Academic Calendar: 2020-2021

Department: Physics

Semester/ Year	Syllabus Module/Unit	No of Lectures	Name of Teacher
Sem-I **(PHSGCOR01T - Mechanics)**	**Mathematical Methods** Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. Ordinary Differential Equations: 1 st order homogeneous differential equations. 2 nd order homogeneous and inhomogeneous differential equations with constant coefficients. **Particle Dynamics** Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **Gravitation** Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). **Oscillations** Oscillations: Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Forced harmonic oscillations, resonance. **Elasticity** Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio- Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion –	10 21 8 6	PPP PPP PPP PPP

	Page 78 Torsional pendulum.- Bending of beam. **Special Theory of Relativity** Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	8	PPP
Sem-II PHSGCOR02T (Electricity and Magnetism)	**Vector Analysis** Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only). **Electrostatics** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field. Electric potential due to an electric dipole. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. **Magnetism** Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. **Electromagnetic Induction** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.	2 18 10 06	PPP

	Linear Network Impedance of L, C, R and their combinations. Thevenin & Norton's Theorem. Maximum power transfer theorem and superposition theorem. Anderson's bridge. **Maxwell's Equations and Electromagnetic Wave Propagation** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization. **General topic** Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances (e) Checking electrical fuses and (f) circuit continuity check. Demonstration on Carey Foster's bridge, potentiometer, resistance box, inductor coil, moving coil galvanometer (in dead beat and ballistic mode) etc. **List of Practicals** 1. To determine an unknown Low Resistance using Carey Foster's Bridge. 2. To verify the Thevenin and Norton theorems. 3. To verify the Superposition and Maximum power transfer theorems. 4. To determine self-inductance of a coil by Anderson's bridge. 5. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width. 6. To study the response curve of a parallel LCR cir cuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q. 7. To study the characteristics of a series RC Circuit. 8. To determine an unknown Low Resistance using Potentiometer. 9. To determine the resistance of a galvanometer using Thomson's	05 09 10 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5 Hours 5	

	method. 10. Measurement of field strength B and its variation in a solenoid (determine dB/dx)	Hours 5 Hours	
Sem-III (PHSGCOR03T) Thermal Physics and Statistical Mechanics	**Laws of Thermodynamics** Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. **Thermodynamic Potentials** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. **Kinetic Theory of Gases** Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **Theory of Radiation** Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh- Jeans Law, Stefan Boltzmann Law and	22 10 10	PPP PPP PPP

	Wien's displacement law from Planck's law. **Statistical Mechanics** Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics (qualitative discussion only) - Fermi-Dirac distribution law (statement only) - electron gas as an example of Fermi gas - Bose-Einstein distribution law (statement only) - photon gas as an example of Bose gas- comparison of three statistics.	6 12	PPP PPP
Paper-IV (3rd Year)	Mechanics and thermodynamics Production and measurement of high vacuum : Rotary and diffusion pump, Mcleod, Pirani, and Penning gauges. Heat engines, thermal efficiency, indicated Horse-power and brake Horse-power, Otto cycle and Diesel cycle, four-stroke petrol and diesel engines, calculation of efficiency and comparison. Energy sources : Conventional energy sources: thermal power plant, relevance of Rankine cycle (qualitative discussion), steam turbine, hydro-electric power plant — basic principle. Non-conventional energy sources: solar, wind, tidal, geothermal, and biogas sources, elementary idea of production and uses.(8 lectures) Electronics : Feedback — basic principle — positive and negative feedback, Barkhausen criterion, oscillator, OPAMP — characteristics, uses of OPAMP as amplifier, oscillator, and filter; light-emitting diodes, 7-segment display, SCR, diac and triac. Digital electronics : combinational circuits — adder and subtractor, multiplexer, demultiplexer, encoder, decoder, sequential circuits — flip-flop, D and J-K, registers and counters. Instruments : cathode-ray oscilloscope, digital multimeter, L and C measurements. Communications : Propagation of electromagnetic waves in atmosphere, various layers of atmosphere — ground and sky waves. Transmission of electromagnetic waves — amplitude and frequency modulation, calculation of power in amplitude	6 8 8 12 8 5 4 10	PPP

	modulation, sideband generation in frequency modulated wave; demodulation — linear diode detector, detection of FM waves, signal-to-noise ratio. Transmission through media : coaxial cables, optical fibre — cladding, energy loss, band width and channel capacity, information carrying capacity of light waves (qualitative); satellite communication, microwave link — modem and internet.	6	