

4. a) (i) List the **three** components that need to be present for a fire to continue to burn. (2 marks)
- (ii) State where a water fire extinguisher is suitable for use on small fires of burning. (2 marks)
- (iii) State where a foam fire extinguisher is suitable for use on small fires of burning. (2 marks)
- (iv) Briefly explain where one should treat a fire with a fire extinguisher. (2 marks)
- b) Define what is meant by PPE. (2 marks)
- c) State **five** pieces of PPE which an electrician could be expected to wear at work. Explain the protection given by each piece. (10 marks)
5. a) Give brief answers based on IET Regulations for the following:
- (i) In a kitchen there are two cookers. As a competent electrician what would be your recommendations to the owner? (3 marks)
- (ii) What is the maximum distance at which an electric cooker may be positioned from the cooker control unit? (2 marks)
- b) State why the IET Regulations require that every installation shall be divided into circuits. (5 marks)
- c) What is meant by **Basic Protection** (formerly known as direct contact) and **Protection** under fault condition (formerly known as indirect contact) (5 marks)
- d) The IET Regulations recommend that every electrical installation should be regularly inspected and tested. At what periodic intervals should the following installations be tested?
- (i) Domestic dwelling (1 mark)
- (ii) Commercial dwelling (1 mark)
- (iii) Shops (1 mark)
- (iv) Caravans (1 mark)
- (v) Construction site (1 mark)
6. a) What is the purpose of inspecting and testing a new installation? (2 marks)
- b) Explain the reason why visual inspection needs to be carried out before commencing testing on a new installation. (5 marks)
- c) List **seven** points that need to be taken into consideration while performing a visual inspection on a new electrical installation. (7 marks)
- d) Explain how an insulation resistance test is carried out on an electrical installation. The answer must include the procedures that need to be followed from the time the supply to the installation is. Show drawings how the instrument is connected to perform the tests and state the minimum acceptable value for each test. (6 marks)

Total: 100 marks

END OF EXAMINATION PAPER



EXAMINATION FOR AUTHORISATION A

Paper 2

Date: 8th February 2023

Time: 15:30 – 18:30 (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) An owner of an apartment is to install a PV System on the roof of the building. The apartment energy meter is at the ground floor, while the building is five storeys high. The only access between the ground floor and the roof is through a service shaft. The PV System is rated 6 kWp ac, 230 V 50 Hz. The PV system will be connected to the main consumer unit which is installed at the ground level through a dedicated cable. The cable route length between the Consumer Unit and the PV System is 25m. This cable will be grouped with another five cables of the same type. The cable to be used is a 3-core XLPE copper sheathed cable and is to be clipped to the wall in the service shaft. The ambient temperature is expected to reach 45°C. Additional information is given in tables 1.1 to 1.4, below.

Calculate:

- i) the maximum generated current by the PV system (2 marks)
- ii) the MCB rating (1 marks)
- iii) the minimum current capacity of the required cable (3 marks)
- iv) the size of cable (2 marks)
- v) the voltage drop in the cable (2 marks)
- vi) the voltage at the PV System terminals if the voltage in the consumer unit is to be maintained at 230 V ac. (4 marks)

- b) Following some months into operation the owner informs you that the apartment's RCD is tripping few times a day. When it is switched ON back it will trip again after some hours.

- i) What type of fault do you expect to find and state why? (3 marks)
- ii) Explain how you would proceed to find the fault (3 marks)

10A	16A	20A	32A	40A
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No of Circuits	1	2	3	4	5	6	7
C_g	1.0	0.8	0.7	0.65	0.6	0.57	0.54

Ambient temperature (°C)	25	30	35	40	45	50	55	60
C_a	1.02	1.0	0.96	0.91	0.87	0.82	0.76	0.71

Cross Sectional Area mm ²	Current carrying capacity (A)	Voltage drop mV/A/m
1	19	46
1.5	24	31
2.5	33	19
4	45	12
6	58	7.9
10	80	4.7
16	107	2.9

2. A 1.5 kW electric heater element develops an earth fault to the metal frame of the electric heater. The heater is supplied from a 230 V a.c. supply and the plug protection fuse is rated 13 Amp. The earth loop impedance at the socket where this appliance is connected is measured as 1.5 Ω.

- a) Draw an equivalent circuit diagram for this fault and show clearly the current paths under fault conditions. (5 marks)
- b) Calculate the electric heater resistance. (4 marks)
- c) If the fault is at 50% of the heater element, what is the heater element resistance between the phase connection and the fault? (3 marks)
- d) Using a clamp ampere meter on the earth cable of the electric heater, 9.73 A were measured. Calculate the fault resistance. (4 marks)
- e) Considering the fault current measured which type of protection in the electrical installation is expected to trip? Is there any other protection that is not expected to trip? Give two reasons for your answer. (4 marks)

3. a) (i) Convert 3.768 kW to watts. (1 mark)
 (ii) How many ohms are there in 0.65 MΩ? (1 mark)
 (iii) Express a current of 0.037 Amps in milli-amperes. (1 mark)

- b) Refer to Figure 1 and calculate:
- (i) The total resistance of the network. (8 marks)
 - (ii) The voltage at point X. (3 marks)
 - (iii) The current through resistor F. (4 marks)
 - (iv) Draw the final equivalent circuit. (2 marks)

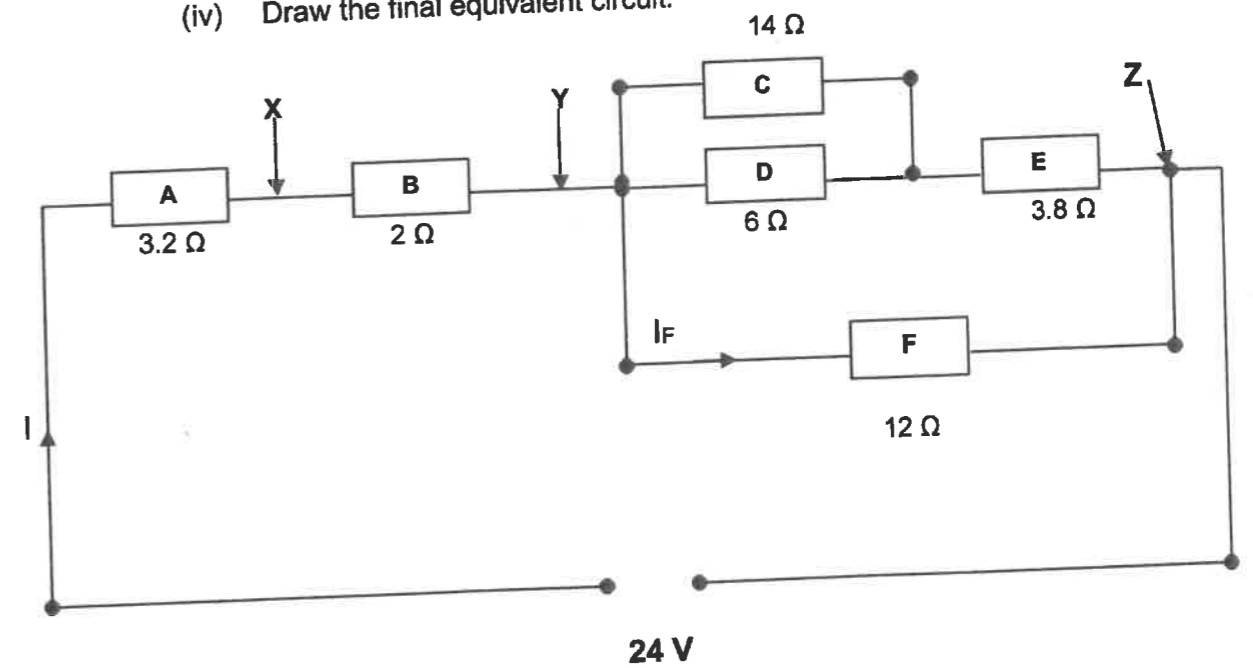


Figure 1