KUMARAGURU college of technology
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Register Number:……..…

M.E DEGREE EXAMINATIONS: JUNE 2018

(Regulation 2015)

Second Semester

COMMUNICATION SYSTEMS

P15COT203 : Advanced Radiation Systems

COURSE OUTCOMES

CO1: Describe the various types of microwave antennas.

CO2: Compare the various types of antenna arrays.

CO3: Design of patch antennas for given set of parameters.

CO4: Analyze and compare various types of antennas.

CO5: Compare various polarizations of Electro-magnetic fields emitted by the antennas.

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. When an electromagnetic wave travels from transmitter to receiver, which factor/s affect/s the propagation level? CO4 [K_2]

   a) Curvature of earth b) Roughness of earth

   c) Magnetic field of earth d) All of the above

2. Among the sequences, which is the correct sequence for determining the field due to current J? The components are (i) Current Source J, (ii) Electric Field, (iii) Magnetic Field, (iv) Electric vector Potential , (v) Magnetic vector Potential CO4 [K_2]

   a) i – iv – ii – iii b) i – v – iii - ii

   c) i – iv – iii – ii d) i – v – ii - iii

3. Match list I with list II and select the correct answer using the codes given below. CO2 [K_2]

List I	List II
A. HPBW of end fire array	1. 1.789 [4(L/λ)]
B. BWFN of broadside array	2. $2\sin^{-1}(\pm\sqrt{N}\lambda/2nd)$
C. Increased directivity of end fire array	3. $57.3°\sqrt{2}/ L/\lambda$
D. Minor lobe minima of end fire array	4. 114.6 / L/λ

a) 2 1 3 4 b) 3 4 1 2

c) 2 3 4 1 d) 3 1 2 4

4. Consider the following statements with respect to binomial array. CO2 [K_2]

1. Design of large binomial array requires larger amplitude ratio of sources.
2. HPBW of binomial array is more than that of uniform array for the same length of array.
3. Directivity of binomial array is lesser than uniform array.
4. In binomial array, secondary lobes can be eliminated if the spacing between the adjacent sources exceeds $\lambda/2$.

Which of these statements are correct?

a) 1,2,3 b) 1,3

c) 3,4 d) 2,4

5. The relation between terminal impedance of screen Z_s and complimentary screen Z_c immersed in a medium with intrinsic impedance η is…. CO4 [K_2]

a) $Z_s\, Z_{c=} \eta^2/4$ b) $Z_s\, Z_{c=} \eta^2$

c) $Z_s\, Z_{c=} \eta$ d) $Z_s\, /Z_{c=} \eta^2/2$

6. The following items consist of two statements, one labeled as the "Assertion (A)" and the other as "Reason (R). Examine those two statements carefully and select the answers to these items using the codes given below: CO4 [K_2]

Assertion (A) : If the dipole is inductive, slot antenna is capacitive and vice versa.

Reason (R) : Lengthening of a $\lambda/2$ antenna makes it more inductive and lengthening of a $\lambda/2$ slot makes it more capacitive.

a) both A and R are individually true and R is the correct explanation of A
b) both A and R are individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

7. Consider the following points with respect to horn antenna. CO4 [K_2]

1. Pyramidal horn half-power beam width in both the *E*- and *H*-planes is about 18°.
2. Horn antennas are extensively used at ultrahigh frequencies under the condition that power gain needed is moderate.
3. Corrugated horn reduces the diffractions at the edges of the aperture by minimizing the incident field.
4. Aperture-matched horn provides significantly better performance than an ordinary horn (in terms of pattern, impedance, and frequency characteristics)

Which of these statements are correct?

a) 2,4 b) 1,2

c) 1,3 d) 3,4

8. Match list I with list II and select the correct answer using the codes given below. CO3 [K_2]

List I	List II
A. Microstrip patch antenna	1. Pyramidal Horn
B. Parabolic reflector antenna	2. Space craft applications
C. Optical Telescopes	3. Spherical to plane wave conversion
D. Feed for reflectors	4. Cassegrain dual reflector system

a) 2 1 3 4 b) 3 4 1 2

c) 2 3 4 1 d) 3 1 2 4

9. The Stokes vector for Linearly Polarized wave in vertical direction is CO5 [K_3]

a) $\begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$ b) $\begin{bmatrix} 1 \\ -1 \\ 0 \\ 0 \end{bmatrix}$

c) $\begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$ d) $\begin{bmatrix} 1 \\ 0 \\ -1 \\ 0 \end{bmatrix}$

10. Cellular communication systems produce an electric field vector 45° to the horizontal. What kind of polarization is this? CO5 [K_3]

a) Elliptical polarization b) Circular polarization

c) Random polarization d) Linear polarization

PART B (10 x 2 = 20 Marks)

11. Define directivity and what is the directivity of an isotropic antenna? CO4 [K_2]

12. Summarize the principle of planar antenna. CO4 [K_2]

13. Calculate the half power points for arrays of two point sources of same amplitude but opposite phase spaced $\lambda/2$ apart. CO2 [K_3]

14. What is antenna synthesis? List out synthesis methods. CO2 [K_2]

15. Define the duality principle. CO4 [K_2]

16. State Babinet's Principle. CO4 [K_2]

17. List the feeding methods of microstrip antennas and draw any two of it. CO3 [K_2]

18. Define spillover & taper efficiencies. CO1 [K_2]

19. An EM wave has the following components: $E_x = 2 \cos \omega t$, $E_y = 2 \cos(\omega t + 90°)$. Determine the following, a) Axial ratio b) Polarization type CO5 [K_3]

20. Review any two Spherical Trigonometry relations. CO5 [K_2]

PART C (6 x 5 = 30 Marks)

21.	Derive the expressions for field components of a half wave dipole antenna.	CO2	[K_3]
22.	Derive the directivity expression of Endfire array.	CO2	[K_3]
23.	Prove that slots and dipoles are dual antennas.	CO4	[K_3]
24.	Design a rectangular Micro strip antenna using a substrate with dielectric constant of 2.2, h = 0.1588 cm so as to resonate at 2.45 GHz.	CO3	[K_4]
25.	Discuss the working principle of Parabolic reflector antenna with neat diagram.	CO1	[K_2]
26.	Differentiate various types of polarization.	CO5	[K_3]

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

27.	Determine the electric field & magnetic field components radiated by an alternating current element.	CO4	[K_3]
28.	It is given that beam width between first nulls equal to 45˚, the number of elements in the array equal to 8,spacing between any two adjacent antennas equal to λ/2.Determine Dolph- Tchebyscheff distribution which yields the optimum pattern.	CO2	[K_4]
29.	Explain in detail about Fraunhoffer & Fresnel diffraction with a neat sketch. Also mention the properties of Cornu's spiral.	CO4	[K_2]
30.	Discuss the basic principle and obtain the expressions for fields radiated by an E plane horn antenna.	CO1	[K_2]
31.	Describe in detail the Poincare sphere representation of wave polarization.	CO5	[K_2]

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