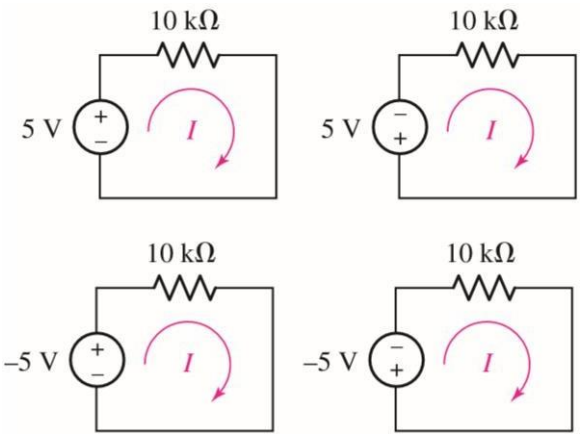
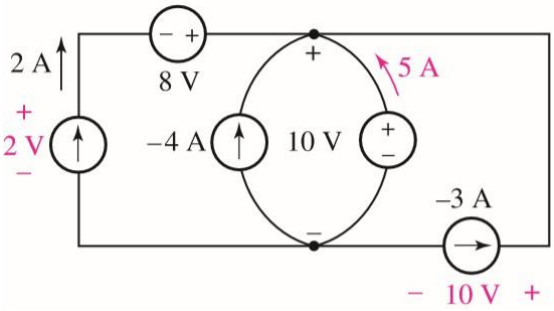
Department of Electrical Engineering
Assignment
Date:
13/04/2020

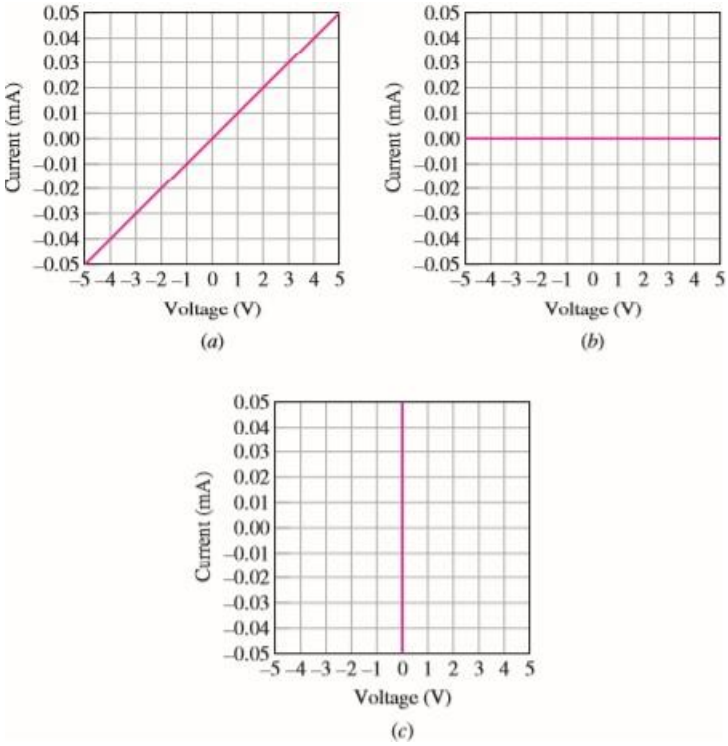
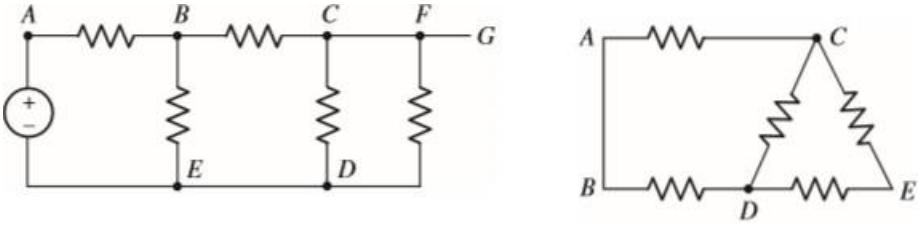
Course Details

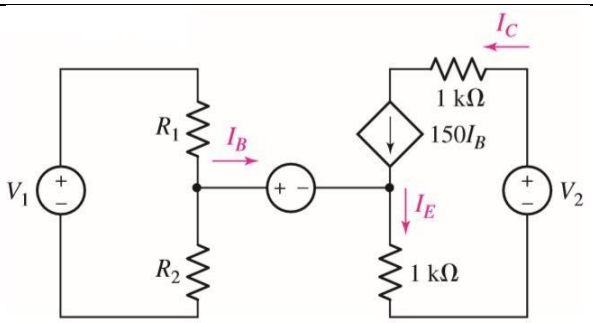
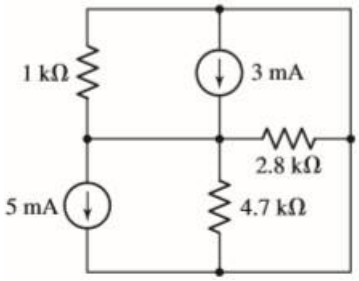
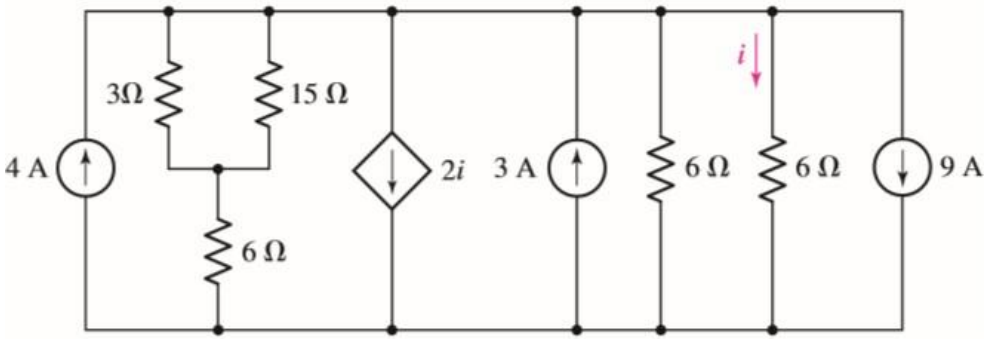
Course Title: Linear Circuit Analysis **Module:** 2
Instructor: Dr.sohail imran **Total Marks:** 30

Student Details

Name: Abdullah **Student ID:** 16194

Q1.	(a)	For each of the circuits in figure, find the current I and compute the power absorbed by the resistor 	Marks 3 PLO1
	(b)	Determine the power supplied by the leftmost element in the circuit of following figure 	Marks 4 PLO1
	(c)	Following figure depicts the current-voltage characteristic of three different resistive elements. Determine the resistance of each, assuming the voltage and current are defined in accordance with the passive sign convention.	Marks 3 PLO1

			
Q2.	(a)	Refer to the circuits of following figures, and answer the following: 1. How many distinct nodes are contained in the circuit? 2. How many elements are contained in the circuit? 3. How many branches does the circuit have? 4. Determine if each of the following represents a path, a loop, both, or neither: i. A to B ii. B to D to C to E iii. C to E to D to B to A to C iv. C to D to B to A to C to E 	Marks 4 PLO2
	(b)	For the circuit of following figure (which is a model for the dc operation of a bipolar junction transistor biased in forward active region), I_B is measured to be 100 μA. Determine I_C and I_E	Marks 6 PLO2

			
Q3.	(a)	Although drawn so that it may not appear obvious at first glance, the circuit of following figure is in fact a single-node-pair circuit. a. Determine the power absorbed by each resistor. b. Determine the power supplied by each current source. c. Show that the sum of the absorbed power calculated in (a) is equal to the sum of the supplied power calculated in (b). 	Marks 5 PLO1
	(b)	Determine the power absorbed by the 15 Ω resistor in the circuit of following figure 	Marks 5 PLO1

Solution of LCA PAPER

ANS:- Finding Current and Power:-

=> For find Current and Power(abs) in each Circuit we will apply Ohm's law.

$$V = IR$$

$$P = V^2/R$$

(1) For Circuit 1:-

Voltage = 5V

Resistence = 10KΩ = $10 \times 10^3 \Omega$

Current = ?

Power(abs) = ?

Solution:-

$$V = IR$$

$$I = V/R = 5/10 \times 10^3$$

$$I = 500\ \mu A$$

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Power = V^2/R

$= (5)^2 / 10\times10^3$

Pabs = 2.5 mW

(2) Figure 2 :

Current = ?

Power = ?

Voltage = -5 V (because in opposite direction)

Resister = $10\times10^3\ \Omega$

Solution :

$V = IR$

$I = V/R = (-5)/10\times10^3$

$I = -500\ \mu A$

Power = V^2/R

$= (-5)^2/10\times10^3$

Pabs = 2.5 mW

(3) Figure 3 :

Voltage = -5 V

Resister = $10\times10^3\ \Omega$

Current = ?

Voltage = ?

Solution:

$$I = V/R$$

$$I = \frac{-5\ A}{10 \times 10^3} = -500\ \mu A$$

$$P_{(abs)} = V^2/R$$

$$= (-5)^2 / 10 \times 10^3$$

$$= 2.5\ mW$$

(8) figure 4 in

voltage = $-(-5)$ V (because in opposite direction)

Resistance = $10 \times 10^3\ \Omega$

Current = ?

Power = ?

Solution:

$$V = IR$$

$$I = V/R$$

$$= 5 / 10 \times 10^3 = 500\ \mu A$$

$$P_{(abs)} = V^2/R$$

$$= (5)^2 / 10 \times 10^3$$

$$P_{(abs)} = 2.5\ mW$$

ANS :- b Find leftmost element.

The left most element in the circuit is 2V through which 2A of current is flowing.

we know that

Power = V x I

= 2 x 2

Power = 4 W

ANS NO 2 (Part C)

Part to (A)

(i) To find the P in the figure we have to find any one, all the point will give the same result

We take

Voltage = 1 V

Current = 0.01 mA = 0.01×10^{-3} A

According to ohm's law

$R = V / I$

$R = \frac{1}{0.01 \times 10^{-3}} = 100 \times 10^{3}\ \Omega$

$\boxed{R = 100k\ \Omega}$

(ii) we have to take any point which is

Voltage = 1 V

Current = 0 V

According to ohm's law

$R = \frac{V}{I}$

$R = \frac{1}{0} = \infty$

$\boxed{R = \infty}$

(iii) we have to take any point which is

$V = 0, \quad I = 0.01\ mA$

$R = \frac{V}{I} = \frac{0}{0.01\ mA} \Rightarrow R = 0$

Q NO: 2 (Part A)

ANS: Figure: 1

(1) Element : 6 elements.
(2) Nodes : 4 nodes
(3) branches : 6 branches.
(4) (a) neither (b) neither
(c) neither (d) neither.

Figure: 2

(1) Nodes : 4 nodes
(2) Element : 5 element
(3) Branches : 5 branches
(4) (a) neither (b) Path
(c) loop & path (d) neither (c repeated)

Q NO 2 (Part b)

ANS: Given:

$$I_B = 100\,\mu A = 100 \times 10^{-6} A$$

Required:

$I_C = ?$

$I_E = ?$

Solution:

According to KCL

Total Current Entering = Total Current leaving.

$$I_E = I_C + I_B$$

we also know that

$$I_C = 150\, I_B$$

$$= (150)(100\,\mu A)$$

$$I_C = 15\,mA$$

Now

$$I_E = 15 \times 10^{-3} + 100 \times 10^{-6}$$

$$I_E = 15.1\,mA$$

Result:

$I_C = 15\,mA$

$I_E = 15.1\,mA$

Q NO 3 Part (A)

Ans:

Given data:

$I_1 = 3 \times 10^{-3} A$

$I_2 = -5 \times 10^{-3} A$

$R_1 = 1 K\Omega = 1000 \Omega$

$R_2 = 2.8 K\Omega = 2800 \Omega$

$R_3 = 4.7 K\Omega = 4700 \Omega$

Solution:

$$I_{Total} = I_1 + I_2$$

$$= (3 \times 10^{-3}) + (-5 \times 10^{-3})$$

$$= -2 \times 10^{-3}$$

For total resistance

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{1000} + \frac{1}{4700} + \frac{1}{2800}$$

$$R_{eq} = 637$$

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(a) Finding Power absorbed by resistor:

(i) Power absorbed by resistor 1:

$$P_1 = V^2/R_1 = (-1.274)^2/1000$$

$$= 1623.07$$

$$P = 1.623 \times 10^{-3}$$

$$P = 1.623\,mW$$

(ii) Power absorbed by resistor 2:

$$P_2 = V^2/R_2 = (-1.274)^2/2800$$

$$= 0.00057967$$

$$P_2 = 579.67\,\mu W$$

(iii) Power absorbed by resistor 3:

$$P_3 = V^2/R_3 = (-1.274)^2/4700$$

$$= 0.00034533$$

$$= 345.3\,\mu W$$

(b) Power Supplied by Source :

(i) Power Supplied by Source 1:

$$P = IV$$
$$= (3\times10^{-3})(-1.274)$$
$$= -0.003822\,W$$
$$= -3.822\times10^{-3}\,W$$
$$P_1 = -3.822\,mW$$

(ii) Power Supplied by Source 2:

$$P = IV$$
$$= (-5\times10^{-3})(-1.274)$$
$$= 0.00637$$
$$P_2 = 6.37\,mW$$

(c) adding all Power absorbed by resistor

$$P_1 = 1.623\,mW$$
$$P_2 = 579.67\,\mu W$$
$$P_3 = 345.3\,\mu$$
$$\Sigma P_{absorbed} = 0.002548$$

$\Sigma P_{absorbed} = 2.548\ mW$

(ii) adding all power supplied by source:

$P_1 = -3.833\ mW$

$P_2 = 6.370\ mW$

$P_{(supp)} = 0.002537$

$P_{(supply)} = 2.54\ mW$

Hence

$\Sigma P_{absorb} = \Sigma P_{(supply)}$

Q NO 3 (Part b)

ANS: Given as

$I_{Total} = 4 - 2i + 3 - 9$

$I_{Total} = -2 - 2i$

Now R_{eq} =

$$\frac{1}{R_{eq}} = \left(\frac{1}{R_1} + \frac{1}{R_2} + R_3\right) + \frac{1}{R_4} + \frac{1}{R_5}$$

$$= \left(\frac{1}{3} + \frac{1}{15} + 6\right) + \frac{1}{6} + \frac{1}{6}$$

$$= \left(\frac{1}{0.4} + 6\right) + \frac{1}{3}$$

$$= (2.5 + 6) + \frac{1}{3} \quad \text{(6Ω in parallel)}$$

$$\frac{1}{R_{eq}} = \frac{1}{8.5} + \frac{1}{3}$$

$$R_{eq} = 2.2174\ \Omega$$

Solution :

$$I = -2 - 2i$$

$$R_{eq} = 2.2174\ \Omega$$

$$V = I \cdot R$$

$$V = (-2 - 2i)(2.2174) \quad -(1)$$

From the figure we know that $V = 6i$

$$6i = (-2 - 2i)(2.2174)$$

$$6i = -4.4348 - 4.4348i$$

$$4.4348i + 6i = -4.4348$$

$$10.4348i = -4.4348$$

$$i = \frac{-4.4348}{10.4348}$$

$$i = -0.425\ A$$

Putting i in eq (1)

$$V = (-2 - 2(-0.425))(2.2174)$$

$$= -2$$

We have to find Power across 15Ω resistor.

$$P = \frac{V^2}{R} \quad - (a)$$

We have to find V first

$$V_{15\Omega} = \frac{6}{6+2.5}$$

$$V_{15\Omega} = 1.8V$$

Putting in eq (a)

$$P = \frac{(1.8)^2}{15}$$

$$\boxed{P = 0.216W}$$