USN | | | | | | | | | | |

06EC64

Sixth Semester B.E. Degree Examination, June/July 2017
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 element is $\lambda/2$. The power is applied with equal magnitudes and a phase differences –dr Obtain the field pattern and find BWFN and HPBW. **(08 Marks)**

c. What are Broad side and End fire arrays? **(04 Marks)**

3 a. Show that the maximum effective aperture of short dipole is equal to $0.119\ \lambda^2$ or D = 1.5 and hence show that the directivity of short dipole is 50% more than an isotropic radiator. **(10 Marks)**

b. A magnetic field strength of $5\mu A/m$ is required at a point on $\theta = \pi/2$ and 2km away from an antenna in free space. Neglecting ohmic loss, how much power must the antenna transmits if it is i) a hertzian dipole of length $\lambda/25$? ii) a half wave dipole iii) a quarter wave monopole? **(10 Marks)**

4 a. Derive an expression for the far field components of a loop antenna. **(10 Marks)**

b. Show that the radiation resistance of a small loop antenna consisting of 'N' terms is given by $R_{rad} = 31200\left(\frac{NA}{\lambda^2}\right)^2\ \Omega$. **(10 Marks)**

PART - B

5 a. Explain Babinet's principle with illustrations. **(08 Marks)**

b. Derive an equation for the impedance of slot antenna. **(08 Marks)**

c. Write a short note on Slot antenna. **(04 Marks)**

6 a. Write notes on :
i) Ultra wide band antennas ii) Turnstile antenna. **(10 Marks)**

b. Discuss the design considerations of an antenna used for satellite communications. **(10 Marks)**

7 a. Describe Ground wave propagation. **(08 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 50 meter and 25 meter are used to establish a communication link at 150 MHz 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 400km and that the maximum electron density in the ionosphere corresponds to a 0.9 refractive index at 10MHz. What will be the range for which MUF is 10MHZ?

i) For Flat earth ii) For curved earth. **(06 Marks)**

*****