The LNM Institute of Information Technology

Department: ECE

Basic Electronics (ECE103)

Exam Type: Mid Term

Time: 90 minutes **Date:** 25/09/2019 **Max. Marks:** 30

Instructions: *1. This question paper consists of 3 printed pages.*
2. All the questions are compulsory.
3. Attempt each new question in a fresh page.
4. Clearly mark all the answers with a box or underline.

Q.1 **a)** In the circuit shown below ***(Fig. 1a)***, find the total resistance R_T, with terminals a and b: **i)** open circuited **ii)** short circuited. **[2]**

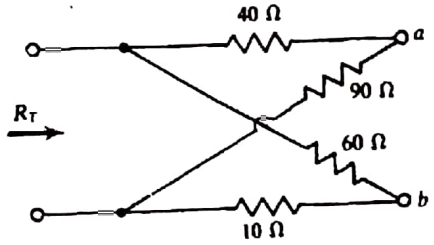

Fig. 1a

b) In the interval $0 > t > 5\pi$ ms, a 20-mF capacitance has a voltage $v = 50.0sin200t$ *(V)*. Obtain the charge, power, and energy. Plot energy (w_c) assuming $w = 0$ at $t = 0$. **[3]**

Q.2 **a)** In the circuit shown below ***(Fig. 2a)***, find the resistance R_{ab}, with the value of each resistance being *30Ω*. **[2]**

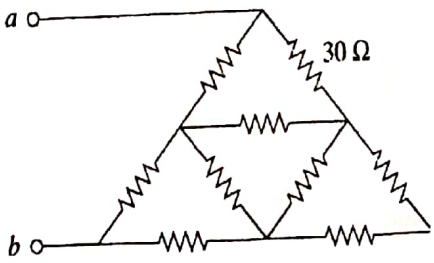

Fig. 2a

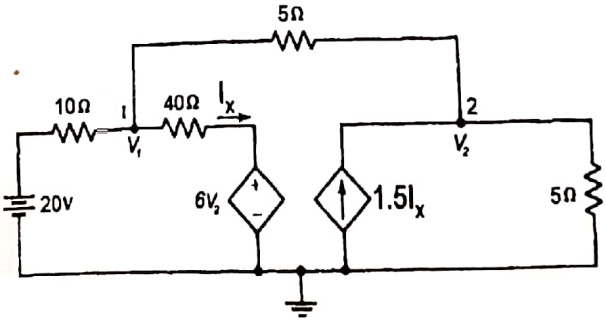

Fig. 2b

b) Obtain voltages V_1 and V_2 given in the circuit shown in ***(Fig. 2b)***. **[3]**

Q.3 a) In the circuit shown below ***(Fig. 3a)***, find the Thevenin's equivalent V_{th} and R_{th} to the left of terminals *a* and *b* (in terms of V_{in}). Also calculate the transfer resistance $R_{transfer} = V_{in}/I_4$ in terms of R_L when R_L is connected. **[3]**

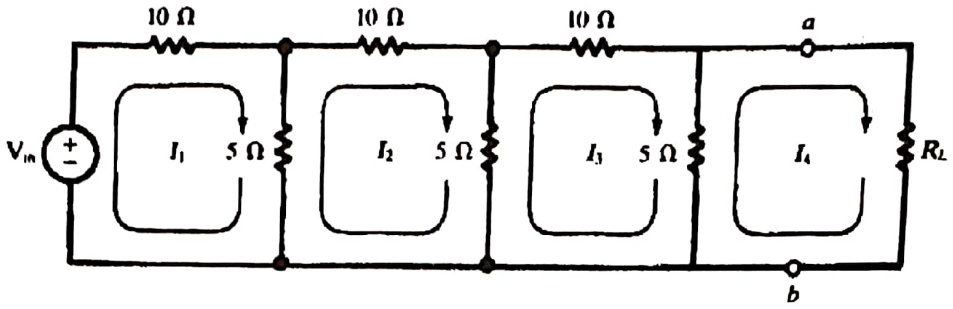

Fig. 3a

b) Find the value of the adjustable resistance ***R*** which results in maximum power transfer across the terminals *ab* for the circuit shown in ***Fig. 3b***. Also determine the value of the maximum power ***Pmax***. **[2]**

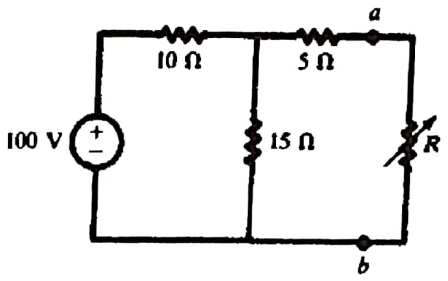

Fig. 3b

Q.4 a) In the circuit shown in ***Fig. 4a***, the initial voltages across the capacitors C_1 and C_2 are 1V and 3V respectively. The switch is closed at time *t=0*. How much energy will be dissipated (in Joules) in the resistor *R* until the steady state is reached. **[3]**

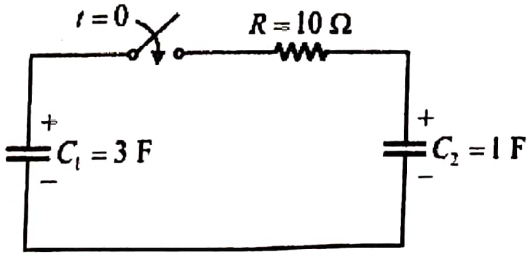

Fig. 4a

b) In the given circuit ***Fig. 4b***, the switch S is closed at $t = 0$. Derive the expression for the rate of change of current $\frac{di(t)}{dt}$ at $t=0^+$. **[2]**

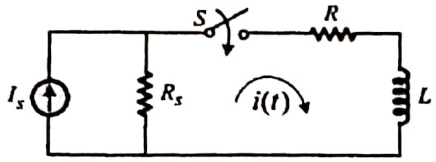

Fig. 4b

Q5. **a)** The responses of a series RLC circuit are: **[3]**

$$v_C(t) = 30 - 10e^{-20t} + 30e^{-10t} \text{ V}$$

$$i_L(t) = 40e^{-20t} - 60e^{-10t} \text{ mA}$$

where v_C is the capacitor voltage and i_L is the inductor current. Calculate the value of R, L and C.

b) For the circuit shown in ***Fig. 5b***, the switch is closed for a long time and opens at $t=0$. Find the response of the system and voltage across capacitor as a function of time for $t > 0$. **[2]**

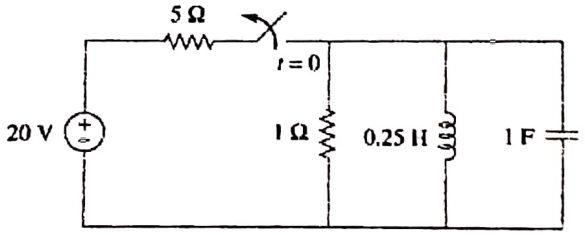

Fig. 5b

Q6. **a)** For the circuit shown ***Fig. 6a***, the switch is closed at $t=0$. Find response of the system and $i(t)$ for $t>0$. **[3]**

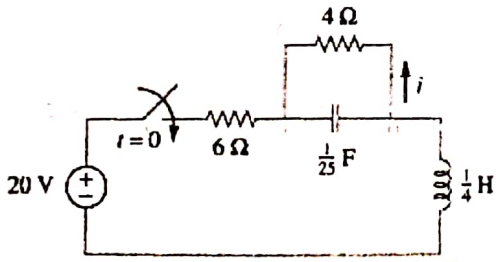

Fig. 6a

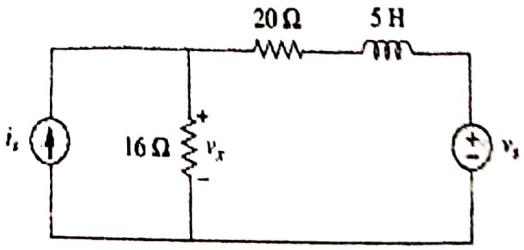

Fig. 6b

b) Using superposition principle, calculate V_x in the circuit shown in ***Fig. 6b*** if $v_s = 50\sin 2t$ V and $i_s = 12\cos\left(6t + 10^0\right)$ A. **[2]**