BECE205L	Engineering Electromagnetics	L	T	P	C
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Pre-requisite	BPHY101L & BPHY101P/Engineering Physics	Syllabus version			
		1.0			

Course Objectives

1. Introduce the basic concepts and properties of Electrostatics & Magnetostatics.
2. Study the propagation of EM wave through time varying Maxwell's equations and to analyze the EM Wave propagation in different conducting and dielectric media.
3. Familiarize the concept of transmission and reflection in various transmission lines and to design different transmission lines and matching circuits using Smith chart.

Course Outcome

At the end of the course, the student will be able to

1. Evaluate and analyse Electric Fields & Electric Potential due to different Charge distributions.
2. Compute and analyze magnetic fields in different materials and media.
3. Analyze the EM wave propagation in conducting as well as in dielectric materials through time varying Maxwell's equations.
4. Illustrate the wave mechanism in different transmission lines at high frequencies using transmission line parameters.
5. Design Impedance matching circuits using Smith chart.
6. Analyze the field components of different waveguides based on various modes of E and H field.

Module:1	Vector Calculus	3 hours

Cartesian, Cylindrical, and Spherical coordinate systems. Divergence, Gradient and Curl.

Module:2	Electrostatics	8 hours

Coulomb's Law, Electric Fields due to Different Charge Distributions, Gauss Law and Applications, Electrostatic Potential, Potential Gradient, Equipotential surfaces, Electric Dipole, Polarization in Dielectrics, Boundary conditions, current density, continuity equation. Laplace and Poisson's equation, Capacitance, Method of Images.

Module:3	Magnetostatics	7 hours

Biot-Savart's Law, Ampere's Circuit Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic Dipole, Magnetization in materials, Boundary conditions, Inductances and Magnetic Energy.

Module:4	Time Varying Fields	5 hours

Faraday's Law and Lenz law, Maxwell's Equations in Integral and differential form, Wave equation, Uniform plane wave propagation in lossy dielectrics, Lossless Dielectrics, Good Conductors and free space. Polarization, Power and Poynting Vector.

Module:5	Transmission Lines	8 hours

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase velocity, input impedance, Reflection Coefficient, VSWR. Characterization of lossless, low loss and distortionless transmission lines. Significance of short circuit and open circuit lines of length λ/8, λ/4 and λ/2.

Coaxial line, Planar transmission lines –Types, Microstrip Lines: field distribution, design equations, Q factor, losses in microstrip lines.

Module:6	**Smith Chart & Matching Circuits**	**7 hours**
Smith Chart configuration and applications: Input impedance, admittance, VSWR, Reflection Coefficient, return loss, standing wave pattern. Matching Circuit Design- Quarter wave, Impedance Transformer, Single Stub, Double Stub and Lumped element matching.		
Module:7	**Waveguides**	**5 hours**
TEM, TE and TM waves, Parallel plate waveguide, Rectangular waveguide, Characteristics of wave guide- guide wavelength, cut off wave length, cut off frequency, wave impedance, phase constant, phase velocity, group velocity. Circular waveguide and Cavity resonator (Qualitative study)		
Module:8	**Contemporary issues**	**2 hours**
Guest Lecture from Industries and R & D Organizations.		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	William Hayt and John Buck, Engineering Electromagnetics, 2017, 8th Edition, Tata McGraw Hill, New Delhi, India.
Reference Books	
1.	Mathew O Sadiku, Elements of Electromagnetics, Oxford University press, New York, USA.
2.	E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, , PEI, India
3.	D. M. Pozar, Microwave engineering, 2013, 4th Edition, Wiley & Sons, USA.

Mode of Evaluation: Continuous Assessment Test, Digital Assignment, Quiz and Final Assessment Test			
Recommended by Board of Studies	14-05-2022		
Approved by Academic Council	No. xx	Date	DD-MM-YYYY