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Question Paper Code : 21463

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Sixth Semester

Electronics and Communication Engineering

EC 2353/EC 63/10144 EC 604 – ANTENNAS AND WAVE PROPAGATION

(Regulations 2008/2010)

(Common to PTEC 2353 – Antennas and Wave Propagation for B.E. (Part – Time) Fifth Semester – Electronics and Communication Engineering – Regulations 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the significance of gain of an antenna?

2. Define the brightness temperature of the antenna.

3. Give the importance of radiation resistance of an antenna.

4. Define Pattern Multiplication

5. The impedance of an infinitesimally thin $\lambda/2$ antenna ($L = 0.5\lambda$ and $L/D = \infty$) is $73 + j\ 42.5\,\Omega$. Calculate the terminal impedance of an infinitesimally thin $\lambda/2$ slot antenna.

6. Draw the geometry for E-plane type of metal-plate lens antenna.

7. Calculate the radio horizon of a TV antenna placed at a height of 166m. If the receiver is at a distance of 66Km, what should be the height of the receiving antenna?

8. Write any four salient features of micro strip antenna.

9. Find the maximum distance that can be covered by a space wave, when the antenna heights are 60 m and 120 m.

10. A HF radio link is established for a range of 2000 Km. If the reflection region of the ionosphere is at a height of 200 Km and has f_c of 6 MHz, calculate MUF.

PART B — (5 × 16 = 80 marks)

11. (a) Examine the effectiveness of the following parameters of an antenna : (4 × 4 = 16)

(i) Beam solid angle

(ii) Directivity

(iii) Pattern Lobes

(iv) Input impedance.

Or

(b) Define and describe the following parameters of an antenna : (4 × 4 = 16)

(i) Radiation pattern

(ii) Polarization

(iii) Bandwidth

(iv) Effective aperture.

12. (a) A thin dipole is $\lambda/15$ long. If it has loss resistance of 1.5 Ohms, Calculate :

(i) Directivity (4)

(ii) Gain (3)

(iii) Effective Aperture (3)

(iv) Beam Solid Angle (3)

(v) Radiation Resistance. (3)

Or

(b) Develop a treatise on following forms of arrays : (4 × 4 = 16)

(i) Linear array

(ii) Two-element array

(iii) Uniform array

(iv) Binomial array.

13. (a) Discuss the construction of the rectangular Horn antenna and draw the measured E – and H-plane field patterns of rectangular horns as a function of flare angle and horn length. (16)

Or

(b) A square-corner reflector has a driven $\lambda/2$ element $\lambda/2$ from the corner. (4 × 4 = 16)

(i) Calculate and plot the far-field pattern in both principal planes.

(ii) What are the HBPWs in the two principal planes?

(iii) What is the terminal impedance of the driven element?

(iv) Calculate the directivity from impedances of driven and image dipoles. Assume perfectly conducting sheet reflectors of infinite extent.

14. (a) (i) With a suitable diagram, depict the construction and operation of a Yagi antenna. (8)

(ii) With a neat sketch design a quad-helix earth station antenna. Calculate the directivity and the effective aperture. (8)

Or

(b) (i) Elaborate on Log-Periodic Antenna with a neat sketch. (10)

(ii) Design a Log-Periodic dipole array with 7 dBi gain and a 4 to 1 bandwidth. Specify apex angle α, scale constant k and the number of elements. (6)

15. (a) Evaluate the value of surface impedance if $\sigma = 5 \times 10^{-5}, \varepsilon_r = 15, \mu = \mu_0$ at

(i) 5 kHz (5)

(ii) 50 kHz (5)

(iii) 500 kHz. (6)

Or

(b) Derive the expressions for phase velocity and group velocity of sky waves. (16)