Course Type	Course Code	Name of Course	L	T	P	Credit
DP	NECC526	Microwave Measurement lab	0	0	3	1.5

Course Objective

- Learn principles and operation of various microwave instruments used in microwave measurements.
- Gain proficiency in measuring and analyzing passive and active microwave components.
- Develop skills to perform the experiment and have an understanding of various RF & microwave devices for advanced communication and sensing applications.

Learning Outcomes

Upon successful completion of this course, students will:

- Familiarity with microwave instrumentation and characterization techniques for various microwave components.
- Develop advanced troubleshooting and optimization skills in advanced communication systems.
- Enhance practical knowledge of RF & Microwave technologies.

Unit No.	Name of experiments.	Practical Hours	Learning Outcome
1	a. Study I-V Characteristics of Gunn diode. b. Study the propagation of the wave in the X-band waveguide & draw the $\omega - \beta$ plot.	03	Understand the I-V characteristics of Gunn diodes and analyze wave propagation in the X-band waveguide by drawing the dispersion $(\omega - \beta)$ diagram.
2	Determination of the VSWR/input VSWR & corresponding impedance of the device at a spot frequency and verify using a Smith chart.	03	Learn to measure and determine the Voltage Standing Wave Ratio (VSWR) and impedance of a device at a specific frequency and validate these measurements using a Smith chart.
3	Experimental determination of the propagation characteristics of the following devices using a microwave test bench. a. Directional coupler, b. Magic Tee	06	Gain practical knowledge on the propagation characteristics of directional couplers and magic tees using a microwave test bench.
4	Determination of the broader dimension of the rectangular waveguide experimentally using a microwave test bench.	03	Develop skills to experimentally determine the broader dimension of a rectangular waveguide using a microwave test bench.
5	Experimental study of the frequency response of various microstrip filters using a microstrip trainer kit and validate their response using a vector network analyzer.	03	Acquire the ability to study and validate the frequency response of various microstrip filters using a microstrip trainer kit and a vector network analyzer.
6	Measurement of the radiation pattern and gain of the Horn antenna in the X-band using a microwave test bench.	06	Learn to measure the radiation pattern and gain of a Horn antenna in the X-band using a microwave test bench.
7	Measurement of the frequency response of RF amplifiers using a microstrip trainer kit and validate their response using a vector network analyzer.	03	Understand and validate the frequency response of RF amplifiers using a microstrip trainer kit and a vector network analyzer.
8	Measurement of the Dielectric Constant of a dielectric sample using a Two-Point Method.	03	Develop the capability to measure the dielectric constant of a material sample using the two-point method.
9	Measurement of the S-parameters of the reciprocal device with the help of a slotted line using a microwave test bench.	03	Learn to measure the S-parameters of reciprocal devices using a slotted line and a microwave test bench.
10	Familiarization with fundamental functionalities of the spectrum analyzer and performing the filter's frequency response measurements.	03	Gain an understanding of the fundamental functionalities of a spectrum analyzer and perform frequency response measurements of filters.
11	Introduction and study of fundamental functionalities of the Vector Network Analyzer (VNA), including its application for measuring parameters of both passive devices (such as LPF) and active devices (such as RF amplifiers).	03	Learn the basic functionalities of a Vector Network Analyzer (VNA) and its applications in measuring parameters of both passive devices (e.g., low-pass filters) and active devices (e.g., RF amplifiers).

12	Acquaintance with anechoic chambers, automatic antenna positioner systems, and its application for measuring antenna gain and radiation pattern of the horn antennas.	03	Develop familiarity with anechoic chambers and automatic antenna positioner systems, as well as their applications in measuring the gain and radiation pattern of horn antennas.
Total		**42**	

Reference Books:

1. M. Sucher, J. Fox, Handbook of Microwave Measurements, Vol. II, 1963
2. G.S. Raghuvanshi, M.L. Sisodia, Basic Microwave Techniques and Laboratory Manual, 2009