Course Code	Course Title	L	T	P	C
BPHY402L	Electromagnetic Theory	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. Understand the need of mathematics in electromagnetism.
2. Attain fundamental knowledge of electric and magnetic fields.
3. Understand propagation of electromagnetic waves.
4. Acquire knowledge on waveguides.
5. Apply for different electromagnetic applications.

Course Outcomes

1. Understand the importance of vector calculus and their applications in the field of Electromagnetism.
2. Apply the knowledge of fields and potentials associated with electromagnetism in real world problems.
3. Derive Maxwell's equation and understand their importance in practical applications.
4. Understand different types of waveguides and their applications in propagation.

Module:1	Electrostatics	6 hours

Introduction - Review of vector calculus - Gradient, Divergence and Curl - Gauss and Stokes theorem - Examples - Electric charges - Properties - Coulomb's law - Electric field - Electric field lines - Electric flux - Gauss' Law

Module:2	Electric Potential	6 hours

Conservative nature of Electrostatic Field - Electrostatic Potential - Laplace's and Poisson equations - Uniqueness theorem - Potential and Electric Field of a dipole - Force and Torque on a dipole

Module:3	Magnetostatics	6 hours

Magnetic field - Magnetic Vector potential - Magnetization - Biot-Savart's Law and its simple applications - Straight wire and circular loop - Ampere's law for a magnetized material - Magnetic field due to solenoid and toroid - energy density

Module:4	Electrodynamics	8 hours

Electromagnetic Induction: Faraday's Law - Maxwell's equations - Boundary conditions - Scalar and vector potentials - Gauge invariance - Electromagnetic energy - Poynting's theorem - Newton's third law in electrodynamics - Maxwell's stress tensor

Module:5	EM Waves and their propagation	7 hours

Electromagnetic wave equation - Propagation of EM waves in non - conducting media and conducting media - Reflection and refraction at the boundary of non-conducting media -Fresnel's coefficients - Brewster's angle and critical angle - Reflection from a conducting plane

Module:6	Wave Guides and electromagnetic radiation	6 hours

Wave guide; TE, TM and TEM modes - Rectangular wave guide - Dynamics of charged particles in static and uniform electromagnetic fields

Module:7	Applications of Electromagnetics	4 hours

Radiation from moving point charges and dipoles - Electromagnetic interference-Electromagnetic compatibility

Module:8	**Contemporary Issues**	**2 hours**
Guest lecture from industry and R & D organisations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Edward M Purcell and David Morin, Electricity & Magnetism – Berkeley Physics Course: Vol.2, 2013, 3rd Edition, Cambridge University Press, India.
2.	David J. Griffiths, Introduction to Electrodynamics, 2015, 4th Edition, Pearson, India.
Reference Books	
1.	R. Murugesan, Electricity and Magnetism, 2019, 10th Edition S. Chand & Co., India.
2.	Nelkon and Parker, Advanced level Physics, 1995, 7th Edition, CBS Publishers, India.
3.	J. H. Fewkes and J. Yarwood, Electricity and Magnetism, 1991, Oxford University Press.
4.	Arthur F. Kip, Fundamentals of Electricity and Magnetism, 1968, McGraw Hill.
5.	John R. Reitz, Frederick J. Milford, Robert W. Christy, Foundations of Electromagnetic Theory, 2008, 4th Edition, Addison-Wesley.
Mode of Evaluation: CAT, Written Assignment, Quiz and FAT	

Recommended by Board of Studies	20-06-2023		
Approved by Academic Council	No. 70	Date	24-06-2023