



EXAMINATION FOR AUTHORISATION A

Paper 2

Date: 3rd July 2024

Time: 9:00 – 12:00 (Three hours)

This examination paper includes six questions. Candidates are requested to choose and answer any FIVE questions clearly indicating the question number of the answered questions.

Write only your Index Number in the space provided in the booklet.

Candidates are requested to answer ALL FIVE questions in the booklet correctly listing the answered question number in the space provided on the booklet's front sheet.

Answers should be written in Blue/Black Ink. Diagrams can be drawn in pencil.

All answers should include the necessary workings, diagrams and formulae.

Use a separate page for each different question.

Each question carries 20 marks.

1. (a) Define OHM'S law (2 marks)
- (b) Figure 1.1 shows the circuit of series and parallel resistance combination. With the aid of sequential diagrams, calculate the total resistance of the circuit. (10 marks)

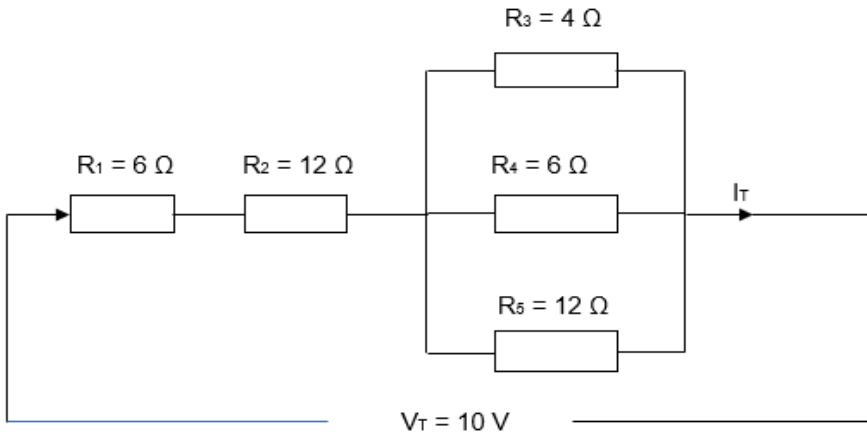


Figure 1.1

- (c) Calculate the following:
- (i) total current in the circuit (2 marks)
 - (ii) potential difference across each resistor. (6 marks)
- (20 marks)**
2. (a) List **FIVE** main hazards of working near electrical circuits. (5 marks)
- (b) The use of PPE is important and recommended to safeguard electrical authorised persons while on duty. Briefly explain **FIVE PPEs** that are commonly used by an electrical authorised person. (10 marks)
- (c) Name the **THREE** elements that form the Fire Triangle. (3 marks)
- (d) What is required to extinguish a fire? (2 marks)
- (20 marks)**
3. (a) Briefly explain the fusing factor and the current rating of a fuse. (4 marks)
- (b) A rewirable fuse is a semi-enclosed fuse to BS3036. State if this statement is **TRUE** or **FALSE**. (1 mark)
- (c) Give **ONE** advantage and **ONE** disadvantage of semi-enclosed fuse when compared to MCB. (3 marks)
- (d) Explain the difference between each of the following protection devices. (You may use diagrams in your explanations)
- (i) Semi-enclosed fuse compared with a fuse to BS88. (4 marks)
 - (ii) MCB compared to a MCCB. (4 marks)
 - (iii) RCD compared to a RCBO. (4 marks)
- (20 marks)**

4. The use of the British Standard BS7671 and the local Electrical Installations Regulations the subsidiary legislation, SL 545.24, are a requirement in Malta.
- (a) List **FOUR** electrical types of installations regulated by the above. **(4 marks)**
 - (b) Mention **FOUR** types of installations which are not regulated by the British Standard BS7671. **(4 marks)**
 - (c) Mention **FOUR** fundamental principles of the British Standard BS7671. **(4 marks)**
 - (d) Explain the meaning of “authorised provider” as defined by the Subsidiary Legislation 545.24. **(5 marks)**
 - (e) Mention **THREE** types of installations that are not regulated by the Maltese Subsidiary Legislation 545.24. **(3 marks)**
(20 marks)
5. An electric water heater is installed in a temporary converted 20-foot container situated in a construction site. The water heater is rated 1.8 kW. The Supply system is single-phase having an earthing system TT type.
- (a) What is the required disconnection time for a faulty circuit in a construction site? **(2 marks)**
 - (b) Calculate the resistance of the water heater heating element. **(4 marks)**
 - (c) The circuit supplying the water heater is supplied by a 3 x 2.5mm² cable from a supply source 20m away. The resistance of the cable core is 7.6 x 10⁻³ ohms/m. Calculate the resistance of the PE conductor and phase conductor. **(2 marks)**
 - (d) The heater element develops a fault to earth exactly at the midpoint. Given that the earth fault impedance Z_e at source is 120 ohms, calculate the earth fault current. (Consider Z_e in total connected on the return path to earth in the equivalent circuit). **(6 marks)**
 - (e) Following a test for a 30mA RCD, what is the expected trip time for the tests at each of the following?
 - (i) 30mA
 - (ii) 150mA. **(4 marks)**
 - (f) For the calculated earth fault current in (d), state if the RCD provides the required protection. Give a reason for your answer. **(2 marks)**
(20 marks)

6. A single-phase domestic owner reported a fault to an electrical authorised person. The customer explained that in a particular room, containing 3 lighting points, he observed strange lighting behaviour. With reference to the circuit below (Figure 6.1), the customer noticed that,
- when S1 is ON and S2 is OFF, L1, L2 and L3 (incandescent lamps) are lit up but very dim.
 - when he switches S2 ON, L3 becomes lit up normally but L1 and L2 are completely off.

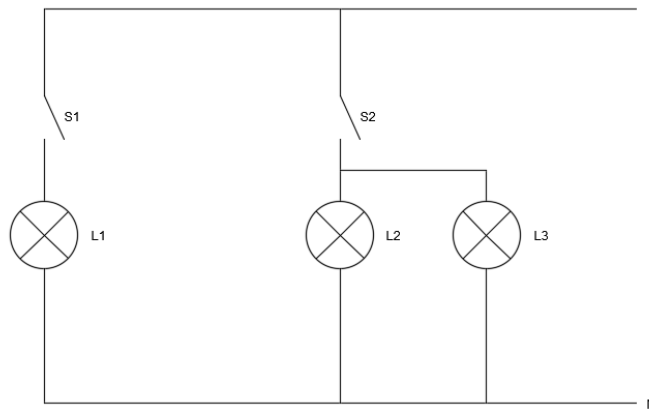


Figure 6.1

- (a) List **THREE** safety precautions that need to be considered by an electrical authorised person before working on the installation to find the fault. **(3 marks)**
- (b) What type of fault do you suspect? **(3 marks)**
- (c) On your answer booklet draw the circuit diagram of Figure 6.1 and on the diagram drawn mark the fault location. **(4 marks)**
- (d) With S1 closed and S2 open the three lamps light up very dim. On the diagram drawn in (c) indicate clearly the flow of current through the lamps. **(6 marks)**
- (e) Explain why the fault did not trigger the final circuit MCB or the RCD to trip. **(4 marks)**
- (20 marks)**

END OF EXAMINATION PAPER