



Vellore – 632014, Tamil Nadu, India
SCHOOL OF ELECTRICAL ENGINEERING
FALL SEMESTER 2023-2024
CAT-I

SLOT: A2+TA2

Programme Name & Branch: **B. Tech. Computer Engineering** Course Code: **BEEE102L**
Course Name : **Basic Electrical and Electronics Engineering**
Faculty Members: **Dr. Arun N., Dr. Janaki M., Dr. Albert Alexander S., Dr. Mukul Chankaya**
Class Number(s): **VL2023240107760**
Date of the Examination:
Duration : 90 minutes **Max. Marks : 50**

General instruction(s):

Q. No	Question	Marks	CO	BL
1.	<p>Find the V_0 voltage across load resistance using Nodal method for the circuit given in Fig. 1.</p> <p>Fig. 1.</p>	10	CO1	BL4

2. Find i_1 , i_2 , and i_3 using Mesh analysis for the circuit shown in Fig. 2.

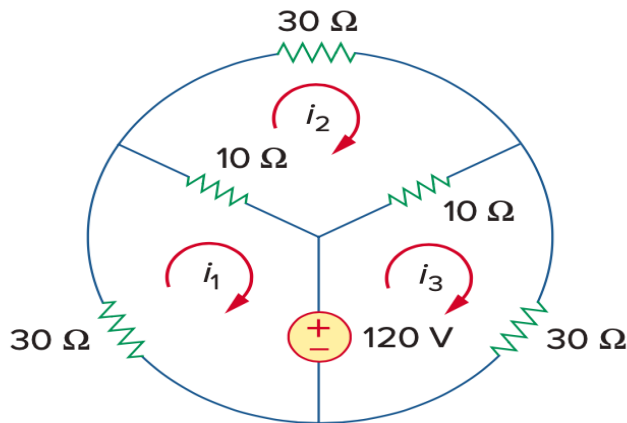


Fig. 2.

Q2 Find i_1 , i_2 and i_3

Loop 1 $30I_1 + 10(I_1 - I_2) + 120 = 0$
 $40I_1 - 10I_2 = -120$
 $4I_1 - I_2 = -12$ (1)

Loop 2 $10(I_2 - I_1) + 30I_2 + 10(I_2 - I_3) = 0$
 $-10I_1 + 50I_2 - 10I_3 = 0$
 $-I_1 + 5I_2 - I_3 = 0$ (2)

10

Loop 3 $-120 + 10(I_3 - I_2) + 30I_3 = 0$
 $-10I_2 + 40I_3 = 120 =$ (3)
 $-I_2 + 4I_3 = 12$ (3)

$$\begin{cases} 4I_1 - I_2 + 0I_3 = -12 \\ -I_1 + 5I_2 - I_3 = 0 \\ 0I_1 + I_2 + 4I_3 = 12 \end{cases}$$

$$\begin{cases} I_1 = -3A \\ I_2 = 0A \\ I_3 = 3A \end{cases}$$

3.

10

CO1

BL4

Find the currents I_1 and I_2 in the circuit given in Fig.3. using Superposition Theorem.

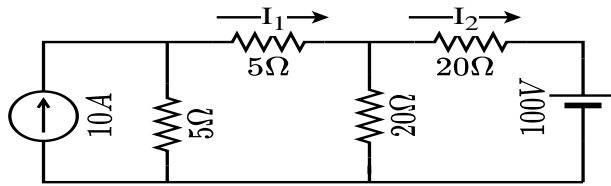


Fig. 3.

Q3 First Circuit source only

By nodal

Node A

$$-\frac{10}{1} + \frac{V_A}{5} + \frac{V_A - V_B}{5} = 0 \quad (1)$$

$$-\frac{50}{5} + \frac{V_A}{5} + \frac{V_A - V_B}{5} = 0$$

$$2V_A - V_B = 50 \quad (2)$$

Node B

$$\frac{V_B}{20} + \frac{V_B - V_A}{5} + \frac{V_B}{20} = 0$$

$$V_B + \frac{4V_B - 4V_A}{20} + \frac{V_B}{20} = 0$$

$$-4V_A + 6V_B = 0 \quad (3)$$

$$-2V_A + 3V_B = 0 \quad (4)$$

$$V_A = 37.5V$$

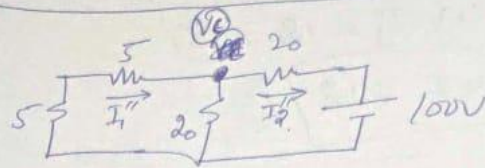
$$V_B = 25V$$

$$I_1' = \frac{V_A - V_B}{5} = \frac{37.5 - 25}{5} = 2.5A$$

$$I_2' = \frac{V_B}{20} = \frac{25}{20} = 1.25A$$

$$I_1' = 2.5A, I_2' = 1.25A$$

with voltage source only



By nodal

$$\frac{V_c}{10} + \frac{V_c}{20} + \frac{V_c - 100}{20} = 0$$
$$\frac{2V_c + V_c + V_c - 100}{20} = 0$$

$$4V_c = 100$$

$$V_c = 25V$$

$$I_1'' = \frac{V_c}{10} = \frac{25}{10} = 2.5A$$

$$I_2'' = \frac{V_c - 100}{20} = \frac{25 - 100}{20} = \frac{-75}{20} = -3.75A$$

$$\begin{cases} I_1'' = 2.5A \\ I_2'' = -3.75A \end{cases}$$

Total I

$$I_1 = I_1' + I_1'' = 2.5 + 2.5 = 5A$$

$$I_2 = I_2' + I_2'' = 1.25 - 3.75 = -2.5A$$

$$\begin{cases} I_1 = 5A \\ I_2 = 2.5A \end{cases}$$

4.

Calculate the value of load resistance (R_L) for the Maximum power transfer to the load for the circuit given in Fig. 4. Also calculate the maximum power delivered to the load resistance.

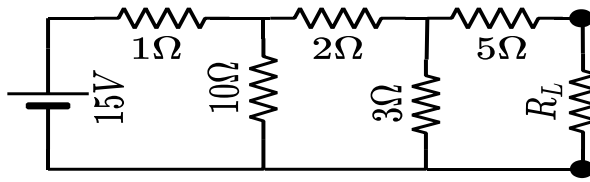


Fig. 4.

Handwritten solution for Fig. 4:

Q4

$$R_{th} = \left[\left(\frac{1 \parallel 10 \right) + 2 \right] \parallel 3 + 5$$

$$R_{th} = 6.4769$$

$$V_{th} = \frac{3 \times 11.54}{5}$$

$$V_{th} = 6.92V$$

$$P_{max} = \frac{V_{th}^2}{4R_{th}} = 1.847$$

$$V_1 - 15 + \frac{V_1}{10} + \frac{V_1}{5} = 0$$

$$10V_1 - 150 + V_1 + 2V_1 = 0$$

$$13V_1 = 150$$

$$V_1 = \frac{150}{13} = 11.54V$$

10

CO1

BL4

5.

A sinusoidal voltage $V(t) = 40 \times \sin(100t)$ is applied to a series RC circuit with $C=99.0 \mu F$, and $R=68\Omega$.

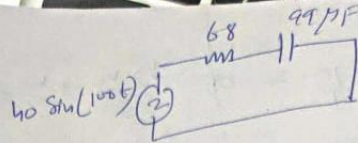
- What is the impedance of the circuit?
- Let the current at any instance in the circuit be $I(t) = I_0 \times \sin(\omega t - \phi)$. Find I_0 .
- What is the phase constant ϕ ?
- Calculate active delivered by the source.

10

CO2

BL4

Q5



$$X_C = \frac{1}{\omega C}$$

$$X_C = \frac{10^6}{100 \times 99}$$

$$X_C = 101.01 \Omega$$

$$Z = \sqrt{(68)^2 + (101.01)^2}$$

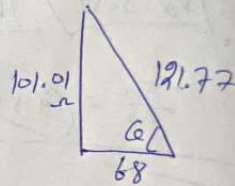
$$a) Z = 121.77 \Omega$$

$$b) V = IZ$$

$$I = \frac{40}{121.77} = 0.3285 A$$

$$c) \phi = \tan^{-1} \left[\frac{101.01}{68} \right]$$

$$\phi = 56.05^\circ$$



$$d) P_{\text{delivered}} = V_{\text{RMS}} \times I_{\text{RMS}}$$

$$P_{\text{delivered}} = \frac{40}{\sqrt{2}} \times \frac{0.3285}{\sqrt{2}} = 6.57 W$$