Marwadi University
Faculty of Diploma studies
Information and Communication Technology

Subject Code: 09CT0604
Subject Name: RF and Microwave Communication
Diploma Year – III (Semester VI)

Objective: The rationale behind this course is to understand RF and Microwave systems.

Credits Earned: 4 Credits

Course Outcomes: After learning this course, students should be able to,

1. Understand basic concepts and applications of microwave systems.
2. Analyze and solve problems related to microwave transmission lines.
3. Analyze and solve problems related to microwave waveguides.
4. Learn to apply use of various passive and active microwave components for different applications.
5. Understand working of microwave amplifier, oscillator, and mixer circuits.

Pre-requisite of course: Electromagnetic Theory.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term work (TW)	
3	0	2	4	50	30	20	25	25	150

Contents:

Sr No	Course content	Total Hrs.
1	**Introduction to Microwaves** History of Microwaves, Microwave frequency bands, General applications of Microwaves, Advantages of Microwaves, Microwave Propagation	03
2	**Mathematical model of Microwave Transmission** Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission	05

3	**Analysis of Microwave Transmission Lines and Waveguides** Transmission line equations & solutions, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, impedance matching, using stub line, skin effect, application of smith chart in solving transmission line problems, Introduction to strip lines**,** Micro strip lines, Rectangular and circular waveguides	**13**
4	**Microwave Network Analysis** Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters	**05**
5	**Passive and Active RF and microwave Devices** Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, Hybrid ring, Wave-guide Corners, Bends, Twists, Attenuator, Circulator, Isolator and Resonator. Microwave Active components: Tunnel diode, Varactor diodes, Step recovery diodes, Schottky Barrier diodes, PIN diodes, Gunn Diodes, IMPATT and TRAPATT diodes, Parametric Amplifiers, Microwave Transistors, Microwave oscillators and Mixers, Klystron, Magnetron	**13**
6	Microwave Frequency Measurement: Wavelength, VSWR, Attenuation and 'Q', Microwave Radiation Hazards: type and protection from hazards	**3**
	Total	**42 hrs.**

References:

1. Sanjeev Gupta, Microwave Engineering, Khanna Pub.
2. Annapurna Das, Sisir K.Das- Microwave engineering, McGraw Hill
3. David. M Pozar, Microwave Engineering, Wiley
4. Robert A Collin, Foundations of Microwave Engineering, Wiley
5. Samuel Liao, Microwave devices and circuits, PHI

Suggested Theory distribution:

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

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
40%	40%	10%	10%	0%	0%

Suggested List of Experiments:

1 Introduction and identification of microwave component.

2 Study of the characteristics of Klystron tube and to determine its electronic tuning range.

3 Study of following characteristics of Gunn Diode
    3.1 Output power and frequency as a function of voltage.
    3.2 Square wave modulation through PIN diode.
4 To determine the frequency & wavelength in a rectangular waveguide working in TE10 mode.
5 Study of function of multi hole directional coupler by measuring the following parameters:
    5.1 Main line and auxiliary line SWR
    5.2 Coupling factor and directivity.
6 To determine the standing wave ratio and reflection coefficient.
7 To measure an unknown impedance with smith chart.
8 To measure SWR of ports, isolation and coupling coefficients of Magic Tee.
9 To measure Input VSWR, Insertion loss and isolation of isolator/ circulator
10 To measure resonant frequency of Cavity resonator.
11 To study and perform the square law behavior of a microwave crystal detector.
12 Introduction to spectrum analyzer and measurement of spectrum of microwave signal using the same.

Reference Materials:

- https://nptel.ac.in/courses/108/101/108101112/
- https://nptel.ac.in/courses/117/105/117105138/
- https://www.udemy.com/course/rf-microwave-radio-transmission-theory-online-course-rahsoft-rahch200/