MICROWAVE ENGINEERING

Course Code	20EC4601C	Year	III	Semester	II
Course Category	Professional 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 Build microwave tubes *for* high-power and high-frequency applications. [L3]
CO3 Identify different types of waveguide passive components and solid state devices for engineering applications.[L3]
CO4 Analyse Microwave Bench for measurement of various microwave parameters.[L4]

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	2											2		2
CO2	3					3	3					3		3
CO3	3				3	3	3					3		3
CO4		2			2	2	2					2		2
Average* (Rounded to nearest integer)	3				3	3	3					3		3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	Introduction to microwaves, Electromagnetic Spectrum and Microwave bands, Applications of microwaves, Limitations of conventional Tubes at Microwave Frequencies. Microwave Tubes: Linear Beam Tubes (O-type): Two Cavity Klystron – Velocity Modulation, Bunching Process, Output Power and Efficiency. Reflex Klystrons – Velocity Modulation, Power Output, Efficiency.	CO1,CO2
II	Helix Traveling-Wave Tubes (TWTs): Slow Wave Structures, Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations. Microwave Crossed Field Tubes (M-Type): Introduction, Cross-field Effects, Cylindrical Traveling Wave Magnetron–Hull Cut-off and Hartree Conditions.	CO1,CO2

III	**Microwave Passive Components** –Waveguide sections: Matched terminations, waveguide bends, corners and Twists, Coupling Probes and Loops, Waveguide Attenuators and Phase Shifters. Waveguide Multiport Junctions: E plane Tee, H plane Tee and Magic Tee. Directional Couplers. Ferrites – Composition and Characteristics, Faraday rotation, Ferrite Components – Gyrator, Isolator and Circulator. Scattering Matrix - Significance, Formulation and Properties, S-Matrix of Waveguide Tee Junctions, Directional Coupler, Circulator and Isolator.	CO1,CO3
IV	**Microwave Solid State Devices**: Introduction, Classification, Applications. Transferred Electron Devices: Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Avalanche Transit-Time Devices- IMPATT, TRAPATT and BARITT diodes.	CO1,CO3
V	**Microwave Measurements**: Description of Microwave Bench – Different components and their features, Precautions, Power measurement, Attenuation measurement, Impedance Measurement, Frequency measurement, VSWR measurement, Measurement of Cavity Q factor.	CO1,CO4

Learning Resources
Text Books
1. Foundations for Microwave Engineering – R.E. Collin, John Wiley, 2nd Ed., 2005
2. Samuel Y Liao, "Microwave Devices and Circuits", 3rd Ed, 2003, Pearson Education
Reference Books
1. Annapurna Das, Sisir K. Das, "Microwave Engineering", 2nd Ed., 2006,Tata Mc-Graw Hill
2. Microwave Engineering- David M.Pozar, John Wiley & Sons , Inc., 2nd Ed, 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.slideshare.net/sarahkrystelle/lecture-notes-microwaves

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