

## MICROWAVE ENGINEERING LABORATORY

<b>VII Semester: ECE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AEC110	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
<b>Contact Classes: Nil</b>		<b>Total Tutorials: Nil</b>		<b>Total Practical Classes: 36</b>			<b>Total Classes: 36</b>	
<b>I. COURSE OVERVIEW:</b>								
<p>The Microwave Engineering Laboratory delivers the necessary hardware support in the area of RF and Microwave Engineering. It focuses on the principles and advanced applications of Microwaves by measuring the characteristics of Microwave components using Microwave bench setup to analyze and simulate various Microwave devices. This is used in real-time applications in the fields of communication systems and home-based automation systems.</p>								
<b>II. OBJECTIVES:</b>								
<b>The course should enable the students to:</b>								
<ul style="list-style-type: none"> <li>I The experiments on microwave test equipment to make measurements of microwave parameters and devices.</li> <li>II The measurement of S-Parameters of microwave components to gain the practical hands on experience on the microwave test bench</li> <li>III The simulation to plot the radiation pattern for an antenna using High Frequency Software Simulator.</li> </ul>								
<b>III. COURSE OUTCOMES:</b>								
<b>After successful completion of the course, students should be able to:</b>								
CO 1	<b>Summarize the Waveguide components and their specifications using microwave test bench set-up.</b>							Understand
CO 2	<b>Sketch the characteristics of Reflex klystron to obtain the electronic tuning range using Klystron bench set up.</b>							Apply
CO 3	<b>Calculate the V-I characteristics of Gunn diode to find out threshold voltage using Gunn bench setup.</b>							Apply
CO 4	<b>Relate the guided wave length with free space and cutoff wave lengths using frequency meter.</b>							Apply
CO 5	<b>Calculate the S-parameters for various microwave components and Voltage Standing Wave Ratio of unknown load to measure characteristics of microwave devices using microwave test bench</b>							Apply
CO 6	<b>Analyze the polar pattern of Horn antenna to find out the antenna parameters using test setup and High Frequency Software Simulator.</b>							Analyze
<b>IV. SYLLABUS:</b>								
<b>LIST OF EXPERIMENTS</b>								
<b>Week-1</b>	<b>STUDY OF MICROWAVE COMPONENTS</b>							
To study the different wave guide components in the microwave bench setup.								
<b>Week-2</b>	<b>MEASUREMENT OF FREQUENCY AND GUIDE WAVE LENGTH</b>							
To measure the frequency of a microwave source and demonstrate relationship among guide dimensions, free space wavelength and guide wave length.								
<b>Week-3</b>	<b>MODE CHARACTERISTICS OF REFLEX KLYSTRON</b>							
To study the characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.								

<b>Week-4</b>	<b>GUNN DIODE CHARACTERISTICS</b>
To study the characteristics of Gunn diode oscillator.	
<b>Week-5</b>	<b>ATTENUATION MEASUREMENT</b>
To measure attenuation and insertion loss of a fixed and variable attenuator.	
<b>Week-6</b>	<b>DIRECTIONAL COUPLER CHARACTERISTICS</b>
To measure coupling factor, insertion loss, isolation and directivity of a Directional coupler.	
<b>Week-7</b>	<b>MEASUREMENT OF IMPEDANCE OF GIVEN LOAD</b>
To measure the unknown impedance of given load using bench set up.	
<b>Week-8</b>	<b>SCATTERING PARAMETERS OF H-PLANE TEE AND E-PLANE TEE</b>
To find the scattering parameters of a three port H-Plane Tee And E-Plane TEE.	
<b>Week-9</b>	<b>MEASUREMENT OF VSWR</b>
To measure the low and high VSWR's of matched terminals.	
<b>Week-10</b>	<b>MEASUREMENT OF SCATTERING PARAMETERS OF MAGIC TEE</b>
To find the scattering parameters of a four port Magic Tee.	
<b>Week-11</b>	<b>CIRCULATOR CHARACTERISTICS</b>
To measure the isolation and insertion loss of a three port circulator.	
<b>Week-12</b>	<b>GAIN AND RADIATION PATTERN OF HORN ANTENNA</b>
Develop a Hello World application using Google App Engine.	
<b>Week-13</b>	<b>MEASUREMENT OF PHASE SHIFT</b>
To measure the Phase shift between two components in the microwave bench set up.	
<b>Week-14</b>	<b>ISOLATOR CHARACTERISTICS</b>
To measure the isolation and insertion loss of an isolator.	
<b>Reference Books</b>	
<ol style="list-style-type: none"> <li>1. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson, 3<sup>rd</sup> Edition, 2003.</li> <li>2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles" ,CBS Publishers and Distributors, New Delhi, 1<sup>st</sup> Edition, 2004.</li> <li>3. F.E. Terman, "Electronic and Radio Engineering", Tata McGraw-Hill Publications, 4<sup>th</sup> Edition, 1955.</li> </ol>	
<b>Web References:</b>	
<ol style="list-style-type: none"> <li>1. <a href="http://www.ee.iitkgp.ac.in">http://www.ee.iitkgp.ac.in</a></li> <li>2. <a href="http://www.citchennai.edu.in">http://www.citchennai.edu.in</a></li> </ol>	
<b>Course Home Page:</b>	

**LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS**

<b>S. No</b>	<b>Name of the Equipment</b>	<b>Range/Model</b>
1	Klystron Based Microwave Bench Setup	--
2	Gunn diode Based Microwave Bench Setup	--
3	VSWR Meter	--
4	FUNCTION GENERATOR	0-1 MHz
5	Slotted Line	--
6	Magic Tee	--
7	Circulator	--
8	Directional Coupler	--
9	Variable Attenuator	--
10	Matched Terminator	--
11	Cathode Ray Oscilloscope	(0-30) MHz
12	Dc Regulated Power Supply	(0-30) V