Ref No. Ex/PE/PC/B/T/215/2024(S)

B. POWER ENGINEERING EXAMINATION -2024

(2nd Year, 1st Semester Supplementary)

SUBJECT – Circuit Theory

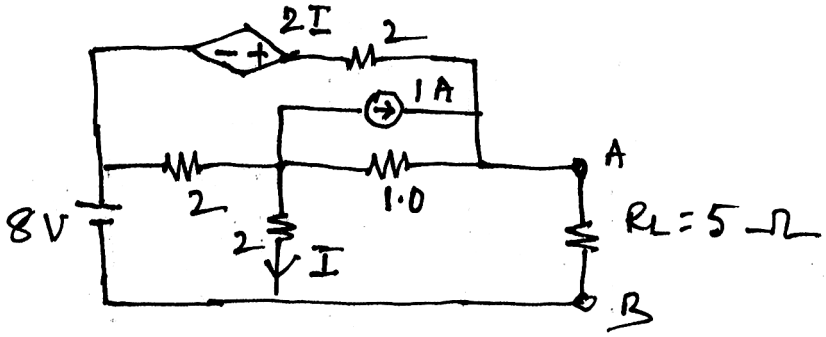
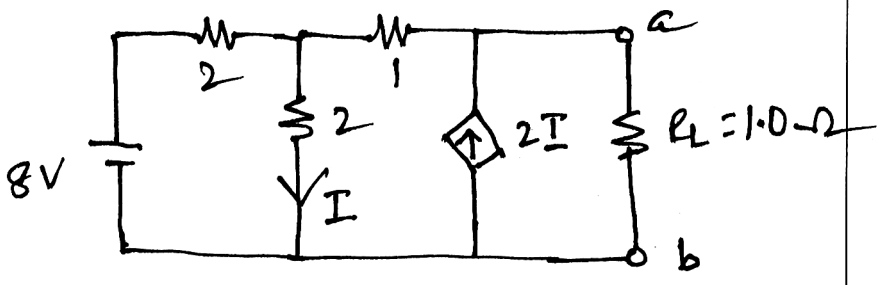
Time: Three hours | Full Marks: 100

Answer ***five*** questions taking ***one*** from each group

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 |
|---|---|---|
| | Group A (CO1)<br>Answer **any one** questions | |
| 1. (a) | State and explain Thevenin's Theorem with suitable example. | 8 |
| (b) | Determine the current flowing through the load resistance using Thevenin' Theorem for the network shown below. Find also the maximum power dissipated.<br>  | 12 |
| 2. (a) | State and explain Norton's Theorem with suitable example. | 8 |
| (b) | Find the current through the 1.0 Ω resistance connected between the terminals *a* and *b* for the network as shown below using Norton's Theorem.<br>  | 12 |

Group B (CO2)
Answer ***any one*** question

3. (a) Define and explain the following with suitable examples:

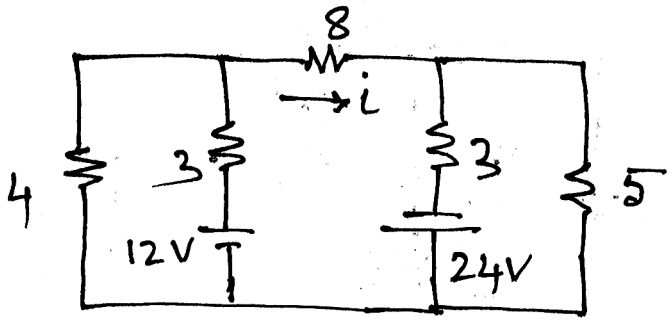
(i) Isomorphic graphs
(ii) Cut set and fundamental cut set
(iii) Fundamental Tie set matrix

3+4+3

(b) What is incidence matrix? The incidence matrix of a directed graph is given below. Draw the directed graph. Also, write down the fundamental cut set matrix for a particular tree of your choice. 10

$$[A] = \begin{bmatrix} -1 & 0 & 0 & -1 & 1 & 0 \\ 0 & 1 & 0 & 0 & -1 & -1 \\ 0 & 0 & -1 & 1 & 0 & 1 \\ 1 & -1 & 1 & 0 & 0 & 0 \end{bmatrix}$$

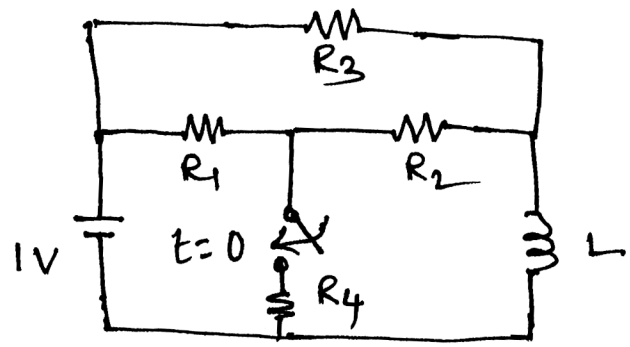
4. For the network as shown below, draw the directed graph and write down the fundamental tie set matrix for a particular tree of your choice. Use it to determine the current *i*. 20




Group C (CO3)
Answer **any one** question

5. Find the response current of a series *RLC* circuit *with* $R = 10\ \Omega$, $L = 2\ H$ and $C = 0.50\ F$ when each of the following driving force is applied. (i) *10 r (t-3)* and (ii) *3 u (t-2)* (iii) $3\delta(t-1)$ 20

6. The circuit shown below is at steady state with the switch *S* open. At $t = 0$, *S* is closed. Obtain the current through the inductor for $t > 0$. Assume
$R_1 = R_2 = R_3 = 1\ \Omega, R_4 = 2\ \Omega$ *and* $L = 1\ H$ 20



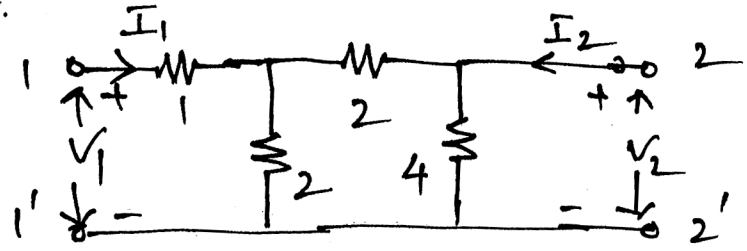

Group D (CO4)
Answer ***any one*** question

7. An rms current of 5A which has a third harmonic component is passed through a coil having $R = 1.0\,\Omega$, $L = 10\,mH$. The rms voltage across the coil is 20 V. Calculate the magnitude of the fundamental and harmonic components of the current if fundamental frequency is $300/2\pi$ Hz. Find also the power dissipated. 20

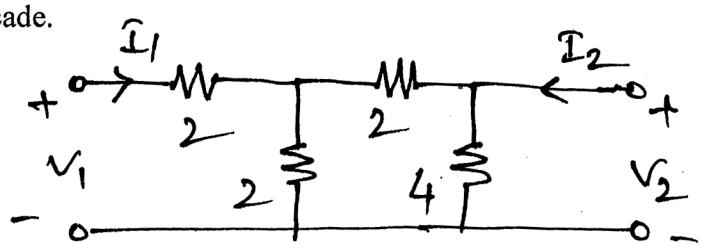
8. A voltage $v = 250\sin\omega t + 50\sin(3\omega t + \pi/3) + 2\sin(5\omega t + 5\pi/6)$ is applied across a series of $R = 20\,\Omega, L = 0.05\,H$. Determine the expression for (a) current (b) power and (c) power factor. 20

Group E (CO5)
Answer ***any one*** question

9. Find the *y*-parameters and *h*-parameters for network as shown below. 20




10. Two identical sections of the network as shown below are connected in cascade. 20




Obtain the transmission (ABCD) parameters of the overall network.