Semester	II
Paper Number	HPHGE2022T & HPHGE2022P
Paper Title	Vibrations, Waves and Optics & Electromagnetism
No. of Credits	06 (Theory – 4, Lab – 2)
Theory/Composite	Composite
No. of periods assigned	Th: 4 periods/week Pr: 2 periods/week
Name of Faculty member(s)	
Course description/objective	The course aims at imparting a basic knowledge in the branch of Vibrations, Waves and Optics at the undergraduate level. The objective of the course is to teach Electrostatics and Electromagnetism to the students at the introductory level. This course will make the students familiar with the basic laws and their applications in electricity and magnetism. The students get the idea of the various network theorems and analyze circuits The experiments will help the students to verify the laws that they have learnt.
Syllabus	As enclosed
Texts	
Reading/Reference Lists	As enclosed
Evaluation	Total – 100 marks (Theory – 60, Practical- 40) Theory – CIA- 10 **Semester Examination – 50** **Group A : (25 marks)** — **Group B (25 marks)** Two 5 marks qs out of three qs — Two 5 mark qs out of three qs Six 2.5 mark qs out of eight qs — Six 2.5 mark qs out of eight qs

Syllabus :

Vibrations, Waves and Optics & Electromagnetism (Credits – Theory -4; Practical – 2)

Module A: Vibrations, Waves and Optics [26 lectures]

Vibrations and Waves : Superposition of parallel and perpendicular simple harmonic motions, Lissajous figures, solution for natural, damped and forced vibration, resonance, sharpness of resonance. Differential equation of wave motion – one dimensional plane progressive wave, energy and intensity of plane wave. Velocity of sound in solid and gaseous medium, velocity of transverse waves in stretched strings. [9L]

Optics : Fermat's principle and its application to reflection and refraction at plane surfaces. Matrix Methods- Reflection, refraction, translation matrices (derivation). Two thin lenses separated by a distance. [5L]
Interference: Concept of spatial and temporal coherence, sustained interference. Newton's ring and Fresnel's bi-prism, Thin films. [4L]
Diffraction – Fraunhofer single slit diffraction, plane transmission grating, Resolving power, Rayleigh's criterion. [3L]
Polarization – Transverse nature of light, concept of double refraction, ordinary ray & extraordinary ray, states of polarization, Brewster's law, optical activity and polarimeter [5L]

Module B: Electromagnetism [26 lectures]

Coulomb's law, potential and field intensity for discrete and continuous charge distribution, Gauss' theorem and its applications (infinite plane, charged spherical shell, charged solid sphere). Capacitors - parallel plate, energy stored by a charged capacitor (parallel plate), effect of dielectric in a capacitor. [8L]
Magnetic effect of current: Biot-Savart's law, application for simple cases – (straight conductor, circular coil), Ampere's circuital law, applications of circuital law in a long solenoid, force on a current carrying conductor in a magnetic field, Lorentz force, action of current on current. [9L]
Steady current – Network analysis, Kirchhoff's laws, Thevenin, Norton and maximum power transfer theorems (statements only) and applications to simple circuits. [6L]

Alternating Current: Phasor diagrams, L-C-R series circuit, resonance, Q factor. [3L]

References :

(1) Advanced Acoustics, D.P. RayChaudhuri
(2) A Handbook of Degree Physics, C.R. Dasgupta
(3) Optics, Ajay Ghatak
(4) Introduction to Electrodynamics, D. J. Griffiths

Vibrations, Waves and Optics & Electromagnetism Lab (Credits – 2) [26 Periods]

1. Determination of the focal length of a given concave lens by combination method.
2. Determination of the refractive index of a liquid and that of the material of the convex lens by using the lens and a plane mirror.
3. Determination of the wavelength of a monochromatic light by Newton's ring method.
4. Calibration of a given polarimeter and determination of the concentration of an unknown sugar solution.
5. Determination of the horizontal component of the earth's magnetic field by using a deflection and an oscillation magnetometer.
6. Determination of the resistance of a galvanometer by the method of half-deflection.
7. Verification of Thevenin, Norton and Maximum Power Transfer theorem for a Wheatstone bridge network.
8. Study of resonance of a series LCR circuit and determination of Q-factor
9. To study Lissajous figures using CRO.

References :

a. A textbook on Practical Physics, K.G. Mazumdar & B. Ghosh, Sreedhar Publishers
b. Advanced Practical Physics Vol 1. B. Ghosh & K.G. Mazumdar, Sreedhar Publishers
c. Advanced Practical Physics Vol 2. B. Ghosh , Sreedhar Publishers
d. An Advanced Course in Practical Physics, D. Chattopadhyay, P.C. Rakshit, New Central Book Agency Pvt. Ltd.