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

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 22EC5PCMTA **Max Marks: 100**
Course: Microwave Theory and Antenna

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		Consider a commercial HDMI cable rated for transmission of 4K videos and Dolby Atmos sound. Identify the transmission line model for this situation and illustrate the appropriate transmission line model with the necessary circuit diagram and voltage equations.	CO2	PO2	**10**
	b		A commercial coaxial cable has a characteristic impedance of 75Ω. This cable is integrated with a load of 50-j25 Ω. What is the value of the input reflection coefficient of this line? Do pure standing waves exist on this line?	CO1	PO1	**06**
	c		List out the various applications of microwaves in both military and commercial domains	-	-	**04**
			UNIT - II			
2	a		Prove that the impedance and admittance matrices of a reciprocal network are symmetric from first principles. Imagine a 50-ohm transmission line constructed on the industry standard FR4 substrate. Would the S-matrix of this network be symmetric?	CO2	PO2	**10**
	b		Illustrate the concept and construction of a Faraday rotation isolator, with necessary sketch	-	-	**10**
			OR			
3	a		Deduce the S-matrix of a multi-hole directional coupler. Also, explain the construction and its operation	CO1	PO1	**10**
	b		A Magic-T with ports 1, 2 (collinear) and 4 (difference arm) is terminated by impedances which offer reflection coefficients Γ_1= 0.5, Γ_2 = 0.6 and Γ_4 = 0.8 respectively. If 1W power is fed at port 3 (sum arm). Calculate the power reflected at port 3 and power transmitted to other ports.	CO1	PO1	**10**
			UNIT - III			
4	a		Consider a typical commercial 4G-LTE base station which is	CO2	PO2	**10**

			connected to a mobile device through line of sight link. Derive the transmission link formula for this scenario. Clearly mention the assumptions made			
		b	Define the following Antenna parameters (i)Radiation Pattern (ii)HPBW(iii)FNBW (iv) Normalized pattern Imagine that a 4G LTE wireless network needs a narrow-beam radiation pattern. Sketch the radiation pattern for this scenario and identify the half-power beamwidth and Beam Width between first nulls	CO2	PO2	**10**
			UNIT - IV			
	5	a	A dipole antenna has a length of 1.25mm operating at 2.4 GHz. Identify the type of dipole antenna and deduce the expression for far-field component of the Electric field for this type of dipole antenna.	CO2	PO2	**12**
		b	Analyse the radiation patterns of two isotropic point sources with the following excitations: Source 1 = 43.265 W at a phase of 43 degrees and Source 2 = 43.265 W at a phase of 223 degrees. The reference axis could be assumed as per your convenience. Also, sketch the pattern when both these antennas are separated by one-half wavelength	CO2	PO2	**08**
			(OR)			
	6	a	Analyze the radiation patterns of two isotropic point sources with the following excitations: Source 1 = 1.526 W at a phase of 0.005 degrees and Source 2 = 1.526 W at a phase of 0.005 degrees. The reference axis can be assumed as per your convenience. Also, sketch the pattern when both these antennas are separated by one-half wavelength	CO2	PO2	**12**
		b	Illustrate the principle of pattern multiplication. Also, apply pattern multiplication to arrive at the far-field radiation patterns for at least two realistic cases, the antenna element is your choice	CO1	PO2	**08**
			UNIT - V			
	7	a	Deduce the far-field Electric field patterns of thin linear antenna	CO1	PO1	**10**
		b	Analyze the steps to design an inset fed patch antenna on a commercial software. Indicate the numerical values at appropriate points to realize a 2.4 GHz patch antenna	CO3	PO5	**10**

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