Course Title	**Antennas and Wave Propagation**
Course Code	**EE5323**
No. of Credit Hrs (Lecture + Tutorial + Lab)	**3 (2+0+1)**
No. of Contact Hrs (Lecture + Tutorial + Lab)	**4 (2+0+2)**
Level-Year	**9/10-5**
Prerequisite (if any)	**EE4300**

1) Course Objectives:

To apply the fundamental concepts of electromagnetic field theory for understanding electromagnetic wave propagation and to use this understanding for analysing the behaviour of transmission lines, wave guides and antennas. Moreover, this course provides experimental foundation for the theoretical concepts.

2) Expected Learning Outcomes:

1. Describe and explain the fundamental characteristics and behavior of electromagnetic wave propagation. PLO1 [1]
2. Apply knowledge of wave propagation to analyze and solve problems related to transmission lines, waveguides, and antennas. PLO1 [1]
3. Investigate and conduct laboratory experiments and simulations to study electromagnetic and microwave devices. PLO3 [6]
4. Employ appropriate instruments and equipment in experiments and validate their outcomes. PLO3 [6]
5. Communicate technical findings and laboratory results effectively through structured reports. PLO8 [3]
6. Recognize and demonstrate professional responsibility by following proper safety procedures in laboratory practices. PLO6 [4]

3) Course Contents:

1. Time varying fields - Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current, Maxwell's Equations, Time-Varying Potentials, Time-Harmonic Fields, Simulation, Applications.
2. Electromagnetic wave propagation - Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Free Space and Conductors, Polarization, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence and Oblique Incidence, S-parameters, Simulation, Applications.
3. Transmission lines - Transmission Line Parameters, Transmission Line Equations, Input Impedance, Standing Wave Ratio, and Power, Smith Chart, Applications of Transmission Lines, Transients on Transmission Lines, Simulation, Applications.
4. Waveguides - Rectangular Waveguides, Transverse Magnetic (TM) and Transverse Electric (TE) Modes, Wave Propagation in the Guide, Power Transmission and Attenuation, Waveguide Current and Mode Excitation, Waveguide Resonators, Simulation, Applications.
5. Antennas - Hertzian Dipole, Half-Wave Dipole Antenna, Quarter-Wave Monopole Antenna, Small-Loop Antenna, Antenna Characteristics, Simulation, Applications.

4) Lab experiments:

1. Characteristics of the reflex klystron tube and electronic tuning range,
2. Characteristics of Gunn Diode and determination of threshold voltage,
3. Measurement of attenuation, Determination of the frequency and wavelength of a microwave in a rectangular waveguide operated in TE10 mode,
4. Measurement of unknown impedance using Smith chart,
5. Determination of standing wave ratio and reflection coefficient, Radiation pattern of simple dipole antenna, Radiation pattern of Half Wave dipole antenna.

5) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

6) Mode of Evaluation: Course Assessment Methods

- Quizzes , Assignment, Homeworks, Reports, Presentations etc.
- Lab Work
- Mid Exam
- Final Exam

Evaluation

No	Assessment Activities *	Percentage
1.	Assignments/Quizzes/HomeWorks/Mini-Projects/Presentations/Reports+Quizzes	15%
2.	Mid Exam	25%
3.	Lab/Tutorial (Lab Exam)	10%
4.	Lab/Tutorial (Lab Reports)	10%
5.	Final Exam	40%

7) Textbook(s):

- Engineering Elements of Electromagnetics, 3rd Edition. Mathew N.O. Sadiku, Oxford University Press.
- Antennas And Wave Propagation, 5th Edition Paperback (2017) John D. Kraus and Ronald J. Marhefka, McGraw Hill.

8) References:

- Electromagnetic Waves, Staelin, David, Ann Morgenthaler, and Jin Au Kong, Upper Saddle River, NJ: Prentice Hall, 1994, ISBN: 9780132258715.