

Reg. No. :

**Question Paper Code : 71739**

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Sixth Semester

Electronics and Communication Engineering

EC 6602 — ANTENNA AND WAVE PROPAGATION

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Determine the electric field intensity at a distance of 10 km from a dipole antenna of directive gain of 6 dB and radiating power of 20 kW.
2. Define gain of an antenna. Mention the relationship between gain and aperture of an antenna.
3. Using pattern multiplication find the radiation pattern for the broadside array of 4 elements, spacing between each element is  $\lambda/2$ .
4. Draw the radiation pattern of an isotropic point sources of same amplitude and same phase that are  $\lambda/2$  apart along X axis symmetric with respect to origin.
5. What are the different types of horn antenna?
6. State Rumsey principle.
7. Mention any four advantages of microstrip antenna.
8. Draw the radiation pattern for isotropic, directional and omnidirectional antenna.
9. Define critical frequency.
10. Draw the various layers of atmospheric structure.

PART B — (5 × 16 = 80 marks)

11. (a) Derive an expression for the power radiated by the current element and calculate the radiation resistance. (16)

Or

- (b) Derive an expression for the far field component of a half wave dipole of an antenna. (16)

12. (a) (i) Explain the principle of reflector antenna and the different types of feed used in a reflector antenna. (10)  
(ii) Explain the working principle of microstrip patch antenna. (6)

Or

- (b) (i) A pyramidal horn antenna with the aperture length of  $10 \lambda$  cm is fed by a rectangular waveguide in  $TE_{10}$  mode. Determine the design parameters of the antenna operating at 2.5 GHz. (10)  
(ii) Compare the slot and dipole antenna. (6)

13. (a) Derive and draw the radiation pattern of 4 isotropic sources of equal amplitude and same phase. (16)

Or

- (b) (i) Describe the principle of phased arrays and explain how it is used in beam forming. (10)  
(ii) Write short notes on binomial arrays. (6)

14. (a) Design a log periodic dipole antenna to cover all the VHF TV channels from 55 MHz to 220 MHz. The required directivity is 9 dB and input impedance is  $50 \Omega$ . The elements should be made of aluminum tubing with 2.0 cm outside diameters for the largest element and the feeder line and 0.48 cm for the smallest element. These diameters yield identical  $(l/d)$  ratios for smallest and largest elements. (16)

Or

- (b) (i) Show the experimental setup for measuring the unknown load impedance using VSWR method and explain. (8)  
(ii) Explain the concept of electronic band gap structure and give any four applications of EBG. (8)

15. (a) Explain how the EM waves are propagated in troposphere layer and discuss the principle of troposcatter propagation. (8 + 8)

Or

- (b) (i) Explain the effect of EM waves in curved earth and flat earth configuration. (8)  
(ii) A mobile link has to be established between two points spaced away 1500 km via ionosphere layer of density  $4.5 \times 10^6 \text{ cm}^{-3}$  at a height 150 km. Calculate the maximum frequency which can be communicated, critical frequency and skip distance. (8)