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10EC64

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

Antennas and Propagation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following terms as related to antenna systems:
i) Beam area ii) Directivity iii) Power gain
iv) Effective aperture v) Radiation resistance **(10 Marks)**

b. Find the directivity of the power pattern given by $U = U_m \sin^2\theta \sin^3\phi$; $0 \le \theta \le \pi$; $0 \le \phi \le \pi$. **(05 Marks)**

c. An antenna has a field pattern given by $E(\theta) = \cos\theta \cos 2\theta$ for $0 \le \theta \le 90°$. Find half power beam width (HPBW) and beam width between first nulls (BWFN). **(05 Marks)**

2 a. Derive an expression for array factor and relative field of linear array of 'n' isotropic point sources of equal magnitude and spacing. **(08 Marks)**

b. Complete the field patterns and find BWFN and HPBW for an array of 4 point sources spaced $\lambda/6$ distance apart. They have a phase difference of $\pi/3$ between adjacent elements. **(06 Marks)**

c. Explain the principle of pattern multiplication with an example. **(06 Marks)**

3 a. Derive the far field components of short dipole. **(07 Marks)**

b. For a short dipole of $\lambda/15$ long and loss resistance of 1Ω. Find:
i) Efficiency
ii) Radiation resistance
iii) Effective aperture **(06 Marks)**

c. Write short notes on:
i) V-antennas
ii) Folded dipole antennas
iii) Rhombic antenna **(07 Marks)**

4 a. Derive the far field expressions for small loop antenna. **(07 Marks)**

b. Explain patch or microstrip antennas with necessary sketch. **(06 Marks)**

c. With relevant sketches, explain the principle of Babinet's principle for complementary linear antennas. **(07 Marks)**

PART – B

5 a. Explain the practical design considerations for the axial mode helical antennas. **(10 Marks)**

b. Write short notes on:
i) Yagi-Uda antenna
ii) Corner reflector antenna **(10 Marks)**

6 a. Explain the constructional details of Sleeve antenna and Turnstile antenna. **(08 Marks)**

b. Write short notes on:
   i) Embedded antennas
   ii) Ultra wideband antennas
   iii) Plasma antennas **(12 Marks)**

7 a. Derive an expression for wave tilt of surface wave. **(08 Marks)**

b. Explain duct propagation in detail. **(06 Marks)**

c. Estimate the wave tilt in degrees of the surface wave over an earth of 5 millimhos conductivity and relative permittivity of 10 at 1 MHz. **(06 Marks)**

8 a. Derive an expression for refractive index of an ionospheric propagation. **(06 Marks)**

b. A high frequency link is established for a range of 2000 km. If the reflection region of ionosphere is at a height of 200 km and has a critical frequency of 6 MHz, calculate maximum usable frequency (MUF). **(06 Marks)**

c. Define the following terms related to ionospheric propagation:
   i) MUF
   ii) Critical frequency
   iii) Virtual height
   iv) Skip distance **(08 Marks)**

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