Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Remedial Examination May 2011

Subject code: 130901 **Subject Name: Circuits and Networks**

Date: 25-05-2011 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Symbols and notations have conventional meaning unless stated.**
4. **Figures to the right indicate full marks.**

Q.1 **(a)** Give the relation between energy (E) and power (P). Derive the equations for the energy stored in a capacitor (C) and an inductor (L) using P=VI. **07**

(b) Prove the maximum power transfer theorem for a practical voltage source (Vs, Rs). What is the maximum power that can be delivered if Vs=20 V and Rs=1 Ohm? **07**

Q.2 **(a)** Derive a tree of the graph of the network in Fig.1. Determine the node voltages V1 and V2, using the mesh analysis. **07**

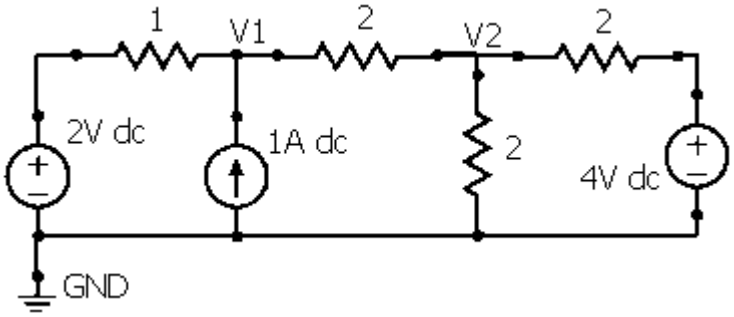

Figure 1 Network of Q. 2. Resistance values are in Ohms.

(b) Determine the node voltages V1 and V2 in the network shown in Fig. 1, by applying the superposition theorem. **07**

OR

(b) In Fig. 1, if 1 Ohm resistance is changed to 1.2 Ohm then determine the source-voltage for compensating for the change. **07**

Q.3 **(a)** Solve for the nodal voltages V1, V2, V3 and V4 as shown in the network in Fig. 2, using the nodal analysis. **07**

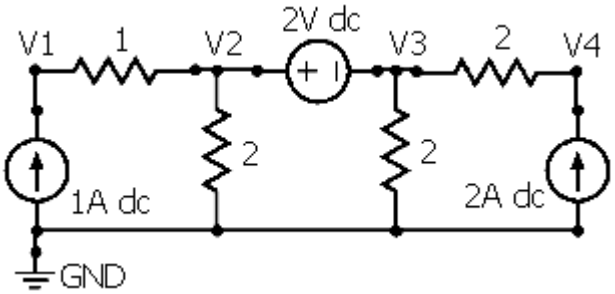

Figure 2 Network of Q. 3. Resistance values are in Ohms.

(b) In Fig. 2, if 2V source is replaced by an open circuit then find Thevenin's and Norton's equivalent circuits across V2 and V3. **07**

OR

Q.3 **(a)** Find the equivalent inductance for the series and the parallel connections of L1 and L2 if their mutual inductance is M. **07**

(b) State Millman's theorem. Obtain the equivalent of a parallel connection of three branches each with a voltage source and a series resistance, (2V, 1 Ohm), (3V, 2 Ohm) and (5V, 2 Ohm). **07**

Q.4 **(a)** Define the time-constant of RL and RC networks and explain the significance of the time-constant. **07**

(b) Explain how to determine the initial conditions in an RL network and the current i(t) based on these conditions. **07**

OR

Q.4 **(a)** Obtain the loop-current i(t) in the RC network in Fig. 3, by solving the differential equation of the loop. **07**

(b) Obtain the voltage across the capacitor Vc(t), in the LC circuit in Fig. 4 using Laplace transform technique if Vc(0)=2V. **07**

Q.5 **(a)** Determine the voltage across the capacitor in the RLC circuit as shown in Fig. 5, if R=400 Ohm using Laplace transform. **07**

(b) Determine the poles of a series RLC circuit, if R=120 Ohm, L=10 mH and C=1 micro-F. Sketch the pole-plot and comment on the nature of the response. **07**

OR

Q.5 **(a)** Explain the short-circuit admittance and the open-circuit impedance parameters for a two port network. **07**

(b) Draw a tree of the network in Fig. 6 taking the branches denoted by (b2), (b4), and (b5) as tree branches. Give the fundamental loop matrix. Determine the matrix loop equation from the fundamental loop matrix. **07**

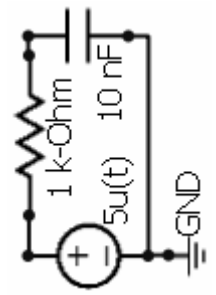

Figure 3 RC network of Q.4 (a).

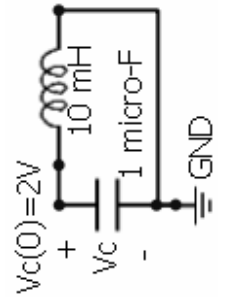

Figure 4 LC network of Q. 4 (b).

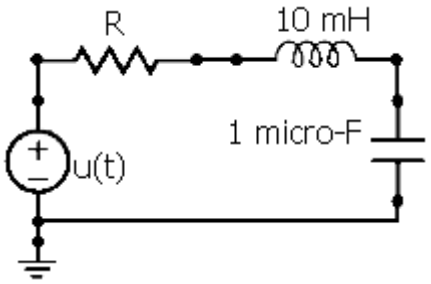

Figure 6 RLC circuit of Q. 5 (a).

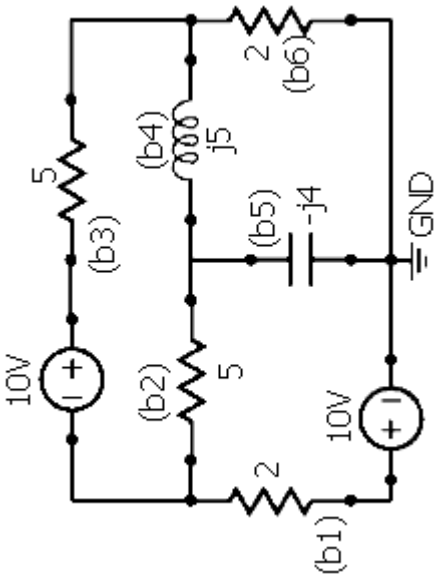

Figure 5 Network of Q. 5 (b). Branch-impedances are in Ohms.

****