Reg. No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

ELECTRONICS AND COMMUNICATION ENGINEERING
Fifth Semester
EC5501 - ANTENNAS AND WAVE PROPAGATION
(Regulation 2019)

Time:3hrs 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-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

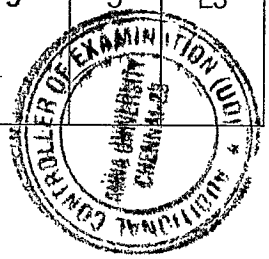
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Define directivity and effective aperture of an antenna	2	1	L1
2	An antenna has directivity of 16 dB, calculate the maximum effective aperture of the antenna operating at 10GHz.	2	1	L2
3	A uniform linear array is required to produce an end-fire beam when it is operated at a frequency of 5 GHz. It contains 60 radiators and are spaced at 0.5λ. Find the progressive phase shift required to produce the end-fire beam. Find the array length.	2	2	L2
4	Obtain the excitation co-efficient of 10 element binomial array and find the array factor.	2	2	L2
5	Compare uniform and tapered apertures.	2	3	L1
6	Find the complementary slot impedance when the dipole impedance is, $Z_d = (50 + j\,75)\Omega$	2	3	L2
7	A UWB antenna operates over a frequency range of 3 GHz to 10.5 GHz. Calculate the fractional bandwidth of this antenna.	2	4	L2
8	List the gain enhancement techniques for modern antennas.	2	4	L1
9	Distinguish clearly between 'ground wave', 'surface wave', 'space wave' and 'Ionospheric wave'.	2	5	L1
10	What is the critical frequency for reflection at vertical incidence if the maximum value of electron density is $1.24 \times 10^6 cm^{-3}$.	2	5	L2

PART- B (5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	i. Analyse and Prove that the radiation resistance of a half wave dipole antenna is 73Ω.	10	1	L4
	ii. Explain how fields are detached from oscillating dipole.	3	1	L3
	OR			
11 (b)	i. Explain the operation and analse the design equations of (a)Yagi Uda Array (5) (b) Spiral antenna (5)	10	1	L4
	ii. Design a Log Periodic Dipole Antenna, to obtain the gain of 9 dB and to operate over a frequency range of 130 MHz - 505 MHz. LPDA having scale factor, $\tau = 0.6$ and spacing factor, $\sigma=0.15$	3	1	L3
12 (a)	i. Consider an N-element uniform linear antenna array with the distance between any two consecutive elements $d=\lambda/2$. The excitation currents of all the elements have equal magnitude and a progressive phase shift of α. Derive the array factor of the array and identify the angle of major lobe, first null, HPBW and first minor location.	10	2	L3
	ii. An array of isotropic radiators is operated at a frequency of 5GHz and is required to produce broadside beam. Find the HPBW and BWFN, if the array length is 10m.	3	2	L3
	OR			
12 (b)	i. State the principle and explain about Pattern Multiplication and find the radiation pattern of 8 isotropic elements fed in phase, spaced $\lambda/2$ apart.	10	2	L3
	ii. What is Pattern synthesis and discuss its requirements?	3	2	L3
13 (a)	i. With neat diagram explain about Horn antenna and derive its design equations	10	3	L2
	ii. Find out the length L, and half flare angles Θ_H and Θ_E of a pyramidal horn antenna for which the mouth height $h = 12\lambda$, and path length difference δ is 0.2λ The horn is fed by a rectangular waveguide with TE_{10} mode.	3	3	L3
	OR			
13 (b)	i. Discuss and analyse the constructional details, principle of operation and feeding types of the Parabolic reflector antenna.	10	3	L2
	ii. Analyze the types of exciting methods of the microstrip patch antenna	3	3	L3
14 (a)	i. Discuss about Phased array antennas and smart antennas in detail.	13	4	L3
	OR			
14 (b)	ii. How can reconfigurable antennas improve the performance of wireless communication systems? Elaborate the key techniques used to enable frequency, pattern, and polarization reconfiguration in antenna design.	13	4	L3

15 (a)	i. With block diagrams explain the operation of Spectrum analyzer.	8	5	L2
	ii. Draw and analyze the experiment setup for measurement of Radiation pattern of Horn Antenna.	5	5	L3
	OR			
15 (b)	i. Explain with the aid of a diagram, how multi-path transmission can arise of a long distance high frequency point to point service? What steps can be taken to minimize the effects of multi-path transmission? Explain how the D-layer and sporadic E layer affect long distance radio communication.	8	5	L2
	ii. A high frequency radio link has to be established between two points at a distance of 2500 Km on earth's surface. Considering the ionospheric height is to be 200km and its critical frequency is 5 MHz. Calculate the MUF for the given path.	5	5	L3



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

Q.No.	Questions	Marks	CO	BL
16.	i. Analyze and derive the expression for near and far fields of an oscillating dipole.	11	1	L3
	ii. An RFID system operates at a frequency of 915 MHz and is used to track inventory in a warehouse. The RFID reader has an output power of 2 W, and the gain of the reader antenna is 4. The RFID tag has a minimum detectable power threshold of 30 μW, and the gain of the tag antenna is 2. Assume free-space propagation, and Analyze using the Friis transmission formula to evaluate the maximum read range between the reader and the tag.	4	1	L5