Qus 1

Given, $32V - 4\Omega - (+V_1 -) - (-8V +) - 2\Omega - (+V_2 -)$ - ground

Step 1 Find current I (clocwise)

$$32 - 4I - 8 - 2I = 0$$

$$24 = 6I$$

$$I = 4A$$

Step 2: Find V_1 (accross 4Ω)

$$V_1 = 4 \times I = 4 \times 4 = 16V$$

Step 3: Find V_2 (accross 2Ω)

$$V_2 = 2 \times I = 2 \times 4 = 8V.$$

Ans $V_1 = 16V$

$V_2 = 8V.$

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Ques 2

Given.

70 V – 10Ω – node A – 5Ω – ground

Dependent source $2V_x$ from node A to ground

V_x = voltage across 5Ω, V_o = voltage at node A

Step 1: KCL at node A:

Let $V_o = V_x$ (Since V_x is across 5Ω)

Current through 10Ω: $I_1 = \frac{70-V_o}{10}$

Current through 5Ω: $I_2 = \frac{V_o}{5}$

Dependent source current $2V_o$

$$\frac{70-V_o}{10} = \frac{V_o}{5} + 2V_o$$

Step 2: Multiply by 10:

$$70 - V_o = 2V_o + 20V_o$$

$$70 - V_o = 22V_o$$

$$70 = 23V_o$$

$$V_o \approx 3.043\,V.$$

$$V_x = V_o \approx 3.043\,V.$$

Ans

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Qus 3

Step 1 Combine top resistors in series

$4\Omega + 4\Omega = 8\Omega$.

Step 2 Combine bottom resistors in series.

$6\Omega + 6\Omega = 12\Omega$.

Combine right-side resistors in parallel

$$\frac{1}{R_{right}} = \frac{1}{12} + \frac{1}{10} + \frac{1}{3}$$

$$= 0.0833 + 0.1 + 0.3333 = 0.5166$$

$$\therefore R_{right} \approx 1.935\Omega.$$

Combine middle 8Ω with top 8Ω in parallel,

$$\frac{1}{R_{top}} = \frac{1}{8} + \frac{1}{8} = 0.25$$

$$R_{top} = 4\Omega.$$

Add in series with R_{right}:

$$R_{series} = 4 + 1.935 \approx 5.935\Omega.$$

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Combine with bottom 12Ω in parallel

$$\frac{1}{R_{eq}} = \frac{1}{5.935} + \frac{1}{12} \approx 0.1685 + 0.0833$$

$$= 0.2518$$

$$R_{eq} = 3.9\Omega \approx 4\Omega.$$

Ans 4Ω.

qus 4

Middle branch ($60\mu F$ and $70\mu F$ in series)

$$C_{mid} = \frac{1}{\frac{1}{60} + \frac{1}{70}} = \frac{1}{0.01667 + 0.014286}$$

$$= \frac{1}{0.030956} \approx 32.31\mu F$$

Bottom branch ($20\mu F$ and $120\mu F$ in series)

$$C_{bot} = \frac{1}{\frac{1}{20} + \frac{1}{120}} = \frac{1}{0.058333}$$

$$= 17.14\mu F$$

∴ All branches in parallel

$$C_{eq} = 50 + 32.31 + 17.14$$

$$\approx 99.45 \quad \text{Ans } 99.45\mu F$$

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Qus 5

150V source with Capacitors,

40μF and 60μF in series. and 20μF and 30μF in series.

equivalent capacitance of branch 1

$$C_1 = \frac{1}{\frac{1}{40} + \frac{1}{60}} = \frac{1}{0.04167} \approx 24\mu F$$

equivalent Capacitance of branch 2

$$C_2 = \frac{1}{\frac{1}{20} + \frac{1}{30}} = \frac{1}{0.08333} = 12\mu F$$

Total, $C_{eq} = C_1 + C_2 = 24 + 12 = 36\mu F$

$$Q_{total} = C_{eq} \times V = 36 \times 150 = 5400\mu C$$

Charge in branch 1 and 2

$$Q_1 = C_1 \times V = 24 \times 150 = 3600\mu C$$

$$Q_2 = C_2 \times V = 12 \times 150 = 1800\mu C$$

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For branch 1

Across $40\mu F$: $V_1 = \frac{Q_1}{40} = \frac{3600}{40} = 90V.$

$60\mu F$: $V_3 = \frac{Q_1}{60} = \frac{3600}{60} = 60V.$

Cheak: $90V + 60V = 150V.$

For branch 2

$20\mu F$: $V_2 = \frac{Q_2}{20} = \frac{1800}{20} = 90V.$

$30\mu F$: $V_4 = \frac{Q_2}{30} = \frac{1800}{30} = 60V$

cheak. $90V + 60V = 150V.$

qus 6

4H, 7H, 8H is series on left

20H, 12H, 10H in series on right.

Then left and right is parallel.

Lets assume,

Left branch: $4H + 7H + 8H = 19H$

Right branch: $20H + 12H + 10H = 42H.$

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$L_{left} = 4 + 7 + 8 = 19\,H$

$L_{right} = 20 + 12 + 10 = 42\,H$.

These are in parallel.

$$\frac{1}{L_{eq}} = \frac{1}{19} + \frac{1}{42}$$

$$= 0.07644.$$

$$\therefore L_{eq} = 13.08\,H.$$

Ans

Ques 7

Top branch total..

$$20 + 100 + 40 = 160\,mH$$

Bottom branch total

$$50 + 40 + 30 + 20 = 140\,mH$$

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Parallel combination :

$$\frac{1}{L_{eq}} = \frac{1}{160} + \frac{1}{140}$$

$$= 0.013393$$

$$\therefore L_{eq} = 74.66 \text{ mH}$$

Ans