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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. | **Semester: VI**

Branch: Electronics and Telecommunication Engineering | **Duration: 3 hrs.**

Course Code: 19ET6PCMWR | **Max Marks: 100**

Course: Microwave and Radar

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	**Marks**
1	a)	Derive the input impedance of a Quarter-Wave Transformer and discuss its use in impedance matching.	*CO2*	*PO1*	**10**
	b)	With neat diagrams, explain the construction and radiation patterns of (i) Horn antenna, and (ii) Parabolic reflector antenna.	*CO2*	*PO1*	**10**
		OR			
2	a)	Compare coaxial line, waveguide, and microstrip transmission line in terms of structure, losses, and frequency applicability.	*CO2*	*PO1*	**10**
	b)	Explain the working of a rectangular waveguide. Derive expressions for cutoff frequency, phase velocity, and characteristic impedance.	*CO2*	*PO1*	**10**
		UNIT - II			
3	a)	Define the Scattering Matrix (S-Matrix). Derive the S-Matrix for a 3-port lossless, matched Magic-Tee.	*CO3*	*PO2*	**10**
	b)	With necessary expressions, explain the concept of matching using Binomial and Chebyshev multisection transformers.	*CO3*	*PO2*	**10**
		OR			
4	a)	What is a signal flow graph? Use Mason's gain formula to determine the overall gain of a given microwave network.	*CO3*	*PO2*	**10**
	b)	Derive the condition for minimum reflection in a tapered transmission line. Explain briefly how it improves impedance matching.	*CO3*	*PO2*	**10**

			UNIT - III			
	5	a)	Explain the structure and S-matrix of (i) Wilkinson Power Divider, and (ii) 90° Hybrid Coupler.	*CO3*	*PO2*	**10**
		b)	With neat sketches, explain the design steps of a microwave bandpass filter using the insertion loss method.	*CO4*	*PO3*	**10**
			OR			
	6	a)	Derive expressions for two-port power gains: available gain, transducer gain, and operating power gain for RF amplifiers.	*CO3*	*PO2*	**10**
		b)	With neat block diagram, explain the working principle of a super-heterodyne receiver and the role of a mixer in it.	*CO4*	*PO3*	**10**
			UNIT - IV			
	7	a)	Derive the Radar Range Equation and explain how different parameters affect detection range.	*CO3*	*PO2*	**10**
		b)	Explain the operation of an MTI Radar and derive the expression for MTI improvement factor.	*CO4*	*PO3*	**10**
			OR			
	8	a)	Compare CW Radar and FMCW Radar. Derive the expression for range in FMCW radar with triangular modulation.	*CO3*	*PO2*	**10**
		b)	Describe the working principle of Monopulse Radar. How is angular resolution achieved in tracking radar?	*CO4*	*PO3*	**10**
			UNIT - V			
	9	a)	Explain Pulse Compression and Synthetic Aperture Radar (SAR) techniques in detail with advantages.	*CO3*	*PO2*	**10**
		b)	Define the Radar Ambiguity Function. Derive and explain its significance in radar signal design.	*CO4*	*PO3*	**10**
			OR			
	10	a)	Explain how the probability of false alarm (PFA) and detection (PD) affect radar system performance. Illustrate with Swerling models.	*CO3*	*PO2*	**10**
		b)	What is Ground Penetrating Radar (GPR)? Discuss its working, applications, and the challenges related to EM hazards.	*CO4*	*PO3*	**10**

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