Ref. No.: Ex/PE/T/126/2017

B. POWER ENGINEERING EXAMINATION -2017

(1st Year – 2nd Semester)

SUBJECT – Circuit Theory

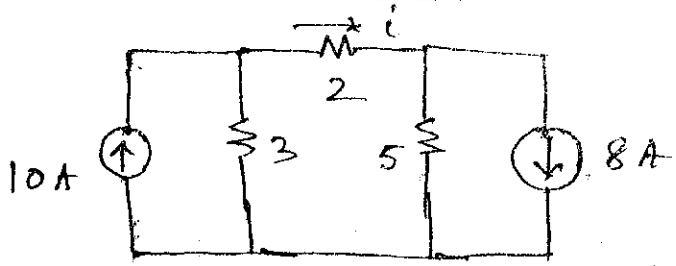
Time: Three hours | Full Marks: 100

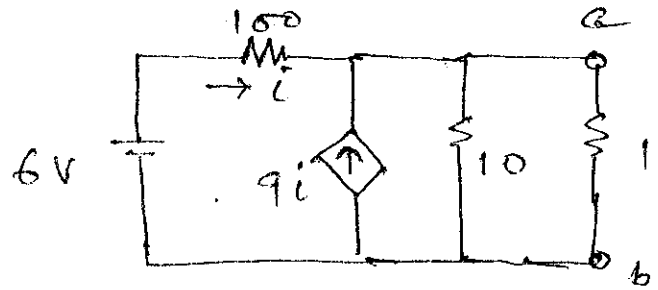
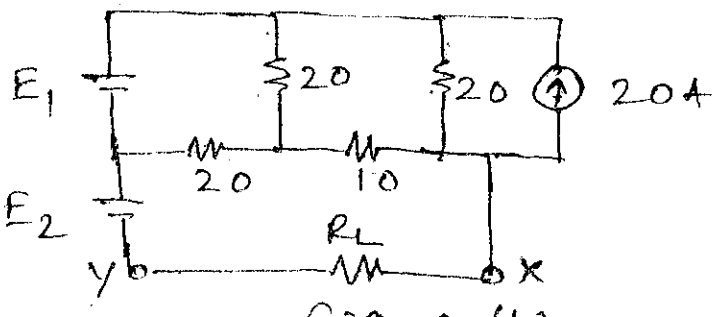
Answer any ***seven*** questions

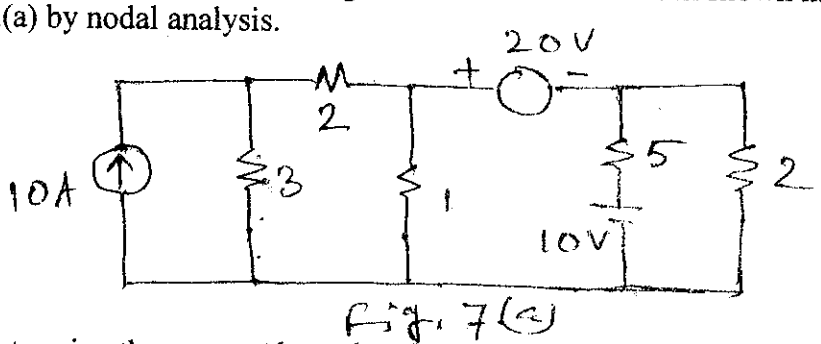
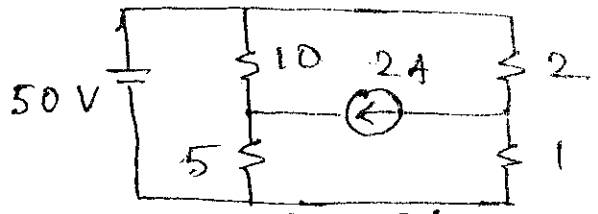
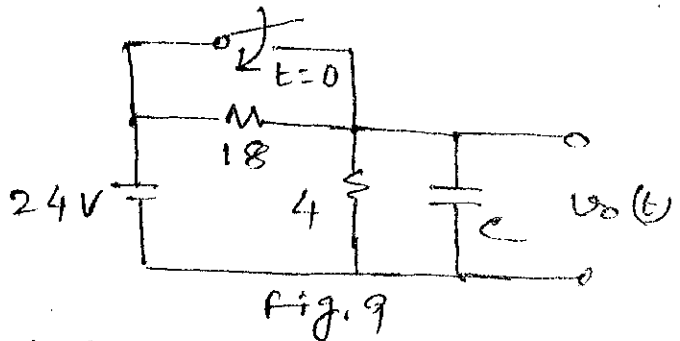
Assume suitable value for missing data, if any

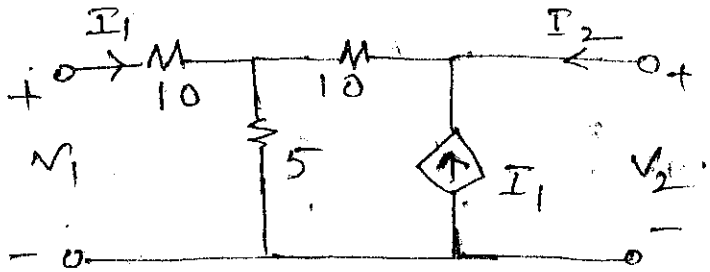
All the values of resistors are in Ω.

All parts of a question to be answered at one place.

No. of Question		Marks
Q. 1. (a)	Define and explain the following with suitable examples: (i) Fundamental Tie set and fundamental Tie set Matrix (ii) Tree and Co-tree of a graph (iii) Odd function symmetry of periodic functions	3+2+2
(b)	The incidence matrix of a directed graph is given below. Draw the directed graph. Also, write down the fundamental tie set matrix for a particular tree of your choice. $[A] = \begin{bmatrix} 0 & 1 & 0 & 1 & -1 & 0 & -1 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 & 0 & -1 \\ -1 & -1 & -1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & -1 & 0 & 0 & 1 & 1 \end{bmatrix}$	7
2. (a)	For the network as shown in fig 2.(a), draw the directed graph and write down the incidence matrix and hence reduced incidence matrix. Use it to determine the current *i*.  Fig. 2.(a)	7 + 7
(b)	For a particular tree of your choice, write the fundamental cut set matrix and verify your answer in 2.(a) using fundamental cut set matrix.	

3.	The input voltage to a series RL circuit is $e(t) = 180\sin(314t + 10^\circ) + 56\sin(942t + 35^\circ) + 18$ The values of R and L are 18 Ω and 0.0413 H. Determine (i) the expression for current (ii) rms values of voltage and current. (iii) average power dissipation in the circuit and (iv) the power factor of the circuit.	14
4.	Discuss the even function symmetry of a periodic function with suitable example. Hence show that Fourier Series of an even periodic function contains only cosine terms plus a constant.	4 +10
5. (a)	State and explain Thevenin's Theorem with suitable example.	4
(b)	Find the current through the 1.0 Ω resistance connected between the terminals a and b for the network as shown in fig. 5.(b) using Thevenin's Theorem.  Fig. 5(b)	10
6. (a)	State and explain Maximum Power Transfer Theorem with suitable example.	4
(b)	For the network shown as shown in fig. 6.(b) below, E_1 = 240 V. (i) If E_2 50 V, find the value of R_L which results in maximum power absorbed in it. What is the value of maximum power? (ii) If E_2 is variable, what should be its value to limit the maximum power dissipation in R_L to 10 W?  Fig. 6.(b)	10

7. (a)	Determine the current through 5 Ω resistor for network shown in fig. 7.(a) by nodal analysis.  Fig. 7(a)	7
(b)	Determine the current through 5 Ω resistor for network shown in fig. 7.(b) by loop analysis.  Fig. 7.(b)	7
8. (a)	Find the response current of a series *RLC* circuit *with* $R = 5\ \Omega$, $L = 1\ H$ and $C = 0.25\ F$ when each of the following driving force is applied. (i) *12 r (t-2)* and (ii) *3 u (t-3)*	8
(b)	A pulse of width *b* and magnitude 10 V is applied at time *t* to a series *RC* circuit with $R = 1.0\ \Omega$ and $C = 0.25\ F$. Find current flowing through the circuit assuming zero net charge across the capacitor.	6
9.	Consider the circuit as shown in fig. 9. The input to the circuit is 24 V. The output of the circuit, the voltage across the capacitor, is given to be $v_o(t) = 16 - 12e^{-0.6t}$ V when $t > 0$  Fig. 9 Determine the value of the capacitance *C*.	14
10. (a)	Derive the condition for reciprocity and symmetry of hybrid parameters (h-parameters) representation of a two port network.	7

(b)	Find the z-parameters for network as shown in fig.10. (b) below.  fig. 10(b)	7