Devi Ahilya University, Indore, India Institute of Engineering & Technology				IV Year BE Branch Electronic & Telecommunication					
Subject Code & Name	**Instructions Hours per week**			**Marks**	**TH**	**CW**	**SW**	**Pr**	**Total**
4ET503 Microwave Engineering	**L**	**T**	**P**	**Max**	**100**	**50**	**50**	**50**	**250**
Duration of Theory Paper: 3 hrs	**4**	**-**	**2**	**Min**	**35**	**25**	**25**	**25**	**110**

Course Objective: The objective of this course is to give students the knowledge and understanding of the basic concepts of Microwave and its components. It gives emphasis to the basic microwave components theories, modeling, analysis, design and also their physical behaviors.

Perquisites: Basic Knowledge of EMFT, Analog Electronic

COURSE OF CONTENTS

Unit I

Microwave components-microwave frequencies, devices, systems, units of measure, hybrid circuits, waveguide tees, magic tees (hybrid trees), hybrid rings (rat-race circuits), waveguide corners, bends and twists, directional couplers, two-hole directional couplers, z & abcd parameters- introduction to s parameters, s matrix of a directional coupler, hybrid couplers, circulators and isolators, microwave circulators, microwave isolators.

Unit II

Microwave linear-beam tubes (o type) and microwave crossed-field tubes (m type) :limitations of conventional vaccum tubes, klystrons, reentrant cavities, velocity-modulation process, bunching process, output power,beam loading, multicavity klystron amplifiers, beam-current density, output current output power of 2-cavity klystron, 4-cavity klystron, reflex klystrons, velocity modulation, power output and efficiency, electronic admittance, helix TWTs, slow-wave structures, amplification process, convection current, axial electric field, wave modes, gain consideration, microwave crossed-field tubes , magnetron oscillators, cylindrical, coaxial and tunable magnetron.

Unit III

Negative resistance devices, transferred electron devices (teds) and avalanche transit-time devices: tunnel diode, gunn-effect diodes, gaas diode, background, gunn effect, RWH theory, differential negative resistance, two-valley model theory, high-field domain, modes of operation, LSA,INP,CDTE diodes, microwave generation ,amplification, avalanche transit-time devices, read diode, physical description, avalanche multiplication, carrier, external current, output power,quality factor, impatt, trapatt and baritt diodes their physical structures, negative resistance, power output and efficiency microwave performance, parametric devices, physical structures, nonlinear reactance and manley - rowe power relations, parametric amplifiers, applications.

Unit IV

Strip lines and monolithic microwave integrated circuits-Microstrip lines, characteristic impedance, losses, quality factor, parallel strip lines, distributed lines, characteristic impedance, attenuation losses, coplanar strip lines, shielded strip lines, references, problems, monolithic microwave integrated circuits, introduction, materials, substrate materials, conductor materials, dielectric materials, resistive materials, monolithic microwave integrated-circuit growth, mimic fabrication techniques, fabrication example.

Unit V

Microwave communication and microwave measurements-microwave communication and their applications, microwave antennas, slotted line vswr measurement, vswr through return loss measurements, power measurement, impedance measurement insertion loss and attenuation measurements- measurement of scattering parameters - measurement of 1 db, dielectric constant measurement of a solid using waveguide. microwave and its applications in medical home industry etc.

References:

[1].Samuel Y.LIAO, *Microwave Devices and Circuits,* 3/e, Prentice Hall of India-2003
[2]. Annapurna Das and Sisir K.Das, *Microwave Engineering*, Tata McGraw-Hill -2000
[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