

<b>COURSE CODE</b>	<b>COURSE NAME</b>	<b>L-T-P-C</b>	<b>YEAR OF INTRODUCTION</b>
<b>EC303</b>	<b>Applied Electromagnetic Theory</b>	<b>3-0-0-3</b>	<b>2016</b>
<b>Prerequisite:</b> Nil			
<b>Course objectives:</b> <ol style="list-style-type: none"> <li>1. To introduce basic mathematical concepts related to electromagnetic vector fields.</li> <li>2. To impart knowledge on the basic concepts of electric and magnetic fields</li> <li>3. To develop a solid foundation in the analysis and application of electromagnetic fields, Maxwell's equations and Poynting theorem.</li> <li>4. To become familiar with propagation of signal through transmission lines and waveguides.</li> </ol>			
<b>Syllabus:</b> Co-ordinate transformation, vector algebra, vector calculus, electrostatics, magneto statics, Maxwell's equations, Boundary condition, Solution of wave equation, propagation of plane EM wave in different media, Poynting vector theorem, transmission lines, Smith chart, Waveguides.			
<b>Expected outcome:</b> At the end of the course, students will be able: <ol style="list-style-type: none"> <li>1. To develop a solid foundation and a fresh perspective in the analysis and application of electromagnetic fields.</li> <li>2. To analyse the propagation of electromagnetic waves in different media.</li> <li>3. To analyze the characteristics of transmission lines.</li> <li>4. To solve the different transmission line problems using Smith chart</li> <li>5. To understand the different modes of propagation in waveguides.</li> </ol>			
<b>Text Books:</b> <ol style="list-style-type: none"> <li>1. John D. Kraus, Electromagnetics, 5/e, TMH, 2010.</li> <li>2. Mathew N O Sadiku, Elements of Electromagnetics, Oxford University Press, 6/e, 2014.</li> <li>3. William, H., Jf Hayt, and John A. Buck. Engineering Electromagnetics. McGraw-Hill, 8/e McGraw-Hill, 2014.</li> </ol>			
<b>References:</b> <ol style="list-style-type: none"> <li>1. Jordan and Balmain , Electromagnetic waves and Radiating Systems, PHI, 2/e,2013</li> <li>2. Joseph A Edminister , Electromagnetics, Schaum's Outline Series McGraw Hill, 4/e, 1995</li> <li>3. Martin A Plonus , Applied Electromagnetics, McGraw Hill, 2/e,1978.</li> <li>4. <u>Matthew N.O. Sadiku &amp; S.V. Kulkarni</u> "'Principles of Electromagnetics', Oxford University Press Inc. Sixth Edition, Asian Edition,2015</li> <li>5. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, Pearson, 6/e, 2006.</li> <li>6. Umran S. Inan and Aziz S. Inan, Engineering Electromagnetics, Pearson, 2010.</li> </ol>			

Course Plan			
Module	Course content	Hours	End Sem. Exam Marks
I	Review of vector calculus, Spherical and Cylindrical coordinate system, Coordinate transformation	1	0
	Curl, Divergence, Gradient in spherical and cylindrical coordinate system.	1	
	Electric field – Application of Coulomb’s law, Gauss law and Amperes current law (proof not required, simple problems only)	1	15
	Poisson and Laplace equations (proof not required, simple problems only), Determination of E and V using Laplace equation.	1	
	Derivation of capacitance and inductance of two wire transmission line and coaxial cable. Energy stored in Electric and Magnetic field.	2	
	Displacement current density, continuity equation. Magnetic vector potential. Relation between scalar potential and vector potential.	2	
II	Maxwell’s equation from fundamental laws.	1	15
	Boundary condition of electric field and magnetic field from Maxwell's equations	1	
	Solution of wave equation	1	
	Propagation of plane EM wave in perfect dielectric, lossy medium, good conductor, media-attenuation, phase velocity, group velocity, skin depth.	3	
FIRST INTERNAL EXAM			
III	Reflection and refraction of plane electromagnetic waves at boundaries for normal & oblique incidence (parallel and perpendicular polarization), Snell’s law of refraction, Brewster angle.	4	15
	Power density of EM wave, Poynting vector theorem, Complex Poynting vector.	3	
	Polarization of electromagnetic wave-linear, circular and elliptical polarisation.	2	
IV	Uniform lossless transmission line - line parameters	1	15
	Transmission line equations, Voltage and Current distribution of a line terminated with load	2	
	Reflection coefficient and VSWR. Derivation of input impedance of transmission line.	2	
SECOND INTERNAL EXAM			
V	Transmission line as circuit elements (L and C).	2	20
	Half wave and quarter wave transmission lines.	1	
	Development of Smith chart - calculation of line impedance and VSWR using smith chart.	2	

	Single stub matching (Smith chart and analytical method).	2	
VI	Parallel-Plate Waveguide - TE & TM waves.	1	20
	The hollow rectangular wave guide – modes of propagation of wave- dominant mode, group velocity and phase velocity - derivation and simple problems only.	3	
	Attenuation in wave guides, guide wavelength and impedance -derivation and simple problems only.	3	
END SEMESTER EXAM			

### Question Paper (End semester exam)

**Maximum marks : 100**

**Time: 3 hours**

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50 % for theory and 50% for logical/numerical problems, derivation and proof.

