KUMARAGURU
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Register Number:……

M.E. DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

COMMUNICATION SYSTEMS

P18COI2202: Advanced Radiation Systems

COURSE OUTCOMES

CO1: Analyze radiation fields of alternating current element and half wave dipole antennas.

CO2: Design and analyze antenna arrays for the given specification.

CO3: Compare different types of aperture antennas.

CO4: Analyze various types of microwave antennas.

CO5: Select appropriate antenna for a given applications.

CO6: Design, operate and analyze the characteristics of various antennas.

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The beam width for a half wave dipole antenna is _____. CO1 [K_1]

   a) 45° b) 90°

   c) 180° d) 245°

2. The side lobe level should be _____ to make Dolph Chebyshev to binomial array. CO2 [K_1]

   a) 0 dB b) 1 dB

   c) 10dB d) -∞ dB

3. _____is the key feature of the Chebyshev array. CO2 [K_2

   a) Have constant side lobes and elements are placed uniformly b) Have varying side lobes and elements are placed uniformly

   c) Minor lobes are present at $|x| > 1$ d) Major lobes are present at $|x| < 1$

4. Matching type item with multiple choice code CO1 [K_2

List I	List II
A. Average Power (P_{av})	i. 1.64
B. Directive gain	ii. $20\pi^2 (L/\lambda)^2$

C. Directivity (λ/2 dipole)	iii. $P_r/4\pi r^2$
D. Radiation resistance of a short dipole	iv.1

a) A-iii, B-iv, C-i, D-ii
b) A-i, B-ii, C-iii, D-iv
c) A-ii, B-iii, C-i, D-iv
d) A-iv, B-i, C-iii, D-ii

5. _____ is used to reduce side lobe levels in aperture antenna. CO3 [K1]
a) Reducing power
b) Increasing the power
c) Using repeaters
d) Tapering

6. For aperture antenna to be efficient and have high directivity, its area should be _____. CO3 [K1]
a) $\geq \lambda^2$
b) $\leq \lambda^2$
c) $\geq 1/\lambda$
d) $\leq \lambda$

7. _____ is used to excite to radiate the microstrip patch antenna. CO4 [K1]
a) Substrate
b) Ground plane
c) Feed line
d) Patch

8. _____ feed line contains two different substrates separated by a ground plane. CO4 [K1]
a) Microstrip line feed
b) Coaxial feed
c) Aperture coupling
d) Proximity Coupling

9. In MIMO, _____ factor has the greatest influence on data rates. CO5 [K1]
a) the size of antenna
b) the number of transmit antennas
c) the height of the antenna
d) the area of receive antennas

10. Interference with adjoining sectorized antenna can be avoided by _____. CO4 [K2]
a) Frequency nulling
b) Frequency beam forming
c) Spatial beam – forming
d) Spatial nulling

PART B (10 x 2 = 20 Marks)

11. What is beam efficiency? CO1 [K1]
12. Define directivity and what is the directivity of an isotropic antenna? CO1 [K2]
13. Differentiate FNBW and HPBW. CO2 [K2]
14. Why is the phased array called as the scanning array? CO2 [K2]
15. What is aperture blockage? CO3 [K1]
16. Calculate the power gain in decibels of an optimum horn antenna whose one side of a square aperture is 10λ. CO3 [K2]

17.	State Babinet's principle.		CO4	[K_2]
18.	Analyze the feeding techniques used in patch antennas.		CO4	[K_2]
19.	List the advantages and disadvantages of Vivaldi antenna.		CO5	[K_1]
20.	Which planar antenna is preferable for mobile stations? Outline the methods to increase the bandwidth of PIFA.		CO5	[K_2]

PART C (6 x 5 = 30 Marks)

21.	State and derive Lorentz reciprocity theorem for the receiving antennas.	5	CO1	[K_3]
22.	Illustrate Schelkunoff Polynomial Method for antenna synthesis.	5	CO2	[K_2]
23.	Write short notes on field equivalence principle and uniform aperture distribution on slot antenna.	5	CO3	[K_2]
24.	Describe the radiation principle of a rectangular patch antenna with a neat diagram.	5	CO4	[K_2]
25.	Illustrate the excitation of rectangular patch and input impedance with appropriate diagram.	5	CO4	[K_2]
26.	Interpret the features of Vivaldi antenna.	5	CO5	[K_4]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27.	Design a half-wave dipole antenna to have a radiation resistance of 73Ω at a distant point P. Obtain the electric, magnetic fields, power and radiation resistance.	10	CO1	[K_3]
28.	Explain the structure of phased array and explain its elements.	10	CO2	[K_2]
29.	Discuss the working of parabolic reflector antenna with neat diagram.	10	CO3	[K_3]
30.	Explain the design procedure involved in the microstrip array and feed network design.	10	CO4	[K_2]
31.	(a) Write short notes on UWB antenna. (b) Discuss the features of MIMO antenna.	5 5	CO5	[K_2]

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