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Question Paper Code : 40455

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

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 — ($10 \times 2 = 20$ marks)

1. Write the expression which relates directivity and beam solid angle. Using the relation give the directivity of an isotropic antenna.

2. How radiation resistance affects antenna efficiency?

3. Enunciate rumsey's principle on frequency independent antennas.

4. List out the applications of microstrip antenna.

5. What are antenna arrays and why are they used in practice?

6. Why the directivity of Binomial Array is less?

7. What is the purpose of slow wave structures used in TWT amplifiers?

8. Differentiate conventional PN Diodes from schottky diodes.

9. Define transducer power gain, operating power gain and available power gain amplifiers.

10. Mention the need for frequency translation of signals.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Describe the following antenna parameters.

(a) gain (b) bandwidth (c) input impedance

(d) effective aperture (7)

(ii) Explain the importance of impedance matching in antennas. (6)

Or

(b) (i) Explain the concept of (a) radiation pattern (b) beam Efficiency

(c) antenna Temperature (7)

(ii) Show the condition under which the fields are classified as near field and far field and explain the same. (6)

12. (a) Discuss the construction and design of a yagi uda array. Show that the impedance of a folded dipole is 300 ohms.

Or

(b) Discuss the principle of operation and the considerations which have to go into the design diameter of parabolic reflector antennas. Give the significance of focal length to diameter ratio and the methods of feeding parabolic reflectors.

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

Or

(b) (i) Explain the principle of pattern multiplication with examples. (6)

(ii) A linear broadside array consists of 4 equal isotropic in-phase point sources with $\lambda/3$ spacing. Identify the directivity and beam width. (7)

14. (a) With a suitable illustrations and scattering matrices, explain the operation of direction coupler and power divider.

Or

(b) (i) With suitable illustrations, discuss the working principle of reflex klystron. (6)

(ii) With neat diagrams, explain the working principle of gunn diode. Also draw the equivalent circuit and V-I characteristics of Gunn diode. (7)

15. (a) Explain the basic characteristics of mixer. Compare and contrast single ended mixer and balanced mixer.

Or

(b) (i) Interpret the steps involved to design a low noise amplifier (7)

(ii) Sketch the input and output stability circles of microwave amplifier and relate the condition for unconditional stability. (6)

PART C — ($1 \times 15 = 15$ marks)

16. (a) A SiGe HBT device has the following scattering parameters at 2.0 GHz: $S_{11} = 0.880\angle -115°$, $S_{12} = 0.029\angle 31°$, $S_{21} = 9.40\angle 110°$, and $S_{22} = 0.328\angle -67°$, Determine the stability of the device, and plot the stability circles if the device is potentially unstable.

Or

(b) Design an amplifier to have a gain of 10 dB at 6.0 GHz, using a transistor with the following scattering parameters ($Z_0 = 50$ ohms): $S_{11} = 0.61\angle -170°$, $S_{12} = 2.24\angle 32°$ and $S_{22} = 0.72\angle -83°$. Plot (and use) constant-gain circles for $G_s = 1$ dB and $G_L = 2$ dB. Use matching sections with open-circuited shunt stubs.

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