International Islamic University Chittagong
Department of Electrical and Electronic Engineering
B. Sc. Engineering in EEE
Final Exam, Spring 2023 (Special)

Course Code: **EEE 1101** Course Title: **Electrical Circuits I**
Time: 2 hours 30 minutes Full Marks: 50

(i) The figures in the right-hand margin indicate full marks
(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions			
CO	**CO Statements**	**PO**	**BL**
CO1	i) Identify (C2) the basic principles of electric circuit analysis (network theorems) to apply in electric networks with DC supply with resistive and reactive elements. ii) Identify (C2) the basic principles of magnetic circuit analysis (ampere's circuital law and others related theorems) to apply in various magnetic circuits.	POb	C2
CO2	Apply (C3) circuital laws and various network theorems to solve dc circuits and to determine various circuit parameters.	POa	C3
CO3	Apply (C3) circuital laws to solve problems of dc response with reactive elements and ampere's circuital law for magnetic circuits.	POa	C3

Bloom's Levels (BL) of the Questions						
Letter Symbols	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Use source conversion technique to find the current through 5 Ω resistor for the network shown in Fig. 1 — CO2 C3 5

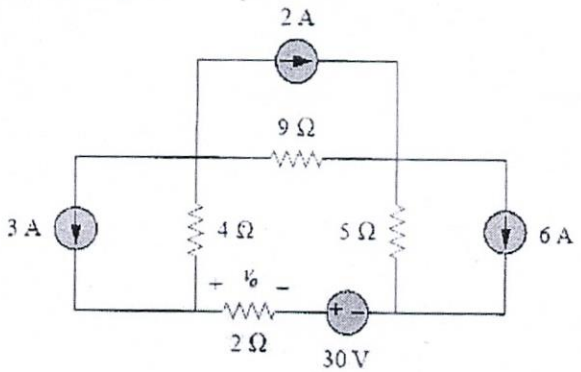

Fig. 1 Network for the question 1. a)

1. b) Apply Superposition theorem to determine the voltage v_x of the network shown in Fig. 2 — CO2 C3 5

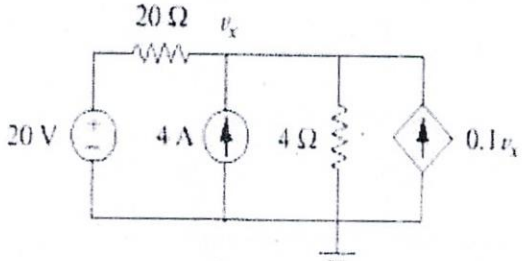

Fig. 2 Network for the question 1. b)

2. a) Find the Norton equivalent circuit for the network external to the resistor R — CO2 C3 5

shown in Fig. 3.

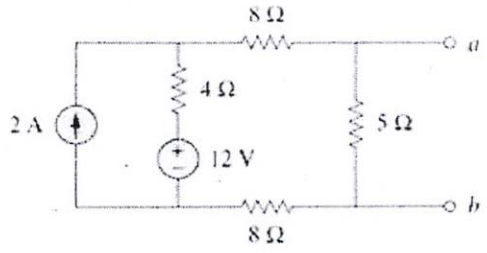

Fig. 3 Network for the question 2. a)

2. b) Find the *Thevenin* equivalent circuit for the network of Fig. 4.between the terminals *a-b*. CO2 C3 5

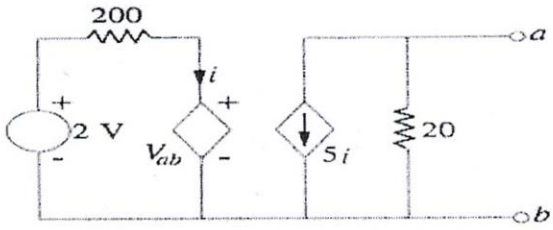

Fig. 4 Network for the question 2. b)

Or,

2. a) Determine the value of R_L that will draw the maximum power from the network shown in Fig. 5. Also calculate the maximum power received by R_L. CO2 C3 5

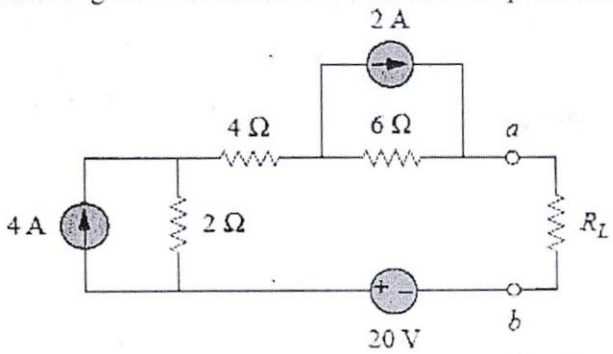

Fig. 5 Network for the question 2. a) (from Or)

2. b) Find the Norton equivalent circuit for the network external to the resistor R shown in Fig. 6. CO2 C3 5

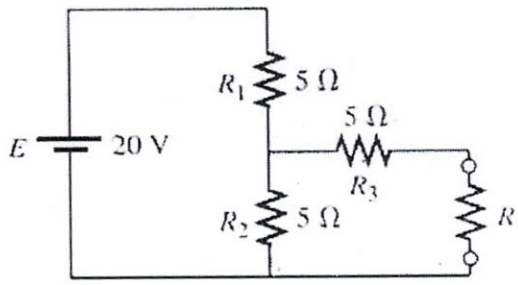

Fig. 6 Network for the question 2. b) (from Or)

Part B

[Answer the questions from the followings]

	a)	Analyze with necessary circuits, equations and timing diagrams; how R-C charging and discharging transient phases work.	CO1	C2	5
3.	b)	For the R-C transient circuit given below in Fig. 7. (i) Find the mathematical expression for the transient behavior of v_C; if the switch is thrown into position 1 at t = 0 s. (ii) Repeat part (i) for i_C. (iii) Find the mathematical expression for the response of v_C and i_C if the switch is thrown into position 2 at t = 15 ms. (iv) Find the mathematical expression for the voltage v_C and current i_C if the switch is thrown into position 3 at t = 30 ms. (v) Plot the waveforms obtained in parts (i) through (iv) on the same time axis for the voltage v_C and current i_C using the defined polarity and current direction shown in the circuit. The waveforms must be plotted on a graph paper and the plotted graph paper must be attached with the answerscript.	CO3	C3	5

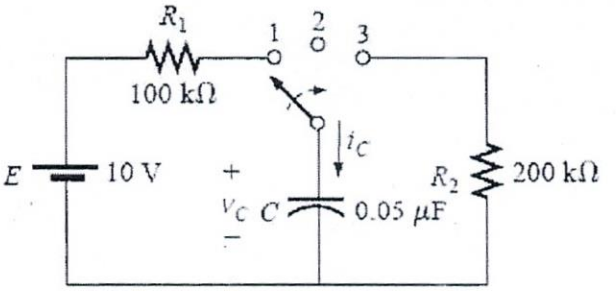

Fig. 7 Network for the question 3. b)

OR

3.	a)	Apply the concept of RL charging and discharging and explain the transient condition for the voltage across capacitor and resistor of a RL circuit.	CO1	C2	5
3.	b)	Find the voltage V_1, V_2, I_1, and I_2 for the network shown in Fig. 8 under steady state condition.	CO3	C3	5

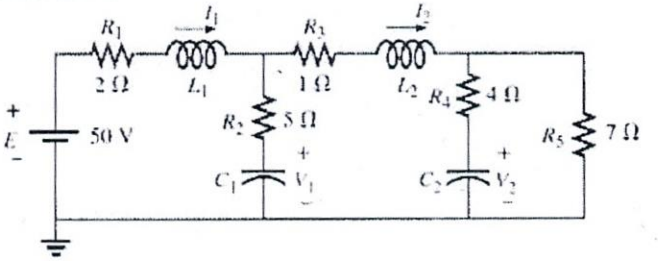

Fig. 8 Network for the question no 3. b) (from Or)

4.	a)	What do you understand by the Hysteresis loop of the B-H curve? Explain the B-H curve in brief in your own word.	CO1	C2	5
4.	b)	What do you understand by magnetic permeability (μ) and relative magnetic permeability (μ_r)? Explain several types of materials on the basis of their relative magnetic permeabilities.	CO1	C2	5
5.	a)	For the magnetic circuit given below in Fig. 9 determine the current I required to produce the magnetic flux $\phi = 0.70 \times 10^{-4}$ Wb. Please ignore the ϕ provided in figure. Draw the electrical analogous magnetic circuit. Use B-H Plot for your calculation and attach with the answerscript.	CO3	C3	5

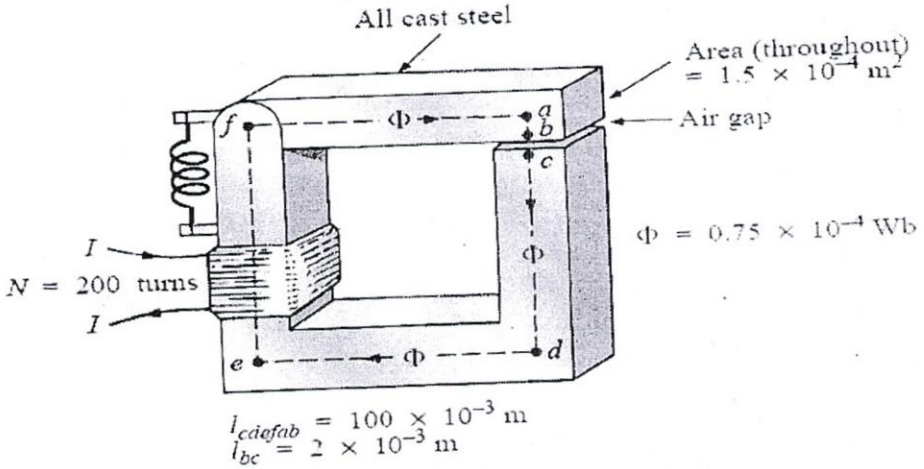

Fig. 9 Network for the question no 5. a)

5. b) Determine the magnetic flux ϕ for the magnetic circuit given below in Fig. 10. The current of the magnetic coil provided in the diagram will be replaced by 4 A. Draw the electrical analogous magnetic circuit. Use B-H Plot for your calculation and attach with the answerscript. CO3 C3 5

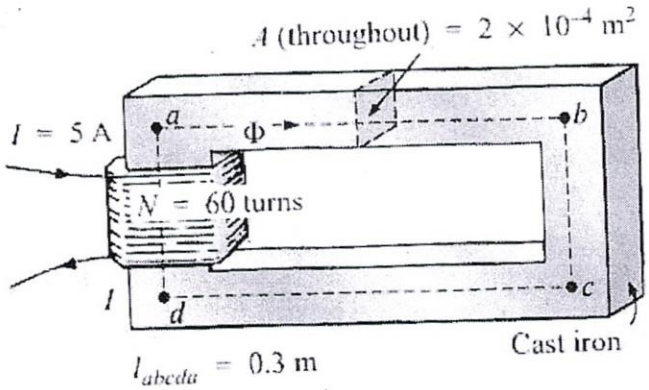

Fig. 10 Network for the question no 5. b)