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

Autonomous Institute Affiliated to VTU

February / March 2023 Semester End Main Examinations

Programme: B.E. **Semester: V**
Branch: Electronics and Communication Engineering **Duration: 3 hrs.**
Course Code: 19EC5PCANT **Max Marks: 100**
Course: Antenna Theory **Date: 23.02.2023**

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

1	a)	Differentiate between :- Directivity and Gain ii) Effective Aperture & Physical Aperture	**05**
	b)	Derive the expression for received power of a radio communication link. A radio link has 15 Watts transmitter connected to an antenna of 2.5m^2, effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5 m^2 and is located at 15 KM distance from the transmitting antenna. Assuming lossless matched conditions, Find the power delivered to the receiver.	**10**
	c)	An antenna has a field pattern given by $E(\theta) = \cos\theta\cos2\theta$ for $0^0 \leq \theta \leq 90^0$ find i. Half power beam width ii. Beam width between first nulls	**05**

UNIT - II

2	a)	Obtain the expression for fields of small loop with neat diagrams.	**10**
	b)	Using poynting vector integration, derive an expression for the radiation resistance of a short electric dipole.	**10**

UNIT - III

3	a)	Explain the principle with an example, that can be used to analyze an array of non-isotropic point sources.	**04**
	b)	Analyze an array of two isotropic point sources fed with same amplitude and in phase input, spaced $\lambda/2$ apart. Find the total field E at a large distance 'r'	**08**
	c)	Derive the expression for the array factor of linear N Isotropic point sources of equal amplitude and spacing.	**08**

OR

4	a)	Analyze a suitable array system of two isotropic point sources in which the peak and null of the radiation pattern is at 180^0 and 0^0	**10**

b) An array of 4 isotropic antennas placed along a straight line. Distance between adjacent elements is half wavelength. The peak is to be obtained in a direction 60^0 from the axis of the array. What should be the phase difference between adjacent elements? Complete the pattern and find BWFN and HPBW. **10**

UNIT - IV

5 a) Explain the principle with illustrations that can be used to analyze slot antennas. **08**

b) Obtain the expression for impedance of Slot antenna in terms of complementary dipole antenna. Compute the slot impedance $\mathbf{Z_s}$, given dipole impedance $\mathbf{Z_d}=(73+j42.5)\Omega$ **12**

OR

6 a) Explain with neat diagrams the different types of rectangular and circular Horn Antennas. Considering the Pyramidal horn, explain
i) flare angle ii) Path length difference and write equations for optimum horn dimensions. **12**

b) Determine the length L, H-plane aperture, flare angles θ_E and θ_H (in E and H planes respectively) of a pyramidal horn for which E-plane aperture $a_E=10\lambda$, path length difference $\delta=0.2\lambda$in E-plane and 0.375λ in H-plane. **08**

UNIT - V

7 a) Explain the features of helical Antenna. Analyze the practical design considerations of the helical antenna with diagram. **07**

b) For a 10 turn helical antenna, find the HPBW, D and sketch the approximate beam pattern Diameter of helix = 6 cm, distance between turns = 1.5 cm. The antenna is to work at 6 GHz **06**

c) Explain how a parabolic antenna gives a highly directional pattern **07**

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