Semester IV

MJCPHY06: **Electrodynamics and Electromagnetism**

Course Title	Credit	Credit Distribution	
		Theory	Practical
Electrodynamics and Electromagnetism	5	5	0

Course Outcomes

After completing the course, the students will be able to:

CO1: Establish and analyse four Maxwell's equations of electromagnetism.

CO2: Uunderstand the propagation of electromagnetic waves in vacuum, dielectrics, conductors and also in guided media and the phenomenon of reflection and refraction of plane waves at different boundaries.

CO3: Understand the importance of energy flow (Poynting Theorem) and its usefulness.

CO4: Get background for further studies and research in different subject areas.

MJCPHY06	Electrodynamics and Electromagnetism (T) - 05 Credit	
Unit	Topics to be covered	No. of Lectures
1	**Maxwell's Equations:**Equation of continuity, **Displacement** Current Maxwell's equations in differential and Integral forms; Vector and scalar potentials, Poynting theorem and Poynting vector, energy conservation (qualitative idea of momentum conservation). Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density, Description of Lorentz force.	10
2	**Electromagnetic Wave Propagation in unbounded media:** Propagation of plane EM waves in free space, and dielectrics ,Transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation of EM wave through conducting media, relaxation time, skin depth.	14
3	**EM Wave Propagation in Bounded Media:** Boundary conditions at a plane interface between two media. Reflection and Refraction of plane waves at plane interface between two dielectric media — Laws of Reflection and Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection. Metallic reflection (normal Incidence).	14
4	**Polarization of Electromagnetic Waves:** Description of Linear, Circular and Elliptical Polarization. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction.	10

| 5 | **Transmission Line:** Propagation of e.m. wave through transmission line, reflection coefficient, standing wave, characteristic impedance, propagation constant.
Wave Guides:
Fundamentals of wave guides, Condition of continuity at the interface. Expressions for field components, TE and TM modes. Propagation properties, cutoff frequency,. Field energy and Power transmission.
Optical Fibres:
Numerical Aperture. Step and Graded Indices (Definitions Only). Single and **Multiple** Mode Fibres (**Concept** and Definition **Only**). | 12 |
| | **Total** | **60** |

Suggested Books:

1. Introduction to Electrodynamics, D.J. Griffiths, Benjamin Cummings. ,
2. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner,Springer
3. Electromagnetic Fields & Waves, P. Lorrain & D. Corson, W.H. Freeman& Co.
4. Electromagnetics, J. A. Edminster, Schaum Series, Tata McGraw Hill.
5. Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, Cambridge University Press.
6. Electrodynamics and Plasma Physics S.L.Kakan ,C. Herajan, CBS publisher
7. Electrodynamics :K.K Chopra &G.C Aggrawal
8. Classical Electrodynamics J D Jakson Wiley