



CLUSTER UNIVERSITY SRINAGAR

SYLLABUS (FYUP UNDER NEP 2020)

Offered By Department PHYSICS

Semester 2nd (Major Course)

Course Title: Electricity & Magnetism in Vacuum

Course Code: UGPHY22J201

Credits: 4 (Theory: 3, Practical: 1)

Contact Hrs: 75 (Theory: 45, Practical: 30)

Max. Marks 100

Theory External: 60; Min Marks: 24

Theory Internal (Continuous Assessment): 15 Marks, Min Marks: 06

Practical Experimental Basis= 15, Min. Marks: 06

Practical Internal (Continuous assessment) = 10, Min. Marks: 04

Objectives:

The objective of the course is to present Electric & magnetic phenomenon in vacuum which offers sufficient support for broadening the outlook of the subject & its applications to other branches of physics

By the end of the course the student shall have developed the ability of solving problems using different (preferably labour saving) approaches & shall also be able to estimate the approach used to tackle advanced problems.

Course Outcomes: Students shall be able to:

Understand vector calculus, Differential and Integral vector calculus & apply to use the two using fundamental theorems.

Understand field & potential concept & and the fundamental physical & mathematical framework of these important concepts.

Compute energy associated with an electric and a magnetic field.

A hands on experience is provided through the Laboratory Course.

UNIT I

(15 Hrs)

Vector Calculus

Vector Differential Calculus:- Separation vector, Scalar & Vector Functions, The operator ∇ , Gradient, Divergence & Curl and their Geometrical Interpretation, product rules of vector differentiation, Second derivatives, Laplacian.

Vector Integral Calculus:- Line, Surface & Volume Integrals, Fundamental theorems for Gradient, Divergence & Curl, (Statements Only), applications to problems in cartesian & spherical coordinates.

Dirac-delta function in 1 & 3 - dimensions.

UNIT II

(15 Hrs)

Charges at Rest

The Electric Field (E):- The law of Coulomb for two & several discrete charges, Electric field, Continuous charge distributions, Calculation of E for line, sheet (discs) & spherical charge distribution, Field lines & Flux, The law of Gauss, Divergence & curl of E, Applications of Gauss's law to problems with Spherical, cylindrical & plane symmetry.

The Electric Potential (V):- Integral & Differential expressions related with E, The ϕ of continuous charge distributions, Calculation of ϕ for infinite line charge & a charged disc and spherical charge distribution.

Energy:-The work done to move a charge, Energy of a discrete charge & continuous charge distributions.

UNIT III

(15 Hrs)

Charges in Motion

The Magnetic Field (B):- The Lorentz force law, trajectory of a charge in **E & B** fields, cyclotron frequency, surface & volume current density, Steady currents, The law of Biot & Savart, B of wire & circular loop carrying current, Divergence & curl of B, Ampere's Law, Applications to straight, planar & solenoidal current configurations, Magnetic vector potential A, Calculation of A of infinite solenoid.

Electrodynamics:- Ohm's law, Motional EMF, Electromagnetic Induction, Faraday's Law (Differential & Integral form), Lenz's law, The induced E Field, Self & Mutual Induction, The Energy in magnetic fields.

Maxwell's Equations:- Ampere's law & Displacement current, Maxwell's equations, Equation of continuity.

List of Experiments:

1. To use a multimeter for measuring (a) Resistance (b) AC and DC Voltages (c) AC and DC current (d) capacitance (e) frequency and checking electric fuses.
2. Ballistic Galvanometer (i) Measurement of charge and current sensitivity (ii) Measurement of Critical damping resistance.
3. To determine a low resistance by Carey Foster's bridge.
4. To determine an unknown Low Resistance using Potentiometer.
5. Determination of high resistance by leakage methods/ substitution method.
6. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
7. To find the value of B_H , the horizontal component of earth's magnetic field using a deflection and a vibration magnetometer.
8. To determine self inductance of a coil by Rayleigh's method.
9. To determine self inductance of a coil by Anderson's bridge.
10. To find the coefficient of mutual inductance of two coils.

Suggested Readings:

1. An Introduction to Electrodynamics, David. J. Griffiths, 4th Edition, Cambridge University Press, 2020.
2. B.Sc. Practical Physics, C. L. Arora, S Chand & Company, 2010.
3. Classical Electromagnetism, H. C. Verma, 1st Edition, Bharati Bhawan, 2022.
4. Electricity and Magnetism, Edward M. Purcell & David J. Morin, 3rd Edition, Cambridge University Press, 2013.
5. Electricity and Magnetism, Berkeley Physics Course, Volume II, Edward M. Purcell, 2nd Edition, McGraw Hill Education, 2017.
6. Physics Volume II, R. Resnick, D. Halliday & K. S. Krane 5th Edition, Wiley, 2007.
7. Foundations of Electromagnetic Theory, John R. Reitz, Frederick J. Milford & Robert W. Christy, 4th Edition, Pearson, 2008.
8. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, Asia Publishing House, 1971.
9. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, Heinemann Educational Publishers, 1985.

