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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: 7007**

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – MAY / JUNE 2024

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.	An antenna can be modelled as an electric dipole of length 4m at 3 MHz. If current is uniform over its length, find the radiation resistance of the antenna.	2	K1	CO1
2.	Compare near field region with far field region.	2	K1	CO1
3.	Sketch the evolution of folded dipole antenna from a short circuited transmission line.	2	K2	CO2
4.	Outline the special features of Binomial Array.	2	K2	CO2
5.	Why smart antennas are called so? Mention its merits and applications with an example.	2	K2	CO3
6.	Define anechoic chamber. Outline its importance.	2	K2	CO3
7.	Recall Huygen's principle for aperture antennas.	2	K1	CO4
8.	Compare Horn antenna and parabolic reflector antenna.	2	K2	CO4
9.	Outline the limitations of Ground Wave Propagation (GWP). Mention any two applications of GWP.	2	K2	CO5
10.	Define Line of Sight (LOS) propagation. Recall the equation for optical range of LOS propagation.	2	K1	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	i. A lossless resonant half-wavelength dipole antenna, with input impedance of 73 ohms, is connected to a transmission line whose characteristic impedance is 50 ohms. Assuming that the pattern of the antenna is given approximately by $U = B_0 \sin^3\theta$ . Find the maximum absolute gain of this antenna.	5	K3	CO1
	ii. Interpret the relationship between gain, directivity, effective length and radiation resistance of antenna.	8	K2	
(OR)				
b)	i. An antenna with a radiation resistance of 48 ohms, a loss resistance of 2 ohms, and a reactance of 50 ohms is connected to a generator with open-circuit voltage of 10 V and internal impedance of 50 ohms via a $\lambda/4$ -long transmission line with characteristic impedance of 100 ohms. a. Draw the equivalent circuit. b. Determine the power supplied by the generator. c. Determine the power radiated by the antenna.	5	K3	CO1
	ii. Derive Friis Transmission formula.	8	K4	
12. a)	Differentiate Half wave dipole with Quarter wave monopole antenna. With neat diagrams derive the field radiated from Half wave dipole antenna.	13	K3	CO2
(OR)				
b)	i. State and explain pattern multiplication principle with a diagram and example.	6	K2	CO2
	ii. Draw a neat sketch of Binomial array and explain its concept in detail. How dough-nut shaped and cubical patterns are obtained? Explain.	7		
13. a)	Draw a neat schematic of VNA (Vector Network Analyzer) and explain its blocks in detail. Differentiate VNA from Spectrum Analyzer.	13	K2	CO3
(OR)				
b)	Draw a neat sketch of rectangular microstrip patch antenna and explain its radiation mechanism. Derive its design equations using transmission model. Also, comment on its feeding techniques with equivalent circuit.	13	K2	CO3

14.	a)	i.	State and explain Babinet's principle with an example.	6	K1	CO4
		ii.	Derive the relation between the impedances $Z_s$ and $Z_d$ in slot antenna. Explain how this relation can be applicable to dipole antennas.	7		
(OR)						
	b)	Explain 1. Dielectric lens antenna 2. Offset feed parabolic reflector.		13	K1	CO4
15.	a)	Compare and contrast Ground wave, space wave and sky wave propagations. Derive the received electric field intensity for 2 ray model.		13	K1	CO5
(OR)						
	b)	i.	Define Fading. Explain the different types of fading with diagrams.	6	K1	CO5
		ii.	Enumerate the advantages and applications of multi hop propagation with diagram.	7		

### PART – C

(1 x 15 = 15 Marks)

Q.No.	Questions	Marks	KL	CO
16. a)	i. A microstrip transmission line of beryllium oxide ( $\epsilon_r = 6.8$ ) has a width-to-height ratio of $w/h = 1.5$ . Assuming that the thickness-to-height ratio is $t/h = 0$ , determine:	7	K4	CO3
	a. effective dielectric constant			
	b. characteristic impedance of the line.	8	K2	CO3
	ii. Draw a neat block diagram of microwave test bench for antenna radiation pattern measurement. Summarize the procedure in detail.			
(OR)				
b)	i. An E-plane horn is fed by an X-band WR 90 rectangular waveguide with inner dimensions of 0.9 in. (2.286 cm) and $b = 0.4$ in. (1.016 cm). Design the horn antenna so that its maximum directivity at $f_r = 11$ GHz is 30 dB.	7	K6	CO4
	ii. Explain the different types of feeding technique used in parabolic reflector antenna with neat diagrams.	8	K2	CO4