# Question Paper

Exam Date & Time: 09-Jan-2023 (02:30 PM - 05:30 PM)

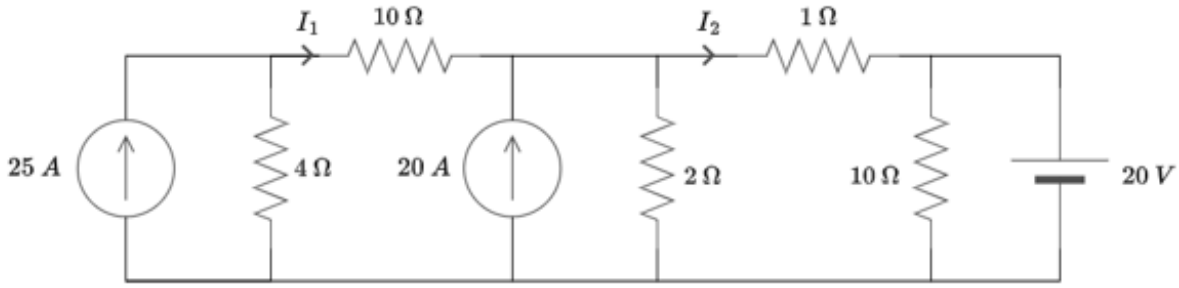
## MANIPAL ACADEMY OF HIGHER EDUCATION

**FIRST SEMESTER B.TECH. EXAMINATIONS - JANUARY 2023**
**SUBJECT: ELE 1071 / ELE-1071 - BASIC ELECTRICAL TECHNOLOGY**

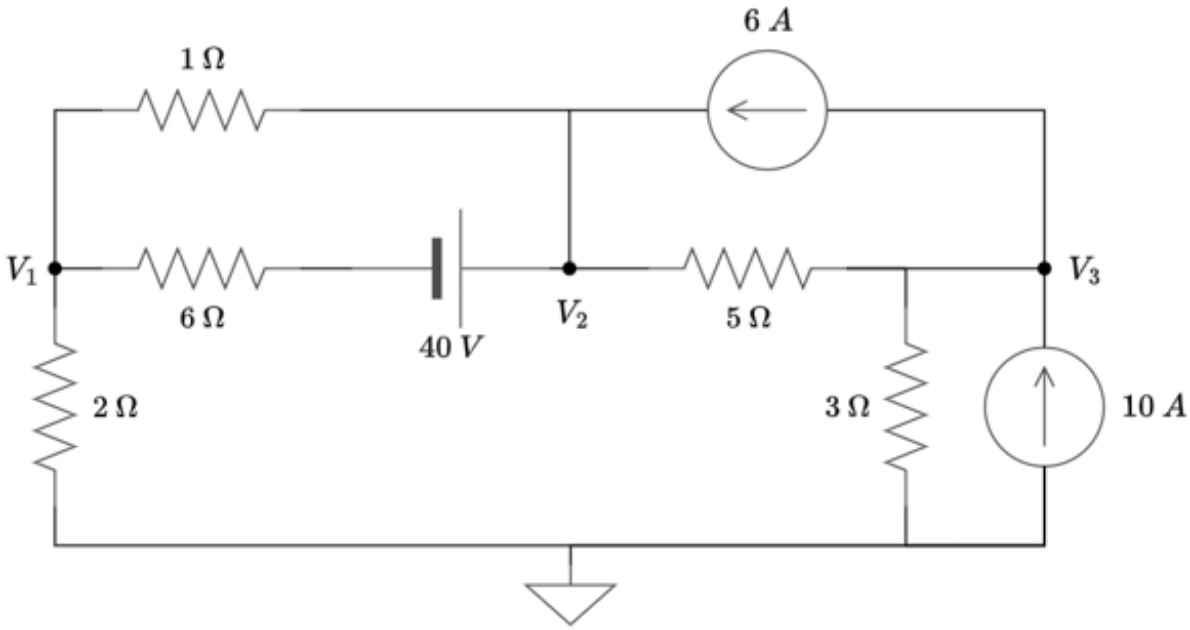
**Marks: 50** **Duration: 180 mins.**

**Answer all the questions.**

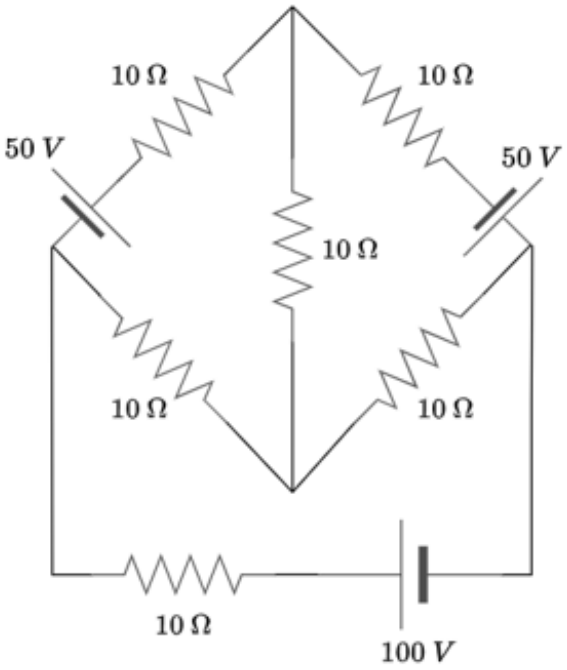
1A) Find the currents $I_1$ and $I_2$ in the given network. (3)



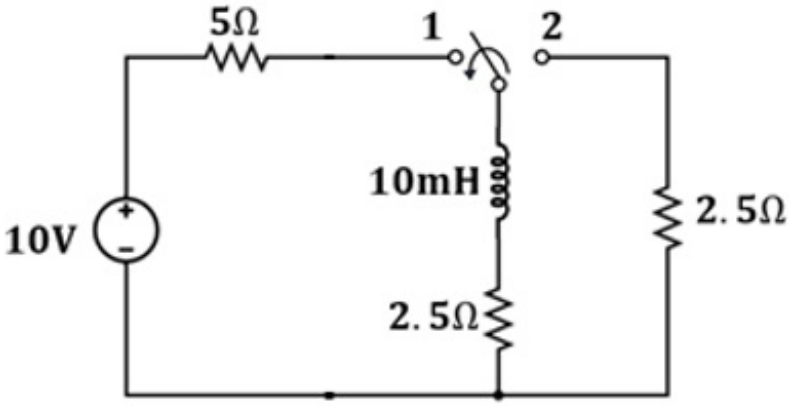

1B) Determine the node voltages $V_1$, $V_2$ and $V_3$ in the given circuit. (3)




1C) Determine the current supplied by **100 V** source to the circuit using **Thevenin's** theorem. (4)



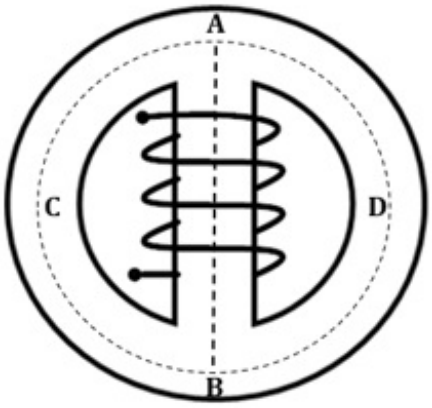

2A) For the network shown, the switch is closed on to position **1** at **t = 0** and then moved to position **2** at **t = 1.4** ms. Determine the current in the inductor when **t = 2.5 ms**. (3)



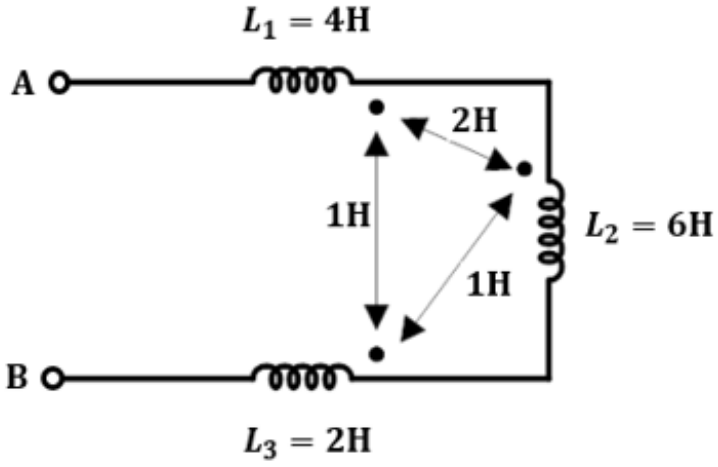

2B) For the magnetic circuit shown, the reluctance of the central limb (AB) is $\mathbf{10 \times 10^5}$ **AT/Wb** and the reluctance of the outer limbs (ACB and ADB) are same and equal to **15 × 105 AT/Wb**. The number of turns in the coil is **1000**. Central limb AB has flux density of **1.25 Tesla** and a mean length of **10 cm**. Assuming uniform area of cross section, determine (4)

a) The current to be flowing in the coil to produce **0.5 mWb** in limb ADB.

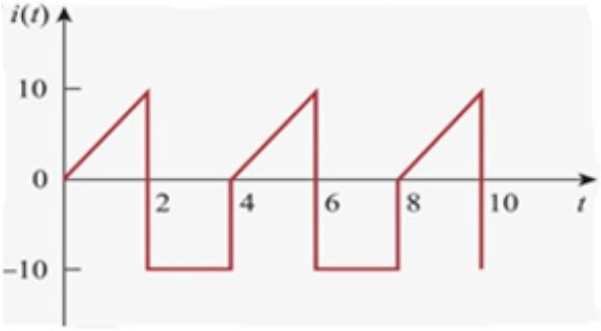
b) The relative permeability of the magnetic material.




2C) Determine the equivalent inductance seen at terminals **A** & **B** in the given network. Also compute the coupling coefficients $\mathbf{k_{12}}$, $\mathbf{k_{23}}$ and $\mathbf{k_{13}}$. (3)




3A) Determine the **RMS** value of the current waveform shown. If the current is passed through a resistor of **10 Ω**, find the power absorbed by the resistor. (3)




3B) A metal-filament lamp, rated at **250 W**, **100 V**, is to be connected in series with a capacitor across a **230 V**, **50 Hz** supply. Calculate: (a) the capacitance of the capacitor, and (b) the phase angle between the circuit current and the supply voltage. (4)

3C) A circuit having a resistance of **12 Ω**, an inductance of **0.15 H** and a capacitance of **100 µF** in series, is connected across a **100 V**, **50 Hz** supply. Calculate: (a) the impedance, (b) the current, (c) the voltages across **R**, **L** and **C**, and (d) the circuit power facor. (3)

4A) A **1-phase** AC generator supplies the following loads: (4)
i) Lighting load of **20 kW** at **unity** power factor.
ii) Induction motor load of **100 kW** at **0.707** lagging power factor.
iii) Synchronous motor load of **50 kW** at **0.9** leading.
Calculate the total **kW** and **kVA** delivered by the generator and the power factor at which it works.

4B) Three similar coils, each having a resistance of **8 Ω** and an inductive reactance of **8 Ω** are connected in **star** across a **415 V**, **3-phase**, **50 Hz** supply. Calculate active, reactive, and apparent power of the load and individual wattmeter readings if the power is measured by two-wattmeter method. (6)

5A) A star-connected balanced load is supplied from a **3-phase** supply with a line voltage of **416 V** at a frequency of **50 Hz**. Each phase of the load consists of a resistance and a capacitor connected in series, and the readings on two-wattmeters connected to measure the total power supplied are **782 W** and **1980 W**. Calculate: (4)
a) The power factor of the circuit
b) The line current.
c) The capacitance of each capacitor.

5B) With a neat schematic discuss the working principle of a 1-phase digital energy meter. (3)

5C) Using circuit representation classify the different types of DC motors. Discuss their features. (3)

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