KUMARAGURU
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B.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Fifth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECT5005: Antennas and Wave Propagation

COURSE OUTCOMES

CO1: Describe different antenna parameters.

CO2: Design and analyze various wire antennas.

CO3: Compare different antenna arrays.

CO4: Illustrate techniques used for antenna parameter measurements.

CO5: Analyze the performance of aperture antennas.

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

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

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

1.	If an antenna has a loss resistance of 20 ohms, power gain of 10, and directivity of 12, then find its Radiation resistance.	CO1	[K$_3$]
2.	State the Reciprocity Principle and its importance in antenna theory.	CO1	[K$_1$]
3.	Find the radiation resistance of a $\lambda/16$ wire dipole in free space.	CO2	[K$_2$]
4.	Distinguish between operating modes of helical antenna.	CO2	[K$_2$]
5.	Outline the significance of the Binomial array.	CO3	[K$_2$]
6.	Find the minimum distance from the transmitter to be maintained for far-field radiation pattern measurement when the diameter of the parabolic reflector is 4 m and the operating frequency is 2 GHz.	CO4	[K$_2$]
7.	Find the power gain in dB of a paraboloidal reflector whose open-mouth aperture is 12 λ.	CO5	[K$_2$]
8.	List the types of horn antenna with the necessary diagrams.	CO5	[K$_2$]
9.	What do you mean by magneto-ionic splitting?	CO6	[K$_1$]
10.	Find the maximum distance at which signal from the transmitting antenna with 144 m height would be received by the receiving antenna of 25 m height.	CO6	[K$_2$]

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

11.	a)	Summarize the various antenna polarization and its impact on signal propagation.	6	CO1	[K2]
	b)	Relate the power received by an antenna, separated by the distance R, with the transmitting antenna. Using the above expression, calculate the power received by the antenna located at 20 Km distance when the EM wave originates from the transmitting antenna with a gain of 30 dB and radiates 70 Watts at 5 GHz. Assume that both antennas are identical.	10	CO1	[K3]
12.	a)	Build the electric and magnetic field components present in the far field region of a half-wave dipole antenna.	12	CO2	[K3]
	b)	A 16-turn helical antenna has a circumference of λ and turn spacing of $\lambda/4$. Find its half-poweream width and axial ratio.	4	CO2	[K3]
13.	a)	Illustrate the geometry and operating principle of the Yagi-Uda antenna with the necessary diagrams.	8	CO2	[K2]
	b)	Develop the resultant field of a 2-element array fed with a current of equal magnitude and out of phase. Assume a spacing of $\lambda/2$ between the elements. Also, sketch its radiation pattern and indicate the directions of maxima, minima, and null.	8	CO3	[K3]
14.	a)	Summarize the experimental procedures used for radiation pattern measurement of low and high-frequency antennas.	8	CO4	[K2]
	b)	Relate the impedances of slot and complementary dipole antennas. Also, find the terminal impedance of the complementary slot for a cylindrical dipole having a terminal impedance of $150 + j50$ ohms.	8	CO5	[K3]
15.	a)	Elaborate on the structure, working principle, and design equations of rectangular microstrip antenna. Also, design a rectangular microstrip patch antenna operating at 2.4 GHz. Use a dielectric substrate with a relative permittivity of 4.7 and height of 1mm. Neglect fringing length.	10	CO5	[K3]
	b)	Summarize the antennas used in mobile handsets.	6	CO5	[K2]
16.	a)	Apply the concept of refraction to get the expression for the refractive index and critical frequency of the ionosphere in terms of the electron number density and frequency.	12	CO6	[K3]
	b)	Distinguish between ground wave and space wave propagation.	4	CO6	[K3]

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