# ANTENNAS AND MICROWAVE ENGINEERING LABORATORY

**VII Semester:** ECE

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | **CIA** | **SEE** | **Total** |
| **AECB30** | **Core** | 0 | 0 | 3 | 1.5 | 30 | 70 | 100 |
| **Contact Classes: Nil** | **Total Tutorials: Nil** | **Total Practical Classes: 36** | | | | **Total Classes: 36** | | |

## I. COURSE OVERVIEW:

The Antennas and Microwave Engineering Laboratory supports intermediate and advanced courses in Electromagnetics and Microwave Engineering. Students experiment with transmission line prop- aga- tion, antennas and microwave circuit components. The microwave laboratories provide the necessary hardware software support for training the students in the area of RF and Microwave Engineering. It offers design, analysis and simulation of various components and devices to under- stand the basics of RF and microwave engineering, to boost the quality of engineering education, deepen understanding, and provide the necessary practical skills to young mind.

## II. OBJECTIVES:

**The course should enable the students to:**

- **I** The experiments on microwave test equipment to make measurements of microwave parameters and devices.
- **II** The measurement of S-Parameters of microwave components to gain the practical hands on experience on the microwave test bench.
- **III** The simulation to plot the radiation pattern for an antenna using High Frequency Software Simulator.

## III. COURSE OUTCOMES:

**After successful completion of the course, students should be able to:**

| | | |
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| CO 1 | **Summarize** the Waveguide components and their specifications using microwave test bench set-up. . | Understand |
| CO 2 | **Sketch** the characteristics of Reflex klystron. to obtain the electronic tuning range using Klystron bench set up. | Apply |
| CO 3 | **Analyze** the characteristics of Directional coupler, circulator and magic tee using microwave test bench setup. | Analyze |
| CO 4 | **Distinguish** the low and high Voltage Standing Wave Ratio of unknown load load to find out the reflection coefficient using slottedline section. | Analyze |
| CO 5 | **Identify** fundamental parameters of the antenna to measure far-field radiation pattern using High Frequency Software Simulator | Understand |
| CO 6 | **Design** various antennas to find out the antenna parameters using test setup and High Frequency Software Simulator. | Create |

## LIST OF EXPERIMENTS

| **Week-1** | **STUDY OF MICROWAVE COMPLONENTS** |
|---|---|

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

| **Week-2** | **MODE CHARACTERISTICS OF REFLEX KLYSTRON** |
|---|---|

To study the characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.

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| **Week-3** | **GUNN DIODE CHARACTERISTICS** |
| To study the characteristics of Gunn diode oscillator. | |
| **Week-4** | **DIRECTIONAL COUPLER CHARACTERISTICS** |
| To measure coupling factor, insertion loss, isolation and directivity of a Directional coupler. | |
| **Week-5** | **MEASUREMENT OF VSWR** |
| To measure the low and high VSWR's of matched terminals. | |
| **Week-6** | **CIRCULATOR CHARACTERISTICS** |
| To measure the isolation and insertion loss of a three port circulator. | |
| **Week-7** | **MEASURMENT OF SCATTERING PARAMETERS OF MAGIC TEE** |
| To find the scattering parameters of a four port Magic Tee. | |
| **Week-8** | **INTRODUCTION TO HFSS** |
| Introduction To HFSS Tool | |
| **Week -9** | **MONOPOLE ANTENNA DESIGN** |
| To find the gain of Monopole Antenna | |
| **Week-10** | **DIPOLE ANTENNA DESIGN** |
| To draw the Radiation Pattern of Dipole Antenna Design | |
| **Week-11** | **MICROSTRIP FEED ANTENNA DESIGN** |
| To find the gain and radiation pattern of Microstrip Feed Antenna Design | |
| **Week-12** | **PROBE FEED PATCH ANTENNA DESIGN** |
| To draw the 3D polar plot of Probe Feed Patch Antenna Design | |
| **Week-13** | **SLOT COUPLED PATCH ANTENNA** |
| To draw the 3D rectangular plot of Slot Coupled Patch Antenna | |
| **Week-14** | **MICROSTRIP  LINE DESIGN** |
| To find the gain of Microstrip  Line Design | |
| **Reference Books** | |

1. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson, 3$^{rd}$ Edition, 2003.
2. HerbertJ.Reich, J.G.Skalnik, P.F.Ordungand H.L.Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi, 1$^{st}$ Edition, 2004.
3. F.E. Terman, "Electronic and Radio Engineering", Tata McGraw-Hill Publications, 4$^{th}$ Edition, 1955.
4. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, "Antennas and Wave Propagation", TMH, 4th Edition, 2010.

**Web References:**

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

**SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 24 STUDENTS**

**HARDWARE:** Desktop Computer Systems 24 nos

**SOFTWARE :** ANSYS HFSS TOOL

**LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 24 STUDENTS**

| S. No | Name of the Equipment | Range/Model |
|-------|-----------------------|-------------|
| 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 |