

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS & COMMUNICATION (SIGNAL PROCESSING & COMMUNICATION) (41)

DESIGN OF MICROWAVE CIRCUITS

SUBJECT CODE: 2744102

M.E. 4TH SEMESTER

Type of course: Major elective V.

Prerequisite: NA

Rationale: There is need of understanding the design of Microwave Circuit for Electronics and Communication Engineering students in the era of the communication.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
		ESE	OEP			PA	RP			
3	0	2#	4	70	30	20	10	10	10	50

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Microwave Circuit Theory Principles: Review of microwave theory, Equivalent voltages and currents; Z, Y, S, and ABCD parameters; Equivalent circuit representation of microwave junctions; Scattering parameter analysis of microwave junctions; Coupling of waveguides through probes,	8	10
2	Impedance Transformers: Review of single, double and triple-stub tuners, waveguide reactive elements, quarter-wave transformers, design of maximally flat and Chebyshev transformers; Introduction to tapered transmission lines.	8	25
3	Power Dividers and Couplers: Scattering matrix of 3 and 4-port junctions; Design of T-junction and Wilkinson power dividers; Design of 90° and 180° hybrids.	8	20
4	Filters: Analysis of periodic structures, Floquet's theorem, filter design by insertion loss method, maximally flat and Chebyshev designs.	8	20
5	Design of Microwave Circuits: Antennas, couplers, LNAs, mixers, and microstrip filters, transistor amplifier, oscillator	12	25

Reference Books:

1. Pozar, D.M., "Microwave Engineering", 3rd Ed., John Wiley & Sons.
2. Edwards, T.C. and Steer M.B., "Foundations for Interconnects and Microstrip Design", 3rd Ed., John Wiley & Sons.
3. Ludwig, R. and Bretchko, P., "RF Circuit Design", Pearson Education.

4. Jia-Sheng Hong M. J. Lancaster, "Microstrip Filters For RF/Microwave Applications", John Wiley & Sons, Inc.
5. Misra, D.K., "Radio-frequency and Microwave Communication Circuits", John Wiley & Sons.

Course Outcome:

1. Students would be able to understand microwave communication circuits and systems
2. Students would learn how to design microwave communication circuits at different frequencies.

List of Experiments:

1. (a) To study the characteristics of wave propagation in a waveguide by studying standing wave pattern and hence to plot ω - β diagram.
(b) To verify relationship between guide wavelength λ_g and free space wavelength λ .
2. Measurement of voltage standing wave ration (VSWR).
3. To study the characteristics of reflex klystron and hence to determine mode number, transit time, electronic tuning range.
4. To study Gunn diode as a modulated source (PIN Modulation) and hence to determine modulation depth.
5. To study isolation, coupling co-efficient s and input VSWRs of an E-H tee or magic Tee.
6. To study substitution method for the calibration of a variable attenuator.
7. To study and measure characteristics of the RFIC components (i.e. coupler, filter etc.)
8. Design and simulation of microstrip planar antenna using CST microwave studio.

Design Engineering Problems/Open Ended Problems:

1. Design of Microstrip antenna resonate at 1.5 GHz.
2. Design of broadband forward wave directional coupler.
3. Design of maximally flat band stop filter which stop signals from 10 MHz to 40 MHz

List of Equipments:

1. Microwave test bench including Microwave sources, power supply, basic components and measuring equipments.
2. CST microwave studio
3. Open access software of filters and matching circuits.
4. Network analyzer

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.