

(3 Hours)

(Maximum Marks 80)

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1. Question No. 1 is Compulsory.
  2. Attempt any 3 questions out of remaining 5.
  3. Assume suitable data if necessary.
  4. Figures to the right indicate the maximum marks.

- Q.1 a) A lossless resonant half-wavelength dipole antenna, with input impedance of 73 ohms, is connected to a transmission line whose characteristic impedance is 50 ohms. Assuming that the pattern of the antenna is given approximately by  $U = B_0 \sin^3 \theta$ . find the maximum absolute gain of this antenna. 05
- b) List salient features of Microstrip antenna. 05
- c) Draw current distribution and radiation pattern of  $0.1\lambda$ ,  $0.5\lambda$ ,  $\lambda$  and  $3\lambda$  simple dipole antenna. 05
- d) What is grating lobe in broadside and end-fire array antenna, how it can be minimized in both. 05
- Q2 a) What is the significance of beamwidth of antenna? If HPBW of directional antenna in E-plane and H-plane is  $30^\circ$  and  $45^\circ$  respectively, calculate directivity and gain of the same antenna. (Assume radiation efficiency = 55%) 10
- b) With neat sketch explain parabolic reflector antenna. List feed mechanism used. 10
- Q.3 a) Derive expressions of radiation resistance of half wavelength dipole antenna. Why, actual length of half wavelength dipole antenna is lies between  $0.47\lambda$  to  $0.48\lambda$  instead of  $0.5\lambda$ . 10
- b) With neat diagram derive important parameters of helical antenna in axial mode. What is the effect of change in length and circumference of the same on the radiation pattern? 10
- Q.4 a) What is pattern multiplication of array antenna, if two isotropic point sources of array are  $\lambda/4$  distance apart and if they fed with equal amplitude and  $\pi/2$  phase, draw radiation pattern of the same. 10
- b) Design 10-element binomial array with a spacing of  $\lambda/2$  between the elements. Determine amplitude distribution of all elements; also calculate the half-power beamwidth (in degrees) and the maximum directivity (in dB). 10
- Q.5 a) Design rectangular microstrip antenna for 2.4 GHz frequency application using Rogers RT/Duroid 5880 substrate with thickness of 1.6 mm. 10
- b) Describe formation of ionized layer in the ionosphere and describe their importance in radio communication. Define critical frequency. 10
- Q.6 Write short notes on (any four)
- a) Polarization measurements. 05
  - b) Ground wave propagation. 05
  - c) Phased (Scanning) Array. 05
  - d) Log-periodic antenna. 05
  - e) Horn antenna. 05