EEE (1)

B.Sc. Engg. (EE), 1st Semester

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Semester Final Examination
Course No.: EEE 4101
Course Title: Electrical Circuit I

Winter Semester, A. Y. 2022-2023
Time: 3 Hours
Full Marks: 150

There are **6 (six)** questions. Answer **all the** questions. Marks are given in the right margin (in brackets) along with course outcome and program outcome. Assume any data if necessary.

1(a) Find the value of V_0 in the network in Fig. 1 (a) without using any network analysis technique. (12.5) (CO1) (PO1)

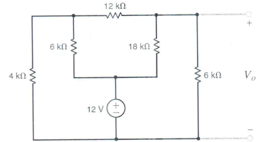


Fig. 1 (a)

1(b) Use nodal analysis to find V_0 in the network in Fig. 1 (b). (12.5) (CO1) (PO1)

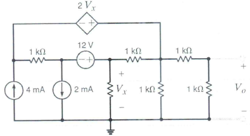


Fig. 1 (b)

2(a) Find V_0 in the circuit in Fig. 2 (a) using loop analysis. (12.5) (CO1) (PO1)

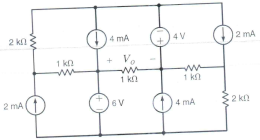


Fig. 2 (a)

2(b) Use superposition theorem to find I_0 in the network in Fig. 2 (b). (12.5) (CO2) (PO2)

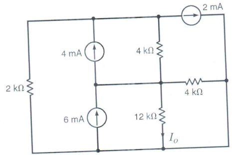


Fig. 2 (b)

3(a) Use Thévenin's theorem to find I_0 in the network in Fig. 3 (a). (12.5) (CO2) (PO2)

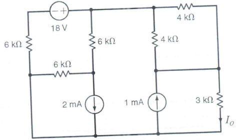


Fig. 3 (a)

3(b) Mention the difference between diamagnetic, paramagnetic and ferromagnetic. Explain the term gauss and permittivity. Find the energy stored by the inductor in the circuit in Fig. 3 (b) when the current through it has reached its final value. (12.5) (CO3) (PO1)

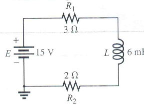
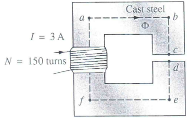


Fig. 3 (b)

4(a) Find the magnetic flux Φ established in the series magnetic circuit in Fig. 4 (a). (12.5) (CO5) (PO1)



$l_{cd} = 8 \times 10^{-4}$ m

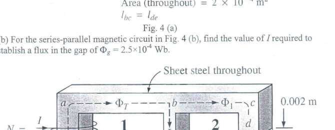
$l_{ab} = l_{be} = l_{ef} = l_{fa} = 0.2$ m

Area (throughout) $= 2 \times 10^{-4}$ m^2

$l_{bc} = l_{de}$

Fig. 4 (a)

4(b) For the series-parallel magnetic circuit in Fig. 4 (b), find the value of I required to establish a flux in the gap of $\Phi_g = 2.5\times10^{-4}$ Wb. (12.5) (CO5) (PO1)



Area for sections other than $bg = 5 \times 10^{-4}$ m^2

$l_{ab} = l_{bg} = l_{gh} = l_{ha} = 0.2$ m

$l_{bc} = l_{fg} = 0.1$ m, $l_{cd} = l_{ef} = 0.099$ m

Fig. 4 (b)

5(a) For the circuit in Fig. 5 (a): (12.5) (CO4) (PO2)

i. Find the total admittance and impedance in polar form.
ii. Sketch the admittance and impedance diagrams.
iii. Find the value of C in microfarads and L in henries.
iv. Find the voltage E and currents I_R, I_L, and I_C in phasor form.
v. Sketch the phasor diagram of the currents I_S, I_R, I_L, and I_C, and the voltage E.
vi. Verify Kirchhoff's current law at one node.
vii. Find the average power delivered to the circuit.
viii. Find the power factor of the circuit, and indicate whether it is leading or lagging.
ix. Find the sinusoidal expressions for the currents and voltage.
x. Sketch the waveforms for the currents and voltage on the same set of axes.

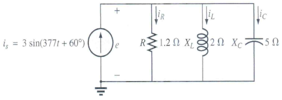


Fig. 5 (a)

5(b) For the network in Fig. 5 (b): (12.5) (CO4) (PO2)

i. Find E, I_R, and I_L in phasor form.
ii. Find the total power factor, and indicate whether it is leading or lagging.
iii. Find the average power delivered to the circuit.
iv. Sketch the admittance diagram.
v. Sketch the phasor diagram of the currents I_s, I_R, and I_L, and the voltage E.

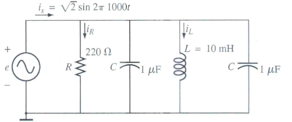


Fig. 5 (b)

6(a) Find the current $\mathbf{I_4}$ for the network in Fig. 6 (a). Also find the voltage across all the elements. (12.5) (CO4) (PO2)

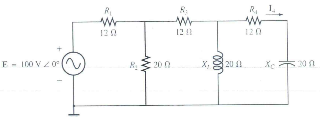


Fig. 6 (a)

6(b) Using mesh analysis, find the current through the capacitive reactance in Fig. 6 (b). (12.5) (CO4) (PO2)

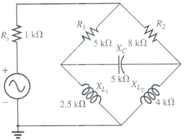


Fig. 6 (b)