SEMESTER	DEPARTMENT	COURSE TITLE
Seventh	Telecommunications Engineering	Microwave Engineering
COURSE CODE	HOURS 3	COURSE SPECIFICATIONS
ET701	UNITS 3	Theoretical Content

1. *Introduction:*

➢ Define the microwave frequencies, bands, and microwave units of measure.

➢ Explain some microwave applications.

➢ Explain and draw a block diagram of basic microwave system.

2. *Rectangular waveguides:*

➢ Explain and draw of rectangular waveguide structure.

➢ Define and explain modes (T_m and T_m) of propagation in rectangular waveguides.

➢ Derive the general expressions of field components using field theory of propagation.

➢ Explain the boundary conditions for rectangular waveguides.

3. *Define and derive the following parameters in rectangular waveguides:*

➢ Cutoff frequency and cutoff wavelength.

➢ Phase velocity and group velocity of a wave travels on a rectangular waveguide.

➢ Guide wavelength and frequency of operation.

➢ Propagation coefficient and phase constant.

➢ Characteristic wave impedance for T_m and T_m modes.

4. *Rectangular cavity and resonators:*

➢ Explain and draw of rectangular cavity resonator structure.

➢ Define and explain modes of propagation in rectangular cavity resonator.

➢ Define and derive resonant frequency, resonant wavelength, length of the cavity at resonance, phase constant, and quality factor.

5. *Circular waveguides:*

➢ Explain and draw of circular waveguide structure.

➢ Define and explain modes (T_m and T_m) of propagation in circular waveguides.

➢ Derive the general expressions of field components using field theory of propagation.

➢ Explain the boundary conditions for circular waveguides.

6. *Define and derive the following parameters in circular waveguides:*

- ➢ Cutoff frequency and cutoff wavelength.
- ➢ Phase velocity and group velocity of a wave travels on a circular waveguide.
- ➢ Guide wavelength and frequency of operation.
- ➢ Propagation coefficient and phase constant.
- ➢ Characteristic wave impedance for T_m and T_m modes.

7. *Circular cavity and resonators:*

- ➢ Explain and draw of circular cavity resonator structure.
- ➢ Define and explain modes of propagation in circular cavity resonator.
- ➢ Define and derive resonant frequency, resonant wavelength, length of the cavity at resonance, phase constant, and quality factor.

8. *Scattering variables and scattering parameters in microwave networks:*

- ➢ Two-port, three-port, and four-port scattering networks.
- ➢ Properties of scattering parameters (matched ports, symmetry of ports, lossless ports).
- ➢ Power in terms of scattering variables.

9. *Define and explain the operation of some microwave passive components such as:*

- ➢ Waveguide three-port junctions and three-port circulators.
- ➢ Magic tees.
- ➢ Directional couplers.

References:
1. Liao Samuel. Y, *Microwave Devices and Circuits*, 3rd Edition, Prentice-Hall.
2. Collin, Robert. E. *Field Theory of Guided Waves*, 1st Edition, McGraw-Hill Book Company, Inc.
3. Collin, Robert. E. *Foundations for Microwave Engineering*, 2nd Edition, McGraw-Hill Book Company, Inc.
4. Pozar, D. M. *Microwave Engineering*, 2nd Edition, John Wiley & Sons, Inc.