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10EC64

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Antennas and Propagation

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
atleast TWO questions from each part.**

PART – A

- 1 a. Define the following with respect to antenna :
 - i) Directivity
 - ii) Radiation pattern
 - iii) Effective aperture
 - iv) Antenna field zones. (08 Marks)
- b. Derive the relation between maximum effective aperture and directivity. (06 Marks)
- c. The effective apertures of transmitting and receiving antennas in a communication system are $8\lambda^2$ and $12\lambda^2$ respectively, with a separation of 1.5km between them. The electromagnetic wave is travelling with a frequency of 6MHz and the total input power is 25KW. Find the power received by the receiving antenna. (06 Marks)

- 2 a. Derive an expression for the total field and plot the field pattern for two isotropic point sources with same amplitude and equal phase spaced $\lambda/2$ apart. (08 Marks)
- b. A linear array consists of 4 isotropic point sources. The distance between the adjacent elements is $\lambda/2$. The power is applied with equal magnitudes and a phase difference – dr. Obtain the field pattern and find BWFN (Beam width first Null) and HPBW. (08 Marks)
- c. What are broadside and End fire arrays. (04 Marks)

- 3 a. A magnetic field strength of $5\mu\text{A/m}$ is required at a point on $\theta = \pi/2$, 2km away from an antenna in free space. Neglecting ohmic loss, how much power must the antenna transmit if it is,
 - i) A hertzian dipole of length $\lambda/25$?
 - ii) A half wave dipole?
 - iii) A quarter wave monopole? (08 Marks)
- b. Derive the radiation resistance of short dipole. (06 Marks)
- c. Explain basic concept of folded dipole antenna and show how impedance transformation is possible using folded dipole. (06 Marks)

- 4 a. Derive an expression for the far field components of a loop antenna. (08 Marks)
- b. Show that the radiation resistance of a small loop antenna consisting 'N' turns is given by

$$R_{\text{rad}} = 31200 \left(\frac{NA}{\lambda^2} \right)^2 \Omega.$$
 (08 Marks)
- c. Write short notes on slot antenna. (04 Marks)

PART – B

- 5 a. Explain with a neat figure the working of a Yagi-uda antenna. Mention the general characteristics and salient features of Yagi – uda antenna. (10 Marks)
- b. A parabolic dish provides a power gain of 50dB at 10 GHz with 70% efficiency. Find out,
 - i) HPBW
 - ii) BWFN
 - iii) Diameter. (06 Marks)
- c. Write a note on Lens antenna. (04 Marks)

- 6 a. Write a note on :
- i) Ultra wideband antennas (08 Marks)
 - ii) Turnstile antenna. (08 Marks)
- b. Discuss the design considerations of an antenna used for satellite communications. (04 Marks)
- c. Discuss briefly about antennas for ground penetrating radar. (08 Marks)
- 7 a. Describe ground wave propagation. (06 Marks)
- b. Derive an expression for resultant electric field strength (E_R) at a point due to space wave propagation. (06 Marks)
- c. The transmitting and receiving antennas with heights 50metre and 25metre are used to establish a communication link at 150MHz with 100 watts power of transmission. Determine : i) LOS distance ii) strength of received signal. (06 Marks)
- 8 a. Define Maximum Usable Frequency (f_{MUF}). Derive an expression of f_{MUF} for curved surface of earth. (08 Marks)
- b. Explain skip distance. Derive an expression for skip distance (D), for flat earth surface. (06 Marks)
- c. Assume that reflection takes place at a height of 400 km and that the maximum electron density in the ionosphere corresponds to a 0.9 refractive index at 10 MHz. What will be the range for which MUF is 10 MHz? i) for flat earth ii) for curved earth. (06 Marks)
