Subject Code: 01CT1516

Subject Name: Engineering Electrodynamics

B. Tech. Year – III (Semester V)

Objective: The objectives of this course are to understand the basics of electromagnetic theories, the antenna parameters and its various applications. This course includes the basic of microwave engineering theories for wave propagation and application of the electromagnetic theory for antenna design to understand the advance optical antenna concepts and its applications and design various types of antenna for different communication application.

Credits Earned: 04 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 knowledgein cutting-edge research areas in electrodynamics (Understand).
2. Build up a basic understanding in electromagnetics and antenna theories (Understand).
3. Create basic antenna structures for various applications (Apply).
4. Analysis and implementation of optical antenna (Analyze).

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	2	4	50	30	20	25	25	150

Content:

Unit	Topics	Content Hours
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	16

2	**Antenna theory and design** Antenna parameters, wire antennas, monopole, dipole, helical, aperture theory, horns and reflector antennas, phased arrays.	08
3	**Microwave engineering** Rectangular waveguides, modes os waveguide, waveguide excitation, waveguide dispersion, transmission lines.	08
4	**Computational Electromagnetics.** Finite difference time domain, absorbing boundary condition, periodic boundaries, finite element method	04
5	**Graphene and Plasmonics Nano Antenna** Graphene and other 2D materials, fundamentals of optical nano antenna, application	06
	Total Hours	**42**

Suggested Text book/Main Reference:

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

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves asguidelines 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%

Suggested List of Experiments:

Perform the following exercises with SPICE tool.

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.
10. Design and simulate 1D FDTD simulation code with perfectly matched layer.
11. Identify the design of the antenna for your mobile phone.
12. Design and simulate the antenna for fulfilling the communication task of mobile communication.
13. Design and simulate 2D FDTD simulation code with perfectly matched layer.
14. Design 50-ohm transmission line.