First Year First Semester
Prod/T/111 ENGINEERING MECHANICS Parts I : Statics

A. Fundamentals of Mechanics.
B. Important Vector Quantities: Displacement, Force, Moment.
C. Free-body Diagram and Equations of Equilibrium: Some important special cases of equilibrium, Concurrent and Parallel forces in a plane and in space.

D.
E. Inertia.

6. Trusses : Method of joints, Method of Sections.
7. Principle of Virtual Work.

Friction.
Centre of Gravity, Centroid, First and Second Moments of Area, Moments of

Parts II : Dynamics

1. Kinematics: Kinematics of rectilinear and curvilinear motion of a particle, Motion of rigid bodies, Instantaneous center of rotation.
2. Principle of Kinetics: Motion of a particle, Motion of a system of particles, Force, Mass & Acceleration, D Alembert's principle
3. Work, Power and Energy: Kinetic energy of a particle, Work-energy in plane motion, Energy equation and conservation of energy, Acceleration from work-energy
4. Impulse and Momentum: Linear Impulse & momentum, Angular Impulse & momentum, Conservation of momentum
5. Friction
6. Periodic Motion: Free vibrations

Prod/T/112 PROJECTION AND SPATIAL GRAPHICS

Objects, conditions and methods of projection; Classification of projections; Scales, scale distortion and conditions of conformability and equivalence; Orthographic projection, Axonometric projections; Isometric, diametric and oblique projections; Introduction to conical equivalence and equivalent cylindrical projections. Basic principles of multi view drawing and Monge's projection; Sectional view; Points in quadrants and octants; Projection of lines and traces of a line; True relative positions of two planes, and of a straight line and a plane; Method of revolution; Projections of polyhedrons; Curved lines and surfaces; Contour mapping of curved surfaces; Plane sections of polyhedrons and curved surfaces; Intersection of planes and surfaces, and lines and surfaces; Development of curved surfaces.

ETech/EE/T/A ELECTRICAL TECHNOLOGY-A

DC Circuits: Kirchhoff's Laws. Maxwell's Loop Current Methods of Analysis. Star-Delta Conversion. Superposition Theorem. Thevenin's Theorem. Maximum Power Transfer.

Magnetic Circuit: MMF, Flux ,Reluctance. B-H Loop. Hysteresis and Eddy current loss. Magnetic circuit analysis with air gap.
AC 1 -phase: Periodic Waves and Sinusoids. Average and RMS Values, Form Factor, Peak.

Factor. Phasor concept of Sinusoids. Impedance and Admittance. Power, Power Factor, V A, V AR. Series R-L-C Circuit ,Parallel R-L-C circuit. Resonance.

Balanced 3-phase: 3-phase AC balanced circuits. Phase-sequence. Star and Delta connections. Power, V A, V AR, Power Factor _or balanced 3-phase circuits.
Power Measurement: Wattmeter circuit connection. Power Measurment by two wattmeter methods in 3phase system.
DC Machines: Construction and general priciple of operation. Generator EMF Equation. Field connection ,shunt series and compound. Generator characteristics.
Motor-equation and general operation. starting and speed control, torque -speed curve. 1-PhaseTransformer: Construction. EMF equation. Phasor diagram. Equivalent circuits. Losses and Efficiency. Open circuit and Short circuit test.
3-Phase Induction Machine: Types of induction machines. Rotating magnetic field, slip ,torque equation, torquespeed curve.DOL starting and reduced voltage starting.
3-Phase Synchronous Machines: Alternator, constructional features, EMF equation, synchronous reactance, power -angle characteristics.
Concept of synchronous motor.
Meters: DC and AC Ammeters and Voltmeters. Megger.Multiplier.

Books :
1. Electrical Science by Prof. S. Chowdhury, Prof. R. Chakraborty & Prof. P. K. Chatterjee.
2. Electrical Machines by Prof. P.K. Mukherjee & Prof. S. Chakravorti.

Prod/Math/T/114 MATHEMATICS-IS

Function of a single variable, Review of limit, continuity and differentiability, Successive differentiation, Rolle's theorem, Mean value theorem, Taylor's theorem, Indeterminate forms, Maxima and minima.
Function of several variables: Limit and continuity, Partial derivatives, Differentials, Euler's theorem on homogeneous function, Partial derivatives of composite function, Implicit function, Taylor's theorem, Maxima and minima, Lagrange's method, Riemann Integration.

Prod/Math/T/115 MATHEMATICS-IIS

Complex numbers, DeMoivre's Theorem, Exponential values of sines and cosines, Hyperbolic functions.
Determinants (upto order 4): Definition and properties, Solution of a system of linear equations by Cramer's rule.

Matrices: Definition Addition and multiplication of matrices, Transpose and inverse of a matrix, Solution of a system of linear equations by matrix method.

Solid Geometry: Cartesian coordinates in three dimension, Direction cosines, Equations of planes and straight lines, Shortest distance between two skew lines, Equations of spheres Cylinders and cones
Application of calculus: Tangent and normal, Curvature, convexity and concavity.

Ph/T/1B PHYSICS-IB

1. Use of vectors in particle mechanics, Unit vectors in spherical and cylindrical polar coordinates, Conservative vector fields and their potential functions - gravitational and electrostatic examples, Gradient of a scalar field, Equipotentials, States of equilibrium, Work and Energy, Conservation of energy, Motion in a central field and conservation of angular momentum.

2. Angular momentum of a system of particles, Torque, Moment of inertia , Parallel and Perpendicular axes theorem, Calculation of moment of inertia for (i) thin rod, (ii) disc, (iii) cylinder and (iv) sphere. Rotational dynamics of rigid body (simple cases).

3. Motion of fluids, Bernoulli's equation and its applications, motion of viscous fluids - Poiseuille's equation.

4. Simple harmonic motion, Composition of simple harmonic motion, Forced vibration and resonance, Wave equation in one dimension and travelling wave solution, Standing waves, Wave velocity and group velocity.

5. Assumption for the kinetic theory of gases, Expression for pressure, Significance of temperature, Deduction of gas laws, Qualitative idea of (i) Maxwell's velocity distribution. (ii) degrees of freedom and equipartition of energy, Specific heat of gases at constant volume and constant pressure.

6. Macroscopic and microscopic description, Thermal equilibrium, Zeroth law of thermodynamics, Concept of international practical temperture scale, Heat and Work, First law of thermodymamics and some applications, Reversible and irreversible processes, Carnot cycle, Second law of thermodymamics, Concept of entropy, Thermodynamic relations.

7. Statistical description of a system of particles, Phase space, Microstates and macrostates, Boltzmann's formula for the entropy, Canonical partition function, Free energy and other thermodynamic quantities in terms of the partition function, Classical ideal gas, Equipartition theorem and its applications.

Ph/S/1 PHYSICS LABORATORY - I (Selected Experiments from the following)

1. Determination of Galvanometer resistance by half - deflection method.
2. Determination of Galvanometer resistance by Thomson's method.
3. To find high resistance by Galvanometer deflection method.
4. To measure mechanical equivalent of heat, J by electrical method (Joule's) using copper calorimeter (radiation correction to be done).

5. To compare to low resistance by drop of potential method.
6. To determine resistance per unit length of wire by using Carey Foster bridge. 7. To estimate strength of a current by using copper voltmeter.

8. a) To compare the EMF's of two cells by using a potentiometer
b) To measure current by using a potentiometer
9. To measure the horizontal components of earth's magnetic field intensity using deflection and vibrating magnetometers.
10. Determination of co efficient of linear expansion by optical lever method.
11. Determination thermal conductivity of metal by Searle's method.
12. To determine co-efficient of viscosity by Capillary flow method.
13. Determination of Young's modulus by Flexure method.
14. To draw mutual and anode characteristics of triode and hence too fine Rp, μ, and gm 15. To draw the transistor characteristics (NPN/PNP) in the given configuration and hence to find hi, hf

16. Determination of refractive index of the material of the glass prism by prism spectrometer (for at least two ?s)
17. Study of collisions in one dimension using a linear air track
18. Use of an air track for obtaining potential energy curves for magnetic interactions.
19. Study of oscillations under potential wells of various shapes using an air track.
20. Experiments on diffraction in single slit, double slit and plane grating using He- Ne laser
a) To find the wavelength of a monochromatic light by single slit.
b) To find slit separation of a double slit.
c) To find number of rulings per cm of a plane grating
21. To find the wavelength of a monochromatic light by Newton rings.
22. Fabry-Perot interferometry: To find out separation of wavelength of sodium D1 & D2 lines.

Prod/S/112 GRAPHICS LABORATORY - I

Manipulation and use of drafting equipment and instruments; Exercises in instrumental drawing; Learning drafting codes as per ISO and IS; Preparation and use of scales; Technical lettering; Engineering geometry with examples from product steriometry; Geometric configurations and evolving solids; Single plane projections of product features; Orthographic and axonometric projections of sample objects; Sectional and auxiliary views; Selected problems on Descriptive Geometry.

Prod/S/113 TECHNICAL ARTS

Introduction to different materials in engineering practices with respect to their workability, formability and machinability with hand-tools and power tools: Specification, identification and use of hand-tools and sensitive machines: Datum selection, location layout and marking problems for wood, plastics and metals: Cutting shearing, chipping, sizing and finishing of woods, plastics and metals: Making temporary and permanent joints between materials by processes of mechanical fastners chemical bonding & revetting. All exercise will be woven around a group of carefully designed product features involving material selection, technology decisions, choice of tooling and fixtures, layout marking and measurtements. Processing of plastic products, Injection moulding and Blow moulding.

Prod/EE/S/114 ELECTRICAL TECHNOLOGY LABORATORY To supplement the course on "Electrical Technology-A".
First Year Second Semester
Hum/T/B HUMANITIES-B

English - 2 Pds/week - 50 Marks Sociology - 2 Pds/week - 50 Marks

HUMANITIES

1.Basic writing skills
2.Report, Covering Letter & Curriculum-Vitae writing 3.Reading and Comprehension
4.Selected Short Stories

Text Book: ENGLISH FOR ALL

SOCIOLOGY

1.Sociology: Nature and scope of Sociology - Sociology and other Social Sciences - Sociological Perspectives and explanation of Social issues

2. Society and Technology: Impact of Technology on the Society - A case study

3. Social Stratification: Systems of Social Stratification - determinants of Social Stratification - Functionalist, Conflict and Elitist perspectives on Social Stratification 4.Work: Meaning and experience of work: Postindustrial society- Post-Fordism and the Flexible Firm

5.Development - Conceptions of and approaches to development - The Roles of State and the Market in the Development

6. Globalization: The concept of globalization - globalization and the nation state - Development and globalization in post colonial times.

7. Industrial Policy and Technological change in India - The nature and Role of the State in India

8. Technology Transfer: The Concept and Types of Technology Transfer-Dynamics of Technology Transfer

9. Technology Assessment: The Concept - Steps involved in Technology Assessment 10. Environment: Sociological Perspectives on Environment - Environmental Tradition and values in ancient India

11.The Development of Management: Scientific Management - Organic Organization - Net Work organization - Post modern Organization - Debureaucratization - Transformation of Management

12. Technological Problems and the Modern Society: Selected Case Studies - Electric Power Crisis, Industrial and/or Environmental Disaster, or Nuclear Accident.

Prod/Chem/T/122 CHEMICAL SCIENCE

Basic properties of chemical bonding; chemical thermodynamics and kinetics; Electrochemistry -electrolytic dissociation and conduction, ionic equilibrium, electrochemical cells, pH and indicators.

Phase rule and its applications, principles of surface chemistry, Chromatography, ion exchange Chemisorptions and structure of solids.

Structure of organics molecules, nomenclature of organics compounds, sterio-chemistry, optical activity; reaction mechanisms; study of organics compounds, polymers and lubricants- synthesis of polymers.

Chemical fuels-fossil fuels (coals and petroleum), produces gas, water gas - blue water gas; Nuclear fuels- binding energy, fission and fusion, controlled fission, power reactor, sources of nuclear fuels, explosives and rocket fuels; water and waste water chemistry.

Prod/Math/T/123 MATHEMATICS-IIIS

Sequence and Infinite Series: Concept of a sequence and its limit, Sum of an infinite series as the limit (if exists) of the partial sum upto n terms. Comparison test, D'Alembert's ratio test and Cauchy root test.

Ordinary Differential Equations: Differential equation of first order exact equation, linear as well as non-linear, Linear differential equation of second and higher orders with constant coefficients. Euler Cauchy equation, Method of variation of parameters.

Integral Transforms: Laplace transforms: Definition and properties, Inverse Laplace transform, Convolution, Application to ordinary differential equations.
Fourier Transforms: Definition and properties, Inverse Fourier transform, Convolution, Application to partial differential equation, Z-transforms, Definition and properties, Applications.

Prod/Math/T/124 MATHEMATICS-IVS

Vector Algebra: Addition of vectors, Multiplication of a vector by a scalar, Components of a vector, Scalar and Vector product of two vectors, Products of three vectors, Applications to Mechanics
Vector Calculus: Vector functions, of a scalar variable, Derivative of vector function, Applications to mechanics, Gradient, divergence and curl, Vector integration, Line, Surface and Volume integrals, Green , Gauss and Stokes theorem, Applications.

Fourier series: Periodic function, Trigonometric series with sines and cosines. Euler formula, Fourier series, Dirichlet's conditions, Even and odd functions, Half range sine and cosine series.
Partial differential equation: Solution of one dimensional wave and diffusion equations and two dimensional Laplace equation by the method of separation of variables, Applications to physical problems.

Prod/ET/T/125 BASIC ELECTRONICS ENGINEERING

Circuits: Response of resistance. Inductance and capacitance in series and in parallel: resonance: Selectivity of impedance: Coupled circuits: Maximum power transfer theorem. Semiconductors: Elements of transistors & solid state devices. Single phase

half-wave and full-wave rectifiers, filters, voltage amplifier, selection of operating point bias, gain of amplifier, equivalent circuits, frequency response, power amplifier, push- pull amplifier; Oscillators: multivibrators, saw tooth generators.

Ph/T/2A PHYSICS-IIA

1. Electric potential and intensity, Flux of electric field, Gauss's law and its application to problems with spherical and cylindrical symmetry, Capacitance- parallel plate and spherical condensers, Energy of a capacitor, Energy density of an electric field, Potential and field due to a dipole, Dielectric polarisation, Electric displacement vector, dielectric susceptibility.

2. Biot-Savart law and Ampere's law in magnetostatics, Calculation of magnetic field in simple situations like (i) straight wire (ii) circular wire (at a point on the symmetry axis) and (iii) Solenoid.
3. Time-varying fields, Faraday's law of electromagnetic induction, Self and mutual inductance, Resonance and oscillation in electrical circuits.

4. Nature of light waves, Interference of light waves, Young's experiment, Spatial and temporal coherence, Fresnel bi-prism, Interference in thin film, Newton's rings, Measurement of film thickness and wavelength, Diffraction of light waves, Huygen's construction, Fresnel and Fraunhoffer diffraction, Fraunhoffer diffraction due to single slit and plane diffraction grating, Approximate rectilinear propagation of light, Zone plate, Polarisation of light waves,

Polarisation by reflection, Brewster's law, Double refraction- ordinary extraordinary rays, Polaroid, Optical activity.

5. Energy levels of the hydrogen atom and the Bohr atom model, X-ray spectra, X-ray diffraction, Bragg's law, Compton effect. De-Broglie waves, Particle diffraction, Uncertainty principle and its application.

Ph/S/2 PHYSICS LABORATORY-II (Selected Experiments from the following)

1. Determination of Galvanometer resistance by half - deflection method.
2. Determination of Galvanometer resistance by Thomson's method.
3. To find high resistance by Galvanometer deflection method.
4. To measure mechanical equivalent of heat, J by electrical method (Joule's) using copper calorimeter (radiation correction to be done).

5. To compare to low resistance by drop of potential method.
6. To determine resistance per unit length of wire by using Carey Foster bridge. 7. To estimate strength of a current by using copper voltmeter.
8. a) To compare the EMF's of two cells by using a potentiometer
b) To measure current by using a potentiometer
9. To measure the horizontal components of earth's magnetic field intensity using deflection and vibrating magnetometers.
10. Determination of co efficient of linear expansion by optical lever method.
11. Determination thermal conductivity of metal by Searle's method.
12. To determine co-efficient of viscosity by Capillary flow method.
13. Determination of Young's modulus by Flexure method.

14. To draw mutual and anode characteristics of triode and hence too fine Rp, μ, and gm 15. To draw the transistor characteristics (NPN/PNP) in the given configuration and hence to find hi, hf
16. Determination of refractive index of the material of the glass prism by prism spectrometer (for at least two ?s)

17. Study of collisions in one dimension using a linear air track
18. Use of an air track for obtaining potential energy curves for magnetic interactions.
19. Study of oscillations under potential wells of various shapes using an air track.
20. Experiments on diffraction in single slit, double slit and plane grating using He- Ne laser
a) To find the wavelength of a monochromatic light by single slit.
b) To find slit separation of a double slit.
c) To find number of rulings per cm of a plane grating
21. To find the wavelength of a monochromatic light by Newton rings.
22. Fabry-Perot interferometry: To find out separation of wavelength of sodium D1 & D2 lines.

Prod/S/122 MANUFACTURING SYSTEMS LABORATORY-I

Introduction to primary technology/technological processes involving forging, bending, blanking, punching and drawing; Preparation of foundry sand and moulds: experiments of properties of foundry sands; post casting fettling, cleaning deburing, polishing and painting operations. Laboratory Experiments in Production Processes on Electric Arc Welding,

Electric Resistance Welding MIG, TIG, Thermit and submerged arc welding; Testing of Joints. Heat treatment, surface preparation, etching and metallographic studies of different materials.

Prod/S/123 BASIC ENGINEERING LABORATORY

Experiments involving calibration of and measurements by direct signal receivers and analogue transducers for major physical quantities; Characterization of materials - solids and fluids: Characterization of resilient systems; investigations of thermal, transporting and radiation properties of materials and fluids; Kinematic synthesis; Laws of Machines.

Prod/ET/S/124 BASIC ELECTRONICS LABORATORY
Experiments pertaining to the theoretical subject "Basic Electronics Engineering" and

commensurate with the same.