CVM UNIVERSITY
(Established under Gujarat Private Universities (Second Amendment) Act : 2019 Gujarat Act No. 20 of 2019)

FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102430105

Course Title: RF and Microwave Circuits

Type of Course: Program Elective I

Course Objectives: To learn the designing techniques of Microwave Circuits.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 / 35	30 / 15	150 / 75

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
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
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
3	Power Dividers and Couplers: Scattering matrix of 3and 4-port junctions; Design of T-junction and Wilkinson power dividers; Design of 90^{o} and 180^{o} hybrids.	8
4	Filters : Analysis of periodic structures, Fouquet's theorem, filter design by insertion-loss method, maximally flat and Chebyshev designs.	8
5	Design of Microwave Circuits: Antennas, couplers, LNAs, mixers, and microstrip filters, transistor amplifier, oscillator.	7

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
10	20	20	20	20	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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, "Micro strip Filters For RF/Microwave Applications", John Wiley & Sons, Inc.
5	Misra, D.K., "Radio-frequency and Microwave Communication Circuits", John Wiley & Sons

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Students would be able to understand microwave communication circuits and systems	**20**
CO-2	Students would learn how to design microwave communication circuits at different frequencies.	**30**
CO-3	Students will develop the ability to design filters, mixer etc.	**30**
CO-4	Students will understand the problem arising to design amplifier, oscillator at high frequency and also get solution of the design of the system.	**20**

List of Practicals / Tutorials:

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 λg and free space wavelength λ.
2	Measurement of voltage standing wave ratio (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 of 5 GHz using CST microwave studio.
9	Design bandpass filter which has center frequency of 5 GHZ having bandwidth of 500 MHz.
10	Design compact UWB antenna having gain of minimum 1dB and frequency range from 3 to 6 GHz using CST microwave studio.

Supplementary learning Material:	
1	Scilab 6.1
2	OPEN EMS , website : http://openems.de/start/index.php
3	Scikit-RF , website : http://scikit-rf.org/

4	NPTEL/ Swayam portal website: https://swayam.gov.in/nc_details/NPTEL

Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
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