Syllabus

2nd Semester

B.Sc. in Physical Sciences

(Physics)

4. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers

240/PHYP/CC201

Semester-II

Course ID - 240/PHYP/CC201

ELECTRICITY AND MAGNETISM

Max. Marks: 50 **Credit 3(45Hrs)**
Internal Assessment: 25 **Time: 3 hrs**

*Note: The paper setter is to set **Nine** questions. Question no. 1 (compulsory based on the entire syllabus) will consist of **five** short answer type questions, each of **two** marks. The rest of the **eight** questions will be set uniformly, with two questions from each unit selected. A student is required to attempt **five** questions, selecting one from each unit along with compulsory question no 1. The question paper shall contain 20 % numerical problems in the relevant papers.*

Course Objective: The course on electricity and magnetism deals with Coulomb's law, the electric field, the potential formulation of electrostatic, capacitors, magnetism, and magnetic materials, and the application of these concepts. The physical context and derivation of Maxwell equations are covered.	**Course Outcome:** The student will be able to understand Gauss's Divergence theorem, Stokes's theorem in dielectrics, and materials' electrical and magnetic properties. The origin and applications of Maxwell's equations should be clear to students.

UNIT-I

Scalar and Vector fields, Differentiation of a vector, Gradient of a scalar and its physical significance, Integration of a vector (line, surface and volume integral and their physical significance), Gauss's divergence theorem and Stocks theorem.

Electric field, Electric field lines, Divergence and curl of electrostatic field, Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations.

UNIT-II

Electric flux, Gauss's Law, and its application to the spherical shell, uniformly charged infinite plane and uniformly charged straight wire, the mechanical force of charged surface, and energy per unit volume.

Polarization, Dielectric materials, Electric displacement, Gauss's theorem in dielectrics, Electrical Susceptibility& Permittivity, and Dielectric constants.

UNIT-III

Lorentz force law, Magnetic forces, Biot-Savart's law and its applications (1) straight conductor (2) circular coil (3) solenoid carrying current, Divergence and curl of the magnetic field, Ampère's circuital law and its applications for simple current configurations.

Faraday's experiments on induction, Faraday's Law, Induced Electric field, Self and Mutual inductance, and Energy in magnetic fields.

UNIT-IV

Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Para-, Dia- and Ferro-magnetism, B-H curve and hysteresis.

Maxwell equation and its derivations, Displacement Current, vector and scalar potentials, boundary conditions at the interface between two different media, Poynting vector, and Poynting theorem.

References:

1. D.J. Griffith, Introduction to Electrodynamics, Pearson Publication
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)
5. Electricity and Magnetism by A.S. Mahajan and A.A. Rangwala (Tata McGraw-Hill).

ELECTRICITY AND MAGNETISM LAB

Marks (External) : 20 **Credits : 1(30Hrs)**
Marks (Internal Assessment) : 05 **Time : 3 Hrs**

1. Each student should perform at least five experiments.
2. The students are required to calculate the error involved in a particular experiment.
3. List of experiments may vary.

List of Experiments:

1. To determine an unknown Low Resistance using Potentiometer.
2. To determine an unknown Low Resistance using Carey Foster's Bridge.
3. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
4. To determine self-inductance of a coil by Rayleigh's method.
5. e/m measurement by Thomson method
6. To determine the mutual inductance of two coils
7. B-H curves for soft and hard ferromagnetic materials.
8. Measurement of self-inductance of a coil by Owen's Bridge

References:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. BSc Practical Physics, Geeta Sanon, R. Chand Publications, 2020.
3. BSc Practical Physics, Harnam Singh, S. Chand Publications, 2020.
4. A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Ed., 1511,Kitab Mahal

5. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
6. Engineering Practical Physics, S. Panigrahi and B. Mallick, 1515, Cengage Learning.