



B.E DEGREE EXAMINATIONS: MAY 2018

(Regulation 2015)

Sixth Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U15ECT604:Antennas and Wave Propagation

COURSE OUTCOMES

- CO1:** Describe the various antenna parameters
CO2: Design and analyze various wire antennas
CO3: Compare different antenna arrays
CO4: Illustrate techniques used for antenna parameter measurements
CO5: Analyze the performance of aperture and lens antennas
CO6: Discuss radio wave propagation

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match list I with list II and select the correct answer using the codes given below

CO1 [K₂]

List I	List II
A. radiation pattern	i. direction of maximum radiation
B. major lobe	ii. polar diagram
C. beam width	iii. isotropic radiator
D. point source	iv. degrees

- | | A | B | C | D |
|----|-----|----|-----|-----|
| a) | ii | i | iii | iv |
| b) | iii | iv | ii | i |
| c) | ii | i | iv | iii |
| d) | iii | i | ii | iv |
2. The intrinsic impedance of free space $\eta_0 =$

CO1 [K₂]

- | | |
|-----------------|----------------|
| a) 377 Ω | b) 73 Ω |
| c) 120 Ω | d) Zero |

3. Which of these statements are correct? CO1 [K₂]
1. A half wave dipole has a length greater than a hertzian dipole.
 2. Yagi uda antenna has a unidirectional radiation pattern
 3. Directional term for half wave dipole electric field is $\tan(\pi/2\cos\theta)/\sin\theta$
 4. V antenna is not a wire antenna
- a) 1,3 b) 1,4
 c) 1,2 d) 2,3
4. Field Components present in the far field region of half wave dipole are CO2 [K₂]
- a) E_r, E_θ, H_ϕ b) E_r, E_ϕ, H_θ
 c) E_θ, H_ϕ d) E_ϕ, H_θ
5. Assertion (A): Arrays of antennas are formed to improve the performance of antennas CO3 [K₂]
 Reason (R): one of the performance improvement is increased directive gain
- 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
6. The formula for total field strength E_T of a two point source element array of equal in amplitude and same phase, at a far away distance is CO3 [K₂]
- a) $E_T = 2 E \sin(\psi/2)$ where $\psi = 2\pi/\lambda d \cos\theta$ b) $E_T = 2 E \cos(\psi/2)$ where $\psi = 2\pi/\lambda d \cos\theta$
 c) $E_T = 2 E \tan(\psi/2)$ where $\psi = 2\pi/\lambda d \cos\theta$ d) $E_T = 2 E \secant(\psi/2)$ where $\psi = 2\pi/\lambda d \cos\theta$
7. Arrange antennas based on the frequency of operation from low frequency, very high frequency, ultra high frequency, microwave frequency CO5 [K₂]
- 4- lens antenna, 3-yagi uda antenna, 2-microstrip antenna, 1-dipole antenna
- a) 2-3-4-1 b) 1-3-2-4
 c) 3-4-2-1 d) 4-1-3-2
8. Parabolic reflector is also called as CO5 [K₂]
- a) Binomial antenna b) Slot antenna
 c) Dielectric antenna d) Dish antenna
9. Assertion (A): For space wave propagation the wave travels from transmitting antenna to receiving antenna in direct or straight line. CO6 [K₂]
 Reason (R): Also ray travels from transmitting to receiving antenna after bouncing or hopping on the ground.

- 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
10. As the ray travels through the sky CO6 [K₂]
- a) The ionosphere do not have any effect on the fields b) Frequency of operation does not produce change in the propagating wave.
- c) Even though there is dense Ions in the sky they do not affect the electromagnetic waves d) The ray and electric field gets affected due to the Ions in the Ionosphere.

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Write the importance of radiation resistance of an antenna. CO1 [K₂]
12. What is FRIIs transmission formula? CO1 [K₂]
13. Mention the applications of travelling wave antenna. CO2 [K₂]
14. Draw the structure of a 3 element Yagi Uda antenna and specify the length of the elements and spacing between the elements in terms of wave length. CO2 [K₂]
15. What are the different type's antenna arrays? CO3 [K₂]
16. Write the principle of pattern multiplication. CO3 [K₂]
17. What is the principle used to measure radiation pattern of an antenna? CO4 [K₂]
18. What are the different types of horn antenna? CO5 [K₂]
19. Define critical frequency of an ionized layer. CO6 [K₂]
20. What are the two types of space wave components? CO6 [K₂]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. (i) Explain the following terms with respect to antenna. (8) CO1 [K₂]
- (1) Radiation pattern (3) Radiation intensity
- (2) directive gain (4) Beam width
- (ii) State and prove reciprocity principle with regard to antennas. (6)

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|--|-----|-------------------|
| 22. Derive the expressions for Electric field and magnetic field components from magnetic vector potential for a Hertzian dipole antenna. | CO2 | [K ₂] |
| 23. Derive the expression for total electric field for an array of two point sources with equal amplitude and same phase. Also obtain its radiation pattern. | CO3 | [K ₂] |
| 24. Explain antenna gain measurement technique with necessary expression. | CO4 | [K ₂] |
| 25. Draw the structure and radiation pattern of Rhombic antenna and explain its operation, design equation and applications. | CO2 | [K ₂] |
| 26. Explain the principle of parabolic reflector antenna and discuss on different types of feeds used with neat diagram. | CO5 | [K ₂] |
| 27. Explain the characteristics of different ionized regions of Ionosphere, drawing the structure above the earth. | CO6 | [K ₂] |
