Midterm ELEC 275 Winter 2024 - B

Principles of Electrical Engineering (Concordia University)

ELEC275: Principles of Electrical Engineering

Midterm EXAM

Version B

Date: Tuesday March 5 5.45pm -8.30pm, 2024

Notes:
1. Each problem: 10 marks, and Total marks: **40**
2. Start a new page of the booklets for every problem
3. Attach this page **only** with your booklets
4. Only ENCS calculator allowed.
5. Closed book exam

Your name: _____ Concordia ID: _____

Problem 1. In the circuit shown in Fig.1, R_1=2.5 Ω, R_2=15 Ω, R_3=6 Ω, R_4=12 Ω, R_5=60 Ω, R_6=20 Ω, R_7=80 Ω,

(a) Calculate the equivalent resistance observed between nodes **a** and **d**, when switch S_1 is closed but S_2 and S3 are open. **(4 marks)**

(b) Calculate the equivalent resistance observed between nodes **a** and **c**, when S_1 and S_3 are open but S_2 is closed. **(4 marks)**

(c) When all switches are closed, what is the total resistance observed between terminals **c** and **d**? **(2 marks)**

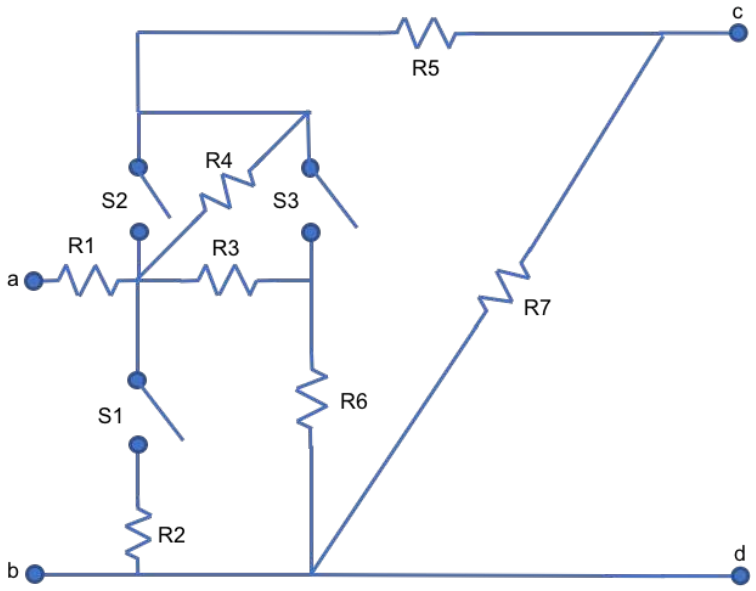

Fig. 1

Problem 2. Using **mesh current method (KVL)**, calculate the current through resistance R_1 in the circuit shown in Fig. 2 and identify the direction of its flow. *First write down the mesh current equation(s)*, and then solve the problem. R_1=10 Ω, R_2=5 Ω, R_3=3 Ω, IS=7 A, and VS=10 V **(5 marks)**

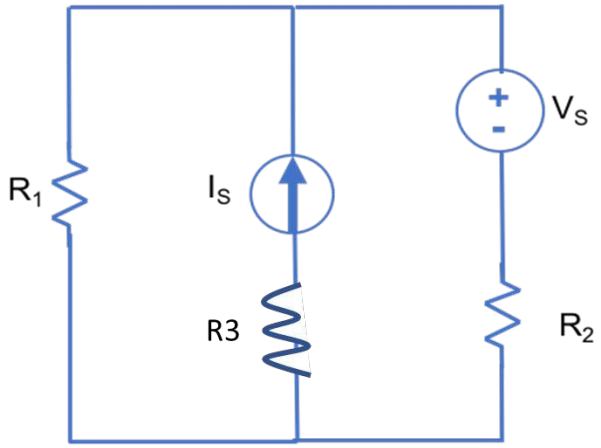

Fig.2.

Problem 3. A circuit shown in Fig. 3 has R_1=15 Ω, R_2=8 Ω, R_3=4 Ω, R_4=4 Ω, R_5=2 Ω, Vs=10 V, I_1=2A and I_2=3A. **Using nodal voltage method (KCL)** to find the voltage across the current source I_1, and to indicate the polarity of the voltage. *First write down the mesh current equations*, and then solve them to find the answer. (**10 marks**)

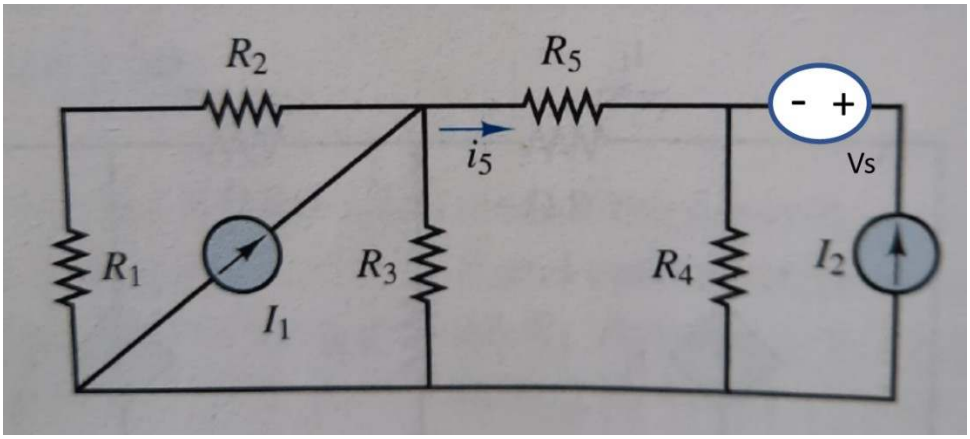

Fig. 3

Problem 4. For the circuit depicted in Fig. 4: R_1=1 Ω, R_2=0.5 Ω, R_3=1 Ω, R_4=0.5 Ω, R_5=0.5 Ω, R_6=100 Ω, V_{S1}=6 V, V_{S2}=15 V, I_{S1}=2 A, I_{S2}=2 A, and I_{S3}=15 A. RL is the load.

(a) Find the **Thévenin voltage (V_{th} = V_{ab}) by first writing circuit equations with only variables,** and then find V_{th}. **(8 marks)**

(b) What is the load value to have a maximum power transfer? and what is the maximum amount of power deliverable to a load? (**2 marks**)

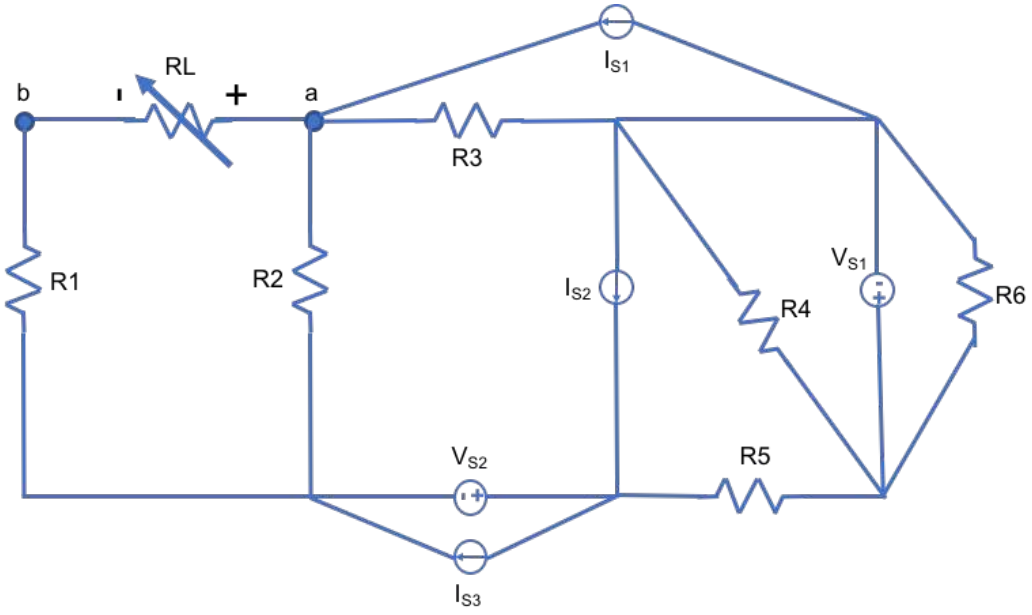

Fig. 4