



Reg. No. : .....

Name : .....

**Eighth Semester B.Tech. Degree Examination, December 2013****(2008 Scheme)****08.825 – Elective V****MICROWAVE DEVICES AND CIRCUITS (T)**

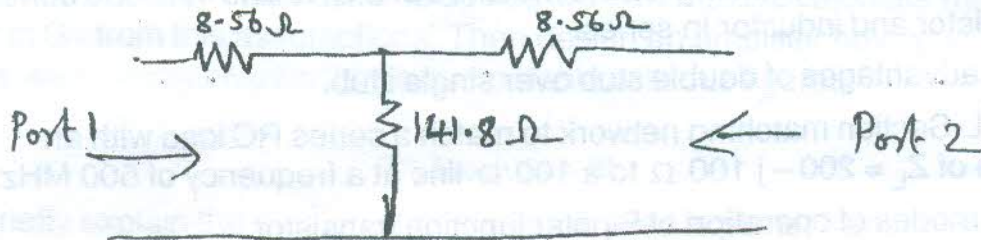
Time : 3 Hours

Max. Marks : 100

**Instruction** : Provide Smith Charts to students on their request**PART – A**

Answer all questions.

1. Find the equivalent voltages and currents for a  $TE_{10}$  mode in a rectangular waveguide.
2. Find the S parameters of 3 dB attenuator in fig. below.



3. List the factors that determine the selection of a matching network.
4. Design a 20 dB single Section coupled line coupler in stripline with a ground plane spacing of 0.32 cm,  $\epsilon_r = 2.2$ ,  $Z_0 = 50 \Omega$ , and a center frequency of 3 GHz. Include the effect of loss by assuming a loss tangent of 0.05 for the dielectric and copper conductor thickness of 2 mil.

OR

Explain the working of TRAPATT diode.

5. Define power gain, available gain and transducer power gain for a 2 port network amplifier.
6. An IMPATT diode has the parameters.  
Carrier drift velocity  $V_d = 2 \times 10^7$  cm/s  
Drift region length  $L = 6 \mu\text{m}$



Max. operating voltage  $V_{0 \max} = 100 \text{ V}$

Max. operating current  $I_{0 \max} = 200 \text{ mA}$

Efficiency  $\eta = 15\%$

Breakdown voltage  $V_{bd} = 90 \text{ V}$

Calculate (a) Maximum CW out put power in watts (b) Resonant frequency in GHz.

7. Draw the circuit of a one port negative resistance oscillator.
8. Explain Richard's transformation.
9. List the Kuroda's identities.
10. Write note on phase shifters. (10×4=40 Marks)

### PART – B

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

#### Module – I

11. a) Match a load impedance of  $Z_L = 100 + j 80 \ \Omega$  to a  $50 \ \Omega$  line using a single series open stub. Assuming load is matched at 2 GHz and that load consists of a resistor and inductor in series. 7
- b) List the advantages of double stub over single stub. 3
12. Design an L-Section matching network to match a series RC load with an impedance of  $Z_L = 200 - j 100 \ \Omega$  to a  $100 \ \Omega$  line at a frequency of 500 MHz. 10
13. a) List the modes of operation of Bipolar junction transistor. 5
- b) Explain the Gunn effect and RWH theory. 5

#### Module – II

14. A typical n type Ga As Gunn diode has the parameters :  
 Threshold field  $E_{th} = 2800 \text{ V/cm}$  ; Applied field  $E = 3200 \text{ V / cm}$  ; Device length  $L = 10 \ \mu\text{m}$  ; Doping concentration  $n_0 = 2 \times 10^{14} / \text{cm}^3$  ; operating frequency  $f = 10 \text{ GHz}$ .
  - a) Compute electron drift velocity
  - b) Calculate current density
  - c) Estimate the negative electron mobility. 10





15. a) An LSA oscillator has the parameters  
Conversion efficiency  $\eta = 0.06$   
Multiplication factor  $M = 3.5$   
Threshold field  $E_{th} = 320 \text{ k V/m}$   
Device length  $L = 12 \text{ } \mu\text{m}$   
Donor concentration  $n_0 = 10^{21}/\text{cm}^3$   
Average carrier velocity  $V_0 = 1.5 \times 10^5 \text{ m/s}$   
Area  $A = 3 \times 10^{-8} \text{ m}^2$   
Determine the output power in mW. 5
- b) Substantiate that a negative one port oscillator needs cavity for sustained oscillations. 5
16. A Ga As F and T is biased for minimum noise figure and has S parameters and noise parameters at 4 GHz ( $Z_0 = 50 \text{ } \Omega$ )  $S_{11} = 0.6 \angle -60^\circ$ ,  $S_{21} = 1.9 \angle 81^\circ$ ,  $S_{12} = 0.05 \angle 26^\circ$ ,  $S_{22} = 0.5 \angle -60^\circ$   $F_{min} = 1.6 \text{ dB}$   $\overline{\text{opt}} = 0.62 \angle 100^\circ$ ,  $R_n = 20 \text{ } \Omega$ .  
For the design purposes, assume device is unilateral and calculate maximum error in  $G_T$  from this assumptions. Then design an amplifier having a 2 dB noise figure with maximum gain that is competable with this figure. 10

### Module – III

17. a) Briefly explain the method of analysis involved in planer transmission line. 7  
b) At high frequencies why we go for distributed line elements rather than lumped elements. 3
18. Write notes on :  
Microstrip line 5  
Coupled strip lines 5
19. a) Write notes on lumped elements capacitors, Inductors and resonators. 6  
b) Draw the equivalent circuits for ON and OFF states of PIN diode. 4