Reg. No. :

Question Paper Code : X10372

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Seventh Semester
Electronics and Communication Engineering
EC8701 – ANTENNAS AND MICROWAVE ENGINEERING
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Smith chart and Immittance chart permitted
Answer ALL questions

PART – A **(10×2=20 Marks)**

1. An antenna has a field pattern given by $E(\theta) = \cos^2 \theta$ for $0° \leq \theta \leq \pi$. Find Half Power Beam Width (HPBW).

2. What is Link Budget ? Mention a simple Link Budget equation.

3. Calculate the beam width between first nulls of a 2.5 m paraboloid reflector used at 6 GHz.

4. What is aperture blockage ? Give one example.

5. State the principle of pattern multiplication.

6. What is reconfigurable antenna ?

7. Give two examples for reciprocal microwave passive device.

8. A Reflex Klystron is operated at 10 GHz with a dc beam voltage of 600 V for $1\frac{3}{4}$ mode, repeller space length of 1 mm and dc beam current of 12 mA. The beam coupling co-efficient is assumed to be 1. Calculate the repeller voltage.

9. VSWR circle has a radius of 0.667 and impedance is 0.25 – j0.5. Calculate the reflection coefficient graphically.

10. Define maximum available gain and noise figure.

PART – B **(5×13=65 Marks)**

11. a) Obtain expression for the field and power radiated by an oscillating dipole and calculate the radiation resistance.

(OR)

b) i) What is impedance matching ? Explain about the techniques used to solve the impedance matching problems. **(8)**

ii) Using FRISS transmission formula find the maximum power received at a distance of 1 Km over a free space. A 100 MHz circuit consisting of a transmitting antenna of 30 dB gain and a receiving antenna with a 25 dB gain is used. The power input to the transmitting antenna is 150 W. **(5)**

12. a) i) Explain in detail about Loop antenna. Derive the expression for fields at Far region. **(7)**

ii) Explain how a Loop antenna is utilized for determining the direction of an incoming radio signal. **(6)**

(OR)

b) i) With neat necessary diagrams, explain parabolic reflector antenna and its different types of feeding system. **(7)**

ii) Briefly explain about frequency independent planar Log spiral antenna. **(6)**

13. a) i) What is broad side array ? Deduce the expression for the Radiation pattern of a broadside array with n- vertical dipoles. **(7)**

ii) Design a 4 element broadside array of $\lambda/2$ spacing between elements. **(6)**

(OR)

b) i) What is non-uniform excitation amplitudes ? Draw the pattern of 10 elements binomial array with spacing's between the elements of $\lambda/2$. **(7)**

ii) Write short notes about Active antenna. **(6)**

14. a) Write short notes on the following Microwave passive devices along with S parameters.

i) Directional Couplers. **(7)**

ii) Attenuator. **(6)**

(OR)

b) i) With the help of two valley theory, explain how negative resistance is created in Gunn diodes. **(7)**

ii) Describe the construction and operation of a basic magnetron. **(6)**

15. a) For a broadband amplifier, it is required to develop a PI-type matching network that transforms a load impedance of $Z_L = (50 - j\,100)\ \Omega$ into an input impedance of $Z_{in} = (10 + j\,20)\ \Omega$. The design should involve the lowest possible nodal quality factor. Find the component values, assuming that matching should be achieved at a frequency of 2 GHz.

(OR)

b) i) Write the mathematical analysis of amplifier stability. **(7)**

ii) Design a microwave amplifier for maximum transducer power gain. **(6)**

PART – C **(1×15=15 Marks)**

16. a) i) Describe with neat sketch the construction details and principle of operation of Klystron amplifier and derive the expression for its optimum bunching distance L_{opt}. **(12)**

ii) Use Smith chart to find the line impedance at a point one quarter wave length from a load of $(40 - j\,20)\ \Omega$. **(3)**

(OR)

b) i) A broad casting station (500 to 1000 KHz band) requires a pattern in the horizontal plane fulfilling the conditions as given below. The max. field intensity with as little variation as possible, is to be radiated in the 90° sector between NE and WE. No nulls in the pattern can occur in this sector. The nulls must be present in the due east and due SW directions in order to prevent interference with other stations in these directions. **(9)**

ii) What is the need of smart antennas ? Briefly explain about Adaptive arrays. **(6)**

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