

Seventh Semester Examination – 2006

ANTENNA ENGINEERING

Full Marks : 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory
and any five from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Explain the following : 2×10
 - (a) What are radiation fields ?
 - (b) How the magnitude of far fields varies with distance ?
 - (c) Why are the near-zone fields called quasi-static fields ?

(d) In the radiation pattern of a uniform linear array of many elements, how many dB down from the principal maximum are the first side lobes ?

(e) Why folded dipole is used ?

(f) What do you conclude if the directivity of an antenna is unity ?

(g) Why is it essential to use arrays for radiation purposes ?

(h) What is meant by the effective area of an antenna?

(i) What is a log-periodic antenna ?

(j) What are an aperture radiator and its complement?

2. Using field equations, show that the directive gain of Hertzian dipole is $D(\theta, \phi) = 1.5 \sin^2 \theta$ and that of a half-wave dipole is $D(\theta, \phi) = 1.64 [\cos^2(\pi/2 \cos \theta) / \sin^2 \theta]$. 10

3. An array of two point sources is excited in the following manner. For each one of them obtain array factor :

(i) Equal amplitude, in phase excitation

(ii) Equal amplitude, 180° out of phase excitation.

Find directions of maxima, minima and half power point and plot approximate pattern in each case.

10

4. (a) What is a microstrip antenna ? In which frequency range they are most popular. Write the expressions for radiation resistance, bandwidth and effective height of microstrip patch.

6

(b) For a polystyrene substrate with relative permittivity of 2.7, what width-substrate thickness ratio results in a 50Ω microstrip transmission line ?

4

5. (a) Elaborate the concept of log-periodic antenna design. What is the necessary phase angle difference between the elements and how is it achieved ?

6

(b) Explain how log-periodic antenna works over a wide band of frequency range ?

4

6. (a) Briefly explain the principle of working of pyramidal horn antenna. 4
- (b) A pyramidal horn antenna having aperture dimension of $a = 5.2$ cm and $b = 3.8$ cm is used at a frequency of 10 GHz. Calculate its gain and half power beam width. Comment on the calculated half-power beam width in relation with that of a dipole. 6
7. (a) Explain the need of directional transmission and how is it achieved at different frequency range? 5
- (b) Derive the expression for the secondary field pattern of parabolic reflectors. 5
8. Write short notes on: (any two) 5×2
- ✓ (a) Retarded vector magnetic potential
- (b) Yagi-Uda array
- (c) Measurement of Radiation pattern.

