ELECTRODYNAMICS, ELECTROMAGNETIC WAVES AND RELATIVITY

Physics Paper-II (3162)
(B.Sc. Part-III)

Dr. Dinesh Patidar

Assistant Professor

Department of Physics

Mohanlal Sukhadia University

Udaipur

Syllabus.....

UNIT – I

Motion of charged particles in **E** and **B** fields: Case of cathode ray oscillograph, positive ray parabola, velocity selector, magnetic focusing, mass spectrography.

Faraday‟s law for electromagnetic induction: Faraday‟s law integral and differential forms; self-inductance of a solenoid and of a law, Maxwell‟s equation for time-dependent electromagnetic field in vacuum and in material media, boundary conditions.

UNIT – II

Electromagnetic potentials: Magnetic vector potential **A** and scalar potential Φ. Poisson‟s equation for **A** in terms of current density, solutions for line surface currents. Coulomb and Lorentz gauge transformations, Lorentz law in terms of potentials.

Maxwell‟s equations and electromagnetic waves: Plane-wave solution for Maxwell‟s equation; orthogonality of **E**, **B** and propagation vector. Poynting vector; energy and momentum propagation, reflection and transmission at dielectric boundaries (normal incidence), polarization by reflection, Brewster‟s angle.

straight conductor, energy stored in an inductor and in the magnetic field. Displacement current; modified Ampere‟s

UNIT – III

Electromagnetic waves in conductors: Modified field equation; attenuation of the wave, reflection at and transmission through a conducting surface.Total internal reflection

Radiation from accelerated charges: Modification(Conceptual only) of Coulomb‟s law to include velocity and acceleration dependent terms in **E** field. Radiation from an oscillating dipole and its polarization. Radial and spherical power of electromagnetic radiation, Radiation pressure equation in free space and medium

UNIT – IV

The Lorentz transformations: Galilean transformations; Newtonian relativity, instances of their failure; electromagnetism, aberration of light, Michelson-Morley experiment; Einstein‟s basic postulates and geometric derivation of Lorentz transformations; invariance of Maxwell‟s equations, length contraction, simultaneity, synchronization and time dilation, Einstein‟s velocity addition rule, Doppler effect in light. Relativistic gravitational Red Shift

UNIT – V

Relativistic dynamics: Variation of mass with velocity, mass energy equivalence, relativistic formulae for momentum and energy.

The structure of space-time: Four vectors; invariance of an interval, time-like, space- like and light-like intervals, Minkowski space.

Relativistic electrodynamics: Electric field of a point charge in uniform motion; transverse components, magnetism as a relativistic phenomenon, transformation of **E** and **B** fields.

Recent developments in Physics including discussion of Nobel prizes in Physics (no questions to be set in the theory examination).

Text and Reference books:

- **D.J. Griffiths: Introduction to Electrodynamics, Prentice Hall of India, 1989.**
- **Reitz and Milford: Introduction to Electrodynamics, Addison-Wesley.**
- **A.M. Portis: Electromagnetic Fields**
- **J.B. Marion: Classical Electromagnetic radiation (Academic Press)**
- **R.P. Feynmann, R.B. Leighton and M. Sands: The Feynmann lectures in physics, Vol. II (B.I. Publications).**
- **B. Saraf et al. : Physics through experiments Vol. I – EMF, constant and varying, Vikas Publishing House.**
- **D.R. Corson and P. Lorrain: Introduction to Electromagnetic fields and waves, Freeman-Taraporevala, Bombay, 1970.**
- **E.C. Jordan and K.G. Balmain: Electromagnetic waves and radiating systems, 2nd Ed., Prentice Hall of India, New Delhi, 1971.**
- **Eletrodynamics ,Electromagetic Waves and Relativity (In Hindi) Kalra,Kakani and Bhandari**