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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2023

ELECTRONICS AND COMMUNICATION ENGINEERING
V SEMESTER
EC5501 & Antennas and Wave Propagation
(Regulation 2019)

Time: 3 hrs

Max. Marks: 100

CO1	Ability to apply EM Concepts to determine antenna parameters
CO2	Ability to design and analyze aperture antennas
CO3	Ability to design and analyze weighted distribution in antenna arrays
CO4	Ability to design and analyze modern antennas
CO5	Ability to apply wave propagation concepts to atmosphere propagation

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Appling, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No	Questions	Marks	CO	BL
1	If the radiation resistance of an antenna is 65 ohms and loss resistance is 10 ohms, find its efficiency.	2	1	3
2	Find the effective area of a half-wave dipole operating at frequency 100MHz and directive gain 1.8?	2	1	3
3	What is the direction of first null of broadside 4-element isotropic antenna having a separation of $\lambda/2$?	2	3	3
4	For a 10-element binomial array with a spacing of $\lambda/2$ between the elements compute the excitation coefficients of the elements and calculate the directivity of the array.	2	3	3
5	Find the directivity of a pyramidal horn antenna with E-plane aperture width 10λ and H-plane aperture width 15λ ?	2	2	3
6	When does spillover occur in parabolic antennas? How can they be avoided?	2	2	3
7	What are adaptive antennas? Mention its applications	2	4	1
8	What are the various reconfigurations possible in antennas?	2	4	1
9	Define multi-hop propagation.	2	5	1
10	Find the MUF for the wave operating at a critical frequency 6MHz and having the skip distance d as 25km and virtual height of 100km in the ionosphere layer.	2	5	3

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No	Questions	Marks	CO	BL
11 (a)	With neat schematics, explain the configuration of an oscillating electric dipole placed at the origin and derive its far field expression and compute its radiation intensity.	13	1	3
OR				
11 (b)	Show that the radiation resistance of a half wave dipole antenna is 73Ω .	13	1	3

12 (a)	Find the array factor of a 2-element array having equal amplitudes and in phase excitation. Compute expressions for maximas and minimas of the array factor and sketch the radiation pattern for element spacing of $d=\lambda$ and $d=\lambda/2$.	13	3	3
OR				
12 (b)	Derive the expression for maxima, minima and beam width of a 'n' element uniform broad side array made with isotropic antenna elements	13	3	3
13 (a) (i)	Draw and describe any two types of horn antennas.	6	2	2
(ii)	Calculate the gain of a parabolic dish antenna of 1 m diameter and 80% efficiency at 9.5 GHz. If spillover decreases the efficiency by 5% what would be the modified gain of the antenna?	7	2	4
OR				
13 (b) (i)	With neat sketches describe the various types of feeding a microstrip patch antenna	6	2	2
(ii)	Find the length and width of a rectangular microstrip antenna using a substrate (RT/duroid 5880) with dielectric constant of 2.2, $h = 0.1588$ cm so as to resonate at 10 GHz	7	2	4
14 (a)	Describe the techniques to design bandwidth enhanced antennas	13	4	2
OR				
14 (b)	Write short notes on (a) Dielectric Resonator Antennas (b) RFID Antennas	13	4	2
15 (a) (i)	How do radio waves propagate in the troposphere? Explain with neat diagrams	10	5	2
(ii)	What is the critical frequency for reflection at vertical incidence if the maximum value of electron density is $1.24 \times 10^6 \text{ cm}^{-3}$?	3	5	3
OR				
15 (b) (i)	If the gain of a reference antenna is known explain how the gain of a antenna under test is measured with the help of neat block diagram,	10	5	2
(ii)	Two identical antennas operating at 2.4 GHz are used to measure their gains. With the transmit power set to 1 W, the power received by the receive antenna kept at a distance of 25 m is -8 dBm. Calculate the gain of the antennas.	3	5	3

PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No	Questions	Marks	CO	BL
16.	Synthesize the excitation for a 4-element, broadside array of isotropic elements spaced $\lambda/2$ apart, that has an array factor with all the side lobes 25 dB below the main lobe.	15	3	5

