Ministry of Higher Education & Scientific Research
University of Technology
Laser & Optoelectronic Eng. Department
Branch: Laser and Optoelectronic Engineering
Class: 1st Year:
Subject: Fundamentals of Electrical Engineering

final examination
Time: 3 hours
Date: 5/6/2016
Examiner: Lecturer Inmar Natiq
Code LOPE: 1203
Academic Year 2015-2016

Attempt five questions only

Q1:choose (a) or (b)

a) For the network in Fig. (1-a),Calculate *Vab, Vb,Vc.*

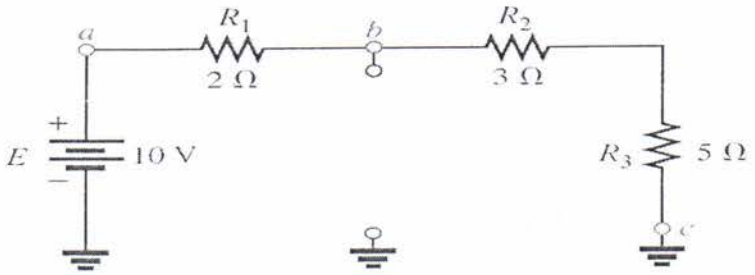
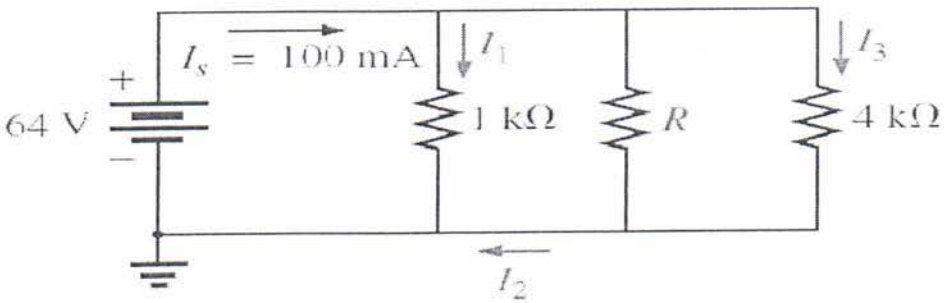


Fig.1-a

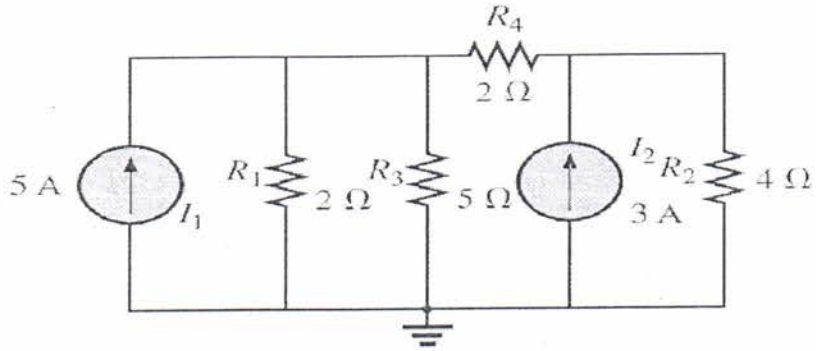
b) Find the unknown quantities for the networks in Fig. (1-b)



10 marks

Fig.1-b

Q2) Write the nodal equations for the networks in Fig. (2). Using determinants, solve for the nodal voltages.



10 marks

Fig.2

Q3) a) if the flux density is (1.2 T) and the area is (1.613×10^{-4} m^2), determine the flux through the core.

b) For the magnetic circuit, if NI=40 At, and l=0.2 m, find magnetizing force.

10 marks

Q4) **a.** For the network in Fig. (3-a) determine the curren(I).
b. Repeat part (a) for the network in Fig. (3-b)
c. Is the reciprocity theorem satisfied?

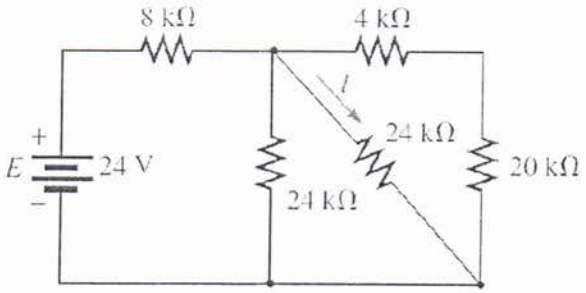


Fig.3-a

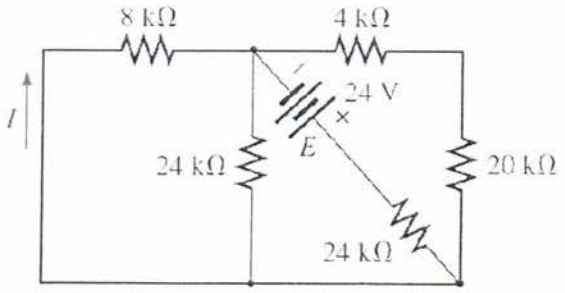


Fig 3-b

10 marks

Q5) Using a Δ-Y or Y-Δconversion, find the current(I) in the networks in Fig.(4)

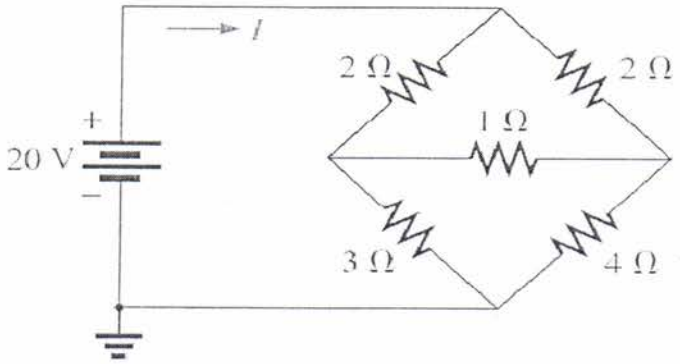


Fig. (4)

10 marks

Q6) Find the indicated currents and voltages(I_S, I_2, I_4, V_1, V_5)for the network in Fig(5):

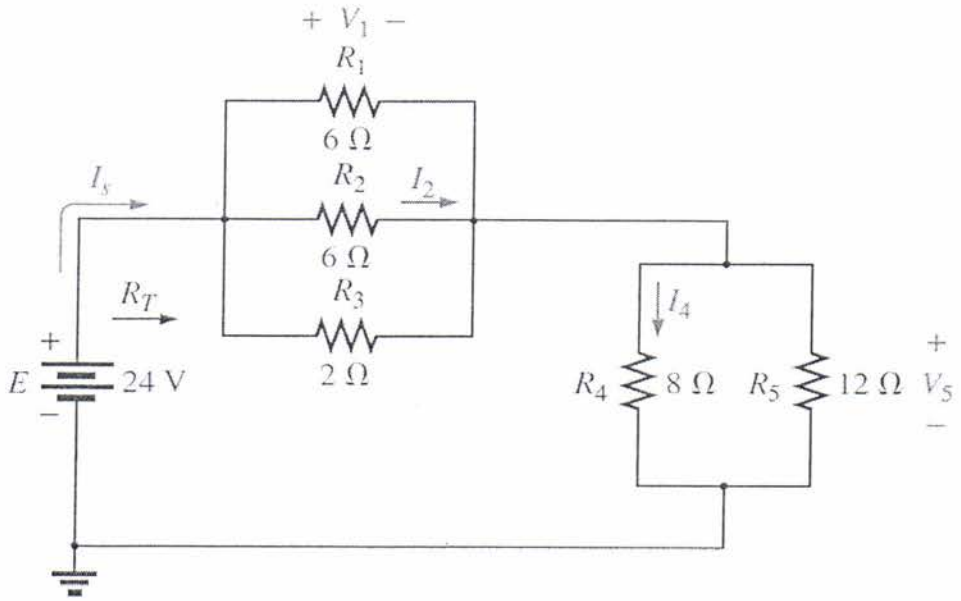


Fig. (5)

10 marks

اجوبة مادة اساسيات الهندسة الكهربائية
مرحلة اولى / ليزر + الكترونيات
٣٠١ امتحان ناطق

Q1 a)

a. Calculate V_{ab}.
b. Determine V_b.
c. Calculate V_c.

Solutions:

a. Voltage divider rule:

$$V_{ab} = \frac{R_1 E}{R_T} = \frac{(2\,\Omega)(10\text{ V})}{2\,\Omega + 3\Omega + 5\,\Omega} = \mathbf{+2\text{ V}}$$

b. Voltage divider rule:

$$V_b = V_{R_2} + V_{R_3} = \frac{(R_2 + R_3)E}{R_T} = \frac{(3\,\Omega + 5\,\Omega)(10\text{ V})}{10\,\Omega} = \mathbf{8\text{ V}}$$

or $\quad V_b = V_a - V_{ab} = E - V_{ab} = 10\text{ V} - 2\text{ V} = \mathbf{8\text{ V}}$

c. V_c = ground potential = **0 V**

Q1 b)

$$I_1 = \frac{64\text{ V}}{1\text{ k}\Omega} = \mathbf{64\text{ mA}}$$

$$I_3 = \frac{64\text{ V}}{4\text{ k}\Omega} = \mathbf{16\text{ mA}}$$

$$I_s = I_1 + I_2 + I_3$$

$$I_2 = I_s - I_1 - I_3 = 100\text{ mA} - 64\text{ mA} - 16\text{ mA} = \mathbf{20\text{ mA}}$$

$$R = \frac{E}{I_2} = \frac{64\text{ V}}{20\text{ mA}} = \mathbf{3.2\text{ k}\Omega}$$

$$I = I_2 + I_3 = 20\text{ mA} + 16\text{ mA} = \mathbf{36\text{ mA}}$$

Q2)

a. V_1 V_2 Tow Nodes

$$V_1\left[\frac{1}{2}+\frac{1}{5}+\frac{1}{2}\right]-\frac{1}{2}V_2 = 5$$

$$V_2\left[\frac{1}{2}+\frac{1}{4}\right]-\frac{1}{2}V_1 = 3$$

$1.2V_1 - 0.5V_2 = 5$

$0.75V_2 - 0.5V_1 = 3$

$1.2V_1 - 0.5V_2 = 5$

$-0.5V_1 + 0.75V_2 = 3$

$$V_1 = \frac{\begin{vmatrix} 5 & -0.5 \\ 3 & +0.75 \end{vmatrix}}{\begin{vmatrix} 1.2 & -0.5 \\ -0.5 & 0.75 \end{vmatrix}} = \frac{(5 \times 0.75) - (3 \times -0.5)}{(1.2 \times 0.75) - (-0.5 \times -0.5)}$$

$V_1 = 8.08\text{ V}$

$$V_2 = \frac{\begin{vmatrix} 1.2 & 5 \\ -0.5 & 3 \end{vmatrix}}{\begin{vmatrix} 1.2 & -0.5 \\ -0.5 & 0.75 \end{vmatrix}} = \frac{(1.2 \times 3) - (-0.5 \times 5)}{(1.2 \times 0.75) - (-0.5 \times -0.5)}$$

$V_2 = 9.39\text{ V}$

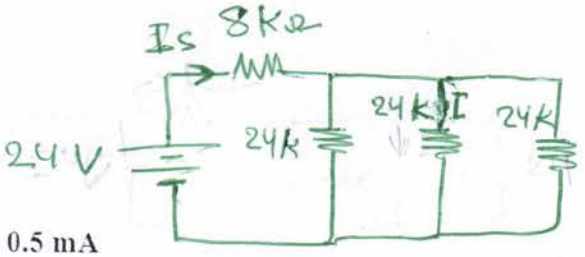
Q3) a)

$\Phi = BA =$ $1.2 * 1.613 * 10^{-4} = 1.93 * 10^{-4}$ Wb

Q3 b)

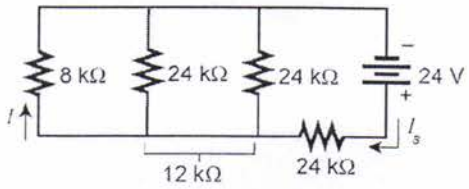
$$H = \frac{NI}{l} = \frac{40 \text{ At}}{0.2 \text{ m}} = 200 \text{ At/m}$$

Q4)



a. $I_s = \dfrac{24 \text{ V}}{8 \text{ k}\Omega + \dfrac{24 \text{ k}\Omega}{3}} = 1.5 \text{ mA}, I = \dfrac{I_s}{3} = \mathbf{0.5\ mA}$

b.

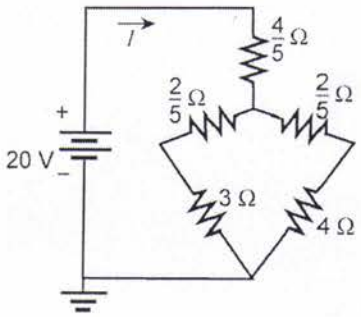


$$I_s = \frac{24 \text{ V}}{24 \text{ k}\Omega + 8 \text{ k}\Omega \,||\, 12 \text{ k}\Omega} = 0.83 \text{ mA}$$

$$I = \frac{12 \text{ k}\Omega (I_s)}{12 \text{ k}\Omega + 8 \text{ k}\Omega} = \mathbf{0.5\ mA}$$

c. yes

Q5) $\Delta \rightarrow Y$



$$I = \frac{20 \text{ V}}{\dfrac{4}{5}\Omega + \left[\dfrac{2}{5}\Omega + 3\Omega\right] \,||\, \left[\dfrac{2}{5}\Omega + 4\Omega\right]}$$

$$= \frac{20 \text{ V}}{\dfrac{4}{5}\Omega + (3.14\,\Omega) \,||\, (4.4\,\Omega)}$$

$$= \mathbf{7.36\ A}$$

Q4) **a.** For the network in Fig. (3-a) determine the curren(I).
b. Repeat part (a) for the network in Fig. (3-b)
c. Is the reciprocity theorem satisfied?

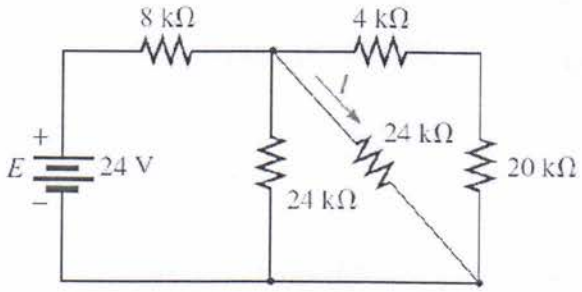


Fig.3-a

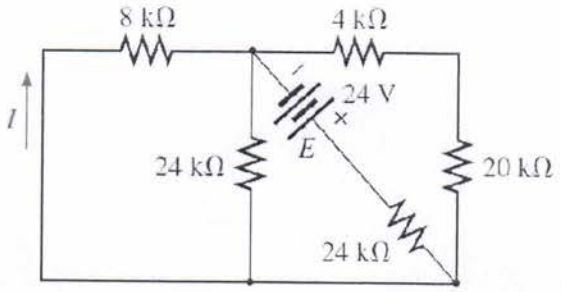


Fig 3-b

10 marks

Q5) Using a Δ-Y or Y-Δconversion, find the current(I) in the networks in Fig.(4)

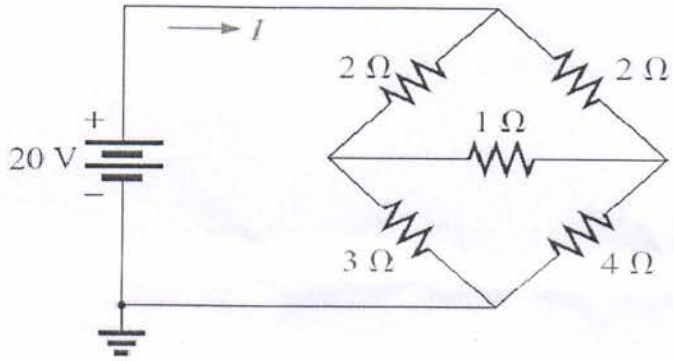


Fig. (4)

10 marks

Q6) Find the indicated currents and voltages(I_S, I_2, I_4, V_1, V_5)for the network in Fig(5):

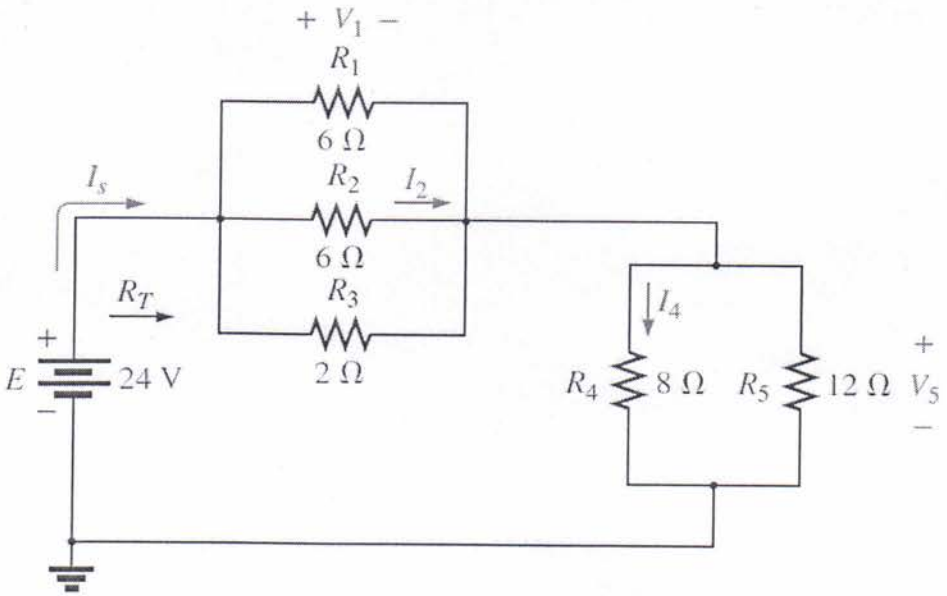


Fig. (5)

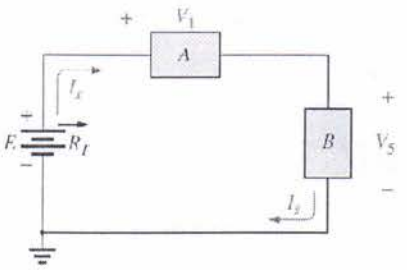
10 marks

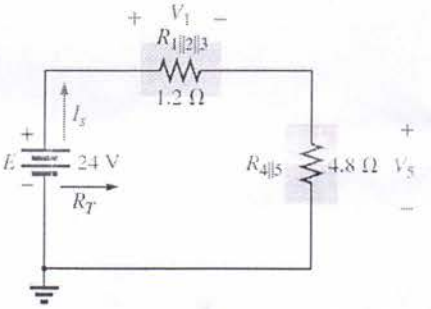
Q6)

$$R_{1\|2} = \frac{R}{N} = \frac{6\ \Omega}{2} = 3\ \Omega$$

$$R_A = R_{1\|2\|3} = \frac{(3\ \Omega)(2\ \Omega)}{3\ \Omega + 2\ \Omega} = \frac{6\ \Omega}{5} = 1.2\ \Omega$$

$$R_B = R_{4\|5} = \frac{(8\ \Omega)(12\ \Omega)}{8\ \Omega + 12\ \Omega} = \frac{96\ \Omega}{20} = 4.8\ \Omega$$





$$R_T = R_{1\|2\|3} + R_{4\|5} = 1.2\ \Omega + 4.8\ \Omega = \mathbf{6\ \Omega}$$

$$I_s = \frac{E}{R_T} = \frac{24\ \text{V}}{6\ \Omega} = \mathbf{4\ A}$$

$$V_1 = I_s R_{1\|2\|3} = (4\ \text{A})(1.2\ \Omega) = \mathbf{4.8\ V}$$

$$V_5 = I_s R_{4\|5} = (4\ \text{A})(4.8\ \Omega) = \mathbf{19.2\ V}$$

Applying Ohm's law,

$$I_4 = \frac{V_5}{R_4} = \frac{19.2\ \text{V}}{8\ \Omega} = \mathbf{2.4\ A}$$

$$I_2 = \frac{V_2}{R_2} = \frac{V_1}{R_2} = \frac{4.8\ \text{V}}{6\ \Omega} = \mathbf{0.8\ A}$$