

EOPE3004 MICROWAVE ENGINEERING (3-0-0)

Course Objectives:

This course provides fundamental knowledge of microwave engineering, covering transmission lines, waveguides (rectangular/cylindrical), and resonator design. Students will learn impedance matching (Smith Chart), analyze microwave components (couplers, attenuators), and study propagation effects. Emphasis is placed on antenna design (dipole, horn) and practical applications in high-frequency circuits and systems.

Module-I: (10 hours)

High Frequency Transmission lines: The Lumped-Element Circuit model for a Transmission line. Wave propagation. The lossless line. Field Analysis of Co-axial Transmission Lines. R, L, C, G parameters of Co-axial & Two wire Transmission Lines. Terminated lossless transmission line. Transmission line as circuit element. The Smith Chart. Solution of Transmission line problems using Smith Chart. Single Stub and Double Stub matching. Low loss line.

Module-II: (10 hours)

Wave guides: Rectangular waveguide, Field solution for TE and TM modes, Field patterns power flow through waveguide. Attenuation due to conductor and dielectric losses. Design of Rectangular waveguide to support Dominant TE₁₀ only.

TEM mode in Co-axial line. Cylindrical waveguide - Dominant Mode. Design of Cylindrical Waveguide to support Dominant TE₁₁ mode. Microwave Resonator: Rectangular Waveguide Cavities. Resonant frequencies and of Cavity Supporting. Dominant mode only.

Module-III: (06 hours)

Excitation of waveguide and Resonators (in principle only) Waveguide Components: Power Dividers and Directional Couplers: Basic Properties. The T-Junction Power Divider. Waveguide Directional Couplers.

Module-IV: (04 hours)

Fixed and Precision Variable Attenuator, Isolator, Circulator (Principle of Operation only). Gunn Oscillator Principle and performance. Simple Analysis electron field interaction.

Module-V: (04 hours)

Microwave Propagation: Line of sight propagation. Attenuation of Microwaves by Atmospheric gases, Water Vapour & Precipitates.

Antenna Analysis and Design: Dipole, Monopole, Loop, Antenna arrays and Pattern synthesis, Horn Antennas: E-And H- Plane Horns. Radiation Patterns. Pyramidal Horn. Gain of Horn Antenna.

Course Outcome:

Upon completion of the course, the students will be able to:

- CO1: Understand the basic principles of Microwave Engineering.
- CO2: Design rectangular and cylindrical waveguides at high frequency.
- CO3: Understand the behaviour of microwave circuits and systems
- CO4: Apply the basic principles of high frequency microwave circuits like filters and amplifiers
- CO5: Demonstrate microwave propagation in atmospheric condition
- CO6: Analyse various antennas like dipole, monopole, loop, broadband and aperture antennas

Text Books:

1. Microwave Engineering by D.M.Pozor, 2nd Edition, John Willy & Sons.
2. Microwave Devices and Circuits, 3rd Edition, Samuel Y, Liao, Perason Education

Supplementary Reading:

1. R. E. Collin, Foundations Microwave Engineering, John Wiley & Sons, Inc.
2. Microwave Engineering, A Das & S Das, TMH.
3. Microwave Devices and Circuits, G S N Raju