Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-5 (Diploma)

Subject: Microwave Engineering - DETEC15210

Type of course: Major (Core)

Prerequisite: Basic knowledge of Network Theory, Electromagnetic Field Theory (EMFT), Transmission Lines, Engineering Mathematics, and Communication Engineering.

Rationale: Microwave Engineering is essential for understanding high-frequency communication systems such as radar, satellite communication, and wireless systems. This course provides knowledge of microwave transmission lines, waveguides, components, devices, and measurement techniques, enabling students to understand real-time applications in communication and electronics industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course Content	Hrs	% Weightage
1	**Microwave Fundamentals & Transmission Lines** Microwave introduction, microwave engineering, component of microwave engineering, importance of microwave engineering, advantages, disadvantages, applications of microwave engineering, transmission line and parameters of transmission line, characteristic impedance, impedance matching, reflection co-efficient, VSWR, efficiency, voltage regulation, losses due to impedance matching and stub matching.	09	20%

2	**Microwave Waveguides** Introduction to waveguides, advantages over transmission lines, characteristics of waveguide, types of waveguide,transmission line vs. waveguide, modes of propagation (TE and TM modes)	09	20%
3	**Microwave passive components** microwave passive components such as directional couplers, waveguide junction, cavity resonator,probes, isolators and circulators, microwave tees(E plane tee, h plane tee), Microwave Technology with Different Frequencies	09	20%
4	**Microwave Devices** Microwave active devices, classification of microwave tubes and solid-state devices, construction, working principle and applications of two-cavity klystron amplifier, reflex klystron, magnetron, Gunn diode, IMPATT diode, comparison of microwave devices, advantages and limitations, applications in radar and communication systems.	09	20%
5	**Microwave Applications** Radar systems: basic principle, block diagram and applications, satellite communication systems, microwave communication links, industrial applications such as heating and drying, medical applications such as diathermy and cancer treatment, modern applications in wireless communication and sensing systems.	09	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Real-Life Application Mapping:** Students identify microwave usage around them (Wi-Fi, mobile tower, microwave oven). and explain its working principle. Upload Report on GMIU Web Portal. (Group of 3 students)	10
2	**Riding the Waves:** Students will explore why microwaves stand out—and where they fall short within the electromagnetic spectrum. Prepare a well-structured report based on their analysis. Upload Report on GMIU Web Portal (Group of 3 students)	10
3	**Innovate with Waves, Connect the Future:** Students will give a presentation on the role of microwaves in next-generation technologies, including wireless communication and smart systems. Presentation should be uploaded to the GMIU web port (Group of 3 students)	10
	Total	**30**

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	15%	10%	20%	05%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the fundamental concepts of microwave engineering,
CO2	Analyze the operation and performance of Microwave waveguides
CO3	Determine the performance parameters of microwave passive components at different microwave frequency ranges.
CO4	Explain the construction and working principles of microwave devices such as klystron, magnetron, and solid-state devices
CO5	Apply microwave engineering concepts in real-world communication systems.

List of Practical:

Sr. No	Description	Unit	Hrs
1	Study of microwave bench setup	1	2
2	Verification of reflection coefficient	1	2
3	Perform Measurement of VSWR	1	2
4	Study of standing wave pattern on transmission line	1	2
5	Frequency and wavelength measurement	1	2
6	Study of waveguide component	2	2
7	Study of E-plane and H-plane tees	2	2
8	Measurement of attenuation	3	2

9	To study Klystron characteristic	4	2
10	To analyze Gunn diode characteristic	4	2
11	To study Power measurement using detector	4	2
12	To Study of directional couple	4	2
13	To simulate one application of Microwave or Radar	5	2
14	To Study satellite orbits.	5	2
15	To calculate azimuth angle and elevation angle in satellite communication.	5	2
	Total		**30**

Instructional Method:

The course delivery method will depend on the requirements of the content and the needs of students. The teacher, in addition to conventional teaching methods by blackboard, may also use any tools such as demonstration, role play, quizzes, brainstorming, MOOCs, etc.

From the content, 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, and Virtual Laboratory

The internal evaluation will be done on the basis of the Active Learning Assignment

Practical/Viva examination will be conducted at the end of the semester for the evaluation of the performance of students in the laboratory.

Reference Books:

[1] Annapurna Das and Sisir K. Das, Microwave Engineering, New Delhi, India: Tata McGraw-Hill Education, 2013.
[2] John D. Kraus, Ronald J. Marhefka and Ahmad S. Khan, Antennas and Wave Propagation, New Delhi, India: Tata McGraw-Hill Education, 2006.
[3] Samuel Y. Liao, Microwave Devices and Circuits, New Delhi, India: Prentice Hall of India, 2003.
[4] R. E. Collin, Foundations for Microwave Engineering, New York, USA: McGraw-Hill, 2001.
[5] G. S. N. Raju, Microwave Engineering, New Delhi, India: I.K. International Publishing House, 2007.
[6] K. C. Gupta, Ramesh Garg, Inder Bahl and Prakash Bhartia, Microstrip Lines and Slotlines, Boston, USA: Artech House, 1996.