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

10TE63

Sixth Semester B.E. Degree Examination, June/July 2018
Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State and explain the following terms as applied to antennas.
i) Directivity ii) Effective height. **(08 Marks)**

b. An antenna has a field patterns given by $E(\theta) = \cos\theta \cos 2\theta$ for $0° \le \theta \le 90°$. Find :
i) The half–power beam width (HPBW) and
ii) The beam width between first nulls (FNBW). **(06 Marks)**

c. Derive Frii's transmission formula. **(06 Marks)**

2 a. State and prove the power theorem. **(05 Marks)**

b. Find the directivity for the bidirectional sine pattern. **(05 Marks)**

c. Derive an expression and draw the field pattern for isotropic point sources of the same amplitude and same phase spaced $\frac{\lambda}{2}$ apart. **(10 Marks)**

3 a. Calculate the value of radiation resistance is the case of a short dipole. **(06 Marks)**

b. Write salient features of folded dipole antenna. **(08 Marks)**

c. A short vertical grounded antenna operates at 900KHz. If the effective height is 30m. Find its radiation resistance. **(06 Marks)**

4 a. State and illustrate Babinet's principle. **(06 Marks)**

b. Show that the radiation resistance of loop antenna is given by $31{,}200\left(\frac{nA}{\lambda^2}\right)^2$. **(08 Marks)**

c. Find the radiation efficiency of a 1m diameter loop ($c = \pi m$) of 10mm–diameter copper wire at i) 1MHz and ii) 10MHz. **(06 Marks)**

PART – B

5 a. Explain the features of a helical antenna and the practical design considerations of the helical antenna. **(10 Marks)**

b. Determine : i) the length L, H–plane aperture and blare angles θ_E and θ_H (in E and H planes respectively) of a pyramidal horn for which the E–plane aperture $a_E = 10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Take $\delta = 0.2\lambda$ in E-plane and $\delta = 0.375\lambda$ in the H-plane ii) Directivity. **(10 Marks)**

6 Write short notes on :
a. Lens antenna **(10 Marks)**
b. Sleeve antenna. **(10 Marks)**

7 a. What is meant by diffraction of radio waves? Explain knife edge diffraction gain. **(08 Marks)**
b. A free space LOS microwave link operating at 10 GHz consists of a transmit and a receive antenna each having a gain of 25dB. The distance between the two antennas is 30km and the power radiated by the transmit antenna is low. Calculate the path loss of the link and the received power. **(06 Marks)**
c. Discuss the salient features of ground wave propagation. **(06 Marks)**

8 a. Explain the mechanism of ionospheric wave prorogation. Also derive an expression for the refractive index of ionosphere. **(10 Marks)**
b. Define the term :
i) Critical frequency
ii) Virtual height. **(05 Marks)**
c. A radio link is established for a range of 300km. If the reflection region of the ionosphere is at a height of 200km with critical frequency of 8MHz, calculate MUF. **(05 Marks)**

* * * * *