Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NPHC509	Electrodynamics and Radiation Theory	3	1	0	4

Course Objective
The course content covers the propagation of electromagnetic waves in linear media (vacuum, dielectric, and conductor).
Learning Outcomes
It familiarizes students with different principles and phenomena when electromagnetic wave propagates in different media.

Unit No.	Topics to be Covered	Lecture Hours	Tutorial Hours	Learning Outcome
1	**Maxwell's Equations:** Displacement current, Maxwell's equations, Vector and Scalar potentials, Gauge transformations, Coulomb gauge, Lorentz gauge, Inhomogeneous wave equation and solution by Green's function, Electromagnetic energy and momentum, Conservation laws,.	10	4	Student should understand the basic mathematical concepts related to electromagnetic vector fields. Students should understand how the Maxwell equations arise as a synthesis of the various individual electromagnetic phenomena considered so far. Students should understand how Maxwell's equations lead to electromagnetic waves and how the speed of light is related to static properties of the vacuum. Students should be able to solve simple problems involving electromagnetic waves in free space.
2	**Covariance of electrodynamics**: Transformation of sources and fields, Electromagnetic field tensor and Maxwell's equations.	04	1	Understanding how the laws of electrodynamics remain invarient under coordinate transformations,
3	**Electromagnetic Waves:** Plane wave propagation in vacuum and in a dielectric medium; Polarization, Reflection and Refraction at dielectric interfaces; Plane wave propagation in conductor, Dispersive media, Normal and Anomalous dispersion, Wave propagation in one dimension, Group velocity, Phase velocity.	10	3	Students should be able to understand different observed phenomena when EM wave propagates throgh different media. They will nderstand the concept of wave guide and application in signal transmission.
4	**Wave guides:** Wave guides and Resonant Cavities, Plane wave propagation in wave guides, Classification of fields, Plane wave propagation in resonant cavities, Resonant modes and Power losses in cavities.	08	3	Apply knowledge of plane wave propagation in waveguides and resonant cavities to characterize transmission properties, resonance phenomena, and power handling capabilities, facilitating the design and optimization of devices such as antennas, filters, and resonators
5	**Radiation Theory:** Field of a localized oscillating source, Liénard-Wiechert potentials, Electromagnetic fields due to an accelerated charge and a uniformly moving charge, Power radiated by an accelerated charge at low and high velocity, Angular distribution of power radiated by an accelerated charge, Bremsstrahlung, Synchrotron, and Cerenkov Radiation, Reaction Force of Radiation fields.	10	3	Students should be able to explain the origin of radiation and its characteristics. They should be able to determine the energy distribution, angular distribution of power and related phenomena.
	Total	**42**	**14**	

Text Books:

1. Classical Electrodynamics; Jackson; John Wiley; 2007
2. Classical Electrodynamics; Greiner; Springer; 1998
3. Introduction to Electrodynamics; Griffiths; PHI Learning; 2009

Reference Books:

1. Classical Electricity and Magnetism; Panofsky and Phillips; Dover Publications, Inc.; 1990
2. Foundations of electromagnetic theory; Reitz, Milford and Christy; Pearson; 2009
3. Electrodynamics; Gupta, Kumar and Sharma; Pragati Prakashan; 2010
4. Classical Electromagnetic Theory; Vanderlinde; John Wiley and Sons; 1993