Coordinators

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Syllabus | **References**

COURSE OUTLINE

This course has been designed to offer as a graduate level as well as undergraduate level core subject to the students of Electronics or Electrical Communication Engineering. The course presumes a basic knowledge of Electromagnetic Field theory and Vector Calculus.
Also, it is presumed that the student has gone through foundation level courses in Electronics Network Theory, Signals and Systems and Communication Systems.
Concepts are built up from the basics and finally related to the present day applications so that students and researchers desirous of working on RF related applications like RF Circuit design, RF Communication or RF propagation finds this course useful.
The course covers the whole gamut of RF and Microwave Design principles and offers the perspective from the Maxwell's field theory viewpoint. However, a large amount of course coverage attempts to reconcile the field theory standpoint with the low frequency circuit theory model and endeavors to develop a framework wherein a student can easily change track and move to either field theory or circuit theory.
The course also tries to imbibe the training to a student to decide when to apply circuit theory and when one needs to switch to a more rigorous field analytic framework.
The course also underscores a basic theme that though Microwave technique is a well developed concept, it has its underpinnings in various modern applications and helps to bridge the mental gap between RF and microwave design on one hand and low frequency circuit design on the other.
This theme is further consolidated at the end of the course by briefly describing state-of-the-art RF systems where microwave design principles are being applied to develop cutting edge technological products.
Finally the course tries to address scientifically a popular belief that electromagnetic radiation has dangerous health ramifications and presents up-to-date research findings about the perception. While so doing the course also tries to open up the vast panorama of modern applications to the field of view of students so that it is appreciated that the military need driven classical microwave technology is being re-applied for solving modern challenges.

COURSE DETAIL

Module No.	Topic/s	No.of Lectures
1	**Introduction to Microwaves**. 1.1 History of Microwaves, Microwave Frequency bands. 1.2 Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.	2
2	**Mathematical model of Microwave Transmission.** 2.1 Concept of Mode . 2.2 Characteristics of TEM, TE and TM Modes. 2.3 Losses associated with microwave transmission. 2.4 Concept of Impedance in Microwave transmission .	4
3	**Analysis of RF and Microwave Transmission Lines.** 3.1 Coaxial Line. 3.2 Rectangular Waveguide. 3.3 Circular waveguide. 3.4 Stripline. 3.5 Microstrip Line.	5
4	**Microwave Network Analysis.** 4.1 Equivalent Voltages and currents for non-TEM lines. 4.2 Network parameters for microwave Circuits. 4.3 Scattering Parameters.	3
5	**Passive and Active microwave Devices**. 5.1 Microwave Passive components: Directional Coupler, Power Divider. 5.2 Microwave Passive components: Magic Tee, attenuator, resonator. 5.3 Microwave Active components: Diodes, Transistors. 5.4 Microwave Active components: oscillators, mixers. 5.5 Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. 5.6 Microwave tubes: Klystron, TWT, Magnetron.	6
6	**Microwave Design Principles.** 6.1 Impedance transformation. 6.2 Impedance Matching. 6.3 Microwave Filter Design.	8

	6.4 RF and Microwave Amplifier Design. 6.5 Microwave Power amplifier Design. 6.6 Low Noise Amplifier Design. 6.7 Microwave Mixer Design. 6.8 Microwave Oscillator Design.	
7	**Microwave Antenna.** 7.1 Microwave Antenna Parameters. 7.2 Microwave antenna for ground based systems. 7.3 Microwave antenna for airborne based systems. 7.4 Microwave antenna for satellite borne systems. 7.5 Microwave Planar Antenna.	5
8	**Microwave Measurements.** 8.1 Power, Frequency and impedance measurement at microwave frequency. 8.2 Network Analyser and measurement of scattering parameters. 8.3 Spectrum Analyser and measurement of spectrum of a microwave signal. 8.4 Noise at microwave frequency and measurement of noise figure. 8.5 Measurement of Microwave antenna parameters.	5
9	**Microwave Systems.** 9.1 Radar Systems. 9.2 Cellular Phone. 9.3 Satellite Communication. 9.4 RFID. 9.5 GPS.	5
10	**Modern Trends in Microwaves Engineering.** 10.1 Effect of Microwaves on human body. 10.2 Medical and Civil applications of microwaves. 10.3 Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC). 10.4 Monolithic Microwave IC fabrication. 10.5 RFMEMS for microwave components. 10.6 Microwave Imaging.	6
	Total	49