BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI- HYDERABAD CAMPUS
FIRST SEMESTER 2019-2020
COURSE HANDOUT PART II

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In addition to Part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No.	:	**EEE G581**
Course Title	:	**RF and Microwave Engineering**
Instructor-in-charge	:	**Sourav Nandi**

1. Course description:

Maxwell's equations, Boundary conditions, Wave propagation, Theorems; Transmission line theory, Smith chart; Waveguides, General solution of waves, Rectangular waveguide, Microwave guiding structures, Microwave networks, S-parameters; Impedance matching, Stub tuning; Transmission line resonators, Rectangular waveguide cavity resonator, Power dividers and directional couplers; Microwave filters.

2. Scope & Objective:

This course deals with radio frequency and microwave engineering, which in other words is the physical realization of electromagnetic theory. The basic knowledge of the student in the field of engineering electromagnetics will be developed to advanced levels. Low frequency systems can be analyzed using *circuit theory,* where concepts like *voltage*, *current* and *impedance* are valid. At intermediate frequencies, the analysis needs inclusion of an additional effect called *reflection* into circuit theory, which now becomes the *transmission line theory*. But at high frequencies, the circuit / transmission line theory has to be replaced with *field theory,* in order to address the new effect of *radiation*. Practical uses of certain theorems based on *field theory* will be described. Commercial electromagnetic simulators will be introduced and the underlying electromagnetic principles will be revisited. Students are supposed to approach the course from a research point of view also. In addition to relying on the subject oriented textbooks, the students are advised to follow technical journal papers also. Skills like preparing and presenting technical report, seminar, etc., will also be developed and evaluated.

3. Text Books

[T1] Pozar, David M, Microwave Engg. WSE , 4th ed , 2012

4. Reference Books

[R1] Rizzi, Peter A., Microwave Engineering: Passive Circuits, PHI, 1988

[R2] Liao, S. Y., Microwave Devices & Circuits PHI/ Pearson Edu., 3rd ed, 2003

[R3] Hong, J-S., Lancaster, M. J., Microstrip Filters for RF/Microwave Applications, John Wiley & Sons Inc., 2001.

5. Course Plan

Sl.No	Topics to be covered	Learning Objectives	Ref. to Book	No. of Lectures
1	Introduction to the course and its components	Course handout discussion		1
2	Lumped element circuit model, Terminated Transmission line, Smith chart, Quarter-wavelength transformer, Lossy transmission lines	Transmission Line Theory	T1: Ch 2	5
3	Scattering matrix, Reciprocal and lossless and matched networks, Transmission (ABCD) matrix, Discontinuities	Microwave Network Analysis	T1: Ch 4	5
4	Matching with lumped elements, Single-stub tuning, Double-stub tuning	Impedance Matching	T1: Ch 5	5
5	Basic theory of Power Dividers and Couplers, 3-Port vs 4-Port Devices; 3-Port Power Dividers, T-Junctions, Wilkinson Power Divider, etc.; 4-Port Devices,	Power Dividers and Directional Couplers	T1: Ch 7	5

	Quadrature Hybrid Coupler, Rat-Race Coupler, etc.			
6	Maxwell's equations, Boundary conditions, Wave propagation, Theorems	Basics of EM Theory	T1: Ch 1	5
7	General solutions for TEM, TE and TM waves, Rectangular waveguide, Stripline, Microstrip line	Waveguides	T1: Ch 3	5
8	Single and parallel resonant circuits, Loaded and unloaded Q, Transmission line resonators, Rectangular waveguide cavity resonators.	Microwave Resonators	T1: Ch 6	5
9	Microwave filters: Basic concepts, Transfer functions, Butterworth, Chebyshev and Elliptic response, Low pass prototype filters, Stepped impedance LPF design	Microwave Filters	T1: Ch 8	6
		Total Number of Lectures		42

Laboratory component: One lab session per week**.** Laboratory component involves hardware as well software (both circuit and full-wave simulations) experiments.

6. **Evaluation Scheme**

Component	Duration	Weightage	Date & Time	Remarks
Midsem Test	90 min	20%	28/9 11:00 – 12:30 PM	Closed Book
Surprise Quiz		10%	During lecture hour	Closed Book
Comprehensive Theory Exam	3 Hrs	30%	02/12 AN	Closed Book
Regular Lab	--	15%	Regular lab performance	Open Book
Term Project	--	20%	Will be announced	Open Book
Lab Exam.	----	5%	Will be announced	Open book

7. **Chamber Consultation Hour**: To be announced in the class
email: sourav@hyderabad.bits-pilani.ac.in

8. **Notices**: Notices concerning this course will be on CMS.

9. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Sourav Nandi
Instructor-in-Charge