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Question Paper Code : 50501

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Seventh Semester

Electronics And Communication Engineering

EC8701 – ANTENNAS AND MICROWAVE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. An antenna has a radiation resistance of 72 ohm and a loss resistance of 8 ohms, determine the antenna efficiency.

2. Define gain of an antenna. Provide the relationship between gain and aperture of an antenna.

3. What is the basic concept of a reflector antenna?

4. State Rumsey principle on frequency independent antenna.

5. Define pattern multiplication.

6. Differentiate broadside array and end fire array.

7. Mention the drawbacks of klystron amplifiers.

8. Why magnetron is called as cross field device? Also mention its application.

9. Define unilateral power gain.

10. What are the parameters used to evaluate the performance of an amplifier?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe the concept of a link budget and link margin with suitable equations. (6)

(ii) Explain the concept of

(1) Gain (3)

(2) Directivity (2)

(3) Radiation Resistance (2)

Or

(b) (i) With suitable illustrations, explain and derive the Friss transmission equation. (7)

(ii) Explain the concept of

(1) Antenna Temperature (3)

(2) Input impedence. (3)

12. (a) Discuss the behaviour of loop antenna, sketch its field pattern. Also, explain how a loop antenna can be used for direction finding.

Or

(b) Explain the working principle of log periodic antenna with suitable diagrams. Also, discuss the various operating regions of the antenna and mention the practical applications of these antennas.

13. (a) Derive an expression for 'n' isotropic point sources of equal amplitude and phase (n element broadside array) with directions of pattern maxima and minima, beam width of major lobes and half power beam width.

Or

(b) Derive an expression for 'n' isotropic point sources of equal amplitude and out of phase (n element endfire array) with directions of pattern maxima and minima, beam width of major lobes and half power beam width.

14. (a) Explain the operation of the power divider with a neat diagram and derive the S matrix for three – port power divider.

Or

(b) Discuss the construction and operating mechanism of TWT (Travelling Wave Tube) amplifier with an interaction region diagram. Also, mention its applications.

15. (a) Describe the operating principle and characteristics of the mixer. Also, explain the operation of a balanced mixer with suitable diagrams.

Or

(b) Discuss the following with suitable illustrations:

(i) Single stub impedance matching. (7)

(ii) Double stub impedence matching (6)

PART C — (1 × 15 = 15 marks)

16. (a) The Triquint T1G6000528 GaN HEMT has the following scattering parameters at 1.9 GHz $(Z_0 = 50\Omega)$: $S_{11} = 0.869\angle -159^0$, $S_{12} = 0.031\angle -9^0$, $S_{21} = 4.250\angle 61^0$, $S_{22} = 0.507\angle -117^0$. Determine the stability of this transistor and plot the stability circle on a Smith chart.

Or

(b) GaAs MESFET is biased for minimum noise figure, with the following scattering parameters and noise parameters at 4 GHZ $(Z_0 = 50\Omega)$: $S_{11} = 0.6\angle -60^0$, $S_{12} = 0.05\angle 26^0$, $S_{21} = 1.9\angle 81^0$, $S_{22} = 0.5\angle -60^0$, $F_{\min} = 1.6dB, \Gamma_{opt} = 0.62\angle 100^0$ and $R_N = 20\Omega$.

For design purposes, assume the device is unilateral, and calculate the maximum error in G_T resulting from this assumption. Then design and an amplifier having a 2.0 dB noise figure with the maximum gain that is compatible with this noise figure.

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