Devi Ahilya University, Indore, India Institute of Engineering & Technology				**IV Year B.E. (Electronics and Telecommunication Engg.)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
7ETRC3 RF AND MICROWAVE ENGG	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	**1**	**2**	**3**	**1**	**1**	**5**
Duration of Theory Paper: 3 Hours							

Course Learning Objectives:

- To give students the knowledge and understanding of the basic concepts of microwave and its components.
- To make students aware about the working and behavior of microwave vacuum tube devices and microwave solid state devices.
- To provide knowledge about the microwave strip lines, microwave integrated circuits fabrication process and microwave measurements.
- To make students aware about applications and hazards of microwave radiations

Prerequisites: Basic knowledge of EM field, transmission lines and Analog electronics

COURSE CONTENTS

UNIT-I

Microwave fundamentals – microwave frequencies, microwave devices, microwave systems, microwave units of measure, Scattering or S – matrix representation of multiport network, microwave waveguides, microwave cavities. Microwave hybrid circuit, waveguide tees, directional couplers, circulators and isolators.

UNIT-II

Microwave Vacuum Tube Devices – Limitations of conventional vacuum tubes in the microwave frequency range, Klystron amplifier, reflex klystron oscillator, travelling wave tube, Magnetron oscillator.

UNIT-III

Microwave semiconductor devices – microwave tunnel diode with its principles of operation and characteristics, Gunn-effect diodes, LSA diodes, Read diode, IMPATT, TRAPATT, BARITT diodes, parametric devices, parametric amplifiers.

UNIT-IV

Strip lines, monolithic microwave integrated circuits (MMIC) and microwave measurements- microstrip lines, parallel strip lines, coplanar strip lines, shielded strip lines, MMIC materials, MMIC growth, MOSFET fabrication, microwave test bench, power

measurement, insertion loss and attenuation measurements, VSWR measurements, return loss measurement by reflectometer, impedance measurement, frequency measurement.

UNIT-V

Application, hazards and some advance topics - Applications of microwave, microwave radiation hazards, introduction to millimeter waves and its applications, design and implementation of microwave and millimeter wave circuits and systems

Course Outcome:

Students earned credits will develop ability to

CO. No.	**CO**	**PO**
CO1	Understand the basic concepts of microwave and its propagation characteristics.	PO-2
CO2	Understand the basic concepts of microwave devices and components.	PO-2, PO-6
CO3	Understand various applications and hazards of microwave.	PO-3, PO-7
CO4	Apply the knowledge of microwave to solve the microwave communication and microwave application based problems.	PO-9
CO5	Apply this knowledge for research in the field of microwave engineering.	PO-11

CO-PO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1		2										
CO2		2				2						
CO3			2				2					
CO4									2			
CO5											2	

BOOKS RECOMMENDED:

[1] Samuel Y. Liao, Microwave devices and circuits, Third Edition, Pearson, 2003
[2] Annapurna Das and S K Das, Microwave Engineering, Third Edition, McGraw Hill, 2015

[3] R.E.Collin, Foundations for Microwave Engineering.,2/e, IEEE Press 2002
[4] David M.Pozar, Microwave Engineering. 2/e,John Wiley & Sons 2003
[5] P.A.Rizzi, Microwave Engineering- Passive circuits - PHI

List of Practical Assignments:

1. Learn how to operate microwave test bench.
2. To study the characteristics of the Reflex Klystron Tube and to determine its electronic tuning range.
3. To plot different Modes of the Reflex Klystron Tube.
4. To study V-I characteristics of Gunn diode.
5. To determine the different parameters of Isolators and Circulators.
6. To measure attenuation.
7. Measurement of scattering parameters of Magic Tee.
8. To Measure main-line and auxiliary-line VSWR, coupling factor and directivity of a multi-hole directional coupler.
9. Measurement of guide wavelength.
10. To determine the standing wave-ratio and reflection coefficient.