SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

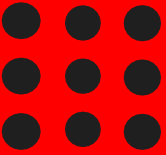Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE201 CIRCUIT THEORY
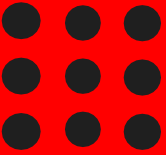
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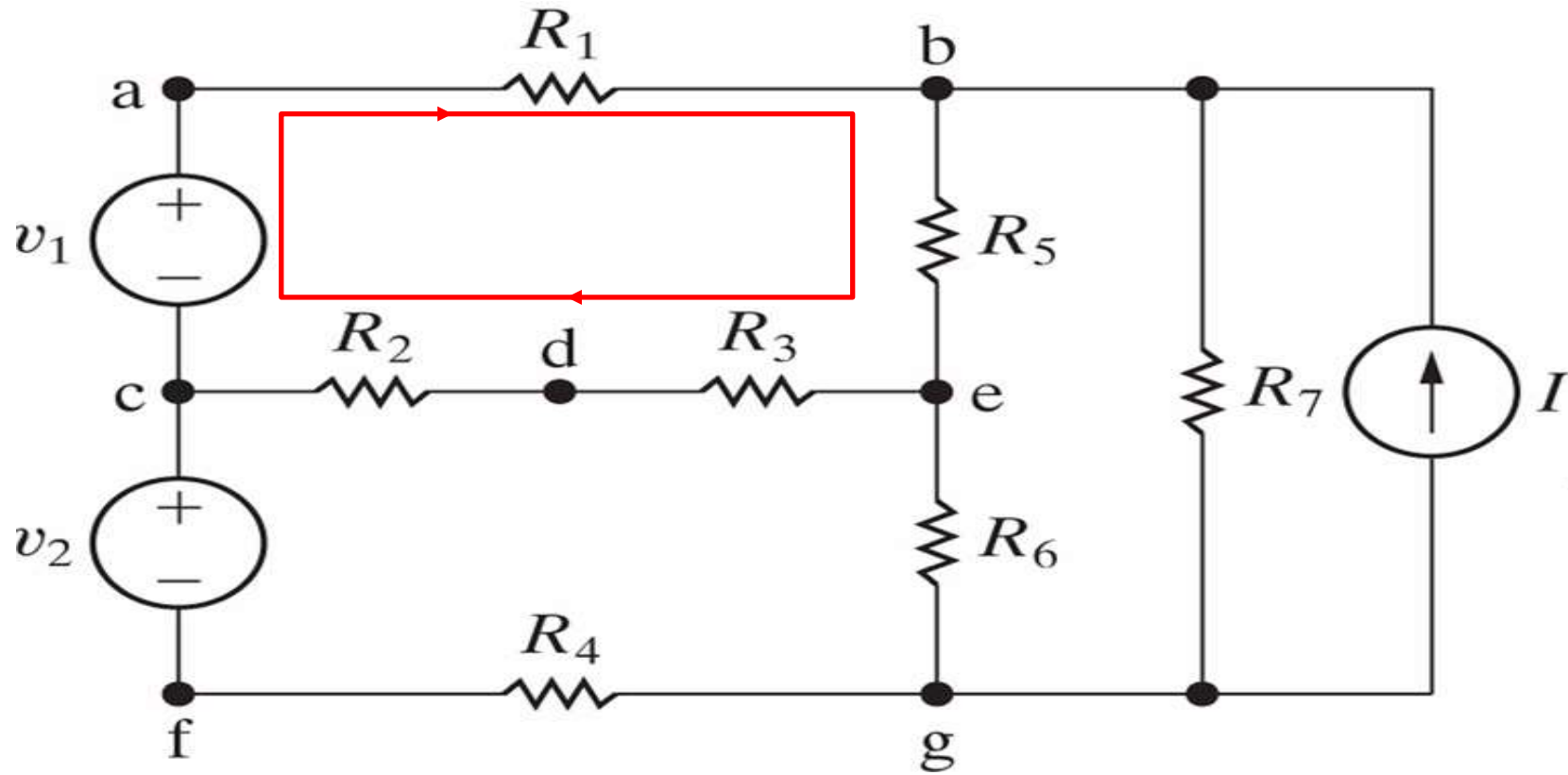
Unit 1 – Basic Circuit Analysis

Techniques of Circuit Analysis

Mesh Analysis

Mesh Analysis

Mesh: a loop that does not enclose any other loops

3

Mesh Analysis: Basic Concepts:

- In formulating mesh analysis we assign a mesh current to each mesh.

$$i_{R_3} = i_a - i_b$$

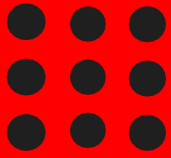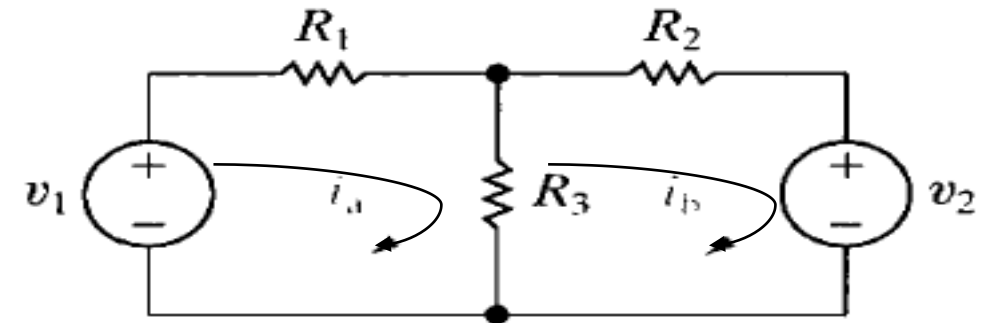$$-v_1 + i_a R_1 + (i_a - i_{b)} R_3 = 0$$

$$i_b R_2 + v_2 - (i_a - i_b) R_3 = 0$$

$$i_b R_2 + v_2 + (i_b - i_a) R_3 = 0$$

Collecting the coefficients of i_a and i_b

$$v_1 = i_a(R_1 + R_3) - i_b R_3 = 0$$

$$-v_2 = -i_a R_3 + i_b(R_2 + R_3) = 0$$

Problem 1:

Use the mesh − current method to find i_a, i_b and i_c

$$-60 + 4i_1 + 10(i_1 - i_2) + 1i_1 = 0$$

$$15i_1 - 10i_2 = 60 \ldots \ldots \ldots (1)$$

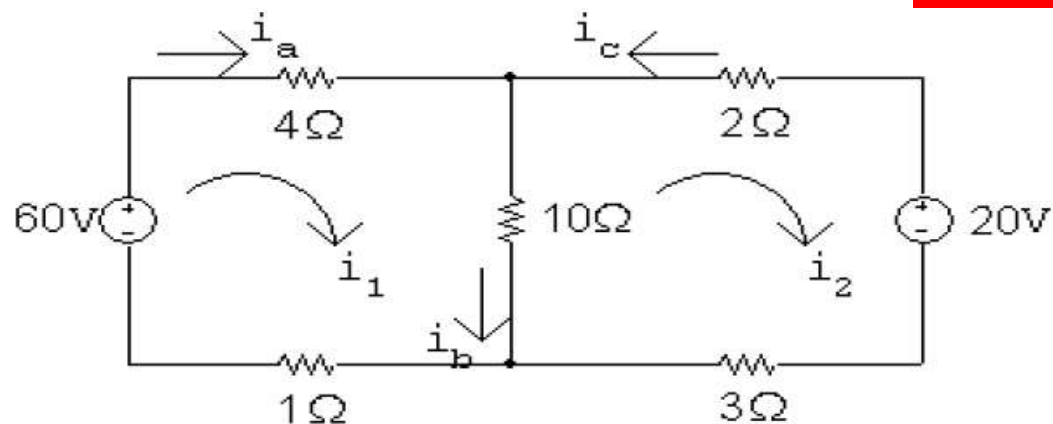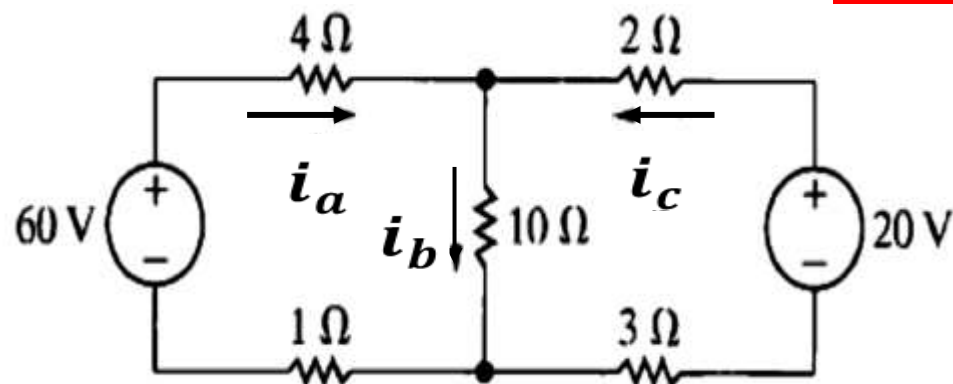$$2i_2 + 20 + 3i_2 + 10(i_2 - i_1) = 0$$

$$-10i_1 + 15i_2 = -20 \ldots \ldots \ldots (2)$$

$$Solving, i_1 = 5.6A, i_2 = 2.4A$$
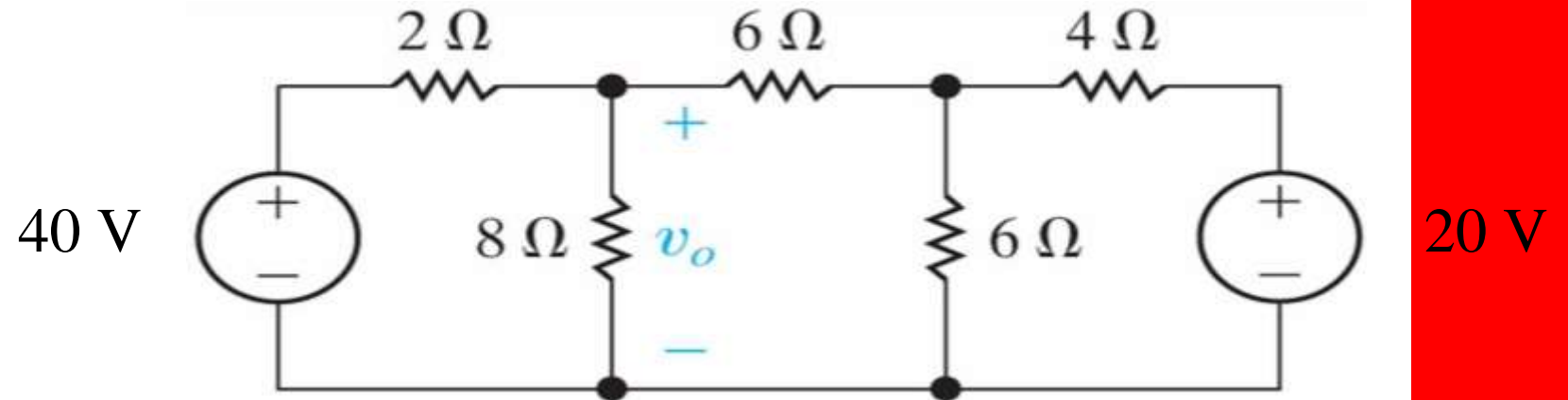
$$i_a = i_1 = 5.6 \ A$$

$$i_b = i_1 - i_2 = 3.2 \ A$$

$$i_c = -i_2 = -2.4 \ A$$

Example 2 Using Mesh-Current Method

Use the mesh-current method to determine the power associated with each voltage source in the circuit shown

$$-40 + 2i_a + 8(i_a - i_b) = 0$$

$$8(i_b - i_a) + 6i_b + 6(i_b - i_c) = 0$$

$$6(i_c - i_b) + 4i_c + 20 = 0$$

$$-40 + 2i_a + 8(i_a - i_b) = 0$$

$$8(i_b - i_a) + 6i_b + 6(i_b - i_c) = 0$$

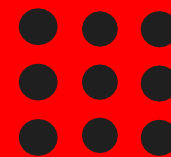$$6(i_c - i_b) + 4i_c + 20 = 0$$

$$10i_a - 8i_b + 0i_c = 40; \qquad i_a = 5.6 \text{ A},$$

$$-8i_a + 20i_b - 6i_c = 0; \qquad i_b = 2.0 \text{ A},$$

$$0i_a - 6i_b + 10i_c = -20. \qquad i_c = -0.80 \text{ A}.$$

$$p_{40V} = -40i_a = -224 \text{ W} \qquad p_{20V} = 20i_c = -16 \text{ W}.$$

$$v_o = 8(i_a - i_b) = 8(3.6) = 28.8 \text{ V}$$

✓ ASSESSMENT PROBLEM
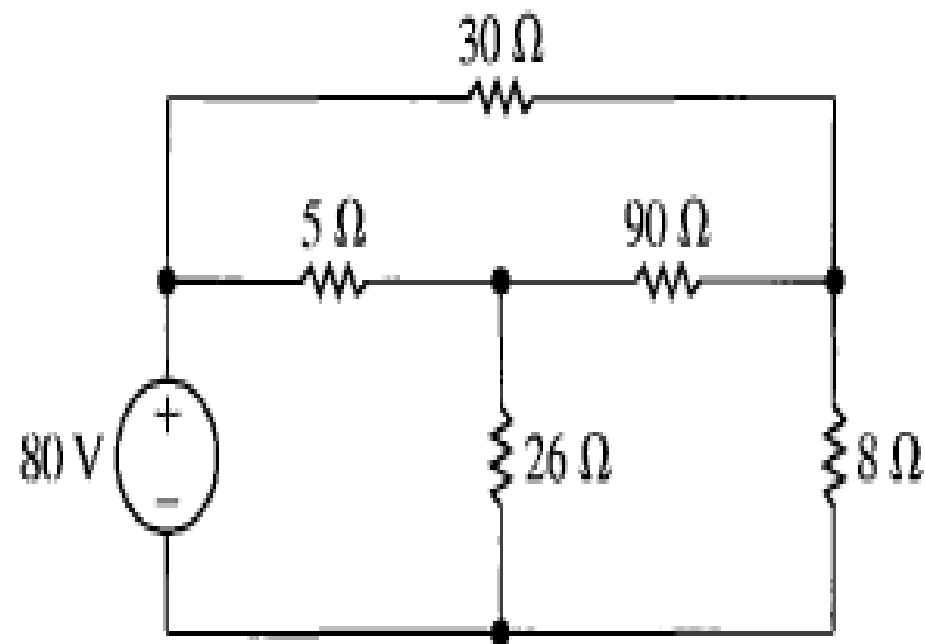
Objective 2—Understand and be able to use the mesh-current method

4.7 Use the mesh-current method to find (a) the power delivered by the 80 V source to the circuit shown and (b) the power dissipated in the 8 Ω resistor.
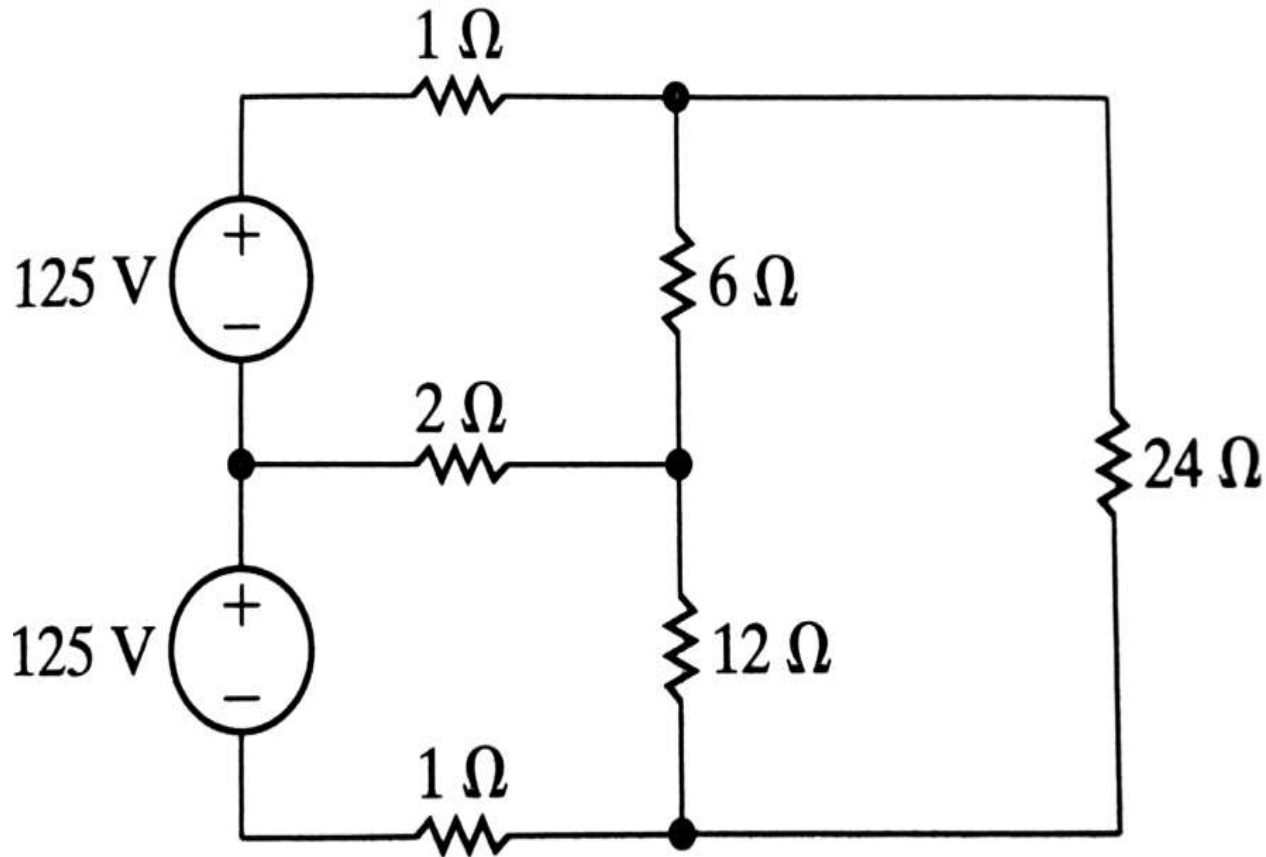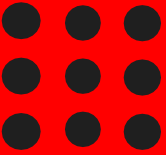
Answer: (a) 400 W;

(b) 50 W.

Problem 3

Using Mesh-Current method, find all the mesh currents.

23.76 A,
18.43 A,
8.66 A

REFERENCES

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3. Mehta V K, Mehta Rohit, "Principles of Electrical Engineering and Electronics", S.Chand & Company Ltd, (2010)- UNIT I and II

4. Mehta V K, Mehta Rohit, "Principles of Electronics", S.Chand & Company Ltd, (2005)- UNIT IV and V

5. https://happho.com/install-concealed-conduit-electrical-wiring-system-properly/

THANK YOU