

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: III

**PHYSICS PAPER III
ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM**

Course Code: 18IIPH3

No. of Hours: 60

COURSE OBJECTIVES

- To develop an understanding of the basic concepts of electricity and magnetism and the basic concepts of electric forces and fields.
- To gain an understanding of magnetic fields and their relationship to electrical fields
- To goal is to gain knowledge and skills in the use of alternating currents and their application in electronics.
- To gain knowledge and develop skills in the use of vectors and vector operations.

LEARNING OUTCOMES

- Apply knowledge of electricity and magnetism to explain natural physical processes and related technological advances.
- Use an understanding of calculus along with physical principles to effectively solve problems encountered in everyday life, further study in science, and in the professional world.

UNIT I

Network theorems and circuit analysis

7 HRS

Review of Ohm's law and Kirchhoff's laws-Superposition theorem-Thevenin's theorem-Norton's theorem-Maximum power transfer theorem (for dc circuits)

Electrostatics

8 HRS

Review of electric field, potential and the relation between them- Concept of electric flux-Gauss' theorem in integral form. applications of gauss theorem- electric intensity at a point between two parallel plane charged conductors- electric intensity at a point outside two parallel plane charged conductors.

Dielectrics- Polarization of dielectrics- Electric dipole- Derivation of expressions for electric field and potential due to an electric dipole.

Capacitor-Capacitance-calculation of capacitances: spherical capacitor, capacity of a spherical conductor enclosed by an earthed concentric spherical shell -Effect of dielectric (derivation)- Energy stored by a charged condenser. problems

UNIT II

Magnetic effects of steady current

15 HRS

Review of magnetism, magnetic field B- Force on a straight current carrying conductor in a magnetic field. Force and Torque on a current loop in a uniform magnetic field. Magnetic field of a moving point charge. Magnetic field of a current carrying element: The Biot savart law- Calculation of B using Biot-Savart Law for a circular loop and solenoid. Ampere's circuital law in integral form. Calculation of B long cylindrical wire and long solenoid using Amperes circuital law.

Ballistic galvanometer, its construction and theory of working. Charge and current sensitivity. Damping and its effects. Application of B.G.: High resistance by leakage with theory. Theory of Helmholtz double coil galvanometer. Comparison of dead-beat and B.G.

UNIT III

Scalar and vector Calculus:

4 HRS

Gradient of a scalar function (use of del operator), Divergence and Curl product rules (explanation with geometrical representation), Line, Surface and volume integrals (explanation with examples). Fundamental theorem for divergence and curl - (statement only).

Maxwell's Equations and electromagnetic waves

11 HRS

Review of Faraday's laws of electromagnetic induction, concept of displacement current and total current. Derivation of Maxwell's equations and their physical significance. Derivation of electromagnetic wave equation (i) dielectric medium (ii) vacuum. Phase velocity of plane monochromatic EM waves in a non-conducting medium. Dispersive and non-dispersive media. Proof of transverse nature of EM waves. Relation between refractive index, dielectric constant of a medium and speed of EM waves through it. Poynting's theorem (qualitative), Poynting vector. Derivation of expression for energy density of EM waves – skin effect and skin depth.

UNIT IV

AC circuits

8 HRS

RMS and average value of AC – definition and expressions, Representation of sinusoids by complex numbers (brief explanation), response of RC, LR, LCR circuits to sinusoidal voltage - j operator method, series and parallel resonant (LR parallel C) circuits (mention condition for resonance with expressions for impedance and current), expression for Q-factor, band width AC bridge - Maxwell bridge (derivation of condition for balance, determination of self-inductance of a coil). Problems.

Thermoelectricity

7 HRS

Seebeck effect; Thermoelectric series; Neutral temperature; Laws of thermoelectricity; Peltier effect, Peltier coefficient; Thomson effect, Thomson coefficient; Application of thermodynamics to thermoelectric circuits (Peltier effect) Thermoelectric diagrams and uses; Applications of thermoelectricity - Boy's radio micrometer, thermopile and thermoelectric pyrometer

Practical Physics – III

List of Experiments

1. To find L and C by equal voltage method
2. Energy consumption in an electrical circuit - to find power factor
3. Resonance in LCR series circuit
4. Resonance in LCR parallel circuit
5. Thermoelectric circuit - find Seebeck coefficients
6. Study of thermo emf as a heat pump
7. Black box - identify & measure R, L and C
8. Verification of Thevenin's theorem
9. Verification of Superposition theorem
10. Verification of maximum power transfer theorem
11. Maxwell's impedance bridge
12. Desauty's bridge

- Note:**
1. A minimum of 8 experiments to be performed
 2. Practical instructions manual to be prepared by faculty of Physics
 3. Demonstration experiments to be considered as Group Project Work

References:

1. Electricity and magnetism by *Brij Lal* and *N. Subrahmanyam*, Rathan Prakashan Mandir, Nineteenth Edition, 1993
2. Principles of Electronics by *V.K Mehta* and *Rohit Mehta*, S Chand & Company, Eleventh Edition, 2008
3. Feynman Lecture series, VolIII, *R.PFeynman* et al, Narosa Publishing House, New Delhi
4. Electricity & Magnetism, *N.SKhare&S.SSrivastava*, AtmaRam & Sons, New Delhi
5. Electricity & Magnetism, *D.LSehgal, K.LChopra,NKSehgal*, S Chand & Co, Sixth Edition, (1988)
6. Electricity & Electronics, *D.CTayal*, Himalaya Publishing House, Sixth Edition(1988)
7. Basic Electronics & Linear Circuits, *N.N Bhargava, D.C Kulshrestha&SC Gupta*, TMH Publishing Company Limited, 28th Reprint,1999
8. Fundamentals of Physics by *Halliday, Resnick* and *Walker*, Asian Books Private Limited, New Delhi, 5th Edition,1994
9. Introduction to Electrodynamics by *DJ Griffiths*
10. Eletromagnetism by *B.B Laud*
11. Eletrical Networks, *Theraja*
12. Electrical Networks, *Malvino*
13. Electricity and magnetism by *A.S Mahajan* and *A. A Rangwala* Ninth edition(1998) Tata McGrawhill Publishing Company Limited New Delhi
14. Electro magnetics *John. D. Kraus* Third Edition MacGraw Hill book Company(1984)