Subject: Fundamental of electrical engineering

Code: ENG 204

Date: 29/7/2018

Level 2

Model Answer Mid Term exam Summer 2018

Question 1 :

1-a : electric current is a time rate of change of charge $i = dq/dt$

resistance : is ability of the element to resist the electric current

power : is the time rate of expending or absorbing energy

b- $q = 5t \sin 4\pi t$ mc

$i = \frac{dq}{dt} = (5t * 4\pi \cos 4\pi t + 5 \sin 4\pi t)$ mA

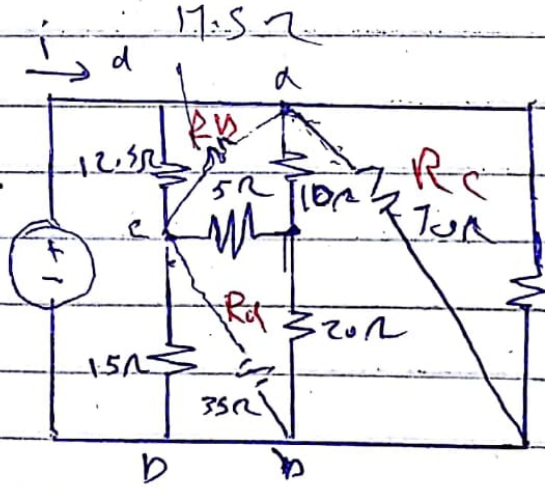
At $t = 0.5$

$\therefore i = 5 \sin 2\pi + 10 \cos 2\pi = 0 + 10 = 31.42$ mA

c- $W = pt = 300 * 3 * 60 * 60 = 3240$ kJ

Question 2 :

10Ω, 20Ω, 5Ω have Y connection we Transfer them to Δ



$R_d = \frac{5*10 + 10*20 + 20*5}{10} = 35\Omega$

$R_b = \frac{5*10 + 10*20 + 20*5}{20} = 17.5\Omega$

$R_c = \frac{5*10 + 10*20 + 20*5}{70} = 7.1\Omega$

Fig (b)

$70\Omega \| 30 = \frac{70 \times 30}{70+30} = 21\Omega$

$12.5\Omega \| 17.5 = \frac{12.5 \times 17.5}{12.5+17.5} = 7.292\Omega$

$15 \| 35 = \frac{15 \times 35}{15+35} = 10.5\Omega$

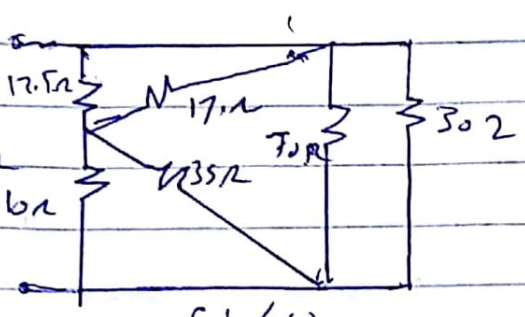
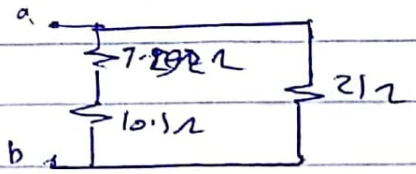


Fig (b)

in Fig c :

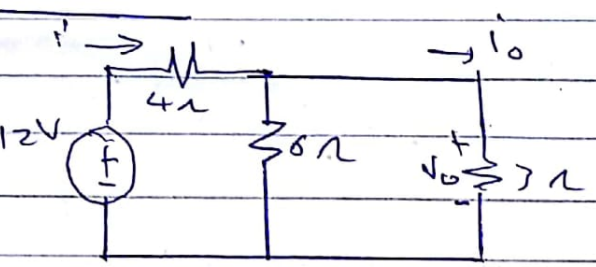


$R_{ab} = (7.292 + 10.5) \| 21$

$= \frac{17.792 \times 21}{17.792+21} = 9.632\Omega$

$i = \frac{V_s}{R_{ab}} = \frac{120}{9.632} = 12.458A$

Q - c :



$R_{eq} = 4 + \frac{6 \times 3}{6+3} = 6\Omega$

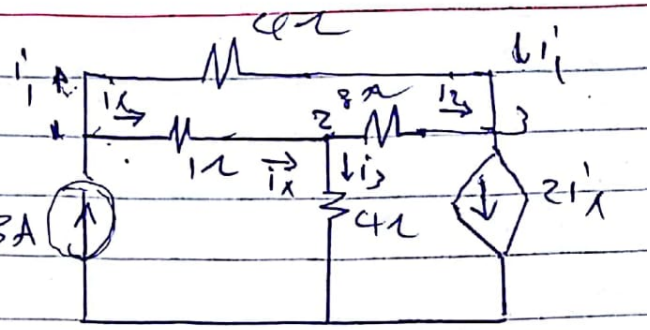
$i = \frac{12}{6} = 2A$

$i_0 = 2 \times \frac{6}{6+3} = \frac{12}{9} = \frac{4}{3} A$

$V_0 = I_0 \times R = \frac{4}{3} \times 3 = 4 V$

Question 3:

and



At node 1

$$3 = -i_1' + i_x' \Rightarrow$$

$$3 = \frac{V_1 - V_3}{4} + \frac{V_1 - V_2}{2}$$

$$3V_1 - 2V_2 - V_3 = 12 \longrightarrow (1) \quad *4$$

At node 2: $i_x' = i_2' + i_3' \Rightarrow \frac{V_1 - V_2}{2} = \frac{V_2 - V_3}{8} + \frac{V_2}{4}$

$$-4V_1 + 7V_2 - V_3 = 0 \longrightarrow (2) \quad *8$$

At node 3:

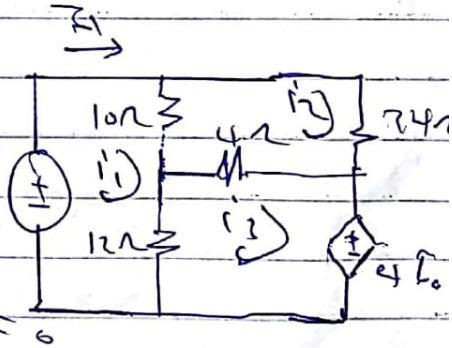
$$i_1' + i_2' = 2i_x' \Rightarrow \frac{V_1 - V_3}{4} + \frac{V_2 - V_3}{8} = \frac{2(V_1 - V_2)}{2}$$

$$\therefore 2V_1 - 3V_2 + V_3 = 0 \longrightarrow (3)$$

Solving 1, 2, 3

$$V_1 = 4.8\,V, \quad V_2 = 7.4\,V, \quad V_3 = -7.2\,V$$

Q3 - b



KVL at mesh 1

$$-24 + 10(i_1' - i_2') + 2(i_1' - i_3') = 0$$

$$11i_1' - 5i_2' - 2i_3' = 12 \longrightarrow (1)$$

For mesh 2

$$24I_o + 4(i_2' - i_3') + 10(i_2' - i_1') = 0$$

$$\therefore -5i_1' + 19i_2' - 2i_3' = 0 \longrightarrow (2)$$

KVL at mesh 3

$$4I_o + 12(i_3' - i_1') + 4(i_3' - i_2') = 0$$

$$-i_1' - i_2' + 2i_3' = 0 \longrightarrow (3)$$

Solving 1, 2, 3

$$\therefore i_1' = 2.25\,A, \quad i_2' = 0.75\,A$$

$$i_3' = 1.5\,A$$