Marwadi University

Syllabus for Bachelor of Technology

Information and Communication Technology

Subject Code: 01CT0405

Subject Name: Engineering Electrodynamics

B. Tech. Year – II (Semester IV)

Objectives:

1. Understand basics of electromagnetic theories.
2. Understand the antenna parameters and its various applications.
3. Understand the basic of microwave engineering theories for wave propagation.
4. Apply the electromagnetic theory for antenna design.
5. Understand the advance optical antenna concepts and its applications.
6. Design various types of antenna for different communication application

Credits Earned: 03 Credits

Course Outcomes: After completion of this course, student will be able to:

1. Build up a basic understanding in several applied electromagnetic topic and to gain knowledge in cutting-edge research areas in electrodynamics.
2. Build up a basic understanding in electromagnetics and antenna theories.
3. Create basic antenna structures for various applications
4. Understand the advance optical antenna concepts and its application.

Pre-requisite of course: NA

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial / Practical Marks		Total Marks
				E	I		V	T	
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term Work	
3	0	0	3	50	30	20	00	00	100

Contents:

Unit	Topics	Contact Hours
1	**Module 1: Fundamental of electrodynamics** Maxwell's equations, boundary conditions, vector and scalar potentials, reciprocity theorem, Huygens' principle, polarization, snell's law, Brewster angle, total internal reflection, constitutive equations, Drude dispersion model, group/phase velocity	14
2	**Antenna theory and design** Antenna parameters, directivity, gain , input impedance, wire antennas, monopoles dipoles helices, aperture theory, horns and reflector antennas, phased arrays, Friis transmission formula, receiving properties of antenna.	09
3	**Microwave engineering** Parallel plate / rectangular waveguides, attenuation of modes, waveguide excitation waveguide dispersion, transmission lines, microwave circuit.	09
4	**Computational Electromagnetics.** Finite difference time domain, absorbing boundary condition, perfectly matched layers, periodic boundaries, finite element method.	5
5	**Graphene and Plasmonics Nano Antenna** Graphene and other 2D materials, Fundamentals of optical nano antenna, Linear antennas, Nonlinear antennas, Application	5
	Total Hours	42

Suggested Text books / Reference books:

1. Antenna Theory: Analysis and Design, by C.A. Balanis, 3rd edition, WILEY Interscience.
2. Antennas and Wave Propagation by J D Kraus, 5th edition, McGraw Hill Education.
3. Microwave Engineering by David. M Pozar, 4th edition, Wiley.
4. Principles of Electromagnetics by Matthew N.O. Sadiku, 6th Edition, Oxford University Press.
5. Optical Antennas by Mario Agio, 1st editions, Cambridge University Press.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
30%	30%	15%	5%	5%	15%

Hands-on workshops will be conducted where following task will be executed

1. Design and simulate Rectangular waveguide for GHz frequency.
2. Design and simulate 90 degree rectangular waveguide for GHz frequency.
3. Design and simulate Hybrid Tee for GHz frequency.
4. Design and simulate Microstrip patch antenna.
5. Design and simulate Spiral patch antenna.
6. Perform the experiment for deriving radiation pattern and S parameter for Wire antennas.
7. Perform the experiment for deriving radiation pattern and S parameter for Yagi uda antennas.
8. Perform the experiment for deriving radiation pattern and S parameter for dipole antennas.
9. Prove the reciprocity theorem for antenna.

Open Ended Projects:

1. Design and simulate 1D FDTD simulation code with perfectly matched layer.
2. Identify the design of the antenna for your mobile phone. Design and simulate the same antenna for fulfilling the communication task of mobile communication.
3. Design and simulate 2D FDTD simulation code with perfectly matched layer and verify it with any professional software.