiarizing them with the studies and movements as well as the new laws that provide protection and relief to women, the textbook.

### UNIT - I

**Understanding Gender:** Introduction- Definition of Gender-Basic Gender Concepts and Terminology- Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

### UNIT - II

**Gender Roles and Relations:** Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex election and Its Consequences-Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary.

### UNIT - III

**Gender and Labour:** Division and Valuation of Labour-Housework: The Invisible Labor-"My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and unaccounted work-Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

### UNIT - IV

**Gender Based Violence:** The Concept of Violence- Types of Gender- based Violence - Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! - Sexual Harassment, not Eve-teasing - Coping with Everyday Harassment - Further Reading: "*Chupulu*".

**Domestic Violence:** Speaking Out Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-"I Fought for my Life..."

### UNIT - V

**Gender and Culture:** Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender

and Popular Literature- Gender Development Issues-Gender Issues- Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals MaryKom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks-The Brave Heart.

**TEXT BOOKS:**

1. All the five Units in the Textbook, “Towards a World of Equals: A Bilingual Textbook on Gender” written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, VasudhaNagaraj, Asma Rasheed, GoguShyamala, DeepaSreenivas and Susie Tharu and published by Telugu Akademi, Hyderabad,Telangana State in the year 2015.

**REFERENCES:**

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. AbdulaliSohaila. “I Fought For My Life...and Won.” Available online at:
3. <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal>.