NIRMA UNIVERSITY
School of Technology, Institute of Technology
B.Tech. Electronics & Communication Engineering
Semester - VII

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Course Code	2EC701
Course Title	Microwave and Antenna Engineering

Course Outcomes (COs):

At the end of the course, the students will be able to –

1. comprehend the important parameters and properties of wire, aperture, reflector, and microstrip antennas and microwave devices.
2. analyse the wire, aperture, reflector, and microstrip antennas, and microstrip devices.
3. design conventional microwave antennas, dividers, couplers, and filters to meet given specifications.
4. test antennas and microwave components using the standard instruments/test benches.

Syllabus **Teaching Hours: 45**

UNIT I: Introduction to Microwave and Antenna Engineering **04**

Microwave frequencies, advantages of microwaves, and general applications of microwaves, Definition and radiation mechanism of an antenna, comparison between an antenna & transmission line, antenna key parameters

UNIT II: Basic Transmission Line Theory **06**

Transmission line equations & solutions, condition for distortion less line, Lines terminated in load, open & short, standing wave and standing wave ratio, line impedance and admittance, Impedance matching, Problem solutions using smith charts

UNIT III: Microwave Network Analysis **04**

Scattering parameters, derivation of scattering parameters of wave-guide tees, directional couplers, circulators, and isolators

UNIT IV: Semiconductor Microwave Devices **06**

Microwave diodes- Schottky barrier diodes, PIN diode, tunnel diode, Gunn diode, Gunn diode as microwave detector, IMPATT diode.

Microwave transistors-Heterojunction Bipolar Transistor (HBT), High electron mobility transistor (HEMT)

UNIT V: Microwave Dividers, Couplers, and Filters **04**

Basic properties of dividers and couplers, types of dividers and couplers, microwave filter design

UNIT VI: Radiation from Wires and Loops **04**

Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop

UNIT VII: Aperture and Reflector Antennas **06**

Huygens' principle, radiation from rectangular and circular waveguides, different horn antennas, parabolic reflector antennas

UNIT VIII: Microstrip Antennas **04**

Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas

UNIT IX: Antenna Arrays **04**

Introduction to the antenna array, Type of antenna array, analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, the principle of pattern multiplication, extension to planar arrays

UNIT X: Antennas and Microwave Measurements **03**

Measurement of antenna losses, gain and radiation patterns

Self-Study:
The self-study content will be declared at the commencement of the semester. Around 10% of the question will be asked from self-study content.

Laboratory Work:
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:

1. C. A. Balanis, Antenna Theory, Analysis, and Design, Wiley India Edition
2. J. D. Krauss, Antennas, McGraw Hill
3. Samuel Liao, Microwave Devices and Circuits, PHI
4. David M Pozar, Microwave Engineering, Wiley India Edition

L = Lecture, T = Tutorial, P = Practical, C = Credit