4EC43: RF AND MICROWAVE ENGINEERING
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To learn fundamentals of Microwave transmission lines, waveguides, Active and passive Microwave Devices, Microwave Components & its applications and recent trends.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per week)			Credits	Assessment Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	CE	ESE	CE	
3	0	2	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Microwaves :** Microwave Frequency bands, requirement of Microwave Frequencies, Advantages of Microwaves, Applications of Microwaves.	03
2	**Microwave Transmission Lines and Waveguides:** Transmission line Voltage and Current Relationship, Propagation Constant, Characteristic Impedance, reflection coefficient, standing waves, SWR, line impedance and admittance, Impedance Matching and Smith chart, Concept of TE, TM, TEM Mode, Losses associated with microwave Transmission, Rectangular waveguides-theory and analysis, Principle of circular waveguide, Rectangular Cavity Resonator.	10
3	**Microstrip Lines :** Introduction to strip lines**,** Micro strip lines, parallel strip lines, coplanar strip lines, effect of dielectric constant, introduction to metamaterial.	06
4	**Microwave Components :** S-Parameter basics, Waveguide Tees, Directional Couplers, Wave-guide Corners, Bends, Twists, Circulators, Isolator , Introduction to Microwave Filters .	07
5	**Microwave Tubes :** Klystrons, Helix and High power gridded control traveling wave tube, Magnetron Oscillators.	06
6	**Semiconductor Microwave Devices** : Microwave bipolar and hetero junction Transistors, Varactor diode, PIN diode, Tunnel Diode, Gunn Diode, IMPATT and TRAPATT diode, Step recovery diodes, Schottky Barrier diodes, Parametric Amplifiers.	07
7	**Microwave Systems, Measurements and applications :** Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Measurement of Microwave antenna parameters. Microwave antennas, Basic	06

Unit No.	Topics	Teaching Hours
	radar principle, Radar range equation, Types of radar, Radiometer System, Microwave Remote sensing, Introduction to RF MEMS, Introduction to Silicon Photonics .	
	Total	**45**

List of References:

1. M.Kulkarni, "*Microwave and Radar Engineering*", Umesh Publishers, 4th Edition, 2016.
2. Samuel Y. Liao, "*Microwave Devices and Circuit*", PHI, 3rd Edition, 2003
3. Edgar Hund , "*Microwave Communications: Components and Circuits*", McGraw Hill, ISE Edition, 1989
4. David M Pozar, "*Microwave Engineering*", Wiley, 3rd Edition, 2010
5. Annapurna Das, Sisir K. Das , "*Microwave Engineering*", Tata McGraw Hill, 3/E, 2000.

Course Outcomes (COs) :

By learning this course students will be able to……

1. Understand and remember basic concepts and applications of microwave systems.
2. Analyze and solve problems related to microwave transmission lines.
3. Design, analyze and solve problems related to microwave waveguide
4. Analyze, test and use, maintain various microwave components.
5. Design simple microwave strip lines, couplers, Microwave filters
6. Understand Concepts of Microwave tubes , Semiconducting device, Measurements.