

<b>COURSE TITLE</b>	<b>ENGINEERING ELECTRODYNAMICS</b>
<b>COURSE CODE</b>	<b>01CT1516</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 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.

**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 (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**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	0	2	50	30	20	25	25

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Fundamental of electrodynamics</b> 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	<b>Antenna theory and design</b> Antenna parameters, Wire antennas, Monopole, Dipole, helical, Aperture theory, Horns and reflector antennas, Phased arrays	8
3	<b>Microwave engineering</b> Rectangular waveguides, Modes of waveguide, Waveguide excitation, Waveguide dispersion, Transmission lines	8
4	<b>Computational Electromagnetics</b> Finite difference time domain, Absorbing boundary condition, Periodic boundaries, Finite element method	4

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
5	<b>Graphene and Plasmonics Nano Antenna</b> Graphene and other 2D materials, Fundamentals of optical nano antenna, Application	6
<b>Total Hours</b>		<b>42</b>

#### **Suggested List of Experiments:**

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Experiment 1</b> Design and simulate rectangular waveguide for GHz frequency.	2
2	<b>Experiment 2</b> Design and simulate 90-degree rectangular waveguide for GHz frequency.	2
3	<b>Experiment 3</b> Design and simulate Hybrid Tee for GHz frequency.	2
4	<b>Experiment 4</b> Design and simulate Microstrip patch antenna.	2
5	<b>Experiment 5</b> Design and simulate Spiral patch antenna.	2
6	<b>Experiment 6</b> Perform the experiment for deriving radiation pattern and S parameter for Wire antennas.	2
7	<b>Experiment 7</b> Perform the experiment for deriving radiation pattern and S parameter for Yagi uda antennas.	2
8	<b>Experiment 8</b> Perform the experiment for deriving radiation pattern and S parameter for dipole antennas.	2
9	<b>Experiment 9</b> Prove the reciprocity theorem for antenna.	2
10	<b>Experiment 10</b> Design and simulate 1D FDTD simulation code with perfectly matched layer.	2
11	<b>Experiment 11</b> Identify the design of the antenna for your mobile phone.	2
12	<b>Experiment 12</b> Design and simulate the antenna for fulfilling the communication task of mobile communication.	2
13	<b>Experiment 13</b> Design and simulate 2D FDTD simulation code with perfectly matched layer.	2
14	<b>Experiment 14</b> Design 50-ohm transmission line	2
<b>Total Hours</b>		<b>28</b>

**Textbook :**

- 1 Principles of Electromagnetics, David. M Pozar, Oxford University Press, 2015
- 2 Optical Antennas, Mario Agio, Cambridge University Press, 2012

**References:**

- 1 Antenna Theory: Analysis and Design, Antenna Theory: Analysis and Design, C.A. Balanis, WILEY Interscience., 2009
- 2 Antennas and Wave Propagation, Antennas and Wave Propagation, J D Kraus, McGraw Hill Education, 2010
- 3 Microwave Engineering, Microwave Engineering, David. M Pozar, WILEY Interscience., 2012

**Suggested Theory Distribution:**

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

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
30.00	30.00	15.00	5.00	5.00	15.00

**Instructional Method:**

- 1 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 2 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.
- 3 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.
- 4 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

**Supplementary Resources:**

- 1 [https://onlinecourses.nptel.ac.in/noc20\\_ee93/preview](https://onlinecourses.nptel.ac.in/noc20_ee93/preview)