

<b>Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering &amp; Technology</b>				<b>II Year B.Tech. (Electronics and Telecommunication Engineering)</b>	
<b>Course Code &amp; Name</b>	<b>Instructions Hours per Semester and Credits</b>				
<b>4RTPC2  EMF AND TRANSMISSION LINE</b>	<b>Classroom Instruction (CI)</b>	<b>Lab Instruction (LI)</b>	<b>Term Work (TW) and Self Learning (SL)</b>	<b>Total no. of Hours Per semester</b>	<b>Total Credits (Total Hours/30)</b>
	<b>L</b>	<b>T</b>	<b>P</b>	<b>TW+SL</b>	<b>120</b>
	<b>20</b>	<b>10</b>	<b>20</b>	<b>70</b>	

### **Course Learning Objective:**

The course is designed

1. To introduce the basic concepts of vector analysis.
2. To evaluate static magnetic fields
3. To understand how materials affect electric and magnetic fields
4. To understand the relation between the fields under time varying situations
5. To understand principles of propagation of uniform plane waves.
6. To understand principles of Transmission L

## **COURSE CONTENTS**

### **Unit I**

**Vector Analysis:** Scalars and Vectors, Vector Algebra, the Rectangular Coordinate System, Vector Components and Unit Vectors, The Vector Field, The Dot Product, The Cross Product, General Treatment on Cartesian, cylindrical, spherical and general curvilinear co-ordinate systems with reference to vectors, operation of Gradient, Divergence, Curl, Laplacian, Gauss's Divergence theorem, Stoke's theorem.

### **Unit II**

**Electrostatics:** Review of electric field quantities and their definitions. Gauss's flux theorem, Poisson's equation and Laplace equation, Uniqueness theorem, Green's theorem, Coulomb's law, dipole moment. Electrostatic field in dielectric: polarization, electric flux density, boundary conditions, capacitor and capacitance, electrostatic shielding, energy stored in electric fields.

### **Unit III**

**Magnetic Fields and Electromagnetic Induction:** Magnetic flux and flux density, static currents in conducting media, Ampere's circuital law, Biot-Savart law, boundary conditions between magnetic media, magnetic force, magnetic potential, magnetic force and torque, Lorentz force on straight and long current carrying conductors in magnetic field, magnetic force between two long and parallel current carrying conductors, Magnetic dipole and dipole moment, energy stored in magnetic field. Faraday's law for induction (transformer and motion), inductor and inductance (self and mutual).

### Unit IV

**Maxwell's Equations & Electromagnetic Waves:** Maxwell's equations, equation of continuity displacement current, Maxwell's equation in point and integral forms, time-varying potentials, wave equations, uniform plane waves in dielectrics and conductors, power loss in a plane conductor, energy storage, Sinusoidally time varying uniform plane wave in free space & conductors, Poynting's vector theorem.

### Unit V

**Transmission Lines:** Introduction of transmission line, Types, Transmission line Parameters, line equations, equivalent circuit, line impedance, input impedance, measurement of secondary constants, line sections, reflection coefficient, VSWR and power, Smith chart and its applications, impedance matching, some applications of transmission lines.

### Course Outcome:

CO.No.	CO
CO1	To understand vector fundamentals, perform vector operations, solve vector calculus problems, use vector identities and apply integral theorems.
CO2	To apply electrostatics principles in engineering, fundamental electrostatic laws and concepts, evaluate electric field intensity, electric flux density, electric potential and energy,
CO3	To analyse magnetic fields using vector calculus, fundamentals of magnetostatics laws and concepts, apply magnetostatic principles in engineering applications.
CO4	To explain the physical foundations of Maxwell's equations, apply Maxwell's equations to static and time varying fields, solve electromagnetic wave equations.
CO5	To understand the fundamentals of transmission lines, compute impedance and reflection parameters, understand matching techniques. Use Smith chart for transmission line problems.

### BOOKS RECOMMENDED:

- [1]. Engineering Electromagnetics, William H. Hayt; Mc-Graw Hill.
- [2]. Theory and Problems of Electromagnetics, Joseph A. Edminister; McGraw Hill.
- [3]. Element of electromagnetics Electromagnetic, Mathew N.O Sadiku, Oxford University Press.
- [4]. Elements of Engineering Electromagnetics, N. Rao, Prentice Hall.
- [5]. Electromagnetics for Engineers, Fawwaz T. Ulaby, Pearson Education.

### CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
4RTPC2.CO1	3	2	2	2	2	2						3	2	1
4RTPC2.CO2	3	3	2	2	2	3						3	3	2
4RTPC2.CO3	3	3	3	2	3	3						3	3	3
4RTPC2.CO4	3	3	3	3	2	2						2	3	3
4RTPC2.CO5	3	2	2	3	2	3						2	2	3

**List of Practical Assignments:**

- [1].To Study Vector Analysis with Matlab.
- [2].To Study the Surface and Volume Integrals with Matlab.
- [3].To study E Field of Linear Charge with Matlab.
- [4].To Study E Field of Surface Charge with Matlab.
- [5].To Study Electric Flux Density with Matlab.
- [6].To Study Electric Flux through a Surface with Matlab.
- [7].To Study Magnetic Field of a Current Sheet with Matlab.
- [8].Measuring the Characteristics of a line.
- [9].Measuring the Attenuation of a line.
- [10]. Measuring the input Impedance of the line.
- [11]. To Study Stationary Waves.
- [12].To Study Smith Chart.