21/12/23 - FN

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 70523

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023

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. What is radiation and mention the condition for radiation?

2. An antenna has directivity of 16 dB, Calculate the maximum effective area of the antenna operating at 12GHz.

3. Identify the radiation resistance of a single turn and an eight turn small circular loop when the radius of the loop is $\lambda/20$ and the medium is free space.

4. Mention the types of feeding structures used for a microstrip patch antenna.

5. Two isotropic point sources are separated by distance $\lambda/2$ and radiated in the direction of 30°. Find the phase angle difference between the two sources.

6. Compare Binomial and Tschebyscheff array.

7. Define Directivity and Coupling factor for Directional Coupler.

8. Mention the high frequency effects in conventional vacuum tubes.

9. Use Smith chart to find the line impedance at a point one quarter wave length from a load of $(80 + j20)\ \Omega$.

10. Define Noise Figure.

PART B — (5 × 13 = 65 marks)

11. (a) Explain in detail about radiation from an Oscillating electric dipole. Derive its far field components.

Or

(b) Prove that the radiation resistance of a half wave dipole antenna is 73Ω.

12. (a) (i) With neat diagram explain about Horn antenna and derive its design equations. (8)

(ii) A pyramidal horn antenna having aperture dimensions of a = 5 cm and b = 4 cm is used at a frequency of 8 GHz. Find its gain and HPBW. (5)

Or

(b) (i) With neat diagram explain about Aperture Antenna. (8)

(ii) Write short notes on Microstrip Antennas. (5)

13. (a) (i) Find the expression for the field and the radiation pattern produced by a N element array with distance of separation is $\lambda/2$ and currents of equal magnitude and phase shift 180°. (8)

(ii) Calculate the directivity and beam width of 5 element broad side array, when the spacing between the individual elements is $\lambda/2$. (5)

Or

(b) Write short notes on

(i) Active Antenna (6)

(ii) Reconfigurable Antenna (7)

14. (a) With neat diagram explain the operation of Magic TEE and Attenuator. (6+7)

Or

(b) (i) With the help of two valley theory, explain how negative resistance is created in Gunn diodes. (6)

(ii) Explain the working principle of IMPATT diode with neat diagram. (7)

15. (a) Using immittance chart, develop a two – component matching network that matches $Z_L = (80 + j20)\ \Omega$ load and $Zs = (10 + j40)\ \Omega$ source. Find the values of the components if a perfect match is desired of 1 GHz.

Or

(b) (i) Write the mathematical analysis of amplifier stability. (6)

(ii) Design a microwave amplifier for maximum transducer power gain. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Assess the working principle and operation of two cavity Klystron amplifier and derive the expression for velocity modulation and bunching process.

Or

(b) Develop a balanced broadband amplifier and discuss the theory behind the operation of couplers and power dividers with neat diagrams.

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