Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD517	Advanced Microwave Measurement & Instrument	3	0	0	3

Course Objective
Provide the student with experience in measurements of RF and microwave hardware and signals using modern equipment.

Learning Outcomes
At the end of this module, students are expected to be able to • Handle high-end instruments like VNA, Spectrum analyzer, power meter, etc. • Characterize different passive and active microwave devices. • Able to setup experiments for real-time situations.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Fundamentals of electromagnetics and microwave engineering, basic instruments for microwave measurements, and Introduction to RF and Microwave Measurements, Overview of State-of-the-Art Microwave Measurements, S-Parameters and Related Black-Box Representation.	8	Understanding of fundamental of microwave engineering and basic tools for the analysis of any microwave network
2	Time Domain Reflectometry (TDR): measurement characteristics of various connector families, transmission lines, complex loads.	7	Students will be learning the basic construction and analysis of TDR.
3	Spectrum Analyzer: for measurement of simple signals on a spectrum analyzer to understand resolution bandwidth, video bandwidth, dynamic range, noise, etc,	7	Will learn spectrum analyzer architecture and applications.
4	Spectrum analyzer architecture, network analyzer architecture, error correction model, Material Property Measurement Using the VNA, a scalar network analyzer.	6	Students will learn VNA basics and error correction model with connection of calibration of the same.
5	Power meter, LCR meter, Noise figure measurement, Noise Measurements Definition, Noise Measurement Basics, special Consideration for Mixers, Phase Noise, Phase-Noise Measurement Techniques signal generator architecture and measurements.	8	The student will familiarize the different advanced instruments and handling like LCR meter, noise meter, etc.
6	Amplifier characterization, mixer characterization, design and build a simple single stub transmission line matching circuit etc.	6	Students will learn how characterize amplifier.
	Total	**42**	

Text Book:
1. Atef Z. Elsherbeni and VeyselDemir, 'The Finite-Difference Time-Domain Method for Electromagnetics with MATLAB Simulations' SciTech Publishing, Inc Raleigh, NC, 2nd edition, 2015.

Reference Books:
1. Matthew N.O. Sadiku, 'Numerical Techniques in Electromagnetics, 3rd Edition, 2009, Prairie View A&M University, Texas, USA
2. Journal Papers of IEEE Transaction on Antenna and Propagation and IEEE Transaction on Microwave Theory and Techniques.