



# **EXAMINATION FOR AUTHORISATION A**

## **Paper 2**

**Date: Thursday 3rd July 2025**

**Time: 09.00 – 12:00 (Three hours)**

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

**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.**

**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 the term Specific Heat Capacity (2 marks)
- (b) A takeaway shop has a water heater tank of 200 litres installed at the premises. The water heater has an electric element rated 3kW. The water temperature flowing in the tank is expected to be 15°C.  
Calculate the:
- (i) heat energy required if the thermostat of the heating element is set at 75°C.  
(The specific heat capacity of water is 4187J/kg°C.) (5 marks)
  - (ii) time required, in hours, to heat the water by using the electric heater to the set-point of 75°C. The thermal efficiency of the water heater is to be 100%. (5 marks)
  - (iii) cost of operating the water heater, if the thermal efficiency of the water heater is 80% and the set-point remains 75°C. Assume the cost per unit (kWh) is 10.47cents. (8 marks)

2 The following box includes five different types of fire extinguishers.

Water  
Foam Spray  
ABC Powder  
Carbon Dioxide  
Wet Chemical

- (a) From the list above name the fire extinguisher/s that:
- i) can be used to extinguish fires in cooking oils and fats (1 mark)
  - ii) cannot be used to extinguish fire in wood, paper and textiles (1 mark)
  - iii) can extinguish fires caused by flammable gases (1 mark)
  - iv) can extinguish fires due to electrical contact. (2 marks)
- (b) A room storing hazardous materials, which under normal conditions produce toxic fumes, caught fire.
- i) List five precautions that need to be taken by the authorised person responsible to work near the live equipment. (5 marks)
  - ii) Explain what happens to the storeroom and electrical equipment after the correct type of fire extinguisher is used to extinguish the fire. (5 marks)
  - iii) List five precautionary measures necessary in a room storing hazardous materials which produce toxic fumes under normal conditions. (5 marks)

3 A 4Kw 230V 50Hz single phase motor works at a power factor of 0.6. It is connected to its starter by a single core pvc insulated copper cables drawn into steel metal conduit (method 3) dedicated solely for this circuit. The length of the run is 25m. The voltage drop in the cables must not exceed 6V. Assume an ambient temperature of 35°C and protection by BS 88 fuses.

- (a) Calculate the load current of the machine. (4 marks)
- (b) From the fuse ratings shown in the table below (Table 1) select the most suitable fuse giving reasons for your choice. (4marks)

FUSE RATING
15 A
20A
25 A
30 A
40 A
40 A
50 A
60 A
80 A
100 A

Table 1 Fuse ratings

- (c) Using the appropriate correction factors from the table below (Table 2) calculate the minimum current rating ( $I_t$ ) to determine the cross sectional area (CSA) of the required cable. (4 marks)

Correction factors for ambient temperature when protection is against short circuit and overload							
Type of insulation	Operating temperature	Ambient temperature °C					
		25	30	35	40	45	50
General purpose PVC	70 °C	1.03	1.0	0.94	0.87	0.79	0.71

Table 2 Ambient temperature factors

(d) Using Table 3 and the value obtained in part 'c' choose the appropriate conductor size. (4 marks)

Single-core cables having thermoplastic (pvc) insulation non armoured (Copper conductors)	
Conductors cross-sectional area (CSA)	Reference method 3 (enclosed in conduit on a wall or in trunking)
mm <sup>2</sup>	2 cables single-phase a.c. or d.c.
1	13.5 A
1.5	17.5A
2.5	24A
4	32A
6	41A
10	57A
16	76A
25	101A
35	125A

Table 3 Current carrying capacity

(e) Using Table 4 below determine the voltage drop. (4 marks)

Voltage drop (per ampere per metre) Conductor operating temperature 70°C	
Conductors cross-sectional area (CSA)	Reference method 3 (enclosed in conduit on a wall or in trunking)
mm <sup>2</sup>	2 cables single-phase a.c.
	mV/A/m
1	44
1.5	29
2.5	18
4	11
6	7.3
10	4.4
16	2.8
25	1.8
35	1.3

Table 4 Voltage drop

4 A retail jewellery shop has the following connected load to the 230V 50Hz AC supply:

Direct heaters: 2 x 2kW, 3 x 1.5kW and 1 x 1.0kW  
Cooker: 5 kW (cooker unit has a socket outlet)  
Water heating (thermostatic): 3kW  
Socket outlets: 30A ring circuit.  
Shop and window lighting: 2.5kW total

(a) Calculate the maximum demand for the installation considering the appropriate diversity factors for the list of load items above. (20 marks)

5 (a) There are several commercial premises that require more frequent testing of an Electrical Installation Condition Report, normally more frequently than 5 years as a minimum. From the list below name any four commercial premises that must be evaluated annually. (4 marks)

- Domestic single-phase installations
- Swimming Pools
- Medical Locations
- Caravan Parks and Marinas
- Cinemas
- Leisure complexes (excluding swimming pools)
- Theatres
- Places of public entertainment
- Agriculture
- Laundrettes (a self-service laundry)

(b) Explain what is meant by a 5-year recommended electrical testing and why it is conducted. (4 marks)

(c) Explain what is tested during a 5-year recommended single-phase electrical installation inspection. (6 marks)

(d) List two items that are not tested during a 5-year electrical installation test. (2 marks)

(e) List two possible outcomes that will be revealed during a periodic inspection. (4 marks)

6 (a) The instruments listed below are used to carry out a variety of Electrical Installation testing. For each of the instruments listed below explain the function and describe how the electrical installation test is carried out.

- (i) A low-resistance ohmmeter (continuity tester) (4 marks)
- (ii) An insulation resistance tester (4 marks)
- (iii) A loop impedance tester (4 marks)
- (iv) A residual current device (RCD) tester (4 marks)
- (v) Polarity Tester. (4 marks)

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