L 1069

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Electronics and Communication Engineering

EC 1151 — CIRCUIT ANALYSIS

(Common to Part-Time B.E.- First Semester – Electronics and Communication Engineering – Regulations 2005)

(Regulations 2004)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Obtain the alternating current that results when an alternating voltage $v = V_m \sin wt$ is applied to a pure capacitor.

2. In the circuit shown in Figure 1, find the value of C which gives an equivalent capacitance of $0.5\mu F$ between A and B.

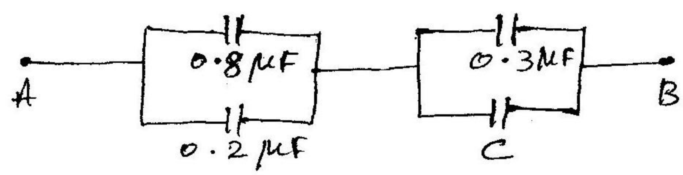

Figure 1

3. State Norton's theorem.

4. What are the limitations of Thevenin's theorem?

5. The current passing through an RLC series circuit is given by $i = I_m \sin wt$. What is the voltage across L and C?

6. Assume a sinusoidal voltage, $v = V_m \sin wt$ is applied to a passive network. What is the average value of power if (a) network contains only inductive element (b) network contains only resistive element.

7. Obtain the natural frequency and time constant of an **RLC series** circuit with $R = 1\,K\Omega$, $L = 100\,mH$, and $C = 0.1\,\mu F$.

8. An inductive coil having a resistance of $20\,\Omega$ and an inductance of 0.02 H is connected in series with $0.01\,\mu F$ capacitor. Calculate :
   (a) Q of the coil, and
   (b) Resonant frequency of the circuit.

9. Two coupled coils with $L_1 = 0.02\,H$, $L_2 = 0.01\,H$ and $K = 0.5$ are connected in series aiding arrangement. Obtain the equivalent inductance in such case.

10. Obtain the dual circuit of Figure 2.

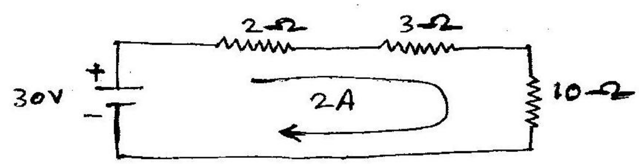

Figure 2

PART B — (5 × 16 = 80 marks)

11. (i) For the circuit shown in Figure 3, find the current through the $30\,\Omega$ load resistor using Norton's theorem.

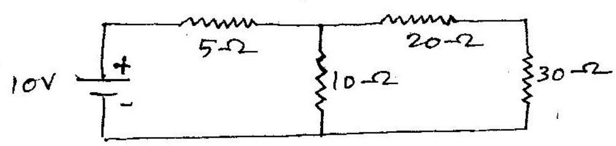

Figure 3

(ii) For the circuit shown in Figure 4, determine the current I, using star-delta conversion.

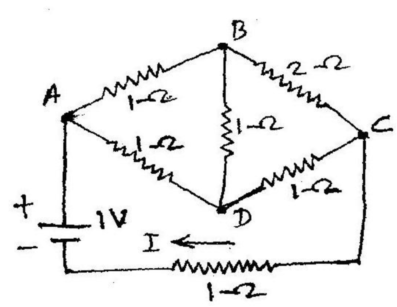

Figure 4

12. (a) (i) In a circuit, the impedances, $z_1 = (5 + j5)\,\Omega$, $z_2 = -j8\,\Omega$, and $z_3 = 4\,\Omega$, are connected in series to an unknown voltage source V. Find the current flowing in the circuit, and the voltage V, if the voltage drop across z_3 is $63.2\angle 18.45^\circ$ V.

(ii) For the circuit shown in Figure 5, find the current through the $10\,\Omega$ resistor.

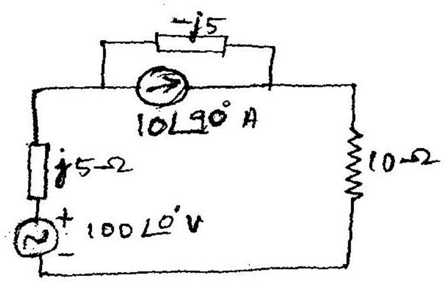

Figure 5

Or

(b) (i) Calculate the power dissipated by the $5\,\Omega$ resistor in the circuit shown in Figure 6 using node voltage method.

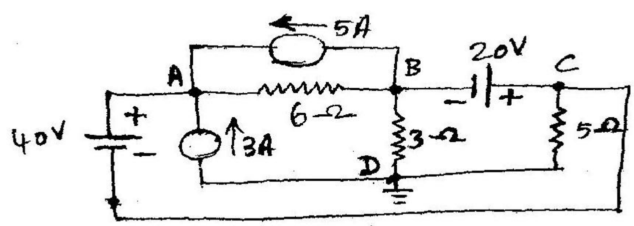

Figure 6

(ii) Find the current in the $12\,\Omega$ resistor of the network shown in Figure 7, using loop analysis.

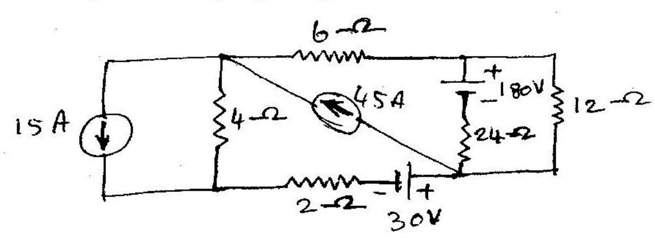

Figure 7

13. (a) (i) Find the steady state response of the circuit shown in Figure 8. using the method of phasors. The applied voltage is $v_1 = \cos wt$. Also draw the phasor diagram showing all phasors.

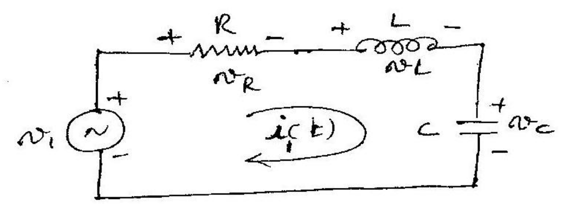

Figure 8

(ii) Find Z_{eq} and Y_{eq} of the circuit shown in Figure 9.

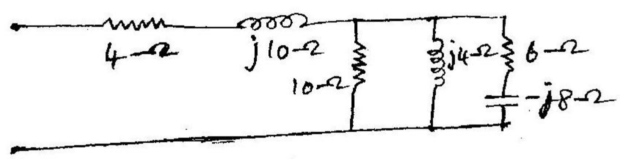

Figure 9

Or

(b) (i) A current of 10 A flows in a circuit with a 30° angle of lag, when the applied voltage is 100 V. Find the resistance, impedance and reactance of the circuit.

(ii) An alternating voltage of 100 V, 50 Hz, is applied across a series combination of R = 50 Ω and C = 500 μF. Find the current, power and the power factor. Draw the phasor diagram.

14. (a) (i) A RC series circuit shown in Figure 10 is energised by a step voltage $Eu(t)$. Assume the circuit is relaxed at $t = 0$, the time of closing of the switch. Obtain the expression for the current, $i(t)$.

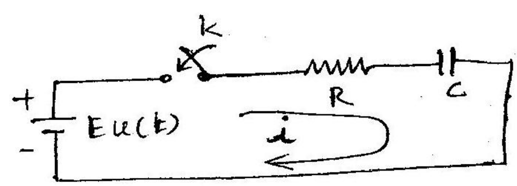

Figure 10

(ii) In the circuit shown in Figure 11, the switch K is changed from position 1 to 2 at $t = 0$. Steady state having been reached before switching. Evaluate : (1) $\frac{di}{dt}$ and (2) $\frac{d^2i}{dt^2}$ at $t = 0^+$.

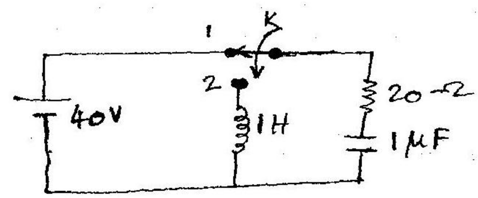

Figure 11

Or

(b) For the circuit shown in Figure 12, determine the value of C at which it resonates when $f = 100$ Hz.

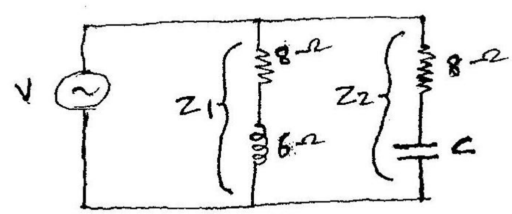

Figure 12

15. (a) (i) In a coupled circuit, $L_2 = 4L_1$, and coupling coefficient $K = 0.6$. When L_1 and L_2 are connected in series opposing, the equivalent inductance is 44.2 mH. Find L_1, L_2 and M.

(ii) For the circuit shown in Figure 13, draw the oriented graph, select a tree, and draw the tie-set schedule.

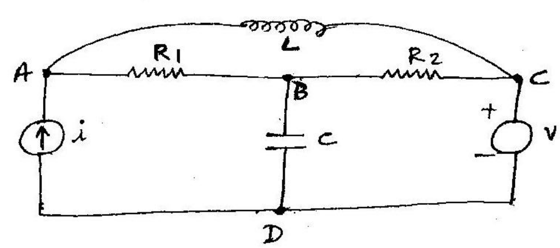

Figure 13

Or

(b) (i) A parallel circuit resonates at 1 MHz, having inductance of 150 μH with Q_0 of 60. Find the value of capacitance and resistance of inductor.

(ii) Draw the graph of the network shown in Figure 14. Select a possible tree of the network graph and draw the cut-set schedule.

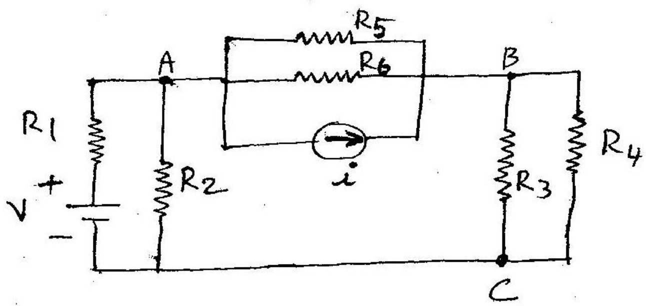

Figure 14