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Question Paper Code : 90484

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Seventh Semester

Electronics and Communication Engineering

EC 8701 — ANTENNAS AND MICROWAVE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Calculate the far field for a half wave dipole antenna operating at a frequency of 300MHz.
2. Write the Friis transmission equation and mention the significance.
3. Define Directivity and maximum effective aperture of an infinite small dipole?
4. Name any two aperture antennas and mention the difference.
5. Explain the principle Pattern Multiplication.
6. Compare Broadside and End fire arrays.
7. List any two applications of Magic Tee.
8. Why slow wave structures are used in TWT?
9. What is the need for impedance matching in microwave circuits?
10. What will be the two possible values of LO frequency, for a down-conversion mixer with input RF frequency of 5GHz and desired intermediate frequency of 500 MHz?

PART B — (5 × 13 = 65 marks)

11. (a) Draw the radiation pattern of any one microwave antenna and explain the following:

    (i) Main lobe

    (ii) Sidelobes

    (iii) Backlobes

    (iv) HPBW

    (v) FNBW (4+3+3+3)

Or

(b) Define and mention the significance of the following antenna parameters with relevant formulas:

(i) Antenna Gain

(ii) Antenna Efficiency

(iii) Effective Area

(iv) Antenna Noise Temperature (4+3+3+3)

12. (a) Derive expressions for the fields radiated from a half wave Dipole and determine its radiation resistance.

Or

(b) Explain the principle of operation of parabolic reflector antenna and detail about the different types of feeding techniques applied.

13. (a) Derive the field strength and draw the radiation pattern of two isotropic point sources separated by $d = \lambda/2$ with equal amplitude and phase.

Or

(b) Consider a uniform linear array with two isotropic point sources having $\lambda/2$ spacing between them and fed with currents of equal magnitude and opposite phase. Derive expression for its array factor and draw its radiation pattern.

14. (a) Explain the principle of operation of Magic Tee and derive its S matrix.

Or

(b) With neat diagram, explain the construction and operating principle of TWT amplifier.

15. (a) Define Power Gain, Available power gain and Transducer power gain. Derive expressions for these power gains in terms of S parameters.

Or

(b) Explain the principle of obtaining frequency up conversion and down conversion using mixer.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A log-periodic dipole array antenna is to be designed for frequency range of 800 MHz to 2000 MHz for a directivity of 9 dBi. The optimum values of ζ and σ are 0.86 and 0.16, respectively. A wire of 0.1 cm diameter is to be used. Calculate the approximate lengths of the longest and shortest dipoles that are to be used, the number of elements in the array and lengths of each array element.

Or

(b) Design a rectangular microstrip antenna for WiFi application at 2.4415 GHz. Choose a substrate material with $\varepsilon_r = 2.32; h = 0.16$ cm; $\tan\delta = 0.001$.
