MICROWAVE ENGINEERING LABORATORY

VII Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEC110	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Total Tutorials: Nil	Total Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

I. Measure the parameters using microwave components.
II. Analyze the generation and propagation of microwaves in waveguides.
III. Evaluate scattering parameters of different microwave junctions.
IV. Determine characteristic parameters of waveguides.

COURSE LEARNING OUTCOMES (CLOs):

1. Understand the microwave spectrum and applications of microwaves.
2. Analyze the types of waveguides, rectangular waveguides and field equations in rectangular waveguide.
3. Determine the wave impedance for a TM and TE wave in rectangular waveguide
4. Understand the types of cavity resonators and determine the dominant mode.
5. Explore the coupling mechanisms for a cavity resonator
6. Understand the waveguide discontinuities: waveguide irises, tuning screws, posts and matched load
7. Analyze the waveguide multiport junctions
8. Understand the Faraday rotation principle and analyze the different ferrite devices.
9. Understand the limitations of conventional vacuum tubes at microwave frequencies and understand the velocity modulation process and bunching process in microwave linear beam tubes
10. Determine the beam current density in Multi cavity Klystron amplifiers
11. Understand the velocity modulation process and power output in Reflex Klystron
12. Determine the amplification process in helix Traveling wave tube (TWT)
13. Describe the 8-cavity cylindrical travelling wave Magnetron
14. Analyze the Hull cut-off and Hartree conditions in Magnetron
15. Illustrate the microwave solid-state devices: microwave tunnel diode and transferred electron devices
16. Determine the RWH theory and modes of operations in Gunn diodes
17. Understand the Avalanche transit time devices: IMPATT diode, TRAPATT diode and BARITT diode
18. Describe the microwave bench set-up with different blocks and their features
19. Determine the measurements of microwave power, attenuation, frequency, VSWR and impedance

LIST OF EXPERIMENTS

Week-1	STUDY OF MICROWAVE COMPLONENTS

To study the different wave guide components in the microwave bench setup.

Week-2	**MEASUREMENT OF FREQUENCY AND GUIDE WAVE LENGTH**
To measure the frequency of a microwave source and demonstrate relationship among guide dimensions, free space wavelength and guide wave length.	
Week-3	**MODE CHARACTERISTICS OF REFLEX KLYSTRON**
To study the characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.	
Week-4	**GUNN DIODE CHARACTERISTICS**
To study the characteristics of Gunn diode oscillator.	
Week-5	**ATTENUATION MEASUREMENT**
To measure attenuation and insertion loss of a fixed and variable attenuator.	
Week-6	**DIRECTIONAL COUPLER CHARACTERISTICS**
To measure coupling factor, insertion loss, isolation and directivity of a Directional coupler.	
Week-7	**MEASUREMENT OF IMPEDANCE OF GIVEN LOAD**
To measure the unknown impedance of given load using bench set up.	
Week-8	**SCATTERING PARAMETERS OF H-PLANE TEE AND E-PLANE TEE**
To find the scattering parameters of a three port H-Plane Tee And E-PlaneTEE.	
Week -9	**MEASUREMENT OF VSWR**
To measure the low and high VSWR's of matched terminals.	
Week-10	**MEASURMENT OF SCATTERING PARAMETERS OF MAGIC TEE**
To find the scattering parameters of a four port Magic Tee.	
Week-11	**CIRCULATOR CHARACTERISTICS**
To measure the isolation and insertion loss of a three port circulator.	
Week-12	**GAIN AND RADIATION PATTERN OF HORN ANTENNA**
Develop a Hello World application using Google App Engine.	
Week-13	**MEASUREMENT OF PHASE SHIFT**
To measure the Phase shift between two components in the microwave bench set up.	
Week-14	**ISOLATOR CHARACTERISTICS**
To measure the isolation and insertion loss of an isolator.	
Reference Books	

1. Samuel Y. Liao, “Microwave Devices and Circuits”, Pearson, 3rd Edition, 2003.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, “Microwave Principles”,CBS Publishers and Distributors, New Delhi, 1st Edition, 2004.
3. F.E. Terman, “Electronic and Radio Engineering”, Tata McGraw-Hill Publications, 4th Edition, 1955.

Web References:

1. http://www.ee.iitkgp.ac.in
2. http://www.citchennai.edu.in