Faculty of Engineering & Technology

Fifth Semester B.E. (Electronics Communication/ Electronics Telecommunication) (C.B.S.) Examination

ANTENNA AND WAVE PROPAGATION

Time : Three Hours] [Maximum Marks : 80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

(5) Use of Smith Chart is permitted.

1. (a) State the various types of transmission lines used in practice and derive the transmission line equation in terms of voltage and current. 8

(b) The characteristic impedance of a certain line is $710 \angle -16°$. When the frequency is 1 kHz, at this frequency the attenuation is 0.01 neper/km and the phase function is 0.035 radians/km. Calculate the resistance, the leakage inductance and the capacitance per km and velocity of propagation. 6

OR

2. (a) Derive the input impedance for a radio frequency line terminated in Z_R. 8

(b) Calculate standing wave ratio and reflection coefficient on a line having $Z_o = 300\ \Omega$ and terminated in $Z_R = 300 + J400\ \Omega$. Show the calculated value of reflection coefficient and standing wave ratio on Smith chart. 6

3. (a) Derive the expression for the radiated field from an infinitesimal dipole. Deduce the field quantities for power radiation and radiation resistance expressions. 7

(b) Find the radiation resistance of a small dipole of length $\lambda/40$, $\lambda/60$ and $\lambda/80$. 3

(c) State the different applications of folded dipole. 3

OR

4. Write a short note on any **THREE** : 13

(i) Hertzian dipole and its application

(ii) Loop antenna and its application

(iii) Half wave length dipole and its application

(iv) Folded dipole and its application.

5. (a) Derive the expression for electric field of a broadside array of n sources and also find the maxima and minima direction along with half power point direction. 5

(b) Define pattern multiplication in brief. 5

(Contd.)

(c) If an array of isotropic radiator is operated at a frequency of 6 GHz and is required to produce a broad side beam, find Null-to-Null beam width. If the array length is 10 m. Also find the directivity. 3

OR

6. (a) Explain the geometry of a log periodic antenna. Give the design equation and uses of log-periodic antenna. 6

(b) (i) Explain how Dolph-Chebychev method is useful for array analysis.

(ii) Design four element broadside array of $\lambda/2$ spacing between the elements. The pattern is to be optimum with a side lobe level 19.1 dB down the main lobe maximum. 7

7. (a) What is microstrip antenna ? Explain the different feeding methods for microstrip antenna. 7

(b) Design a rectangular microstrip antenna using a substrate (RT/duroid 5880) with dielectric constant of 2.2, h = 0.1588 cm so as to resonate at 10 GHz. 6

OR

8. (a) Explain the concept of fringing effects of microstrip antenna and give the formula for width and length of microstrip antenna. 7

(b) Design a circular microstrip antenna using a substrate (RT/duroid 5880) with a dielectric constant of 2.2, h = 0.1588 cm so as to resonate at 10 GHz. 6

(Contd.)

9. (a) What are the different types of horn antenna ? Explain pyramidal horn antenna in detail. 7

(b) Write short notes on any **TWO** :

(i) Casse grain dual reflector

(ii) Aperture antenna applications

(iii) Plane reflector. 6

OR

10. (a) The aperture dimensions of a pyramidal horn antenna are 16 × 8 cm. If is operating at a frequency of 8 GHz. Find the beam width, power gain and directivity. 5

(b) Explain the working principle, radiation pattern and applications of the corner reflector; also compare corner reflector with parabolic reflector. 8

11. (a) State reciprocity principle in antenna measurement. 6

(b) Explain the different techniques to measure antenna gain and explain one in detail. 8

OR

12. (a) Explain in brief fading, noise and interference. 6

(b) What are the types of measurement ranges ? 4

(c) Which layer is suitable for propagation of high frequency signals ? Why ? 4