II Year: EVEN SEMESTER

INTERDISCIPLINARY CORE COURSE-2 (ESC)

EC202- ELECTROMAGNETIC FIELD THEORY

Details of course: -

Course Title	Course Structure			Pre-Requisite
	L	T	P	
Electromagnetic Field Theory	3	1	0	Basic knowledge of vector calculus, Electric and Magnetic fields and its laws.

Course Objective:
To develop a comprehensive understanding of electromagnetic theory, including vector analysis, Maxwell's equations, electromagnetic wave propagation, transmission lines, and waveguides, to solve complex engineering problems.

Course Outcomes (CO):
1. Apply knowledge of Vector Analysis and Coordinate Systems and their transformations.
2. Apply Maxwell's equations to solve problems in electromagnetics.
3. Elucidate, formulate and analyze electromagnetic wave propagation in various kinds of media.
4. Analyze and design transmission lines, utilizing parameters, impedance matching and optimize performance metrics.
5. Apply waveguide theory to analyze rectangular waveguides and solve field equations for different modes.

S. No.	Content	Contact Hours
Unit 1	Operational Vector Analysis: Review of Coordinate systems and Transformations– Cartesian, Circular and Spherical coordinates and Transformations. Vector Calculus – Differential length, Area and Volume; Line, Surface and Volume Integrals; Del Operator, Gradient of a scalar, Divergence of a vector and Divergence theorem, Curl of a vector and Stokes theorem.	06
Unit 2	Maxwell's Equation:Continuity equation and Relaxation Time, Electric and Magnetic Boundary conditions; Poisson's and Laplace equations, Displacement current,Significance of loss tangent, Maxwell equations in their general time varying forms, Phasor notations of signals, Maxwell equations in phasor notation, Helmoltz wave equations.	10
Unit 3	Electromagnetic Wave Propagation: Electromagnetic Wave Equation in a general medium and its solution, Wave propagation in lossless and lossy dielectrics, Plane waves in free space, Plane waves in good conductors, skin	10

	effect, Power and Poynting's vector, Reflection and refraction of plane waves at normal and oblique incidence.	
Unit 4	Transmission Lines: Transmission line parameters and equations; Input impedance, VSWR, and Power; Complex reflection coefficient, Short and Open Circuit Stubs, Smith Chart, Some applications of Transmission lines, Transients on transmission lines.	08
Unit 5	Waveguides: Rectangular waveguides, Field equations for Transverse Electric and Magnetic modes, Wave propagation in the guide and its propagational characteristics, Power transmission and attenuation, Waveguide current and mode excitation.	08
	Total	42

Books:-

S. No	Name of Books/Authors/Publisher
1	Elements of Electromagnetics by M. N. O. Sadiku, Oxford University Press, 5th edition
2	Engineering Electromagnetics by Hayt and Buck, Tata McGraw Hill, 8th edition
3	Fields and Waves in Communications Electronics by Ramo, Whinnery and Van Duzer, John Wiley & Sons, 3rd edition
4	Field and Wave Electromagnetics by David K Cheng, Pearson Education (India), 2nd edition