

# MICROWAVE DEVICES AND ANTENNA DESIGN

(Core Subject)

<b>Course Code:</b>	17B11EC512	<b>Semester:</b>	5 <sup>th</sup> Semester, B. Tech (ECE)
<b>Credits:</b>	4	<b>Contact Hours:</b>	L-3, T-1, P-2

## Course Objectives

At the completion of this course, the student should have knowledge of the applications of Electromagnetics in microwave devices, basic antenna systems and antenna arrays.

## Course Outcomes

After the successful completion of the course student should be able to:

1. Learn the applications of Electromagnetics applied to variety of Microwave Devices and Antenna Systems and their properties.
2. Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.
3. Know the operating principles of microwave devices and their characteristics measurements.
4. Integrate various disciplines in electromagnetic so that the student appreciates microwave devices and antennas from a system standpoint.
5. Familiarize the student with the procedure of designing simple antennas and array design.
6. At the conclusion of the course, the student should have a far greater capacity to read and understand technical articles such as those seen in the IEEE Transactions Microwave theory and techniques and also on IEEE Transaction on Antennas and Propagation to use them in real time applications.

## Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
1.	Introduction to Microwaves: Frequency allocations, Microwave waveguide, Rectangular waveguide and its analysis, circular waveguide, modes of propagation, dominant modes, cut off wavelength, mode excitation.	Pozar	5
2.	Microwave Generators And Amplifiers: Reflex klystron, two cavity and multi cavity klystron amplifiers and oscillators, basics of Magnetrons and traveling wave tubes and their applications.	Liao	8
3	Microwave Devices: Scattering matrix of microwave waveguide junction, properties of S-	Pozar	8

	matrix, E-plane tee, H-plane tee, magic tee, attenuators, directional couplers, ferrite devices, Faraday rotation, gyrator, isolator, circulators and cavity resonators, Gunn diode and its modes of operation.		
4	Antenna Basics: Directional properties of antennas, Radiation patterns, antenna gain and aperture, antenna terminal impedance, self and mutual impedance, front to back ratio, antenna beam width and bandwidth, antenna efficiency, antenna beam area, polarization, antenna temperature and reciprocity properties of antennas.	R.S.Elliot	6
5	Antenna Arrays: Classification of arrays, linear arrays of two point sources, linear arrays of n-point sources, pattern multiplication, array factor, linear arrays of equal amplitude and spacing (Broadside and end fire arrays), directivity and beam width Chebyshev arrays, Introduction to planar arrays.	R.S.Elliot	6
6	Special Antennas: VLF and LF antennas (Hertz and Marconi antennas), receiving antenna and radio direction finders. Folded dipole antennas, Yagi-uda antenna, horn antennas, microwave dish, helical antennas, microstrip antennas.	Ballanis	9
<b>Total Number of Lectures</b>			42

## Evaluation Scheme

1. Test 1 :15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
  - 10 Marks : Class performance, Tutorials & Assignments
  - 10 Marks : Quizzes
  - 5 marks : Attendance

## Text Books

1. Pozar, David M. *Microwave engineering*, John Wiley & Sons, 2009.
2. Liao, Samuel Y. *Microwave solid-state devices*. Prentice Hall, 1985.

3. Elliot, Robert S. *Antenna theory and design*. John Wiley & Sons, 2006.
4. Balanis, Constantine A. "Antenna theory analysis and design." *John Willey and Son's Inc., New York* (1997).

## Reference Books

1. Jordan, E. C., and K. G. Balmain. *Electromagnetic Waves and Radiating Systems*, Prentice Hall." *Englewood Cliffs, New Jersey* (1968).
2. Robert E. Colin. *Foundations for Microwave Engineering*, McGraw Hill, 2<sup>nd</sup> Edition, 2001.
3. John D. Kraus & R.J Marhefka, *Antennas for all applications*, The McGraw-Hill Companies, 2<sup>nd</sup>/3<sup>rd</sup> edition, 2006
4. C.A. Balanis, *Antenna Theory, Analysis and Design*. NY: John Wiley and Sons, 2<sup>nd</sup> edition, 2002
5. WL Stutzman & GA Thiele, *Antenna Theory and Design* , John Wiley and Sons, 2<sup>nd</sup> edition, 1997