Academic Calendar: 2019-2020

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.	10	PPP
	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.	21	PPP
	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).	8	PPP
	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 –	6	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).	2	PPP
	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.	18	ppp
	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.	10	ppp
	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.	06	ppp

	Linear Network		ppp
	Impedance of L, C, R and their combinations. Thevenin & Norton's Theorem. Maximum power transfer theorem and superposition theorem. Anderson's bridge.	05	
	Maxwell's Equations and Electromagnetic Wave Propagation	09	ppp
	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		ppp
	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.	10 Hours	
	List of Practicals	5 Hours	
	1. To determine an unknown Low Resistance using Carey Foster's Bridge.		
	2. To verify the Thevenin and Norton theorems.	5 Hours	
	3. To verify the Superposition and Maximum power transfer theorems.	5 Hours	
	4. To determine self-inductance of a coil by Anderson's bridge.	5 Hours	
	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.	5 Hours	
	6. To study the response curve of a parallel LCR cir cuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.	5 Hours	
	7. To study the characteristics of a series RC Circuit.	5 Hours	
	8. To determine an unknown Low Resistance using Potentiometer.	5 Hours	
	9. To determine the resistance of a galvanometer using Thomson's	5	

	method.	Hours	
	10. Measurement of field strength B and its variation in a solenoid (determine dB/dx)	5 Hours	
Paper-II (2nd Year)	**(Only SI units are to be used)** **Group A: Geometrical Optics** 1. Geometrical Optics: Fermat's Principle, laws of reflection and refraction at a plane surface, refraction at a spherical surface, lens formula. Combination of thin lenses equivalent focal length. 2. Dispersion and dispersive power, chromatic aberration and its remedy, different types of Seidel aberration (qualitative) and their remedy. Eye-piece : Ramsden and Huygen's type. Astronomical telescope and compound microscope - their magnifying power. **Group B : Physical Optics** 3. Light as an electromagnetic wave, Full electromagnetic spectrum, properties of electromagnetic waves, Huygens' principle - explanation of the laws of reflection and refraction 4. Interference of light: Young's experiment, intensity distribution, conditions of interference, interference in thin films, Newton's ring. 5. Diffraction: Fresnel and Fraunhofer class, Fresnel's half-period zones- zone plate. Fraunhofer diffraction due to a single slit and plane transmission grating (elementary theory)- resolving power. 6. Polarization: Different states of polarization, Brewster's law, double refraction, retardation plate, polaroid, optical activity. **Group C : Electricity II** 7. Magnetic effect of current: Biot Savart's law, Ampere's circuital	15 20 45	PPP

law (statement only), magnetic field due to a straight conductor, circular coil, solenoid, endless solenoid, Magnetic field due to a small current loop - concept of magnetic dipole, Ampere's equivalence theorem.

8. Lorentz force, force on a current carrying conductor in a magnetic field. Torque on rectangular current loop in a uniform magnetic field.

9. Magnetic materials: intensity of magnetization, relation between B, H and M – illustration in the case of bar magnet, magnetic susceptibility - dia, para and ferromagnetic materials - statement of Curie's law. Hysteresis in a ferromagnetic material - hysteresis loss.

10. Electromagnetic induction: self and mutual inductances in simple cases, energy stored in inductor.

11. Varying currents: growth and decay of currents in L-R circuit; charging and discharging of capacitor in C-R circuit.

12. Alternating current: mean and r.m.s. Values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit — power factor, vector diagram, resonance in a series LCR circuit, Q-factor, principle of ideal transformer.

Group D : Electronics

15

13. p-n junction diode — bridge rectifier — capacitance input filter, Zener diode — voltage regulator, Transistors — α and β parameters and their interrelations; output characteristics in CE mode, single stage CE amplifier approximate expressions of current and voltage gain with the help of 'Load Line'.

14. Digital circuits : binary systems, binary numbers. Decimal to binary and reverse conversions; binary addition and subtraction.

15. Logic gates : OR, AND, NOT gates — truth tables. Statement of de Morgan's theorems, NOR and NAND as universal gates.

Group E : Modern Physics

30

16. Postulates of the Special Theory of Relativity, Lorentz transformation equations (statement only)- formulae of (i) Length contraction; (ii) Time dilation; (iii) Velocity addition; (iv) Mass variation, and (v) Mass-energy equivalence.

17. Quantum theory of radiation : Planck's concept radiation formula (statement only) — qualitative discussion of photo-electric effect and Compton effect in support of quantum theory; Raman effect.

	18. Bohr's theory of hydrogen spectra — concept of quantum number, Pauli exclusion principle. 19. Crystalline nature of solid, diffraction of X-ray, Bragg's law; Moseley's law — explanation from Bohr's theory. 20. Wave nature of material particles, wave-particle duality, wavelength of de Broglie waves, Heisenberg uncertainty principle, Schroedinger equation, particle in a one-dimensional infinite well — energy eigenvalues, wavefunction and its probabilistic interpretation. 21. Binding energy of nucleus — binding energy curve and stability; Radioactivity successive disintegration radioactive equilibrium, radioactive dating, radioisotopes and their uses, nuclear transmutation — fission and fusion — nuclear reactor.		
Paper-III **(2nd Year)** **(Practical)**	**Group A Marks – 30 Time – 2.5 hrs.** 1. Determination of modulus of rigidity of the material of a wire by dynamical method. 2. Determination of moment of inertia of a metallic cylinder – rectangular bar about an axis passing through its C. G. 3. Determination of the coefficient of linear expansion of a metallic rod using an optical lever. 4. Determination of the pressure coefficient of air. 5. Determination of the refractive index of the material of a lens and that on a liquid using a convex lens and a plane mirror. 6. Determination of the focal length of a concave lens by auxiliary lens method or by combination method. 7. Determination of the frequency of a tuning fork with the help of a sonometer (either by using formula or by n-e curve). 8. Determination of the horizontal component of the Earth's magnetic field using a deflection and an oscillation magnetometer. 9. Determination of the resistance of a suspended coil galvanometer by the method of half-deflection and to		ppp

calculate the figure of merit of the galvanometer (using the same data).

10. To draw I – V characteristics of (i) resistor and (ii) a P-N junction diode in forward biased condition .

(Plot both the characteristic curves on the same graph paper. Estimate from the graphs (i) the resistance of the resistor and (ii) the dynamic resistance of the diode for three different currents. One current should correspond to the intersecting point of the two curves.

Group B Marks – 40 Time – 3.5 hrs.
(At least ten experiments must be performed)

1. Determination of Young's modulus of the material of a beam bythe method of flexure. (single length only)

2. Determination of the coefficient of viscosity of water by Poiseuille's method. (the diameter of the
capillary tube to be measured by the travelling vernier microscope)

3. Determination of the surface tension of water by capillary rise method. (Capillary tubes to be supplied)

4. Determination of the refractive index of the material of a prism by drawing curve using spectrometer.

5. To determine the wavelength of a monochromatic light by Newton's ring method.

6. To calibrate a polarimeter and hence to determine the concentration of sugar solution.

7. Determination of the temperature coefficient of the material of a coil using a Carey-foster bridge. (3 sets of reading for both temperatures) (Resistance per unit length of the bridge wire has to be measured)

8. To draw the e-t curve of a thermocouple using potentiometer and dead-beat galvanometer, andhence to find out the thermo-electric power of the couple at a specified temperature. (Resistance of the potentiometer wire has to be measured using a P. O. Box).

9. To draw the I-V characteristics of the bridge rectifier (i) without using any filter and (ii) using a capacitance input filter. (The bridge rectifier should be fabricated by the student using four diodes. % voltage regulations has to be calculated from each graph at a specified load current.)

10. To draw the reverse characteristics of a Zener diode and to study its voltage regulation characteristics using a variable load.

	(Breakdown region should be identified in the graph. % voltage regulation has to be calculated for two load currents.) 11. To draw the output characteristics of a transistor in CE configuration (for atleast five base currents) and hence to determine the A. C. current gain from the active region of the characteristics. 12. To verify the truth tables of OR and AND logic gates using diodes. To construct AND, OR and NOT gates from NOR/NAND IC gates on breadboard. 13. To measure the voltage across the inductance (L) , capacitance (C) and resistance (R) of a series LCR circuit for different frequencies of the input voltage with the help of a A. C. milli-voltmeter (or suitable digital meter). Hence to study the variation of impedence of L and C with frequency of the impressed voltage. (value of R should be known) OR 14. To draw the resonance curve of a series LCR circuit and hence to determine the Q-factor of the circuit.		
Paper-IV (3rd Year)	Mechanics and thermodynamics Production and measurement of high vacuum : Rotary and diffusion pump, Mcleod, Pirani, and Penning gauges.	6	PPP
	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.	8	
	Energy sources : Conventional energy sources: thermal power plant, relevance of Rankine cycle (qualitative discussion), steam turbine, hydro-electric power plant — basic principle.	8	
	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.	12	
	Digital electronics : combinational circuits — adder and subtractor, multiplexer, demultiplexer, encoder, decoder, sequential circuits — flip-flop, D and J-K, registers and counters.	8	
	Instruments : cathode-ray oscilloscope, digital multimeter, L and C	5	

	measurements.	4	
	Communications : Propagation of electromagnetic waves in atmosphere, various layers of atmosphere — ground and sky waves.		
		10	
	Transmission of electromagnetic waves — amplitude and frequency modulation, calculation of power in amplitude modulation, sideband generation in frequency modulated wave; demodulation — linear diode detector, detection of FM waves, signal-to-noise ratio.	6	
	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.		