KUMARAGURU
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B.E DEGREE EXAMINATIONS: DEC 2022
(Regulation 2018)
Fifth Semester
ELECTRONICS AND COMMUNICATION ENGINEERING
U18ECT5005: Antennas and Wave Propagation

COURSE OUTCOMES
CO1: Describe different antenna parameters (K2).

CO2: Design and analyze various wire antennas (K4).

CO3: Compare different antenna arrays (K2).

CO4: Illustrate techniques used for antenna parameter measurements (K3)

CO5: Analyze the performance of aperture antennas (K4).

CO6: Identify the different types of propagation of radio waves at various frequencies. (K2)

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Find the maximum effective aperture for a beam antenna having half power beam widths of 30° and 35°?	CO1	[K$_3$]
2.	Classify the field zones associated with antenna.	CO1	[K$_2$]
3.	Solve the radiation resistance of a short dipole of length 0.3 m operating at 100 MHz.	CO2	[K$_3$]
4.	How does the helical antenna behave when pitch angle $\alpha = 0°$ and $\alpha = 90°$?	CO2	[K$_2$]
5.	Distinguish between Broadside and End-fire array.	CO3	[K$_3$]
6.	The maximum dimension of the aperture antenna is 1.5 m and the operating frequency is 900 MHz. Find the minimum distance from the transmitter to be maintained for far field radiation pattern measurement?	CO4	[K$_3$]
7.	Recall the various feeds used in reflectors?	CO5	[K$_2$]
8.	What is the required aperture area for an optimum rectangular horn antenna operating at 2 GHz with 18 dBi gain?	CO5	[K$_3$]
9.	Summarize the factors that cause attenuation in ground wave propagation.	CO6	[K$_2$]
10.	Find the maximum usable frequency of a wave having critical frequency of 30 MHz and is incident at an angle of 30°?	CO6	[K$_3$]

Answer any FIVE Questions
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Define effective aperture. Obtain the expression for the effective aperture of a simple dipole antenna.	6	CO1 [K$_3$]

b)	Deduce the expression for power received by an antenna which is separated by the distance R from the transmitting antenna. Assume that both antennas are identical. Using the above expression, evaluate the maximum power received at 0.5 km over free-space 1 GHz circuit consisting of a transmitting antenna with a 25 dB gain and a receiving antenna with a 20 dB gain? The gain is with respect to a lossless isotropic source. The transmitting antenna input is 150 W.	10	CO1	[K₃]

12.	a)	Deduce the expressions for electric and magnetic field components present in the far field region of a $\lambda/2$ antenna.	12	CO2	[K₃]
	b)	Find the directivity in dB of 20 turn helix, having pitch angle, $\alpha = 12°$ and circumference of one wave-length.	4	CO2	[K₃]

13.	a)	Illustrate the geometry of Rhombic antenna along with the design equations (Use any one design method).	8	CO2	[K₃]
	b)	Build the resultant field of a 2-element array which is fed with the current of equal magnitude and in-phase. Assume a spacing of $\lambda/2$ between the elements. Clearly indicate the directions of major lobe, and minor lobe in the radiation pattern. Also find HPBW and FNBW of the given array.	8	CO3	[K₃]

14.	a)	Explain the antenna impedance measurement technique used for frequencies below 30 MHz with necessary expressions and diagram.	8	CO4	[K₂]
	b)	Differentiate between slot and complementary dipole antenna. Also find the terminal impedance of complementary slot for a cylindrical dipole having terminal impedance of 250 + j100 ohms.	8	CO5	[K₃]

15.	a)	Elaborate the structure, working principle, and design equations of rectangular microstrip antenna. Make use of the equations, design a rectangular microstrip patch antenna operating at 5.4 GHz. Use a dielectric substrate with a relative permittivity of 2.2 and height of 1mm. Neglect fringing length.	10	CO5	[K₄]
	b)	Summarize the antennas used in mobile handsets.	6	CO5	[K₂]

16.	a)	Discuss briefly about wave propagation that is suitable at VHF band. A VHF communication is established with 50 W transmitter at 100MHz. Find the distance upto which the LOS communication may be possible if the heights of transmitting and receiving antennas are 20m and 15m.	8	CO6	[K₄]
	b)	Discuss the effects of Earth's Magnetic Field on Radio wave Propagation.	8	CO6	[K₃]

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