

MICROWAVE ENGINEERING

Course Code	19EC4601D	Year	III	Semester	II
Course Category	Programme Elective II	Branch	ECE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	TLWG
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes

Upon successful completion of the course, the student will be able to	
CO1	Interpret various frequency bands of microwave range and their designations in electromagnetic spectrum and applications of microwaves. [L2]
CO2	Analyze the properties of microwave tubes and microwave solid state devices [L4]
CO3	Identify different types of waveguide passive components for engineering applications. [L3]
CO4	Build Microwave Bench for measurement of various microwave parameters.[L3]

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1									1	2
CO2	3	2	2	2									1	2
CO3	3	2	2	3									1	2
CO4	3	2	2	2									1	2
Average* (Rounded to nearest integer)	3	2	2	2									1	2

Syllabus

Unit No.	Contents	Mapped CO
I	Microwave Tubes Electromagnetic Spectrum and Microwave bands, Applications of microwaves, Limitations of conventional Tubes at Microwave Frequencies, Microwave Tubes –Classification. O-type Tubes : Two Cavity Klystron – Re-entrant Cavities, Velocity Modulation, Bunching Process, Expressions for O/P Power and Efficiency. Reflex Klystrons – Velocity Modulation, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.	CO1, CO2
II	Helix Traveling -Wave Tubes (TWTs): Slow Wave Structures, Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations. M-Type Tubes - Introduction, Cross-field Effects, Cylindrical Traveling Wave Magnetron –Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics	CO1, CO2

III	Microwave Waveguides and Components– Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card and Rotary Vane type; Waveguide Phase Shifters – Dielectric and Rotary Vane type. Scattering Matrix Properties - Waveguide Multiport Junctions - E plane and H plane Tees, Magic Tee, S- matrix. Two–Hole Directional Couplers, S- matrix of a Directional Coupler. Ferrites– Composition and Characteristics, Faraday rotation, Ferrite Components – Gyrator, Isolator and Circulator, Smatrix.	CO1,CO3
IV	Microwave Solid State Devices Introduction, Classification, Applications. TE Devices – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Avalanche Transit-Time Devices- IMPATT and TRAPATT,PIN diode	CO1,CO2
V	Description of Microwave Bench – Different components and their Features, Errors and Precautions, Measurement of Attenuation, Frequency, Microwave Power using Bolometer Bridge, Calorimetric method, Measurement of VSWR, Cavity Q, Impedance Measurement.	CO1,CO4

Learning Resources

Text Books

1. Foundations for Microwave Engineering – R.E. Collin, John Wiley, 2nd Edition, 2005
2. Samuel Y Liao, “Microwave Devices and Circuits”, 3rd edition, 2003, Pearson Education.

Reference Books

1. Annapurna Das, Sisir K Das, “Microwave Engineering”, 2nd edition, 2006, Tata McGraw Hil
2. Microwave Engineering- David M.Pozar, John Wiley & Sonsm, Inc., 2nd Edition, 2004
3. Microwave Circuits and Passive Devices – M.L. Sisodia and G.S.Raghuvanshi, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
4. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999

e- Resources & other digital material

- 1 <https://nptel.ac.in/courses/108/103/108103141/>
2. http://www.intechopen.com/---/passive_microwave_components_ana_antenna 3.
- 3.<http://www.slideshare.net/sarahkrystelle/lecture-notes-microwaves>
