

<b>University of Mumbai</b>			
<b>CLASS: T.E. (Electronics Engineering)</b>		<b>Semester - V</b>	
<b>SUBJECT: Electromagnetic Engineering</b>			
Periods per week (each of 60 min.)	Lecture	03	
	Practical		
	Tutorial	01	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical examination		
	Oral Examination	-	
		Term Work	25
		Total	125

<b>Objective</b>	Electromagnetic Field Theory deals with electric and magnetic field vectors, whereas circuit theory deals with voltages and currents that are the integrated effects of electric and magnetic fields. An understanding of Electromagnetics is a must to appreciate Wave Propagation, Antenna Theory, Microwave and Optical Fiber System.-	
<b>Pre-requisite</b>	Vector Algebra	
<b>Module</b>	<b>Contents</b>	<b>Hours</b>
1	<b>Basics of Electromagnetics</b> Co-ordinate systems, line, Surface & Volume Integral, Curl, Divergence & Gradient, Electric Charge, Coulomb's law, Charge distribution, Electric Field Intensity, field due to distributed charges, Electric Flux, Gauss's law, Divergence Theorem, Electric Potential & Potential Gradient, Ampere's Law, Magnetic Flux, Faraday's Law, Poisson & Laplace's Equations	<b>(06)</b>
2	<b>Maxwell Equations:</b> Formation of Maxwell's Equations Derivation of various basic electro magnetic laws using Maxwell's Equations, Conditions at Boundary Surfaces	<b>(06)</b>

3	<b>Electromagnetic Waves</b> The wave equation for free space & conducting medium, Uniform Plane wave, Intrinsic Impedance, Helmholtz Equations, Propagation characteristics of Electromagnetic Wave, Polarization, Poynting's Theorem, Instantaneous, Average & Complex Poynting vector	(05)
4	<b>The uniform plane wave Propagation</b> plane wave reflection and dispersion, reflection of uniform plane waves at normal incidence, standing wave ratio, wave reflections from multiple interfaces, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, total reflection and total transmission of obliquely incident waves, wave propagation in dispersive media, pulse broadening in dispersive media.	(06)
5	<b>Transmission Lines</b> Circuit representation of the parallel-plane transmission line, Transmission Line equations, Transmission Line parameters, Terminated Transmission line, Use of Smith Chart, Impedance matching techniques	(08)
6	<b>Radiation &amp; Electromagnetic Interference (EMI)</b> Potential Functions & the electromagnetic field, Potential functions for sinusoidal oscillations, The alternating current element (or Oscillating Electric Dipole), Power radiated by a current element & radiation resistance, EMI Sources, Effects of EMI, Need of EMC (Electromagnetic Compatibility), Electrostatic Discharge(ESD)	(05)

**Text Books:**

1. E. C. Jordan & K. G. Balmain-Electromagnetic Waves & Radiating Systems, 2e, PHI, 1988.
2. G.S.N.Raju, Electromagnetic Field Theory and Transmission Lines, Pearson Education, 2e, 2008
3. R.K.Shevgaonkar, Electromagnetic Waves, Tata McGraw-Hill, 2006

**Additional Reading:**

1. John D Krauss, Engineering Electromagnetics, McGraw-Hill, 6e, 2001.

2. Edminister, Engineering Electromagnetics, Schaum series, Tata McGraw-Hill, 2e, 1992.
3. Samuel Liao, Microwave Devices and Circuits, Prentice Hall publication, 3e -1994
4. Edgar Hund., Microwave Communication Components & Circuits, Glencoe/ 3e, Mc-Graw- Hill
5. Nannapaneni Narayana Rao, Elements of Engineering Electromagnetics, 6e, Pearson Education
6. Ashutosh Pramanik, Electromagnetism- Theory & Applications, PHI, 2e-2004
7. David K. Cheng, Field and Wave Electromagnetics, 2e, Pearson Education

#### **Tutorials:**

- At least eight tutorials based on the above syllabus out of which one tutorial should be based on transmission line problems using Smith Chart only.
- Student shall write some simple Electromagnetic Fields Related simulation programs using MATLAB/SCILAB to demonstrate the applications of field theory.

#### **Term-work:**

A journal shall be consisting of solved problems in tutorials based on teachings in the lectures, in addition to assignments along-with some simple Electromagnetic Fields Related Simulation programs using MATLAB/SCILAB which will demonstrate the applications of field theory. A test based on the above contents shall be conducted and the test paper shall be attached to the journal as a part of term-work

The distribution of marks for term work shall be as follows,

Tutorials : 10 marks.

Test (at least one) : 10 marks.

Attendance (Tutorials and Theory) : 05 marks.

The final certification and acceptance of term-work ensures the satisfactory performance of Tutorials work and minimum passing in the term-work.

#### **Theory Examination:**

1. Question paper will comprise of total 7 questions, each of 20 marks.
2. Only 5 questions need to be solved.
3. Question number 1 will be compulsory and will cover all modules.
4. Remaining questions will be from the same module or mixed in nature. (e.g.- suppose Q.2 has part (a) from, module 3 then part (b) will be from any module other than module 3.)
5. **In the question paper, weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.**
6. No question should be asked from pre-requisite module

