Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1724101 **Date: 06/07/2012**

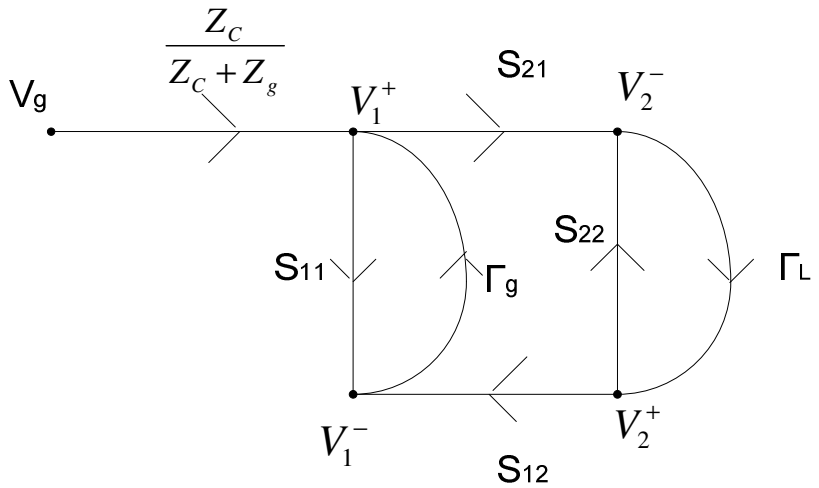
Subject Name: RF and Microwave Circuits

Time: 10:30 am – 13:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Find ratio of $\frac{V_1^+}{V_g}$ from given signal flow graph , by using reduction techniques. **07**



(b) Design an m derived T section low pass filter with cutoff frequency of 1.5 MHz and nominal impedance of 75 Ω. Assume that f_∞ = 2.05 MHz. **07**

Q.2 **(a)** Show that the admittance matrix of a reciprocal , lossless N port network has purely imaginary elements. **07**

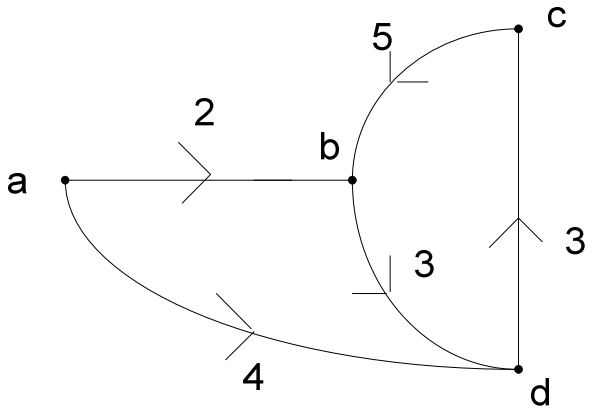
(b) A load line of impedance Z_L=250 - j450 Ω at 5 GHz is connected to a 100 Ω line. Calculate the position and length of short circuited stub designed to match this load to the line, so that maximum power can be transferred to the load. Use Smith chart to solve this problem. **07**

OR

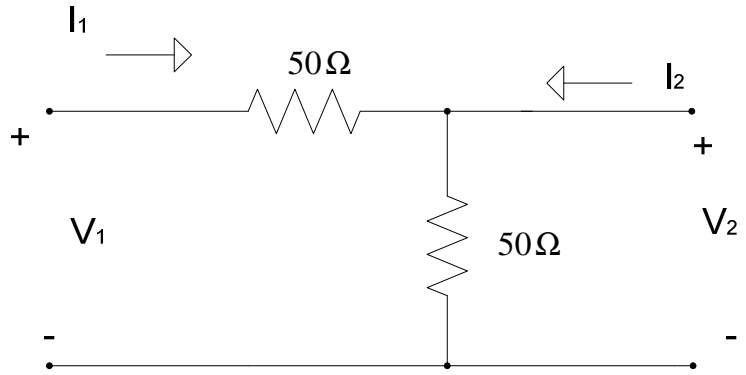
(b) A RF input signal at 900 MHz is down converted in a mixer to an IF frequency of 80 MHz. What are the two possible local oscillator frequencies and the corresponding image frequencies? **07**

Q.3 **(a)** (1) Prove that reciprocal network is symmetrical network. **04**

(2) Find transfer function d/a from given signal flow graph , by using reduction techniques. **03**



(b) Find S and Z matrix of given circuit below. **07**



OR

Q.3 **(a)** A 2.5 W power source is connected to the input of a directional coupler with C= 20 dB, D=25 dB and insertion loss of 0.7dB. Find the output powers in dBm at the through, coupled and isolated ports. Assume all ports are to be matched. **07**

(b) Design a 100 MHz Colpitts oscillator using a transistor in common emitter configuration with $\beta = \frac{g_m}{G_i} = 30$, and a transistor input resistance of R_i = $1/G_i$=1200 Ω . Use an inductor with L = 0.10 μH, with Q of 100. What is the minimum Q of the inductor for which oscillation will be sustained? **07**

Q.4 **(a)** A lossless 100 Ω transmission line is terminated by an impedance of 200 +j200 Ω. Find the location of the first V_{max} and first V_{min} if operating wavelength is 5 cm. Use Smith chart to solve this problem. **07**

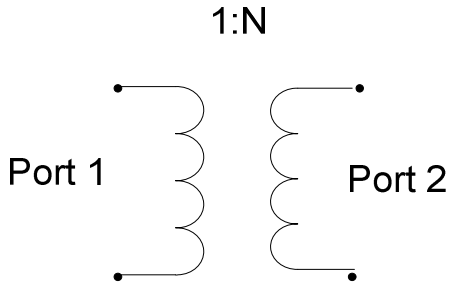
(b) Explain different materials and their characteristics used for MMIC's fabrication. **07**

OR

Q.4 **(a)** The SWR on loss less 100 Ω line is 5. Calculate the maximum and minimum values of voltage and current on the line when the incident voltage is 35 V. **07**

Q.4 **(b)** A YIG sphere with 4ΠMs = 2000 G lies in a uniform magnetic field having a strength of 1400 Oe. What is the magnetic field strength inside the YIG sphere? **03**

(c) Find ABCD matrix of following circuit **04**



Q.5 **(a)** Derive the expressions for S parameters in terms of the ABCD parameters. **07**

(b) A 600 Ω lossless transmission line is fed by a 50 Ω generator. If line is 250 meter long and terminated by load of 550 Ω, determine in dBs (i) reflection loss (ii) transmission line loss and (iii) return loss. **07**

OR

Q.5 **(a)** A quartz crystal operating at 10MHz has equivalent circuit parameters of R= 30 Ω , C= 27 fF and Co=5.5 pF. What is the value of inductance in the equivalent circuit? What is the Q of this crystal ? What is the percentage difference between the series and the parallel resonant frequencies? **07**

(b) A ferrite medium has saturation magnetization of M_s= 1500/4Π , and is magnetically lossless. If there is a z directed bias field Ho= 1000 Oersted , find the permeability tensor at 8 GHz. **07**

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