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Question Paper Code : 71215

M.E. DEGREE EXAMINATION, JUNE/JULY 2013.

First Semester

Communication Systems

CU 9211/CU 911/10244 CM 102 – ADVANCED RADIATION SYSTEMS

(Regulation 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is an isotropic radiator?

2. "The effective aperture of an antenna is not necessarily the same as the physical aperture" – Comment on this statement.

3. A power gain test of a reference antenna and a test antenna resulted in the following data : Input power to the reference antenna – 400 mw. Input power to the test antenna is 100 mw. Calculate the power gain.

4. State any two advantages of Reflector antenna.

5. The noise figure of an amplifier at room temperature (T = 290K) is 0.2 dB. Find the equivalent temperature.

6. What would be the phases of the element excitations to make the major lobe point along 45° of the line of the array?

7. Why are wide band antennas required?

8. How will you increase band width of a patch antenna?

9. Find the terminal impedance of an infinitesimally thin $\lambda/2$ slot antenna when the impedance of infinitesimally thin $\lambda/2$ dipole antenna is $73 + j\,42.5\,\Omega$.

10. Design a log periodic dipole array with 7 dB gain and a 4 to 1 bandwidth. (Given from "carrel" curve that 7 dB gain corresponds to $\alpha = 15°$, K = 1.2 and $S/\lambda = 0.15$).

PART B — (5 × 16 = 80 marks)

11. (a) (i) Define the effective length of a linear antenna for transmitting. Upon what factor does it depend? (4)

(ii) Assume a sinusoid current distribution on a centre fed, thin straight half wave dipole. Find its effective length. What is its maximum value? (6)

(iii) What is Hertzian dipole? Find the directive gain and the directivity of a dipole. (6)

Or

(b) (i) In a microwave communication link, two identical antenna operating at 10 GHz are used with power gain of 40 dB. If the transmitter power is 1 W, find the received power, if the range of the link is 30 KM. (6)

(ii) Describe the construction, working and applications of :

(1) Loop Antenna. (5)

(2) Mobile phone Antenna. (5)

12. (a) (i) Explain the important features of the horn antenna and the principle of its working. (8)

(ii) How is the antenna fed and what are its applications? (4)

(iii) Why is an electromagnetic horn antenna a well matched antenna? At what frequencies are such antenna used? (4)

Or

(b) (i) Describe the construction, working, applications, merits and limitations of slot antenna. (10)

(ii) Find the terminal resistance of complementary slot for a cylindrical dipole with length to diameter ratio of 28 and length of 0.925λ having terminal impedance of (710+j.0) ohms. (6)

13. (a) (i) Explain Dolph–Chebyshev distribution for linear broadside arrays. (6)

(ii) Design a broadside Dolph–Chebyshev array of 10 elements with spacing 'd' between the elements and with a major to minor lobe ratio of 26 dB. Calculate the excitation co-efficient and form the array factor. (10)

Or

(b) (i) Describe the concept and working of a Binomial distributions based antenna array with an example. (6)

(ii) Design a 8 element broadside array of isotropic sources of $\lambda/2$ spacing between elements. The pattern is to be optimum with a side lobe 26 dB down the main lobe maximum. (10)

14. (a) Discuss on the need, construction, working and applications of Microstrip array and feed network with necessary diagrams.

Or

(b) Using cavity model analysis obtain the expressions for the radiated fields of a rectangular microstrip patch antenna.

15. (a) Explain the measuring methods of

(i) antenna gain (6)

(ii) Impedance and (5)

(iii) antenna factor measurement. (5)

Or

(b) Write detailed notes on the following with appropriate diagram :

(i) Log periodic dipole. (8)

(ii) Ridge guide. (8)
