AMITY UNIVERSITY
UTTAR PRADESH

Course Title: ADVANCED MICROWAVE ENGINEERING
Course Code: ECE602
Credit Units: 06
Level: PG

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	1	4	0	6

Course Objectives: This course provides comprehensive knowledge of microwave frequencies, microwave devices, microwave transmission lines, microwave passive and active circuits and measurements.

Prerequisites: Basic microwave theory including waveguides, basic components, frequency, wavelengths.

	Weightage (%)
Module I	**20%**
Characteristics features of microwaves,Applications of microwaves,Maxwell's equations,Plane wave in dielectric and conducting media, Waveguide analysis,VSWR, and impedance,Waveguide discontinuities.S-matrix representations,Matrices of some typical microwave components such as attenuator, matched load, power divider, directional coupler, magic tee, Ferrite devices, Wave propagation in ferrite medium, Faraday rotation, isolator, circulator.	
Module II:	**20%**
Microwave Amplifier,Design using s-parameter,Stability criteria,Constant power and gain circles,Parametric amplifiers,Oscillators and mixers:Gunn oscillators,IMPATT diodes, TRAPATT diodes, BARITT diodes,Transited oscillator, oscillator circuits, Mixers, Mixers noise figure, Mixed analysis,Microwave Filter design based on binomial and chebychev quarter wave transforms,Impedance and coupled cavity filters.	
Module III:	**20%**
Review of development and application of transmission lines;Closed form models for the micro strip line;Closed form models for the coplanar waveguide line Characteristics of coupled micro strip and coupled coplanar waveguide;Circuit models of discontinuities in micro strip lines and the coplanar waveguides: Micro strip line resonator;Micro strip patch resonators: rectangular, circular and ring	
Module IV:	**20%**
Microwave Integrated Circuits (MIC),Technology of hybrid MICs.Design of MIC components: transitions, couplers, filters Power dividers, oscillators, modulators, phase shifters and amplifiers.Design of millimeter wave components: transitions, couplers, power dividers, filters, oscillators, switches, phase shifters and amplifiers	
Module V:	**20%**

Microwave power measurements.Slotted line techniques for VSWR Measurement.Impedance Measurement.Measurement of scattering parameters using network analyzer.Frequency Measurements. Slotted line method and frequency meter.Measurement of Q for transmission type cavity	

Student Learning Outcomes:

- Identify and describe principle and operation of advanced microwave devices and circuits.
- Students are able to analyze where and how advanced microwave components are used.
- Design microwave circuits using basic microwave components and devices.
- Construct application based circuits using microwave diodes/transistors etc.

Pedagogy for Course Delivery:

The course would be covered under theory and laboratory. In addition to assigning small project–based learning, early exposure to hands-on design to enhance the motivation among the students. It incorporates designing of problems, analysis of solutions submitted by the students groups and how learning objectives were achieved. Continuous evaluation of the students would be covered under quiz, viva etc.

List of Laboratory Experiment

1. To find out the resonant frequency of given micro strip line resonators and analyze the output characteristics.
2. To find out the resonant frequency of given micro strip ring resonators and analyze the output characteristics
3. To study and analyze the output characteristics of micro strip line based branch line directional coupler.
4. To study and analyze the output characteristics of micro strip line based band pass filter.
5. To study and analyze the output characteristics of micro strip line based low pass filter.
6. To study and analyze the output characteristics of micro strip line based hybrid ring coupler.
7. To study and analyze the output characteristics of micro strip line based strip line directional coupler.
8. To study the output characteristics of different micro strip line based attenuator pads.
9. To study the output characteristics of strip line power divider and shorts at different microwave frequencies.
10. To simulate micro strip line and ring resonators at different frequencies. Analyze the simulated results with the help of existing transmission line models.
11. To simulate micro strip line filters at different frequencies. Analyze the results with the help of filter models.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical (%)	Total
66.66%	33.33%	100%

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	Mid-Term Exam(CT)	**S/V/Q**	**HA**	Attendance(A)	
Weightage (%)	10%	8%	7%	5%	70%

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Lab Assessment (P):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	**PR**	**LR**	V	
Weightage (%)	5%	10%	10%	5%	70%

A: Attendance, PR- Performance, LR – Lab Record, V – Viva. EE- External Exam,

Text & References:

- S.Y. Liao, “Microwave devices & Circuits”, Prentice Hall of India, 3rd Ed. 1995.
- Edited by H.A. Watson, “Microwave Semiconductor devices and their circuit applications”, McGraw Hill Book Co. New York 1969.
- K.C. Gupta, “Microstripline & Slot lines” Artech House.
- E.L. Giunzton, “Microwave Measurements”, Mc Graw Hill Book Co. Inc. 1957.
- R. E. Colins: “Foundations for Microwave Engineering”, John Wiley & Sons, Inc, 2005.