GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Electronics and Communication Engineering
Semester	VII	Version	1.0.0.0
Effective from Academic Year	2026-27	Effective for the Batch admitted in	July 2023
Course Code	2EC71PE03	Course Name	Microwave Engineering

Teaching Scheme						Examination Scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites

Basic knowledge of electromagnetic field theory, transmission lines, and high-frequency circuit concepts.

Course Outcomes

On successful completion of the course, the students will be able to:

CO1	Understand the fundamental concepts, frequency bands, propagation characteristics, and system components of microwave engineering.
CO2	Analyze transmission lines, propagation modes, waveguides, and apply Smith Chart techniques for solving microwave network problems.
CO3	Explain, compare, and evaluate the characteristics of various microwave passive and active devices used in microwave systems.
CO4	Understand radar engineering basics, analyze radar system components, radar performance parameters, and types of radar used in modern applications.

Theory Syllabus

Unit	Content	Hrs.
1	**Introduction to Microwaves:** Fundamentals of microwave engineering, evolution of microwave communication technologies, frequency spectrum allocation, and microwave bands used in satellite, radar, medical, industrial, and wireless communication systems. Microwave system block diagram, advantages and limitations of microwaves, and their major applications.	5
2	**Transmission Lines and Wave Propagation:** Electromagnetic wave equations, transmission line equations and their solutions, characteristic impedance, reflection and transmission coefficients, standing waves, and standing wave ratio. TEM, TE, and TM modes with field patterns. Smith Chart fundamentals and applications such as impedance matching, VSWR estimation, admittance analysis.	8
3	**Waveguides and Microwave Network Analysis:** Rectangular and circular waveguides, dominant and higher-order modes, cutoff conditions, Two-port Network and its parameters, Reciprocal and lossless Network, S parameters, Properties of S parameters.	10
4	**Microwave Passive & Active Components and Devices:** Waveguide tees (E-plane, H-plane, magic tee), bends, twists, corners, directional couplers, power dividers, isolators, circulators, resonators, and attenuators. Active microwave devices including PIN diode, Gunn diode, Tunnel diode, Varactor diode, Schottky diode, IMPATT and TRAPATT diodes are covered. Microwave tubes such as klystron amplifiers, reflex klystron, travelling wave tube (TWT), and magnetron.	12
5	**Microwave measurement and introduction to Radar Engineering:** Network analyzer, Spectrum analyzer, Measurement of Power, Frequency and impedance, S parameter at microwave frequency. Fundamentals of radar systems, Different types of radars such as continuous-wave radar, frequency-modulated CW radar, pulse radar, MTI radar, tracking radar, primary and secondary surveillance radars.	10

Practical Content

Practical assignments and tutorials are based on the above syllabus.

Text Books

1	Microwave and Radar Engineering, M. Kulkarni, Umesh Publication.
Reference Books	
1	Microwave Devices and Circuits, Samuel Liao, PHI.
2	Microwave engineering, Annapurna Das, Sisir K. Das, Tata McGraw-Hill Publishing.
ICT/MOOCs Reference	
1	nptel.ac.in/courses/108103141

Mapping of CO with PO and PSO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	1	1	0	0	2	1	2	3	3	2
CO2	3	3	2	3	2	0	0	0	0	1	1	2	3	3	2
CO3	3	2	3	2	2	1	1	0	1	2	1	1	3	2	3
CO4	3	2	2	2	2	1	1	1	0	2	1	2	3	2	2