B.Sc. Eng.SWE/1st Sem. Date: 09 January 2026

# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

**DEPARTMENT OF NATURAL SCIENCES**

**Mid-Term Examination**
**Course Number**: PHY 4143
**Course Title**: Physics II

**Winter Semester**: 2024-2025
**Full Marks**: 120
**Time**: 2 Hours

**Please answer according to the order of the questions**. Answer all the **4 (FOUR)** questions. The symbols have their usual meanings. Marks of each question and the corresponding CO and PO are written in the brackets.

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**1. a)** Explain Kirchhoff's current law (KCL) and Kirchhoff's voltage law (KVL) with a simple DC circuit diagram. (12) (CO2) (PO1)

**b)** Define current source and voltage source. Write the conditions for converting a current source into voltage source and vice-versa. (08) (CO1) (PO1)

**c)** From the circuit shown in Fig. 1 compute $i_{R2}$ *and* $i_{R6}$. Given $I_s = 2.2$ A, $R_1 = 39$ Ω, $R_2 = 12$ Ω, $R_3 = 100$ Ω, $R_4 = 82$ Ω, $R_5 = 56$ Ω and $R_6 = 120$ Ω. (10) (CO3) (PO2)

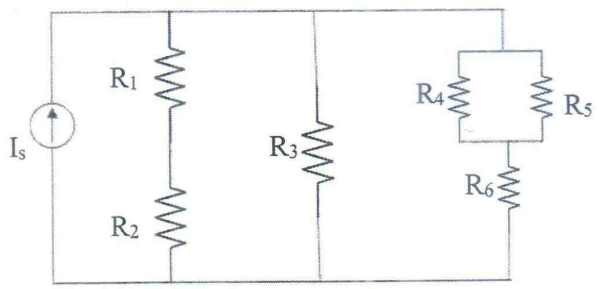


Fig. 1

**2. a)** Discuss the formulae for Wye-delta and Delta-Wye transformation with suitable circuit diagram. 08 (CO1) (PO1

**b)** Determine the values of $V_1$ and $V_2$ using the nodal analysis of the circuit shown in Fig. 2. 10 (CO3) (PO2)

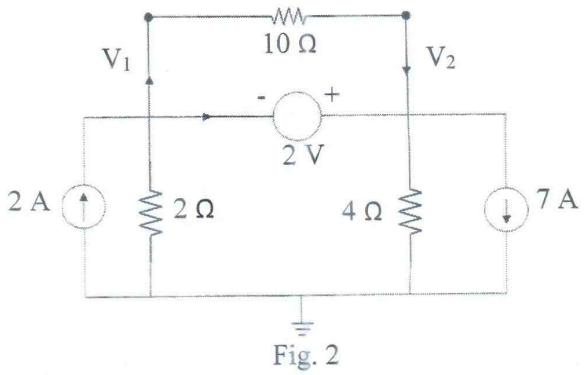


Fig. 2

c) Determine the value of currents $I_0$, $i_1$, $i_2$ and $i_3$ using the mesh analysis in the following circuit (Fig. 3). 12 (CO3) (PO2)

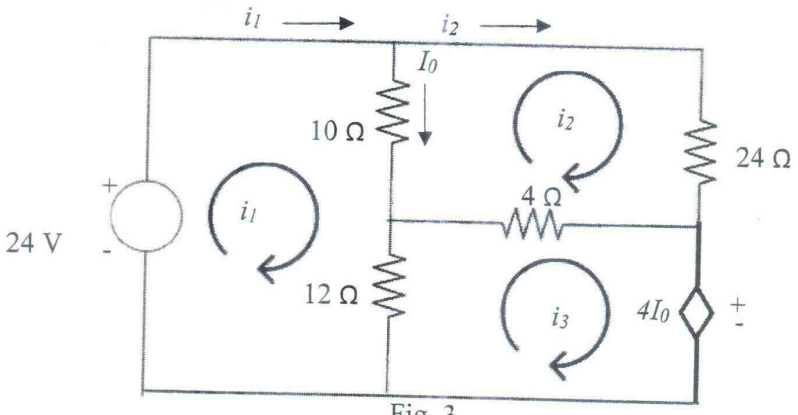


Fig. 3

**3. a)** State Thevenin's and Norton's Theorems and find the relationship between Thevenin's and Norton's equivalents. 10 (CO1) (PO1)

b) Applying Thevenin's theorem, determine the value of $V_{TH}$, $R_{TH}$, the load current $I_L$ flowing through the load resistor, and the load voltage across it in Fig. 4. 10 (CO3) (PO2)

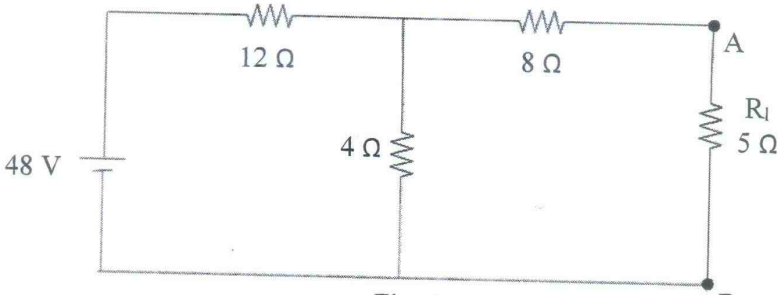


Fig. 4

c) Determine the current in each branch of the network shown in Fig.5 using superposition theorem. 10 (CO3) (PO2)

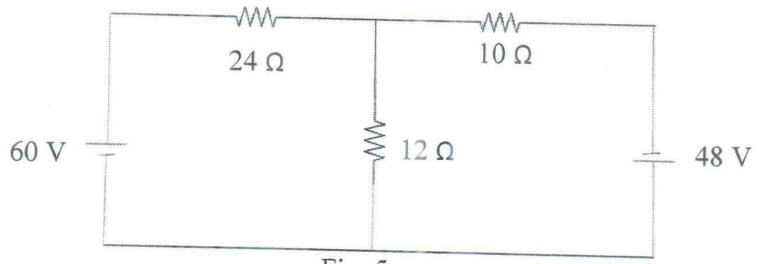


Fig. 5

**4. a)** State and explain Faraday's law of electromagnetic induction. 06 (CO1) (PO1)

b) Explain the working principle of an ac generator with suitable diagram. 10 (CO2) (PO1)

c) Express the reactance for a pure inductive and pure capacitive ac circuit and formulate the phase relationship between current and voltage for each. 14 (CO2) (PO1)