Code No. 10393

FACULTY OF ENGINEERING

B.E. 3/4 (ECE) II Semester Main Examination, April 2006

ANTENNAS AND PROPAGATION

Time : Three Hours] [Maximum Marks : 75

*Note:— Answer **all** questions of Part A and answer **five** questions from Part B.*

PART—A

(Marks : 25)

1. An antenna has a field pattern given by $E(\theta) = \cos^2 \theta$ for $0° \leq \theta \leq 90°$. Find the directivity. 3
2. What is broadside array ? 2
3. What is the length of the longest element of a log-periodic antenna operating at frequencies from 100 to 500 MHz ? 3
4. What is a frequency independent antenna ? 2
5. What is the radiation resistance of an infinitesimally small dipole whose overall length is $L = \lambda/50$? 3
6. What is an atmospheric duct ? 2
7. Define antenna polarization. 2
8. Find the relative ratio of the two lengths of a rectangular aperture antenna with total quality factor $Q_t = 14.14$. 3
9. Write two important applications of loop antenna and helical antena. 2
10. In ionospheric propagation employing 8 MHz critical frequency with 100 km virtual height for a particular layer, 200 km skip distance has been noticed. Calculate the angle of incidence. 3

PART—B

(Marks : 5×10=50)

11. (a) Derive the Friis Transmission formula. 4

    (b) A radio link has a 15-W transmitter connected to an antenna of 2.5 m^2 effective aperture at 5 GHz. The receiving antenna has an effective aperture of 0.5m^2 and is located at a 15 km line-of-sight distance from the transmitting antenna. Assuming lossless, matched antennas, find the power delivered to the receiver. 6

12. (a) Determine the electromagnetic fields for an infinitesimal electric current element. 4

(b) Show that in the near field region there is no time average power flow associated with the field components. 6

13. (a) Derive expression for radiated electric field of a n-element array with uniform excitation (magnitude and phase) and inter-element spacing $\lambda/2$. 4

(b) Consider an array of two identical infinitesimal dipole separated by a distance $\lambda/4$ with same magnitude excitation but a phase excitation difference β between the elements. Find the nulls of the total field for $\beta = 0$; $\beta = \pi/2$. 6

14. (a) Derive expression for far field patterns of a circular loop antenna with uniform current. 6

(b) Find the radiation resistance of a single turn and 6-turn small circular loop. The radius of the loop is $\lambda/30$ and the medium free space. 4

15. (a) Explain the measurement technique of the impedance pattern of an antenna. 5

(b) In the measurement of the antenna gain using three antenna method, three horn antennas A, B and C are measured in pairs at 12 GHz. The separation of antennas is 8 m. The transmitted power is +3 dBm. The received powers are –31 dBm, –36 dBm and –28 dBm for antenna pairs AB, AC and BC, respectively. Find the gains of the antennas. 5

16. (a) In what respect binomial array is advantageous when compared to uniform linear array ? Explain with an example. 6

(b) Explain the effect of inter-element phase shift on beam scanning of an array antenna. 4

17. Write short notes on:

(a) Line of sight propagation 3

(b) Travelling wave antennas 3

(c) Yagi Uda array 4