Course Code	Course Name	Credits
26PH501	ELECTROMAGNETIC THEORY	04

Course Objectives

- To understand the concepts of dispersion and scattering of electromagnetic waves in different media.
- To study electromagnetic potentials and fields associated with moving charges.
- To analyze radiation mechanisms due to accelerated charges and antenna systems.
- To explore the principles of radio wave propagation and their applications in communication systems.
- To introduce the fundamentals of plasma physics and its behavior in electric and magnetic fields.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Explain dispersion phenomena and scattering mechanisms in gases, liquids, and solids.
- Analyze electromagnetic potentials and fields produced by moving charges.
- Evaluate radiation processes such as Larmor radiation and antenna radiation systems.
- Describe different modes of radio wave propagation and their practical significance.
- Understand plasma behavior under electric and magnetic fields and its applications.

Unit 1 - Dispersion and Scattering (12 Hrs.)

Dispersion: Normal and Anomalous- Characteristics of Dispersion- Dispersion in gases- Experimental demonstration of anomalous dispersion in gases-dispersion in solids and liquids- Theory of scattering of electromagnetic waves-coherence and incoherence of scattering light.

Unit 2 – Potentials of Electrodynamics (12 Hrs.)

Solution of inhomogeneous wave equation by Fourier analysis-Lenard wiechert potentials- Electromagnetic fields from Lenard wiechert potentials of a moving point charge - Electromagnetic fields of a Uniformly moving point charge – Abraham –Lorentz formula- Lorentz force in terms of electromagnetic potentials.

Unit 3 - Acceleration of Radiations (12 Hrs.)

Radiation from an accelerated charge at low velocity- larmor's formula- Radiation from an accelerated charge at high velocity- Angular distribution of radiation emitted by an accelerated charge- Cherenkov radiation –Electric quadruple radiation- Radiation due to a small current element- Radiation from linear antenna- half wave antenna-Antenna array.

Unit 4 – Radio wave Propagation (12 Hrs.)

Types of wave Propagation- Ground wave Propagation- Propagation of space waves-Skip distance and maximum usable Frequency- Eccles Larmor Theory- Effect of earth magnetic field on radio wave propagation - Splitting of radio waves in ionosphere Elementary idea of micro wave and optical communications.

Unit 5 - Plasma Physics (12 Hrs.)

Definition of plasma: Qausi-neutrality of Plasma - It's occurrence in nature plasma; Charged particles in Electric field and Magnetic fields-Charged particles in simultaneous electric and magnetic field –Non homogenous magnetic field-magneto hydrodynamics-mechanical behavior of fluid –Magnetic confinement –cylindrical plasma – Plasma pinched-Alfven waves.

Reference Books:

1. Electromagnetic theory and electrodynamics – Satya Prakash 2008.
2. Introduction to Electrodynamics" – David J. Griffiths
3. Classical Electromagnetic Radiation" – Marion &Heald
4. Antennas and Wave Propagation" – J. D. Kraus
5. F. F. Chen — Introduction to Plasma Physics and Controlled Fusion

Websites and eLearning Sources:

1. https://nptel.ac.in/courses/108104087
2. https://youtu.be/QBvuHfmKp48?si=CVTV4tZh_B0eYMS0
3. https://youtu.be/vuGetRyv4qI?si=6e6Ukb23Q7sZ4sQb

COs and Bloom's Taxonomy Mapping – 26PH501		
Course Outcomes	**On successful completion of this course, students will be able to**	**BTL**
CO1	Recall and explain vector calculus and fundamental electromagnetic field concepts.	K1, K2
CO2	Apply electrostatic and magnetostatic principles to solve field problems.	K3
CO3	Analyze electromagnetic wave propagation, radiation, and scattering phenomena.	K4
CO4	Evaluate antenna systems, plasma behavior, and EM wave interactions.	K5
CO5	Develop solutions for advanced electrodynamics problems and real-world applications.	K6

BTL (Bloom's Taxonomy Level) - K1 – Remembering, K2 – Understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6 - Create

Relationship Matrix – 26PH501													
Course Outcomes	**Programme Outcomes (POs)**						**Programme Specific Outcomes (PSOs)**						**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	
CO1	3	2	1	1	1	1	3	2	1	1	1	1	1.58
CO2	3	3	2	1	1	1	2	3	2	2	1	1	1.92
CO3	3	3	3	2	1	1	2	3	3	2	2	1	2.25
CO4	3	3	3	2	2	1	2	3	3	3	2	2	2.42
CO5	3	3	3	3	2	2	3	3	3	3	3	2	2.75
												Total	2.18

Mean Score: 3- High, 2- Medium/Moderate, 1-Low