



6. (a) i. What is the scope of earthing in an Electrical Installation? **(3 marks)**
- ii. List the basic needs of earthing in an Electrical Installation. **(3 marks)**
- (b) A rod earth electrode is driven into the ground on the curb or pavement of a private dwelling. With the aid of diagrams, explain how this is carried out and its main purpose. **(7 marks)**
- (c) Describe with the aid of a diagram how to carry out an earth electrode resistance test. State also the maximum value of the earth electrode resistance acceptable. **(7 marks)**

Total: 100 marks

EXAMINATION FOR AUTHORISATION B

Paper 2: Electrical Installation Technology

Date: 4 February 2022

Time: 16:00 – 19:00 (Three hours)

END OF EXAMINATION PAPER

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) Explain what is meant by the terms **Maximum Demand** and **Diversity Factor** as applied to industrial installations. **(6 marks)**

(b) An electrical installation of a small restaurant consists of a:

- a 60A TP&N main MCB
- 4 by 32A single phase MCB
- 3 by 16A single phase MCB
- 32A TP&N MCB for the lift.

The following load is to be added:

- 9 ring circuit each having 10 by 13A socket outlets
- 6 by 3 kW thermostatically controlled water heaters
- 2 by 12 kW three phase motors having 0.8 power factor and efficiency of 90%
- A 32kVA 3 phase microwave heating system

Assuming a three phase 400/230V supply system, explain with the aid of a diagram how the additional load is to be incorporated and how the modifications necessary to the main distribution board is to be carried out. **(14 marks)**

2. (a) State what is meant by the term **electrode boiler** and state the advantages and disadvantages of an electrode boiler compared with an immersed element boiler. **(10 marks)**

(b) Describe how the electricity regulations provide for safety in the installation of electrode boilers. **(5 marks)**

(c) Draw a circuit diagram of an electrode boiler and its protection system. **(5 marks)**

3. Using clear and well-labelled diagrams show the construction of the following cables which could be used underground in a trench.

- i. PVC insulated and PVC sheathed cable in a conduit or pipe **(4 marks)**
- ii. Split-concentric cable. **(4 marks)**
- iii. CONSAC cable **(4 marks)**
- iv. Mineral Insulated Cable with PVC Sheath covering **(4 marks)**
- v. Paper Insulated Lead Sheathed and Armoured cable. **(4 marks)**

4. (a) Trunking is used extensively in industrial installations. There are many types of trunking. Show by a neat sketch in each case the construction of the types of trunking listed below:

i. Common trunking as used in domestic installations. **(2 marks)**

ii. Vertical trunking with compartments. **(2 marks)**

iii. Horizontal trunking with compartments for power, extra-low voltage circuits and fire alarm circuits. **(2 marks)**

iv. Vertical trunking for supporting runs of cable longer than 5 metres. **(2 marks)**

v. Rising main Bus-bar trunking. **(4 marks)**

vi. Over-head Bus-bar Trunking. **(4 marks)**

(b) Give one example where Rising Main Bus-bars are most suited. **(2 marks)**

(c) Give one example where Over-head Bus-Bar Trunking are most suited. **(2 marks)**

Your diagrams must be neat and they must show clearly the different features of each type of trunking.

5. (a) State the purpose for using a **starter** to start a motor. **(4 marks)**

(b) Describe the following tests that should be carried out in order to ensure the correct operation of:

i. the under-voltage release **(4 marks)**

ii. the over current release. **(4 marks)**

(c) Refer to a Direct online motor starter (DOL):

Name two types of overload protection that are used by a DOL starter. **(4 marks)**

(d) Calculate the full load current for the DOL starter controlling a motor 7.5 kW (10 HP). The three-phase squirrel cage induction motor has a supply voltage of 415V, 50Hz and 1450 rpm. The efficiency of the motor is 90% and has a p.f. of 0.85. **(4 marks)**