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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
 [AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
 Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 70049

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2025

Sixth Semester

Electronics and Communication Engineering

U19EC627 – ANTENNA AND WAVE PROPAGATION

(Regulation 2019)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Interpret the relationship between antenna Gain and Directivity.	2	K2	CO1
2.	Outline the significance of FRISS's transmission equation in antenna analysis.	2	K2	CO1
3.	Compare end fire array antenna with broadside array antenna.	2	K2	CO2
4.	What do you mean by retarded Vector potentials? Recall its expression.	2	K1	CO2
5.	How can you increase the radiation resistance of a loop antenna?	2	K2	CO3
6.	Compare network analyzer with spectrum analyzer.	2	K2	CO3
7.	State Huygen's Principle.	2	K1	CO4
8.	List the various applications of Lens Antennas.	2	K1	CO4
9.	What is meant by fading and how fading can be compensated?	2	K1	CO5
10.	Find the maximum distance that can be covered by a space wave, when the transmitting and receiving antenna heights are 40 m and 80 m respectively.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. Explain the parameters: Radiation pattern and Polarization of an antenna.	6	K2	CO1
	ii. An antenna has radiation resistance of 72Ω and loss resistance of 8Ω and power gain of 12dB. Determine the antenna efficiency and directivity.	7	K5	CO1
(OR)				
b)	i. With necessary diagrams and expressions explain the Reciprocity theorem related to antennas.	6	K2	CO1
	ii. Calculate the directivity (in dB) of the unidirectional antenna having a Power pattern $P(\theta, \Phi) = P_m \cos\theta$. ($0 \leq \theta \leq 2\pi$, and $0 \leq \phi \leq \pi/2$).	7	K3	CO1
12. a)	i. Derive the expressions for power radiated and radiation resistance of halfwave dipole antenna.	9	K2	CO2
	ii. Show that an isotropic radiator radiates 1 KW power dissipates a field of 173mV/m at a distance of 1Km.	4	K3	CO2
(OR)				
b)	i. Plot the radiation pattern of a 4 element linear broadside array with isotropic point sources with spacing $d = \lambda/4$. Also find FNBW of the array.	8	K2	CO2
	ii. Derive expressions for the field radiated by two isotropic point sources fed with current of same magnitude and phase.	5	K3	CO2
13. a)	i. Discuss in detail about Smart antennas.	7	K2	CO3
	ii. Design a three element Yagi-Uda antenna to operate at a frequency of 200 MHz.	6	K3	CO3
(OR)				
b)	i. With neat block diagram, how Gain of an antenna can be measured.	5	K2	CO3
	ii. Design a rectangular micro strip antenna using a substrate with a dielectric constant of 2.25 and operating at 9 GHz. Assume the height of Substrate is $h = 0.16$ cm.	8	K3	CO3
14. a)	Outline the significance of lens antennas at microwave frequencies. Compare the merits and demerits of lens antennas with parabolic antennas.	13	K2	CO4
(OR)				

	b)	i.	State and explain Babinet's principle.	5	K2	CO4
		ii.	With the help of field equivalence principle, derive the fields radiated by rectangular antenna.	8	K2	CO4
15.	a)	i.	Describe the structure of the atmosphere and specify the factors affecting the radio wave propagation.	8	K2	CO5
		ii.	Calculate the critical frequency for reflection at vertical incidence, if the maximum value of electron density is $1.24 \times 10^6 \text{cm}^{-3}$.	5	K3	CO5
(OR)						
	b)	i.	Why do we use high frequency waves in sky wave propagation? Explain the mechanisms of propagation.	7	K2	CO5
		ii.	A transmitter radiates 100W of power at a frequency of 50MHz, so that space wave propagation takes place. The transmitting antenna has a gain of 5 and its height is 50m. The receiving antenna height is 2m. It is estimated that field strength of 100 V/m is required to give a satisfactory result. Calculate the distance between transmitter and receiver.	6	K3	CO5

PART – C

(1 x 15 = 15Marks)

Q.No.			Questions	Marks	KL	CO
16.	a)	i.	Analyze the design considerations of rectangular horn antenna with necessary sketch. Draw various types of horn structure along with its radiation patterns.	9	K4	CO4
		ii.	Calculate the length, width and flare angles θ_E and θ_H of a pyramidal horn antenna for which the mouth height $h=10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode.	6	K3	CO4
(OR)						
	b)	i.	Analyze the design considerations and construction of parabolic reflector antennas along with necessary diagrams.	9	K4	CO4
		ii.	A parabolic antenna having a circular mouth is to have power gain of 1000 at $\lambda = 10 \text{ cm}$. Estimate the diameter of the mouth and HPBW of the antenna.	6	K3	CO4