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P 1174

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Seventh Semester

Electronics and Communication Engineering

EC 431 — ANTENNAS AND PROPAGATION

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Beam solid angle.
2. Brief the concept of Duality Theorem.
3. What is meant by Broad side array and End fire array?
4. Write the principle of pattern multiplication.
5. Derive the value for gain of half wavelength antenna.
6. What is pitch angle in helical antenna and how is it calculated?
7. Draw the structure of a 3-element Yagi-uda Antenna and specify the length of the elements and spacing between the elements in terms of wave length.
8. A parabolic reflector antenna is designed for operation at 3000 MHz. Its largest dimension is 20 feet. For measurement of radiation pattern, what should be the minimum distance between primary and secondary antenna.
9. What is known as diversity reception?
10. What is the critical frequency for reflection at vertical incidence if the maximum value of electron density is $1.24 \times 10^6 \text{ cm}^{-3}$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the expression for Directivity in terms of beam solid angle. (8)
(ii) Explain how electric field lines are formed and get detached from short dipole antenna. (8)

Or

- (b) (i) Derive the Friis transmission equation that relates the power received to power transmitted between two antennas separated by distance $R > \frac{2D^2}{\lambda}$. (8)
(ii) Derive the expression for maximum effective area including reflection losses, polarization losses and also conduction and dielectric losses. (8)
12. (a) (i) Derive the maxima directions, minima directions and Half power point direction for an array of two point sources with equal amplitude and phase. (8)
(ii) Find the direction of pattern maxima, pattern minima for an array of n sources with equal amplitude and spacing in End-fire case. (8)

Or

- (b) (i) Find the direction of pattern maxima, pattern minima for array of n sources with equal amplitude and spacing in broad - side case. (8)
(ii) Derive the maxima directions, minima directions and Half power point direction for array of two point sources with equal amplitude and opposite phase. (8)
13. (a) Derive the expressions for Electric field and magnetic field components from magnetic vector potential for a Half-wave dipole antenna. (16)

Or

- (b) Explain the operation of helical antenna in Normal mode and axial mode. Find the Axial ratio in both modes of operation and also the normalized for field pattern in axial mode of operation. (16)
14. (a) Explain the structure of Rhombic antenna and its radiation pattern. How Rhombic antenna is designed in alignment design and maximum E - design. (16)

Or

- (b) Explain the turnstile antenna operation and show that 70 ohms dual co-axial line will be matched appropriately when connected to terminals of turnstile antenna. (16)

15. (a) (i) Derive the Expression for refractive index of the Ionosphere (neglecting Earth's magnetic field effects). (8)
- (ii) Explain the characteristics of different ionized regions of Ionosphere, drawing the structure above the earth. (8)

Or

- (b) (i) Show that the radius of curvature of wave path is function of rate of change of dielectric constant (or) refractive index with height in space wave propagation. (8)
- (ii) Explain Ground wave propagation and obtain expression for field strength. (8)
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