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Question Paper Code : X 20459

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Seventh Semester
Electronics and Communication Engineering
EC 6701 – RF AND MICROWAVE ENGINEERING
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Write the ABCD matrix for transformer with n : 1 turns.
2. Define attenuation loss.
3. What are the conditions to transfer maximum power from source to load ?
4. Define transducer power gain.
5. What are the different types of directional coupler ?
6. Write the relation between VSWR and reflection coefficient and write the range for the same.
7. What is negative resistance in Gunn diode and draw the characteristics.
8. What are the applications of reflex klystron ?
9. Define return loss and write the expression.
10. Draw the general setup for any measurement in microwave frequency.

PART – B **(5×13=65 Marks)**

11. a) i) Explain the transmission line matrix for two port network and derive S matrix for the two-port network. **(8)**

ii) Why is S matrix used in microwave ? Define each parameter in S matrix for a two port network. **(5)**

(OR)

b) The S matrix of the two port network is

$$[s] = \begin{bmatrix} 0.15\angle 0° & 0.85\angle -45° \\ 0.85\angle 45° & 0.2\angle 0° \end{bmatrix}$$

i) Determine whether the network is reciprocal or lossless.

ii) If the two port is terminated with matched load, what will be the return loss at the port 1 ?

iii) If the short circuit is placed on port 2, what will be the resulting return loss at port 1 ?

12. a) Using the Smith chart, design all possible combinations of discrete two element matching networks that match the source impedance $50 + j25\Omega$ to load impedance $25 - j50\Omega$. Assume characteristic impedance as 50Ω and an operating frequency of 2 GHz. **(13)**

(OR)

b) What are the key parameters to evaluate the performance of an amplifier ? Discuss the various aspects of amplifier – power relation for RF transistor amplifier design. **(13)**

13. a) Discuss the structure, principle of operation and derive S parameters of isolator and circulator. **(13)**

(OR)

b) Explain the following with neat diagram :

i) waveguide corners **(2)**

ii) bends **(3)**

iii) twists **(3)**

iv) hybrid ring **(2)**

v) two-hole directional coupler. **(3)**

14. a) A two cavity klystron amplifier has the following parameters:

V_0 = 1000 V, R_0 = 40 Kohm, I_0 = 25 mA, f = 3 GHz. The gap spacing in either cavity (d) = 1 mm, spacing between the two cavities (L) = 4 cm, effective shunt impedance, excluding beam loading R_{Sh} = 30 Kohm. (A) Find the input gap voltage to give maximum voltage V_1. (B) Find the voltage gain, neglecting the beam loading in the output cavity (C) Find the efficiency of amplifier, neglecting beam loading (D) Calculate the beam loading conductance. **(3+4+3+3)**

(OR)

b) i) What are the major differences between TWT and Klystron ? **(5)**

ii) A linear magnetron has the following operating parameters. Anode voltage V_0 = 10 kV, Cathode current I_0 = 1 A, Magnetic flux density B_0 = 0.01 Wb/m_2, distance between cathode and anode d = 5 cm. Find Hull cut-off voltage for fixed B_0 and Hull cut-off magnetic flux density for a fixed V_0. **(8)**

15. a) Explain the principle of operation of (i) VSWR meter (ii) power meter (iii) spectrum analyser (iv) network analyser and types. **(13)**

(OR)

b) Draw and explain the setup to measure the attenuation and insertion loss of a variable attenuator.

PART – C **(1×15=15 Marks)**

16. a) A two cavity Klystron amplifier has the following specifications : **(15)**

Beam voltage, V_0 = 900 V

Beam current, I_0 = 30 mA

Frequency f = 8 GHz

Gap spacing in either cavity, d = 1 mm

Spacing between center of cavities, L = 4 cm

Effective shunt impedance, R_{sh} = 49 KΩ

Determine :

i) Electron velocity

ii) dc transit time of electron

iii) Maximum input voltage

iv) Voltage gain.

(OR)

b) A slotted line is used to measure the frequency and it was found that the distance between the nulls is 1.85 cm. Given the guide dimension as 3 cm × 1.5 cm, calculate the frequency. **(15)**

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