

6. (a) A fault developed between two cores of an underground cable measuring 550 metres in length. A test was carried out at both ends and resistances obtained were 20.4Ω from end A and 0.2Ω from end B.
- i. Draw a simple diagram showing the cable, the fault and the resistances. **(3 marks)**
 - ii. Find the distance of the fault from A. **(7 marks)**
- (b) A two core cable has an insulation resistance of 200 Mega ohms per 91.7 metres of cable length. If the cable is 4.58 meters long and is connected to a 230 V supply, find:
- i. insulation resistance of the cable **(5 marks)**
 - ii. the total leakage current. **(5 marks)**

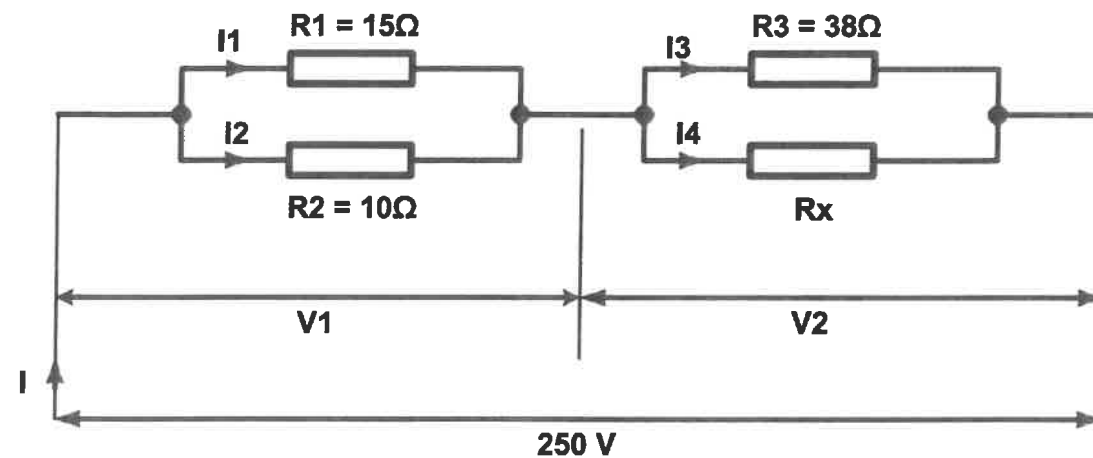
END OF EXAMINATION PAPER

EXAMINATION FOR AUTHORISATION A

Paper 1: Theory
Date: 12 July 2022
Time: 9:00 – 12:00 (Three hours)

This examination paper contains six questions. Candidates are requested to answer any FIVE (5) questions. Candidates are also requested to include all their work in the booklet provided. Every answer should include all workings, any necessary diagrams and formulae. Use a fresh page for each different question. Each question carries 20 marks.

1. (a) State Ohm's law as applied to a direct current (D.C.) circuit. **(3 marks)**
- (b) From the circuit shown below.
- Calculate;
- i. The value of the resistor R_x such that the total power dissipated in the circuit is 2.5 kW. **(9 marks)**
- ii. The current flowing in each of the four resistors. **(8 marks)**



2. (a) With the aid of well labelled diagrams explain briefly the construction of a single phase
- Double wound transformer **(3 marks)**
 - Auto transformer. **(3 marks)**
- (b) Explain the principle of operation of a single phase double wound transformer. **(4 marks)**
- (c) What safety precaution need to be considered when using an Auto transformer. **(4 marks)**
- (d) A double wound single phase transformer has its primary winding connected to a supply of 230 V and its secondary winding is supplying a load at 60 V. If the primary winding has 1200 turns, find:
- i. The number of secondary turns **(3 marks)**
- ii. The secondary current when the current taken from the supply is 3 Amps. **(3 marks)**

3. A capacitor C is connected in series with a 40Ω resistor across a supply of frequency 60 Hz. A current of 3 Amps flows and the circuit impedance is 50Ω .

(a) Draw a well labelled diagram for the configuration. **(2 marks)**

Calculate the following:

- i. the value of capacitance C **(4 marks)**
- ii. the supply voltage **(3 marks)**
- iii. the phase angle between the supply voltage and current **(3 marks)**
- iv. the p.d. across the resistor **(3 marks)**
- v. the p.d. across the capacitor. **(3 marks)**
- vi. Draw the phasor diagram. **(2 marks)**

4. (a) Explain the term **Heating effect**. **(3 marks)**
- (b) The water of volume 0.075 m^3 (75 litres) is to be raised in temperature from 15°C to 85°C using a 3 kW heater. Assuming that 20% of the energy is wasted, determine the time that the operation will take to reach the set temperature. **(10 marks)**
- (c) Heat energy of 10 MJ is supplied to 113 litres of water initially at 15°C . Assuming that none of the heat is wasted, calculate the final temperature of the water. **(7 marks)**

Note: specific heat capacity of water is $4187 \text{ J}/(\text{Kg } ^\circ\text{C})$,

Mass of 1 m^3 of water is 10^3 kg and

$1 \text{ m}^3 = 10^3 \text{ litres}$.

5. A coil is wound uniformly over a wooden ring having a mean circumference of 60 cm and a cross-sectional area of 5 cm^2 . The coil has 600 turns and its resistance is 8Ω . If it is connected to a 20 V dc supply, calculate:
- i. the magneto motive force, m.m.f. **(5 marks)**
- ii. the magnetizing force H. **(5 marks)**
- iii. the force on the conductor. **(5 marks)**
- iv. torque produced. **(5 marks)**