B.E. Electronics Engineering / Electronics & Telecommunication / Communication Engineering
Seven Semester (CBS)

EN / ET / EC-701 : UHF and Microwave

P. Pages : 2 **GUG/W/18/1782**

Time : Three Hours * 1 3 9 3 * Max. Marks : 80

Notes : 1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) A two cavity Klystron has the following parameters **10**

Beam Voltage V_o = 20 kV
Beam current I_o = 2A
operating frequency f = 8 GHz
Beam coupling coefficient $\beta_i = \beta_o = 1$

dc electron beam current density $\rho_o = 10^{-6}\ c/m^2$

signal voltage V_1 = 10V (rms)
shunt resistance of the cavity $Rsh = 10\,k\Omega$

Total shunt resistance including load $R = 30\,k\Omega$

Calculate

a) The plasma frequency
b) The reduced plasma freq for R = 0.5
c) The induced current in the output cavity.
d) The induced voltage in the output power
e) The output power delivered to the load.
f) The power gain
g) The electronic efficiency

b) What are the limitation of conventional tuber at microwave frequencies. **6**

OR

2. A two cavity Klystron amplifier has the following parameters. **16**

$V_o = 1000V$ $R_o = 40\,k\Omega$

$I_o = 25\,mA$ $f = 3\,GHz$

Gap spacing in either cavity d = 1 mm
spacing between the two cavities L = 4cm
effective shunt impedance, excluding beam loading $Rsh = 30\,k\Omega$

a) Find the input gap voltage to give maximum voltage V_2.
b) Find the voltage gain, neglecting the beam loading in the output cavity.
c) Find the efficiency of the amplifier, neglecting beam loading.
d) Calculate the beam loading conductance and show that neglecting it was justified in the preceding calculations.

3. a) Explain the operation of TWT with us physical construction and electrode arrangement. **8**

b) Derive an expression for the cut-off magnetic flux density with reference to a cylindrical cavity magnetron. **8**

OR

4. a) A traveling wave tube has following characteristics **8**

Beam voltage $V_o = 2$ kV

Beam current $I_o = 4$ mA

Frequency f = 8 GHz

Circuit length N = 50

Characteristic impedance $Z_o = 20\Omega$

Determine :

i) Gain parameter C ii) The power gain in decibels.

b) What are slow wave structure. Explain how a helical TWT actives amplification. **8**

5. a) What is scattering matrices. Explain the properties of scattering (s) matrix. **8**

b) Prove that scattering (s) matrix of H - plane Tee is **8**

$$S = \begin{bmatrix} \frac{1}{2} & -\frac{1}{2} & \frac{1}{\sqrt{2}} \\ -\frac{1}{2} & \frac{1}{2} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} & 0 \end{bmatrix}$$

OR

6. a) Explain the operation of directional coupler with its scattering (s) matrix. **8**

b) What are the application of magic Tee explain any one in details. **8**

7. a) What is Gyrator. Explain its operation with neat diagram. **8**

b) Explain the operation of four port circulator with its S matrix. **8**

OR

8. a) Explain the operation of Farday rotation isolator. **8**

b) Determine the [s] of a 3-port circulator given insertion loss of 0.5 dB, isolation of 20 dB and VSWR of 2. **8**

9. a) What is microstrip lines. Explain losses in microstrip lines. **8**

b) Explain the self balancing bridge technique for measuring medium powers in the range of 10 mW to 10 W. **8**

OR

10. a) Explain any two methods of measuring impedance of a terminating load in a microwave system. **8**

b) What is parametric amplifier. Discuss the amplification mechanism of a parametric amplifier by use of its equivalent circuit. **8**

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