Reg. No. : ....

Name : ....

Seventh Semester B.Tech. Degree Examination, May 2013
(2008 Scheme)
08.703 : MICROWAVE ENGINEERING (T)

Time : 3 Hours

Max. Marks : 100

PART – A

Answer **all** questions.

1. List the differences between 'O' type and 'M' type tubes.

2. Derive the resonant frequency of rectangular cavity.

3. Why conventional tubes can't be operated at high frequencies and how these effects are taken cared in Klystron ?

4. An X band pulsed cylindrical magnetron has the following parameters.

   Anode voltage, $V_o = 26$ kV; Beam current $I_o = 27$ A; Magnetic flux density, $B_o = 0.336$ Wb/m^2, Radius of cathode cylinder a = 5 cm; Radius of vane edge to center b = 10 cm. Compute :

   a) cyclotron angular frequency

   b) cut off voltage for a fixed B_o

   c) cut off magnetic flux density for fixed V_o.

5. List the applications of microwave solid state devices.

6. A certain GaAs MESFET has the following parameters : Channel height : a = 0.1 μ m; electron concentration $N_d = 8 \times 10^{17}$/cm^3; relative dielectric constant $\varepsilon_r = 13.1$. Calculate the pinch off voltage.

7. List the S parameters of a 2 port network. Also show the wave directions entering and leaving a 2 port network.

8. Define coupling factor, insertion loss and directivity associated with a directional coupler.

9. List the advantages and disadvantages of microwave radio.

10. Write note on hot standby protection switching arrangement. **(10×4=40 Marks)**

PART – B

Answer **any 2** questions from **each** Module.

Module – I

11. With diagram explain the working of 2 cavity Klystron amplifier. Derive the expression for velocity modulation. Also draw the apple gate diagram. **10**

12. a) A reflex Klystron operates under the following conditions :

$V_o = 600$ V; $I_o = 11.45$ mA; $L = 1$ mm; $R_{sh} = 15$ kΩ; $f = 9$ GHz. The tube is oscillating at f at peak of $n = 1 \frac{3}{4}$ mode. Assume $\beta = 1$. Find :

a) microwave gap voltage and

b) repeller voltage for mode $1\frac{3}{4}$. **5**

b) Find the optimum length for $1\frac{3}{4}$ mode of a repeller space of reflex Klystron which operates with centre frequency 9 GHz with dc beam voltage 600 V and repeller voltage $V_R = 250$ V and $\eta = 1.76 \times 10^{11}$ C/Kg. **5**

13. A travelling wave tube (TWT) operates under the following parameters.

Beam voltage $V_o = 3$ kV; Beam current : $I_o = 30$ mA; characteristic impedance of helix : $Z_o = 10$ Ω; circuit length $N = 50$ frequency : $f = 10$ GHz. Determine :

a) gain parameter C

b) output power gain A_p in dB and

c) all four propagation constants. **10**

Module – II

14. Derive the hull cut off voltage equation for cylindrical magnetron. **10**

15. Explain in detail the different modes of operation of Gunn diode. **10**

16. With equivalent circuit of tunnel diodes explain series loading and parallel loading. Also explain how a tunnel diode works as amplifier with suitable microwave components. **10**

Module – III

17. A symmetric directional coupler has an infinite directivity and a forward attenuation of 20 dB. The coupler is used to monitor the power delivered to a load Z_l as in fig. 1 Bolometer 1 introduces a VSWR of 2.0 on arm 1; bolometer 2 is matched to arm 2. If bolometer 1 reads 9 mW and bolometer 2 reads 3 mW
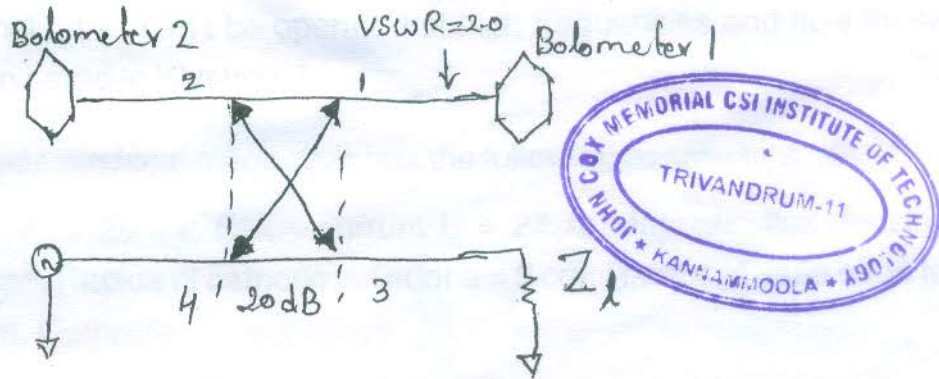

Fig. 1

a) Find the amount of power dissipated in the load Z_l.

b) Determine the VSWR on arm 3. **10**

18. With the aid of Smith chart explain how impedance is measured at microwave frequency range using simple laboratory equipments. **10**

19. With diagrams explain microwave radio repeaters. Contrast IF and baseband repeaters. **10**