Ref. No.: Ex/PE/PC/B/T/215/2024

B. POWER ENGINEERING EXAMINATION -2024

(2nd Year – 1st Semester)

SUBJECT – Circuit Theory

Time: Three hours | Full Marks: 100

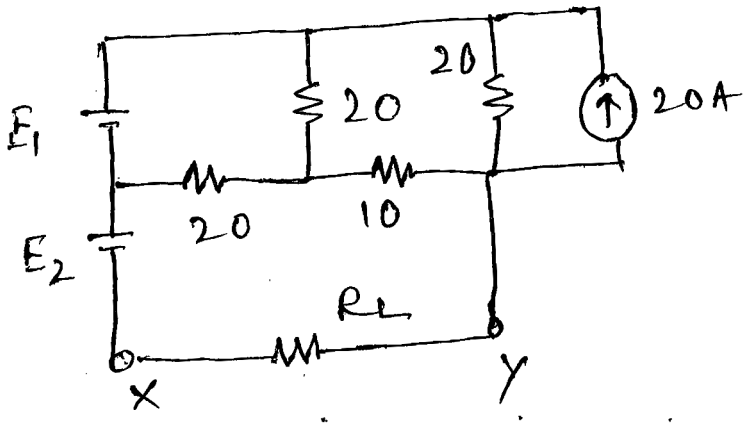
Answer any ***five*** questions as directed under each group

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 Answer **any one** questions	
1.(a)	State and prove Maximum Power Transfer Theorem with suitable example.	6
(b)	In the circuit shown 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 and the corresponding maximum power (ii) If E_2 is variable, what should be its value to limit the maximum dissipation in R_L to 10 W?	14
2. (a)	What is a supermesh? Explain the techniques for the solution of networks having supermesh with suitable example.	8
(b)	For the network as shown below, determine the current flowing through the 6 Ω resistor.	12



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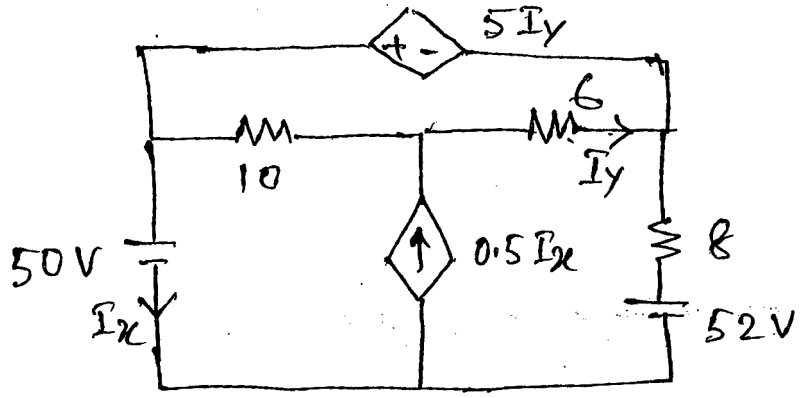


Group B

Answer ***any one*** question

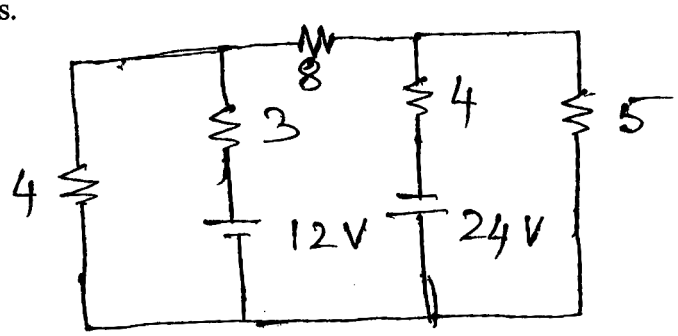
3. (a) Define and explain the following with suitable examples: 4+3+3

(i) Cut set and fundamental cut set matrix
(ii) Tie set matrix
(iii)Incident matrix

(b) The incidence matrix of a directed graph is shown below. Draw the directed graph. Select a particular tree of your choice and write down the fundamental cut set matrix for the same. 10

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

4. For the network as shown below, draw the directed graph and write down the reduced incidence matrix. Use it to determine the branch voltages. 20



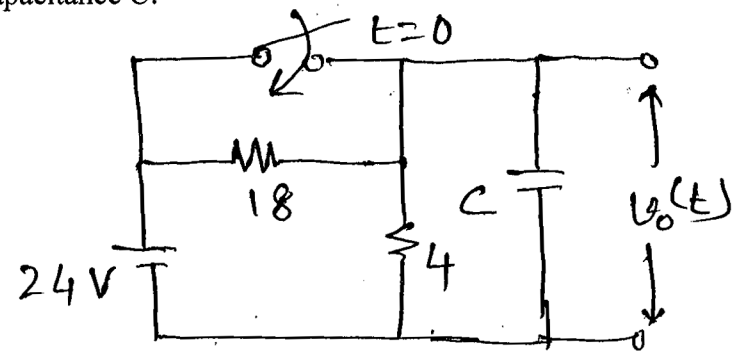
Group C

Answer **any one** question

5. (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)* — 10

(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. — 10

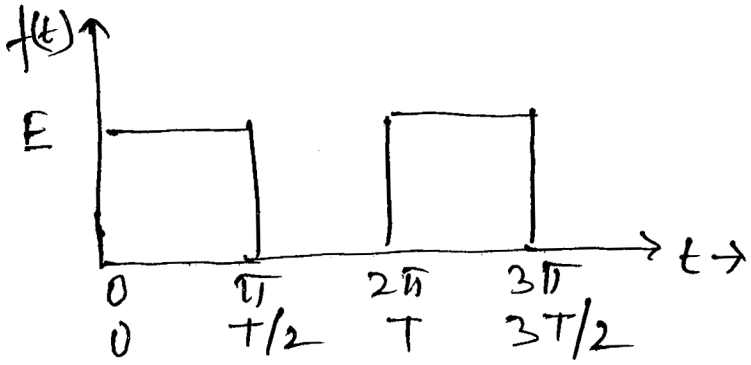
6. Consider the circuit as shown in below. The input to the circuit is 24 V. The output of the circuit, the voltage across the capacitor, is given to be $v_o(t) = 16 - 12e^{-0.6t}$ V when $t > 0$. Determine the value of the capacitance *C*. — 20



Group D

Answer ***any one*** question

7. Determine the Fourier Series for the following waveform and plot the magnitude spectrum. — 20



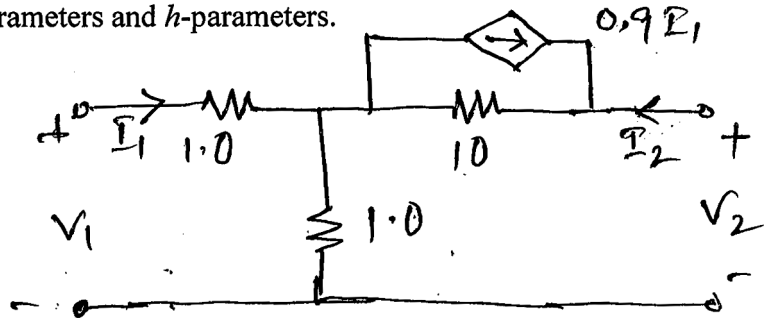
8. Determine the two parameters, power consumed by the circuit and the power factor of the circuit whose expression for the voltage and currents are as follows: 20

$$v(t) = 269 \sin(314t + 10°) + 79 \sin(942t + 48°)$$
$$i(t) = 19.8 \sin(314t - 47°) + 2.2257 \sin(942t - 29.7°)$$

Group E

Answer ***any one*** question

(9) Find the *Z*-parameters for the network shown below. Hence find Y-parameters and *h*-parameters. 20



10. Two identical sections of the network as shown below are connected in cascade. Obtain the transmission (ABCD) ` overall network. 20