BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus

INSTRUCTION DIVISION
FIRST SEMESTER 2015-2016
Course Handout Part II

Date: 03/06/2015

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 radio frequency (RF) engineering emphasizing on the microwave range of the radio spectrum. As the operating frequency increases, parameters like attenuation, phase shift, reflection, radiation etc will become critical in deciding the performance of the system. An RF engineer uses field theory to solve for electric and magnetic fields, instead of circuit theory that is used by electrical engineer to solve for voltages and currents.

The course will start with electrodynamic behavior of materials and typical applications. Transmission line theory will then be covered followed by microwave network analysis. Planar microwave technology and microwave measurements using VNA will be demonstrated. Waveguides and cavity resonators, especially their special applications in the fields of high power RF and material characterization will follow. Students will be introduced to commercial electromagnetic simulators. In the beginning of the course, the FDTD method will be covered and the students are supposed to form groups and implement it in MATLAB for solving a given structure.

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. Taflove, *Computational Electrodynamics - the finite difference time domain method*, 3rd Ed., Artech house, 2005
(d) Research papers, Technical reports
(e) Lecture notes

4. Course Plan:

Lec. No.	Lecture topic	Contents	Comments
1	Course handout discussion	Introduction to the course and its components	These topics are given as guidelines only.
2-4	Electromagnetic fields and materials	Dielectric and conducting media, Complex permittivity, SiC load, Tensor permeability, Faraday rotation, Ferrite phase shifter	
5-12	Transmission line theory	High frequency systems, Basic transmission line parameters, Generator and load mismatches, Small reflections, Impedance matching, Matching bandwidth, Smith chart , Planar transmission line technology	
13-20	Microwave network analysis	S-parameters, ABCD parameters, Signal flow graphs, Vector network analyzer (VNA), calibration and measurements, Power divider, Directional coupler, Magic-T, Isolator, circulator etc	
21-28	Waveguides and cavity resonators	Rectangular and circular waveguides, Cavity resonator - Equivalent circuit, Operating modes-applications, Cavity perturbation and application, Measurement of cavity Q-factor and coupling factor using VNA, Excitation of waveguides and cavities	
29-40	Computational Electromagnetics	Introduction to commercial EM simulators - CST Microwave studio, Ansys HFSS, Finite difference time domain (FDTD) method - Yee algorithm, Modeling objects, boundaries and excitation, Absorbing boundary condition, Extraction of S-parameters	

5. Evaluation Scheme:

Component	Duration	Marks (200)	Weightage	Date & Time	Evaluation type
Short assignments	Take home	30	15 %	Report (hard copy) submission	
Course assignment	Take home	50	25 %	MATLAB simulation and output verification	
Mid sem. Exam	90 min	50	25 %	5/10 10:00 - 11:30 AM	Open / Closed book
Comprehensive Exam	3 hours	70	35 %	1/12 AN	Open / Closed book

6. Chamber Consultation Hours: To be announced in the class

7. Notices: Notices concerning this course will be displayed on Nalanda / EEE Notice Board.

8. 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 any evaluation. Decision will be made based on the genuineness of the absence reason.

Instructor-in Charge

Chamber : 2210-D