BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2014-2015
Course Handout Part II

Date: 02/08/2016

Course No.	**: EEE G581**
Course Title	**: RF AND MICROWAVE ENGINEERING**
Instructor in charge	**: Dr. Praveen Kumar A.V.**
Instructor	**: none**

1. Scope and objective of the course:

The course deals with the theory and design of systems in the microwave range of the radio spectrum. At these higher rates of oscillations, as the wavelength is comparable to the component / interconnect size, parameters such as the attenuation, phase shift, reflection, radiation etc will become critical in limiting the system performance. Hence an RF engineer relies on full wave / field theory (instead of the low frequency circuit theory) to characterize high frequency systems.

The course will cover transmission lines from the simple two wire line to the obscure planar lines. Phenomena such as reflection, coupling, radiation etc from such lines will be analyzed. High power transmission lines, popularly known as waveguides, their design and selection will be described. Transformation of a waveguide to a cavity resonator will follow with some interesting applications in the field of material science and particle physics. Analysis of microwave networks and devices will be covered where various microwave devices will be modeled using the S-matrix. The use of Vector Network Analyzer (VNA) will be briefed and some VNA measurements will be demonstrated. Theory of FDTD method and its MATLAB implementation will be covered.

2. References:

(a) David M. Pozar, *Microwave Engineering*, 3rd Ed. Wiley India, New Delhi, 2005
(b) R.E. Collin, *Foundations for Microwave Engineering*, 2nd Ed. Wiley India, New Delhi 2005
(c) A. Das and S. K. Das, *Microwave Engineering*, 2nd Ed., Tata McGraw Hill, 2009
(d) Selected IEEE papers (will be given later)

3. Course Plan:

Lect. No.	Lecture topic	Contents
1	Course handout discussion	Introduction to the course and its components
2-11	Transmission lines and Impedance matching	Basic transmission line parameters, Generator and load mismatches, Concept of global and local reflections, Smith chart, Impedance matching, Matching bandwidth, Single and multi-section matching, Tapered section, Stub matching, Planar transmission lines- types, comparison. Microstrip lines-quasi-TEM mode, quasi-static model, design aspects, losses, Higher order modes, Surface waves, Coupled line theory, Microstrip discontinuities.
12-21	Computational Electromagnetics	Numerical techniques in electromagnetics, Commercial EM simulators, Finite difference time domain (FDTD) method - Yee algorithm, Modeling objects, boundaries and excitation, Absorbing boundary condition, Extraction of S-parameters, Problem for final project
22-31	Microwave networks and devices	Concept of impedance, S-parameters and properties, Multiple input devices, Waveguide junctions, Magic-T, Power divider, Directional coupler, Isolator, circulator, Signal flow graphs, VNA calibration and measurements, Introduction to Microwave sources, Amplifiers and Filters
31-40	Waveguides and cavity resonators	Design of Rectangular and circular waveguides for frequency, bandwidth and efficiency. Evanescent, Dominant and higher order mode operations, Coaxial connectors Cavity resonator - Equivalent circuit, Measurement of Q-factor and coupling factor, Typical applications- Rectangular cavity for material study, Circular cavity for particle acceleration, Excitation of cavities

4. Evaluation Scheme:

Component	Duration	Weightage	Marks (200)	Date & Time	Evaluation type
Seminar	30 mins	15 %	30	Power point presentation and viva	
Course assignment	--	25 %	50	MATLAB simulation and output verification	
Mid sem. Exam	90 min	20 %	40	3/10 8:00 - 9:30 AM	Closed book
Comprehensive Exam	3 hours	40 %	80	1/12 AN	Open / Closed book

5. Chamber Consultation Hours: Will be announced in the class

6. Notices: Notices concerning this course will be displayed on Nalanda.

7. Absence and Makeup policy: Instructor in charge must be informed in advance in case a student is likely to be absent on the date of an evaluation. Decision will be made based on the genuineness of the absence reason.

Instructor-in Charge,
Chamber : 2210-D