

22EC402 MICROWAVE ENGINEERING

Hours Per Week :

L	T	P	C
3	0	2	4

PREREQUISITE KNOWLEDGE: Electromagnetic waves and Transmission Lines, Antenna Theory.**COURSE DESCRIPTION AND OBJECTIVES:**

This course offers concepts of Microwave Frequencies, waveguides, microwave Devices, microwave Systems. The objective of this course is to enable the student to understand wave guides for transmission lines, microwave components, microwave solid-state devices, microwave tubes and microwave measurement techniques.

MODULE-1**UNIT-1****12L+0T+8P=20 Hours****MICROWAVE WAVEGUIDES:**

Microwave Frequencies, Microwave Devices, Microwave Systems.

Rectangular Waveguides: Wave equations in Rectangular Waveguides, TE, and TM Modes in Rectangular Waveguides.

Circular Waveguides: Wave equations in Circular Waveguides, TE, TM, and TEM Modes in Circular Waveguides.

UNIT-2**20L+0T+8P=20 Hours****MICROWAVE COMPONENTS AND MEASUREMENTS:**

Microwave Components: Cavity Resonators, Microwave Hybrid Circuits (E-plane, H-plane, and Magic Tee), Directional Couplers, Circulators, and Isolators.

Microwave Measurements: Components of Microwave Bench Set-Up, Frequency and Wavelength Measurement, VSWR Measurement, and Microwave Power Measurement.

PRACTICES:

Design and verify the following Microwave Wave waveguide and components using Simulation Software (HFSS/CST/ANSYS).

- Verify the Mode pattern and cut-off frequency of TE and TM Modes Rectangular waveguide.
- Verify Mode Pattern and cut-off frequency of TE, TM, TEM Modes Circular waveguide
- Verify the Q-factor and Resonant frequency of Cavity Resonators (Rectangular and Circular).
- Verify S-Parameters of Hybrid Circuits.
- Verify S-Parameters Circulators and Isolators.

MODULE-2**UNIT-1****12L+0T+8P=20 Hours****MICROWAVE LINEAR BEAM TUBES (O-TYPE):**

Introduction, Limitations of Conventional Tubes.

Two-Cavity Klystron: Velocity Modulation Process, Bunching Process, Output Power, and Efficiency.

Reflex Klystron: Velocity Modulation, Power Output, and Efficiency.



Source- <https://www.cobhameee.com/microwave-components-and-systems/>

SKILLS:

- ✓ Choose the required component for power coupling in the microwave communication systems.
- ✓ Select the high-power amplifier/oscillator for the microwave frequency operation.
- ✓ Identify the required low power oscillator for receiver applications.
- ✓ Measure the impedance value of the given load through VSWR measurement.

UNIT-2**12L+0T+8P=20 Hours****MICROWAVE CROSS-FIELD TUBES (M-TYPE):**

Magnetron Oscillators: Cylindrical Magnetron.

Microwave Solid State Devices: Gunn Diode, PIN Diode, and Schottky Diode.

PRACTICES:

Design and verify the following Microwave Waveguide and components using Simulation Software (HFSS/CST/ANSYS).

- Analyze of microwave linear beam tubes.
- Analyze of microwave cross field tubes.
- Verify S-Parameters of Reconfigurable switch using PIN diode.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Analyze the Microwave Frequencies and Waveguides	Analyze	1	1, 2, 4, 5, 9, 10, 12
2	Apply S-parameter concept to analyze various microwave components and perform various microwave measurements.	Apply	1	1, 2, 4, 5, 9, 10, 12
3	Analyze the Microwave O-Type Tubes.	Analyze	2	1, 2, 4, 5, 9, 10, 12
4	Analyze the Microwave M-Type Tubes, and various Microwave Solid State Devices	Analyze	2	1, 2, 3, 4, 5, 9, 10, 12

TEXT BOOKS:

1. Samuel. Y. Liao, "Microwave Devices and Circuits", Pearson Education, Third Edition, 2008.
2. David M. Pozar, "Microwave Engineering", 4th edition, John Wiley and Sons, 2012.

REFERENCE BOOKS:

1. John Wiley and Robert E. Collin, "Foundations for Microwave Engineering", 2nd edition, John Wiley and sons, 2002.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBS Publishers and Distributors, 2004.
3. M.Kulkarni, "Microwave and Radar Engineering", 5th edition, Umesh Publications, 2014.