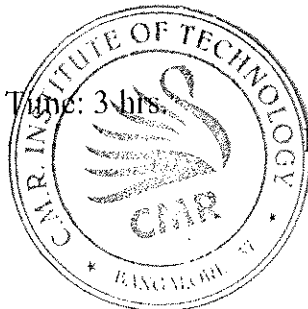


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10TE63

Sixth Semester B.E. Degree Examination, June/July 2016

Antennas and Propagation

Time: 3 hrs.

Max. Marks: 100

Note: 1) Answer FIVE full questions, selecting at least TWO questions from each part.
2) Assume any missing data suitably.

PART – A

- 1 a. Define the term antenna aperture. Derive the equation for directivity in terms of aperture. (06 Marks)
- b. Show that the directivity of a short dipole is 50% greater than the directivity of an isotropic antenna. (06 Marks)
- c. A lossless resonant $\frac{\lambda}{2}$ dipole antenna having an input impedance of 73Ω is to be connected to a transmission line having characteristics impedance of 50Ω . The radiation intensity pattern of the antenna is given by, $U = U_m \sin^3 \theta$. Find the overall gain of the antenna. (08 Marks)
- 2 a. State and prove the power theorem. (05 Marks)
- b. Derive an expression and draw the field pattern for an array of two isotropic point sources of same amplitude and opposite phase. (07 Marks)
- c. Obtain the field pattern for a linear uniform array of 6 isotropic point sources spaced $\frac{\lambda}{2}$ apart. The power is applied with equal amplitude and in-phase. Also find maxima and sidelobe levels for the pattern and calculate FNBW and HPBW. (08 Marks)
- 3 a. Derive an expression for radiation resistance of short electric dipole. (08 Marks)
- b. A thin linear short dipole antenna is $\frac{\lambda}{12}$ long. Find the radiation resistance and efficiency of the dipole for loss resistance of 1.2Ω . (04 Marks)
- c. Explain following antennas with relevant diagrams: (i) Folded dipole antennas (ii) Long-wire antennas. (08 Marks)
- 4 a. Considering general case derive the far field equations for loop antenna. (08 Marks)
- b. Explain Babinet's principle with illustration. (04 Marks)
- c. Derive the equation for impedance of a slot antenna in terms of the impedance of the complementary dipole antenna. (08 Marks)

PART – B

- 5 a. With the help of neat diagrams, explain : (i) Sleeve antenna and (ii) Turnstile antenna. (08 Marks)
- b. Explain features and practical design considerations of the helical antenna. (08 Marks)
- c. Design Yagi-Uda antenna of six elements to provide a gain of 12 dBi if the operating frequency is 200 MHz. (04 Marks)

- 6 a. Explain : (i) Ultra wide band antenna. (10 Marks)
(ii) Lens antenna. (10 Marks)
- b. With the help of neat diagrams explain, (i) Parabolic reflectors (ii) Antennas for ground penetrating RADAR. (10 Marks)
- 7 a. Derive an expression for field intensity in the case of space wave propagation. (10 Marks)
- b. Explain duct propagation. (05 Marks)
- c. Determine :
(i) the radio horizon distance for a transmitting antenna height of 300 feet.
(ii) the radio horizon distance of a receiving antenna with a height of 100 feet.
(iii) the maximum range of space wave communication for the above antenna heights. (05 Marks)
- 8 a. Explain the mechanism of ionospheric wave propagation. Also derive an expression for the refractive index of ionosphere. (10 Marks)
- b. Define the terms: i) Critical frequency, ii) Skip distance for ionosphere with neat diagrams. (05 Marks)
- c. Calculate the value of frequency at which the electromagnetic wave should be propagated in the D₂ region. It is given that refractive index $\mu = 0.5$ and electron density $N = 10^{12}$ electrons/m³. (05 Marks)
