Government PG College, Ambala Cantt

Session: 2023-2024 (Even semester)

Name of Assistant Professor: Dr. Samiksha Kumari

Class: B.Sc Ist year (Sem-II) Medical

Subject: Physics (Paper: Elementary Electricity, Magnetism & EM Theory, PHY-202)

SYLLABUS

Max. Marks:50

Internal Assessment Marks: 15

End Term Exam Marks: 35

Time: 3 hours

Note: Nine questions will be set in total. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks. 20% numerical problems are to be set. Use of scientific (non-programmable) calculator is allowed.

UNIT-I

Vector background and electric field: Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance, Gauss’s divergence theorem, Stoke’s theorem.

UNIT-II

Magnetic field and magnetic properties: Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, properties of B (i) ∇.B = 0 (ii) ∇ ×B = µoJ, Magnetic Materials, types, Hysteresis curve and importance of Hysteresis Curve.

UNIT-III

Time varying electromagnetic fields and electromagnetic waves: Electromagnetic induction, Faraday’s laws of induction and Lenz’s Law, Derivation of Maxwell’s equations and their physical significance. Boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation), Poynting vector and Poynting theorem.

UNIT-IV

D.C. and A.C. circuits: D.C. Network theorems: Thevenin’s theorem, Norton theorem, Superposition theorem; Analysis of LCR Series and parallel resonant circuits.

Recommended Books/e-resources/LMS:

1. Electricity and Magnetism (Berkley, Phys. Course 2), Edward M. Purcell, 1986 McGraw Hill Education.

2. Electricity and Magnetism: A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill), 1988.

3. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw

4. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.

5. Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education

6. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.

7. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

8. Field and Wave Electromagnetics (2nd Edn.), David K. Cheng , Addison-Wesley Publishing Company

**COURSE OBJECTIVES:**

* To understand the basic mathematical concepts related to electromagnetic vector fields.
* Students will familiar with nature and types of magnetic materials.
* To understand the properties of permanent magnet and electromagnet.
* To understand the concept of electric and magnetic fields.
* To introduce the concept of different coordinate systems, Maxwell’s equation.
* Define, describe and draw magnetic field lines around a single magnet.
* Understand the basic electronics concepts.

Course Learning Outcomes:

After completing this course, the learner will be able to:

1. Explain and differentiate the vector and scalar formalisms of electrostatics. Also be able to apply Gauss’s Divergence & Stokes theorem to solve various problems in electrostatics.

2. Describe the magnetic materials & important properties of magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials.

3. Derive Maxwell equations and their physical significance and familiar boundary conditions at the interface between different media. The students will also be able to have basic idea about the propagation of electromagnetic waves.

4. Analyze DC/AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.

5. Learn to present observations, results, analysis and different concepts related to experiments of Electricity and Magnetism.

Lesson Plan

Minor (One class in one week)

Session Started: 15 Feb 2024

Session Ended: 31 May 2024

Holi Break: 23-31 March 2024

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| **Week** | **Topic** |
| **1** | **Unit 1: Vector background and electric field:** Gradient of a scalar and its physical significance,  |
| **2** | Line, Surface and Volume integrals of a vector and their physical significance, |
| **3** | Flux of a vector field, Divergence and curl of a vector and their physical significance |
| **4** | Gauss’s divergence theorem, Stoke’s theorem. **Revision**  |
| **5** | **Unit 2: Magnetic field and magnetic properties** : Magnetic induction, Magnetic flux,  |
| **6** | Solenoidal nature of vector field of induction, properties of B (i) ∇.B = 0 (ii) ∇ ×B = µoJ, Magnetic Materials, types, |
| **7** | Hysteresis curve and importance of Hysteresis Curve, **Revision & Tests** |
| **8** | **Unit 3: Time varying electromagnetic fields and electromagnetic waves :** Electromagnetic induction, Faraday’s laws of induction and Lenz’s Law |
| **9** | Derivation of Maxwell’s equations and their physical significance. Boundary conditions at interface between two different media |
| **10** | Propagation of electromagnetic wave (Basic idea, no derivation) |
| **11** | Poynting vector and Poynting theorem, **Revision** |
| **12** | **Unit 4: D.C. and A.C. circuits:** D.C. Network theorems:  |
| **13** | Thevenin’s theorem,  |
| **14** | Norton theorem, Superposition theorem |
| **15** | Analysis of LCR Series and parallel resonant circuits |
| **16** | **Revision & Tests** |