Linear Circuit Theory

L04: Concepts of Mesh and Super mesh analysis

- Solution of last lecture question
- Concepts of mesh and super mesh
- Questions based on mesh analysis

Tutorial Sheet

Q-1 L = 2 mH, $V_L(t) = ?$

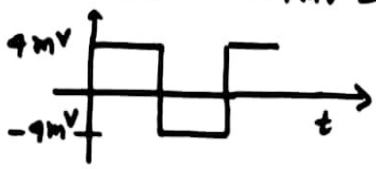
$I(t) = 2t - 2 \quad 0 < t < 2$

$-2t + 6 \quad 2 < t < 4$

$\frac{dI(t)}{dt} = 2 \quad 0 < t < 2$

$-2 \quad 2 < t < 4$

$V_L(t) = L\frac{dI(t)}{dt}$, 4 mV $0 < t < 2$, -4 mV $2 < t < 4$



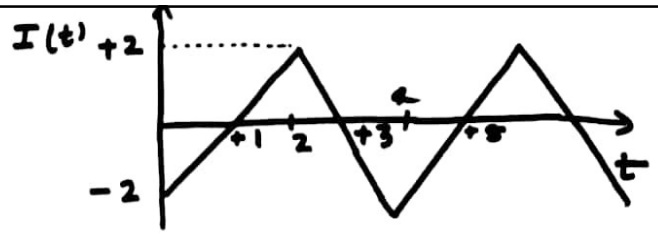
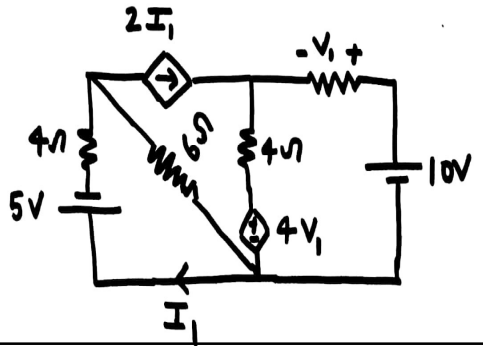
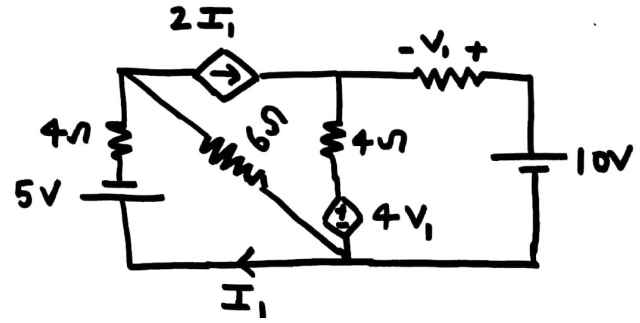


Fig-1

(b)



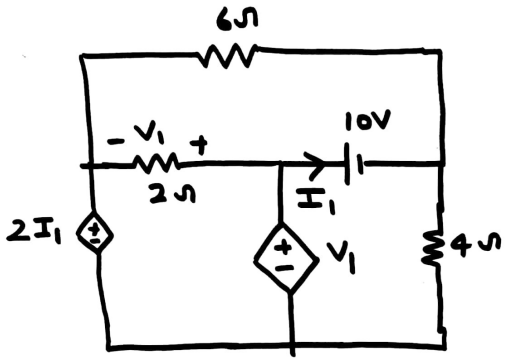
Q-2 Calculate V1 and I1



$$-V_1 + 10 - 4V_1 + 4\left(\frac{V_1}{2} + 2I_1\right) = 0$$

$$-6I_1 + 5 + 4I_1 = 0$$

(c) Calculate V1 and current in 4 ohm resistance



$$V_1 - 2I_1 = V_1$$

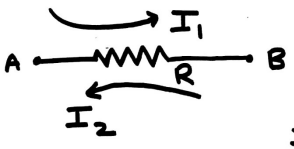
$$I_1 = 0$$

$$\frac{0 - (V_1 - 10)}{6} + \frac{V_1 - 10}{4} = 0$$

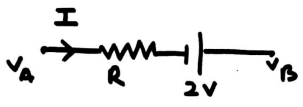
$$V_1 = 10$$

Concepts of Mesh analysis:

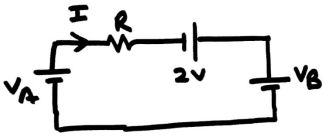
- Selection of mesh



- Assumption of mesh current



- Apply the KVL



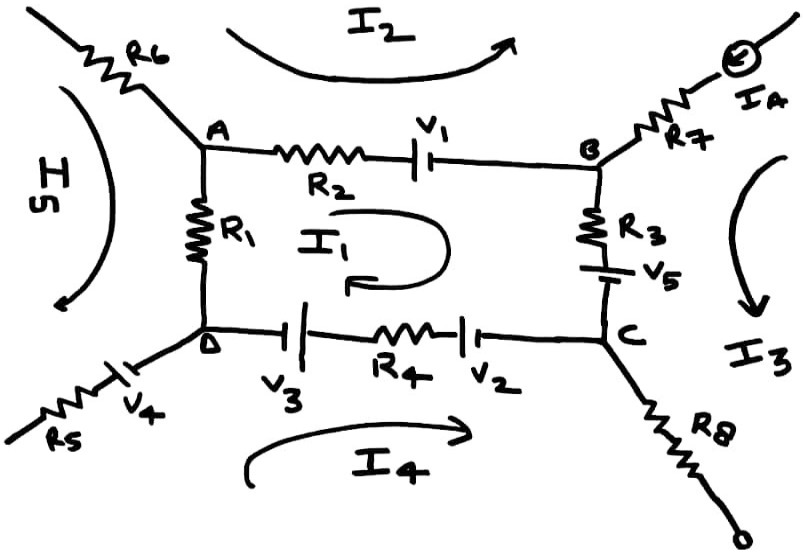
$$-V_A + IR - 2 + V_B = 0$$

$$I = \frac{V_A - V_B + 2}{R}$$

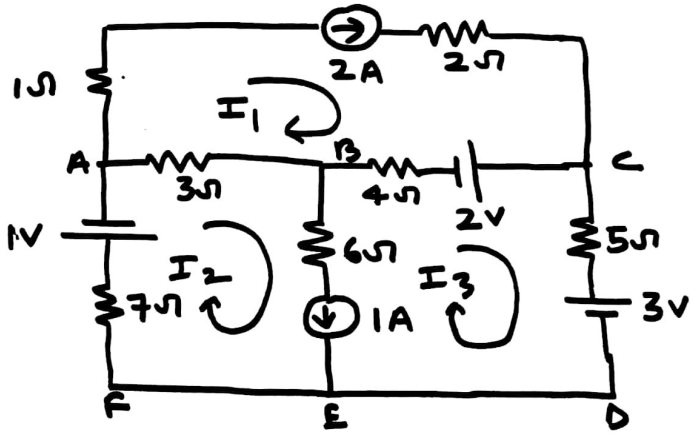
KVL in a loop

KVL in ABCDA

$$R_2(I_1+I_2) + V_1 + R_3(I_1+I_3) + V_5 - V_2 + R_4(I_1-I_4) + V_3 + R_1(I_1-I_5) = 0$$



Solve the problem



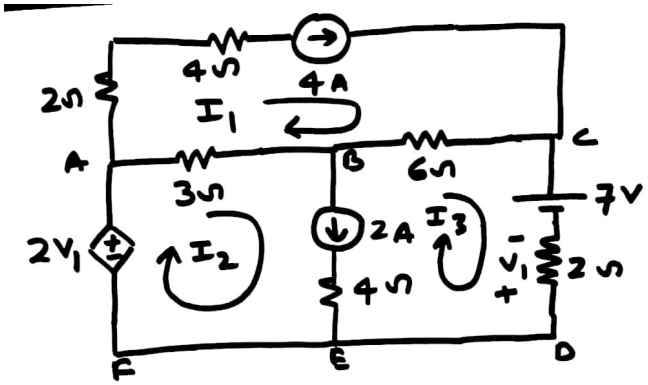
$I_1 = 2$

$I_2 - I_3 = 1$

$3(I_2 - I_1) + 4(I_3 - I_1) - 2 +$

$5I_3 + 3 + 7I_2 + 1 = 0$

Super mesh problem with dependent source



$I_1 = 4$

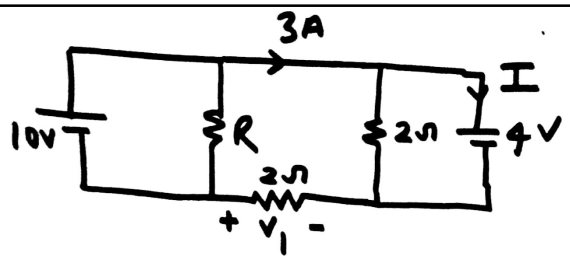
$I_2 - I_3 = 2$

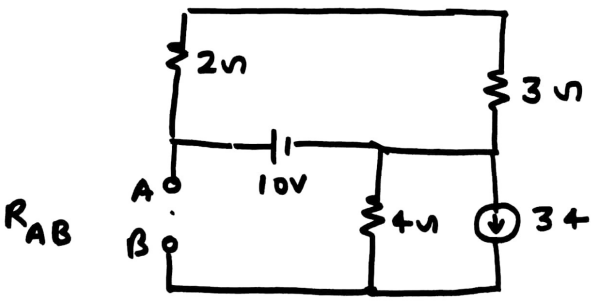
$3(I_2 - I_1) + 6(I_3 - I_1)$

$+ 7 + 2I_3 - 2V_1 = 0$

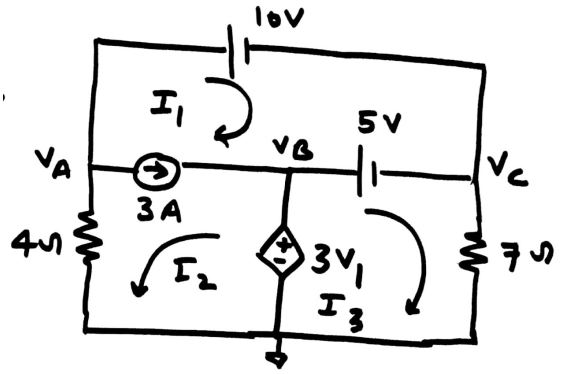
$V_1 = -2I_3$

Tutorial problem





I 4V1



Next lecture

- Discussion on these problem
- Concept of mutual Inductance
- Problem and solution based on mutual inductance

Thank you