COURSE TITLE	**RF AND MICROWAVE COMMUNICATION**
COURSE CODE	**01CT1605**
COURSE CREDITS	**4**

Objective:

1 This course is designed to understand and analyses various components used in RF and Microwave communications like transmission lines, waveguides, microwave components etc. It also focuses on various methods and tools used to analyses various circuit designs. Subject is extended to the design of strip lines and micro strip lines, MIC, MMIC

Course Outcomes: After completion of this course, student will be able to:

1 Understand applications, concepts and design aspects of transmission lines and waveguides
2 Apply scattering and other parameters in microwave circuit analysis and design
3 Measure various parameters using smith chart
4 Understand design and analyse various microwave components, tubes and circuits
5 Design of microwave strip and integrated Circuits

Pre-requisite of course: Basic understanding of electrodynamics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction** Spectrum of RF and microwave frequencies, Frequency bands and regions of spectrum allocations, Decibel for power ratios, representation of Power-Voltages dBm, dBW, dBμV/m, Modeling lumped and distributed components at radio frequencies, Propagation of EM waves, Application of RF and microwaves	6
2	**Transmission lines and distributed systems** Introduction to transmission lines and familiar examples, Lumped and distributed systems, Telegraph equations and the waves solution, Wave equation, Characteristic impedance and propagation velocity, Load effect on the reflected wave, Types of transmission lines (coaxial, conductor- pair, printed – microstrip, stripline), Standing-wave in a transmission-line, Reflection coefficient and voltage-standing-wave-ratio (VSWR), Efficiency of power-transfer, Short, open, and matched loads' impedance as viewed at the end of a variable-length transmission line, Reflection parameters, Transmission parameters, Wave representation of two-port and the s-parameters, Phase velocity and group velocity	10

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Contents : Unit	Topics	Contact Hours
3	**The Smith Chart and Impedance Matching** Smith chart – impedance on the reflection plane, Review of transmission lines and impedances matching , L, pi, T, sections, transmission lines and stubs	8
4	**Microwave Components** Wave-guide tees, Magic tee, Directional couples, Circulars and isolators, Corners, Bends, Twists, Flanges, Matched termination, Coupling probes, Loops	7
5	**Microwave Tubes and Circuits** Limitations of conventional tubes at UHF & Microwave, Klystrons, Velocity modulation, Multi cavity klystron, Reflex klystron, Traveling wave tube, Magnetron	6
6	**Micro Strip & Integrated Circuits** Strip lines, micro strip lines, MIC, MMIC	5
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment-01** Introduction to HFSS Software	2
2	**Experiment-02** To Understand 3D Modeling, Properties, Commands & Attributes for Antenna Design	2
3	**Experiment-03** To Apply Wave Port Excitation, Radiation Setup & Analysis to antenna using HFSS	2
4	**Experiment-04** To create, simulate, and analyze a UHF probe using the Ansoft HFSS Design Environment	2
5	**Experiment-05** To create, simulate, and analyze a Monopole and Dipole Antenna using the Ansoft HFSS Design Environment.	2
6	**Experiment-06** To create, simulate, and analyze a waveguide horn Antennas using the Ansoft HFSS Design Environment.	2
7	**Experiment-07** To create, simulate, and analyze Horn Antenna using the Ansoft HFSS Design Environment.	2
8	**Experiment-08** To create, simulate, and analyze Helix Antenna using the Ansoft HFSS Design Environment.	2
9	**Experiment-09** To create, simulate, and analyze Array Antenna using the Ansoft HFSS Design Environment	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
10	**Experiment-10** To create, simulate, and analyze Probe Feed Patch Antenna using the Ansoft HFSS Design Environment.	2
11	**Experiment-11** To create, simulate, and analyze Slot Coupled Patch Antenna using the Ansoft HFSS Design Environment.	2
12	**Experiment-12** To create, simulate, and analyze corner reflector using the Ansoft HFSS Design Environment.	2
Total Hours		**24**

Textbook :

1 Microwave Devices and Circuits, Samuel Liao, phi, 1980
2 Microwave Engineering, David Pozar, Wiley, 2009
3 Microwave Technology, Dennis Roddy, PHI, 1986
4 Microwave Engineering, Annapurna Das, Sisir K.Das, TMG, 2008

References:

1 Microstrip Circuit Analysis, Microstrip Circuit Analysis, David H. Schrader, Prentice Hall PTR, New Jersey, 1995
2 Radio-Frequency and Microwave Communication Circuits, Radio-Frequency and Microwave Communication Circuits, Devendra K. Misra, John Wiley & Sons , 2012
3 RF and Microwave Circuit and Component Design for Wireless Systems, RF and Microwave Circuit and Component Design for Wireless Systems, Kai Chang, Inder Bahl, Vijay Nair, wiley, 2001

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
20.00	20.00	30.00	15.00	10.00	5.00

Instructional Method:

1 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
2 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.

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Instructional Method:

3 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

4 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

Supplementary Resources:

1 http://www.ni.com/product-documentation/3992/en

2 https://www.keysight.com/main/editorial.jspx?cc=IN&lc=eng&ckey=2129625&id=2129625&cmpid=zzfindrfresource

3 https://www.udemy.com/rf-microwave-radio-transmission-theory-online-course- rahsoft-rahch200

4 https://rfandwireless.com/tutorials

5 https://www.qsl.net/va3iul/Files/RF_courses_lectures.htm

6 https://nptel.ac.in/courses/108101112

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