International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Final Exam, Spring 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 element in a dc circuit, various network theorems, dc responses reactive circuit elements and magnetic circuits.
CO2	Apply various circuital laws, network theorems for solving dc circuits. They will also be able to solve problems related to dc response of reactive elements and magnetic circuits.

Bloom's Levels of the Questions						
Letter Symbols	**R**	**Un**	**Ap**	**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 current i passing through the 4 Ω   CO2   E   5
resistor in the circuit of **"Fig. 1"**. Replace the 2 A current source by a 4 A
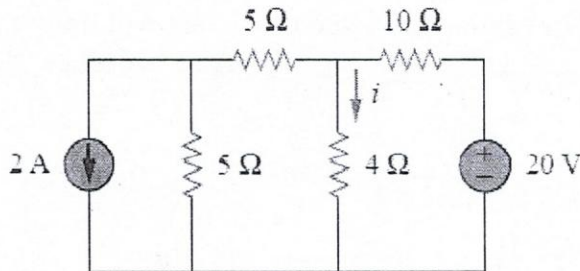current source.

Fig. 1

1. b) Find I in the network of **"Fig. 2"** by superposition theorem. Replace the 10 V   CO2   E   5
source by a 20 V source.
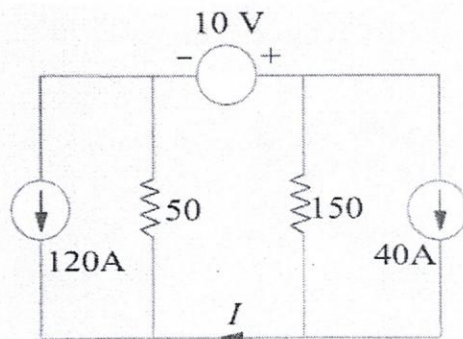

Fig. 2

Page 1 of 4

2. a) State Thevenin Theorem. Find the Thevenin equivalent circuit for the portions   CO2   E   5
        of the networks of "**Fig. 3**" external to points a and b. Finally calculate the
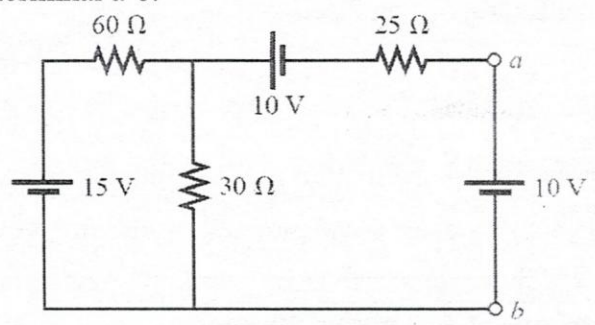   current through terminal a-b.

Fig. 3

2. b) State Norton Theorem. Draw the Norton equivalent circuit for the network   · CO2   E   5
        external to the resistor R shown in "**Fig. 4**". Calculate the current through R.

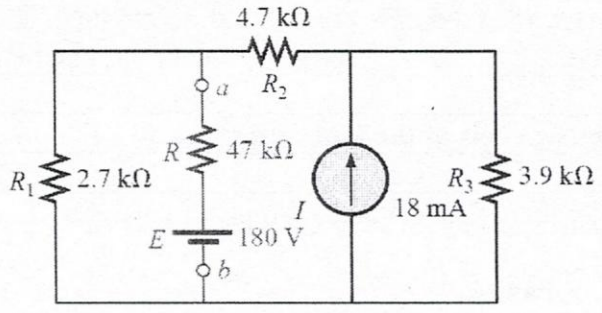**Fig. 4**

Or,

2. a) State maximum power theorem. Determine the value of R_L that will draw the   CO2   E   5
        maximum power from the circuit given in "**Fig. 5**" Also calculate the
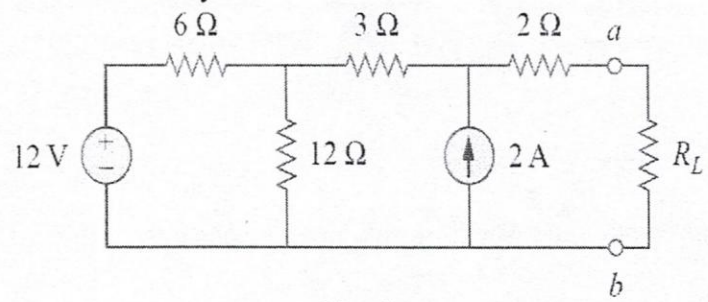   maximum power received by R_L.

Fig. 5

2. b) Find the Thevenin & Norton Equivalent for the circuit given in "**Fig. 6**"   CO2   E   5
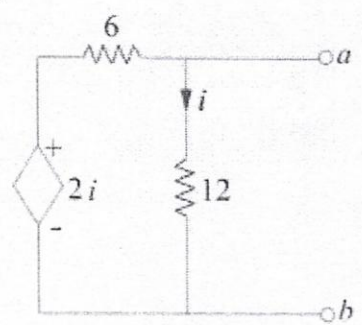   between the terminals a-b.

Fig. 6

Part B

[Answer the questions from the followings]

3. a) What do you understand about the capacitance of a capacitor? Explain the Time constant of a capacitive circuit.   CO1   An   4

3. b) For the R-C transient circuit given in "**Fig. 7**";   CO2   E   6

(i) Find the mathematical expression for the transient behavior of the voltage across the capacitor of the circuit shown below 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 = 40 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 = 50 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.
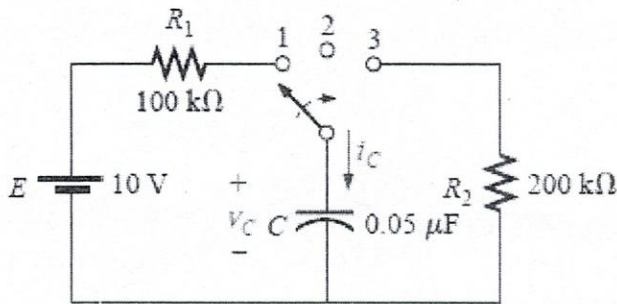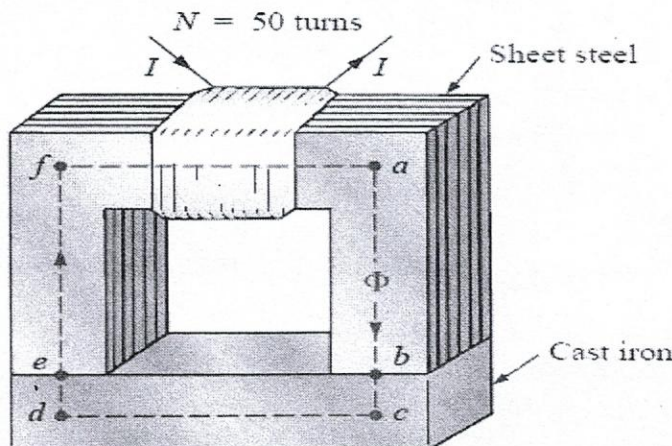

Fig. 7

4. a) Explain the Ohms law in a magnetic circuit and make a relation with the electrical circuit.   CO1   Un   4

4. b) For the magnetic circuit given in "**Fig. 8**" determine the current I required to produce the magnetic flux $\phi = 3.4 \times 10^{-4}$ Wb. Please ignore the ϕ provided in figure. Draw the electrical analogous magnetic circuit. Use B-H Plot for your calculation (if required) and attach with the answerscript.   CO2   E   6

$l_{ab} = l_{cd} = l_{ef} = l_{fa} = 4$ in.
$l_{bc} = l_{de} = 0.5$ in.
Area (throughout) = 1 in.^{2}
$\Phi = 3.5 \times 10^{-4}$ Wb

Fig. 8

Part B

[Answer the questions from the followings]

3. a) What do you understand about the capacitance of a capacitor? Explain the Time constant of a capacitive circuit.   CO1 An 4

3. b) For the R-C transient circuit given in "**Fig. 7**";   CO2 E 6

(i) Find the mathematical expression for the transient behavior of the voltage across the capacitor of the circuit shown below 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 $t = 40$ ms.

(iv) Find the mathematical expression for the voltage v_C and current i_C if the switch is thrown into position 3 at $t = 50$ 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.
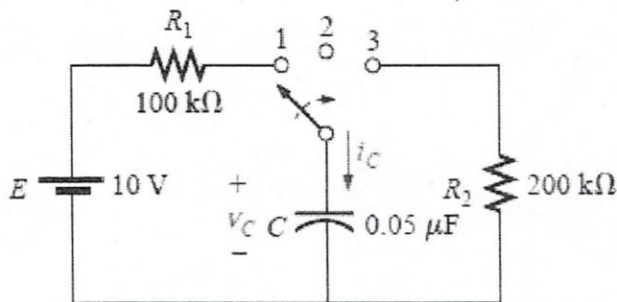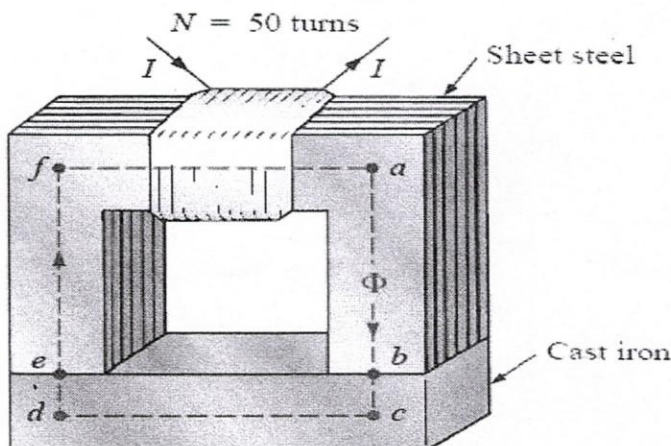

Fig. 7

4. a) Explain the Ohms law in a magnetic circuit and make a relation with the electrical circuit.   CO1 Un 4

4. b) For the magnetic circuit given in "**Fig. 8**" determine the current I required to produce the magnetic flux $\phi = 3.4 \times 10^{-4}$ Wb. Please ignore the ϕ provided in figure. Draw the electrical analogous magnetic circuit. Use B-H Plot for your calculation (if required) and attach with the answerscript.   CO2 E 6
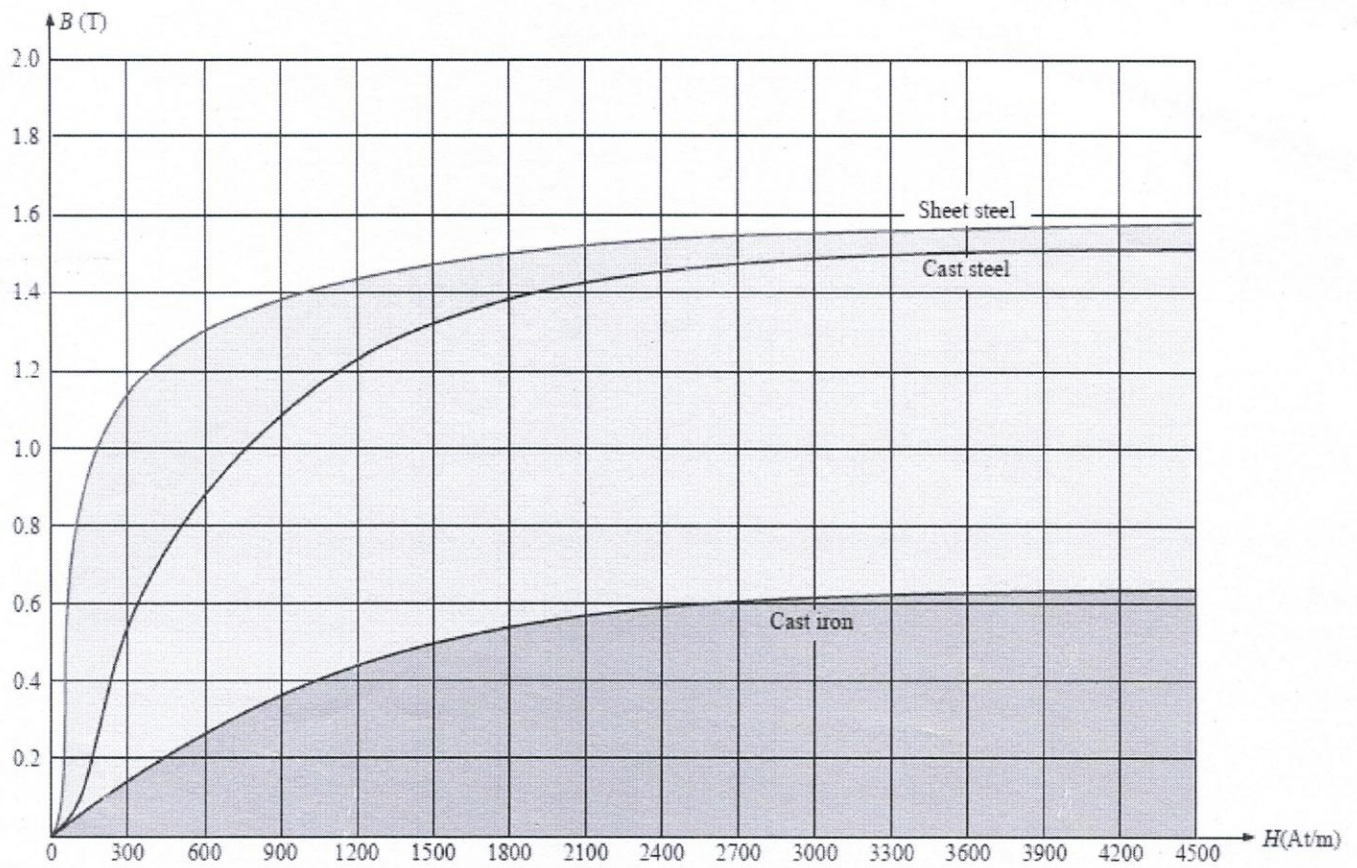

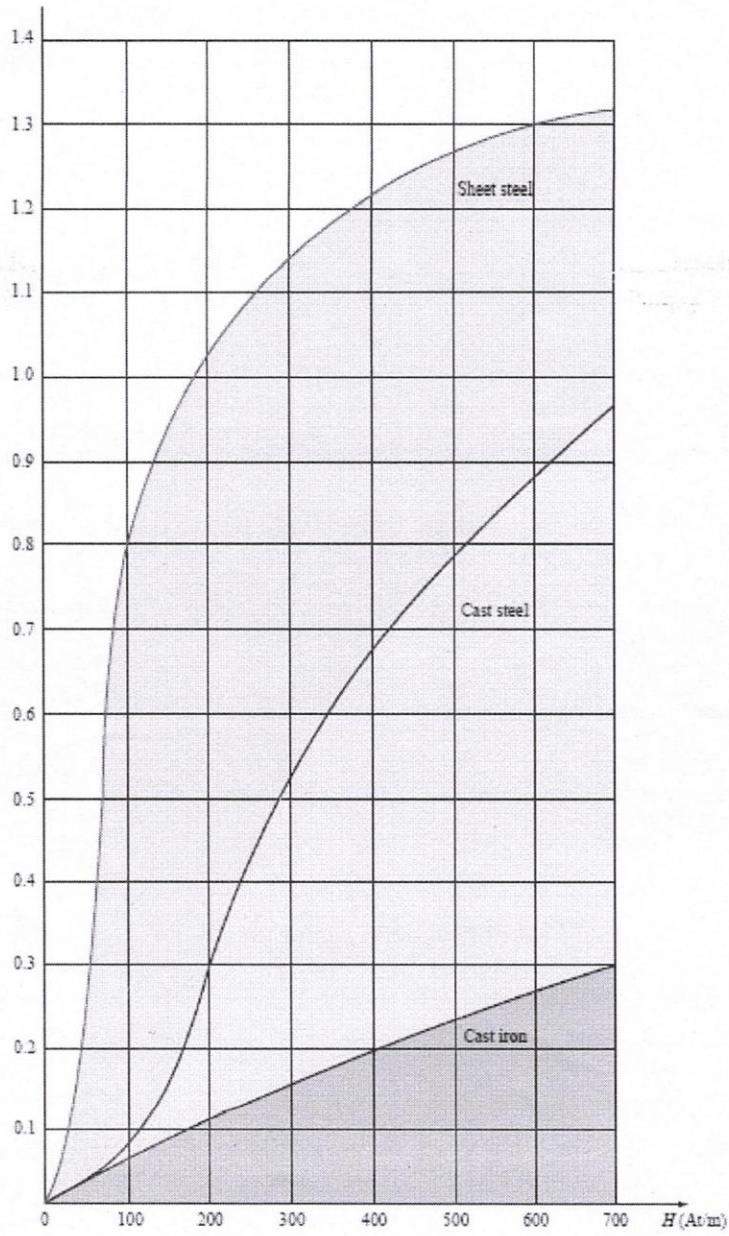$l_{ab} = l_{cd} = l_{ef} = l_{fa} = 4$ in.
$l_{bc} = l_{de} = 0.5$ in.
Area (throughout) $= 1$ in.^{2}
$\Phi = 3.5 \times 10^{-4}$ Wb

Fig. 8

B-H Plot of Magnetic Materials

B-H Plot of Magnetic Materials