GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering Syllabus

Subject Code : ME02004061

Subject Name : RF and Microwave Design Techniques

WEF Academic Year :	2024-25
Semester :	2
Category of the Course :	PEC-04

Prerequisite :	Higher Engineering Mathematics, basic knowledge of Electromagnetic Field theory foundation level courses in Electronics Network Theory, Signals and Systems and Communication Systems Antenna theory and wave propagation, Fundaments of semiconductor devices.
Rationale :	PG Students of EC Engineering need to possess good understanding of the fundamentals and applications of RF signals and Microwave engineering in wireless communication, microwave frequency operated devices and appliances. They can identify role of microwave semiconductors, solid state devices and MMIC fabrication technology in microwave design. They are expected to be able to design RF frequency/microwave transmission line, coupler, power divider, amplifiers, Resonators, Mixer, oscillators and matching networks. They will be practiced in high frequency analysis and synthesis using S-parameter and microwave measurements. They will be able to design microwave communication system.

Course Scheme :

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content :

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Introduction to Microwaves History and applications of Microwaves, Mathematical Model of Microwave Transmission-Microwave transmission modes, waveguides and transmission lines, Impedance Matching, Microwave Network Analysis- ABCD and Scattering parameters	9	20
2	Passive and Active Microwave Devices Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Microwave Tubes.	10	20
3	Microwave Design Principles	20	40

	Microwave Filter Design, Microwave Transistor Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.		
4	Microwave Measurements, Microwave Systems, Effect of Microwaves on human body, Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging	9	20
	Total	**48**	**100**

Reference Book :

1. D.M.Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.
2. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide toSuperior Design", AuthorHouse, 2009.
3. R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
4. G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And NonLinear Techniques", John Wiley 1990.
5. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
6. Radmanesh, "RF and Microwave Electronics Illustrated" , Pearson Education, 2004.
7. Guillermo Gonzalez " Microwave Transistor Amplifiers analysis and design " , Prentice Hall

Course Outcome :

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	To identify role of RF/Microwave engineering in communication and other field.	UN
02	To analyze high frequency parameters of two port RFNetworks and represent in circuit form.	AN
03	To design RF transistor amplifiers and matching networks.	CR
04	To formulate S-matrix for n-port junction, microwave components and cylindrical cavity resonators.	EV
05	To design and operate microwave amplifiers, filters and oscillators.	CR
06	To identify high frequency limitations to design microwave devices	AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

1. To study V-I characteristics of Gunn Diode.
2. To determine the frequency and wavelength in a rectangular waveguide working on TE10mode.
3. To determine the standing wave ratio.
4. To measure input and output power for H-palne, E-plane and Magic tee.
5. To design and simulation of short circuited Ideal Transmission line using ADS
6. To design and simulation of open circuited ideal transmission line using ADS
7. To design and simulation of short circuited microstrip Transmission line using ADS
8. Design and simulation of Band Pass Filter using ADS.
9. Design and simulation of Low pass Filter Using ADS.
10. Design and simulation of directional coupler using ADS.
11. Design and simulation of power divider using ADS.
12. Design a GaAs FET amplifier for maximum gain at 4.0 GHZ
13. Design a GaAs FET amplifier having a 2.0 dB noise figure with the maximum gain that is compatible with noise figure.
14. Design an impedance transforming network using two element L matching circuit that matches agenerator resistance of 400 Ω to a load resistance is 20 Ω. The center frequency for the circuit is 6MHz.
15. Design a transistor oscillator at 4 GHz using a GaAs FET. Choose a terminating network to match to a 50Ω load, and appropriate tuning network.
16. A wireless local area network application require a local oscillator operating at 2.4 GHz. Design a dielectric resonator oscillator using bipolar transistor. It should include matching network for outputtermination.
17. Design matching network to match broader load variable range with minimum reflection coefficient value.
18. Design optimum resonator with best values of operating frequency and quality factor.

List of Laboratory/Learning Resources Required:

1. ADS
2. http://nptel.ac.in

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