International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Final Exam, Autumn 2022

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) of the Questions	
CO1	Reflect a basic understanding on current, voltage, energy, power, sources and circuit elements in a dc circuit, various network theorems, dc responses with reactive circuit elements and magnetic circuits.
CO2	Apply circuital laws and network theorems to solve dc circuits.
CO3	Apply circuital laws to solve problems of dc response with reactive elements & ampere's circuital law for magnetic circuits.

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) Use source conversion technique to find the voltage V_O in the circuit shown in Fig. 1. CO2 App 5

1. b) Use Superposition theorem to determine the voltage v_x of the network shown in Fig. 2. CO2 App 5

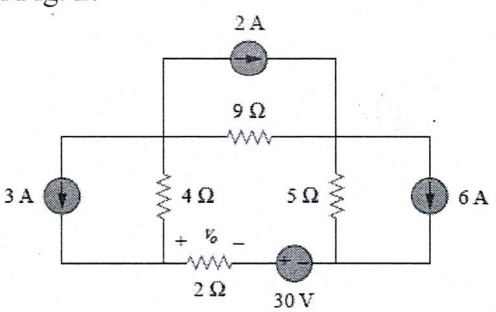


Fig. 1 Network for the question 1(a).

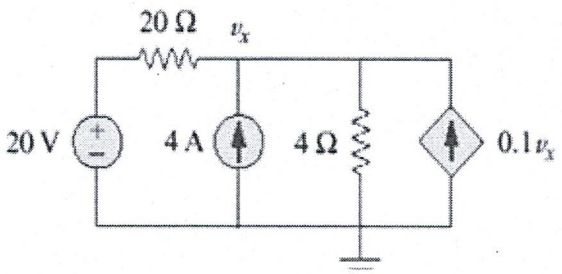


Fig. 2 Network for the question 1(b).

2. a) Apply Thevenin's Theorem to find the current through 4 Ω resistor. Here you need to consider 4 Ω resistor as R_L (Fig. 3) CO2 App 5

2. b) Find the Norton equivalent circuit for the network external to the resistor R shown in Fig. 4. CO2 App 5

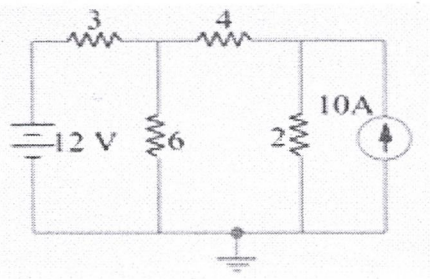


Fig. 3 Network for the question 2(a).

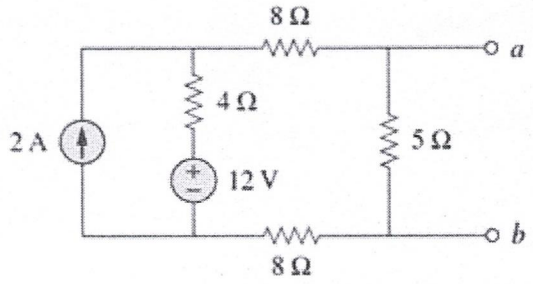


Fig. 4 Network for the question 2(b).

Or,

2. a) Determine the value of R_L that will draw the maximum power from the circuit given below in figure: 2(a)/Or. Also calculate the maximum power received by R_L. CO2 App 5

2. b) Find the Thevenin & Norton Equivalent for the circuit given below between the terminals a-b in figure: 2(b)/Or. CO2 App 5

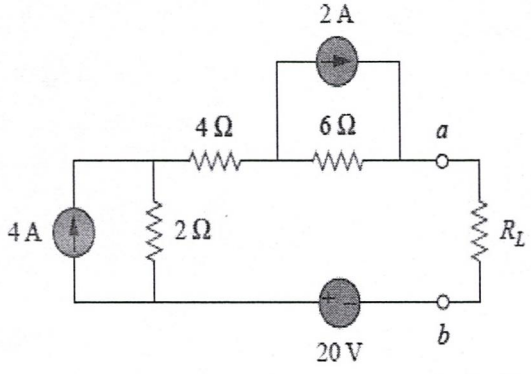


Fig. 5 Network for the question 2(a) (from Or).

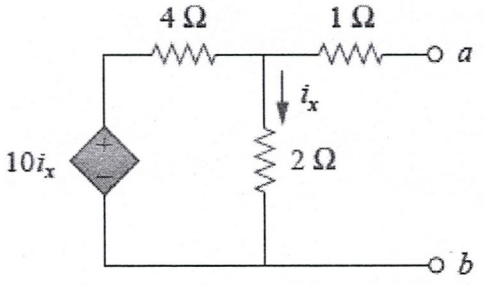


Fig.6 Network for the question 2(b) (from Or).

Part B

[Answer the questions from the followings]

3. a) Apply the concept of RC charging and discharging and explain the transient condition for the voltage across capacitor and resistor of a RC circuit. CO3 App 5

3. b) Find the voltage across the capacitor in fig-7, under steady state condition. Also, determine the amount of charge stored on the capacitor plates. CO3 App 5

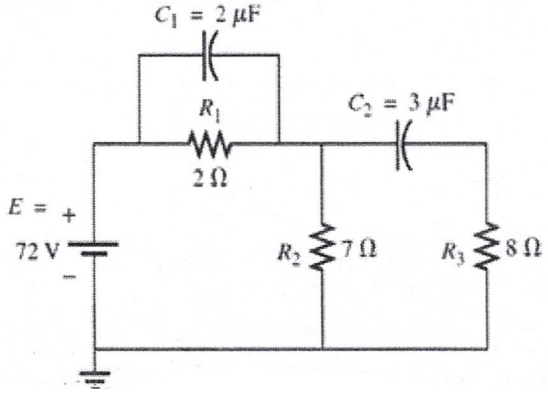


Fig. 7 Network for the question 3(b).

Or

3.	a)	Analyze with necessary circuits, equations and timing diagrams; how R-L charging and discharging transient phases work.	CO3	An	5
3.	b)	For the R-L transient circuit given below in figure: 3(b)/Or, the inductor has an initial current of 4 mA in the mentioned direction; (i) Find the mathematical expression for i_L for the complete charging phase. (ii) Repeat part (i) for v_L. (iii) Plot the waveforms obtained in parts (i) and (ii) on the same time axis for the current i_L and voltage v_L 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	App	5

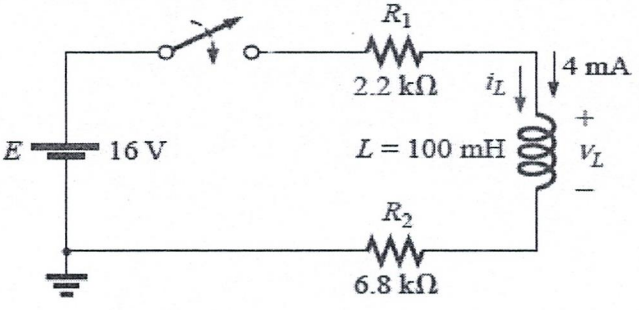


Fig. 8 Network for the question 3(b) (from Or).

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	U	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 permeability.	CO1	U	5
5.	a)	Determine the secondary current I_2 for the transformer of Fig. 9 if the resultant clockwise flux in the core is 1.5×10^{-5} Wb. (The necessary B-H curve will be provided with question. You need to indicate the conversion between B and H in the curve. Please attach the B-H curve with your answer script).	CO3	App	5
	b)	Determine the magnetic flux ϕ for the magnetic circuit given below in figure: 5(b). The current of the magnetic coil provided in the diagram will be replaced by 6 A. Draw the electrical analogous magnetic circuit. Use B-H Plot for your calculation (if required) and attach with the answer script.	CO3	App	5

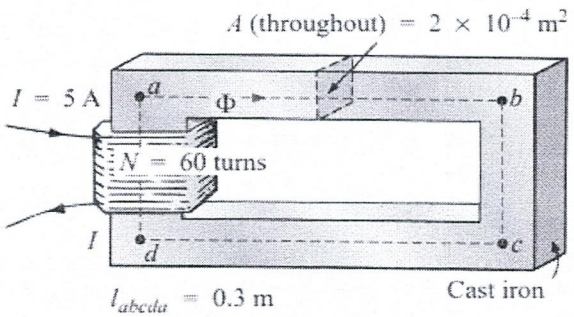
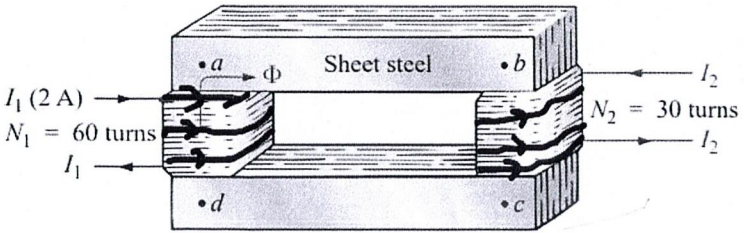


Fig. 9 Network for the question 5(b).


Sheet steel
a
b
c
d
Φ
I_1 (2 A)
N_1 = 60 turns
I_1
I_2
N_2 = 30 turns
I_2
Area (throughout) = 0.15×10^{-3} m^2
l_{abcda} = 0.16 m