

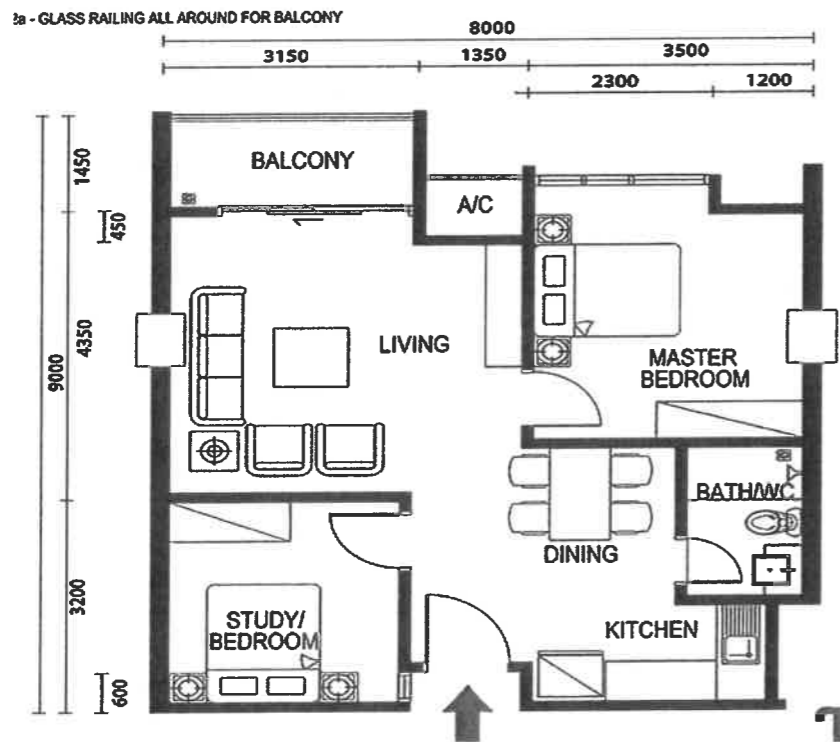
5. (a) Swimming pools designs incorporate electrical installations and equipment. Every zone of the swimming pool falls into a particular classification. These classification requirements are based on the dimensions of three zones. Explain the zone boundaries for each zone given below:

- i) Zone 0 (4 marks)
- ii) Zone 1 (4 marks)
- iii) Zone 2. (4 marks)

b) Draw a detailed zone diagram for a swimming pool and a paddling pool. (8 marks)

6. a) Explain, with the aid of a diagram, how a TT-earthing system is tested and certified. (5 marks)

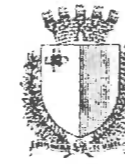
b) A customer provides an apartment plan as shown below.



The customer requested the authorised person to design the electrical installation and provide a bill of quantity for the proposed works. Copy the apartment building plan without furniture and

- i. draw the conduit layout for the power circuits (5 marks)
- ii. draw the conduit layout for the lighting circuits (5 marks)
- iii. provide an estimated bill of quantities for the proposed design. (5 marks)

Measurements are given for guidance purpose only. Any assumptions taken are to be stated.



## EXAMINATION FOR AUTHORISATION A

### Paper 2

Date: 6th July 2023

Time: 9:00 – 12:00 (Three hours)

**END OF EXAMINATION PAPER**

This examination paper includes six questions. Candidates are requested to answer any FIVE (5) questions showing 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. An Air Traffic Control Tower has been re-wired in **flat twin** and **earth**, 70° C cable. All the cables are concealed within the building framework where possible. The supply system is a 230-volt single phase, 50 Hz, TT system and a 30 mA RCD is used. The earth fault loop impedance needs to be checked to confirm the suitability of the consumer earth electrode.

Using the information given above, answer the following questions:

- (a) Which test instrument will be used to carry out the test? **(2 marks)**
- (b) Describe how the test should be carried out. **(6 marks)**
- (c) What is the maximum earth fault loop impedance value permitted for a TT system installation? Show all calculations. **(4 marks)**
- (d) State the value of electrode resistance above which the value of the electrode resistance is considered unstable. **(4 marks)**
- (e) State **one** method that could be used to test the resistance of the earth electrode and name the instrument used for this test. **(4 marks)**

2.(a) Calculate the current demand, including diversity, for a six-way consumer unit comprising the following circuits in a domestic dwelling. It is important to calculate both the **maximum demand** and the **demand with diversity** where applicable for each respective circuit. Assume the supply to be 230 V 50 Hz. The circuits are:

**Circuit 1** – A lighting circuit consisting of 10 points. Assume a minimum of 100 watts per point and a **66% diversity for lighting**. **(3 marks)**

**Circuit 2** – The kitchen work surface is to be illuminated by 10, 30-watt fluorescent tubes fixed to the underside of the cupboards above the surface. Assume also a **66% diversity for lighting**. **(3 marks)**

**Circuit 3** – A thermostatically controlled 3 kW immersion heater, installed in a 30-litre water storage vessel. **No diversity allowed.** **(2 marks)**

**Circuit 4** – A ring circuit of 13 A socket outlets installed in accordance with the IET Regulations and protected by a 32-amp MCB. **No diversity allowed.** **(2 marks)**

**Circuit 5** – A radial circuit of 13 A socket outlets installed in accordance with the IET Regulations protected by a 32-amp MCB. A **40% diversity allowed**. **(3 marks)**

**Circuit 6** – A radial circuit of 13 A socket outlets installed in accordance with the IET Regulations protected by a 20-amp MCB. A **40% diversity allowed**. **(3 marks)**

- (b) Calculate;
  - (i) The total design current. **(1 marks)**
  - (ii) The total installed demand with diversity. **(1 marks)**

(c) Comment on the effect on the total demand with diversity. **(2 marks)**

3. (a) Sketch a complete cycle of an A.C. sine wave voltage waveform. Label, mark and define the following terms on the sketched sine wave.

- Peak Value, **(2 marks)**
- RMS Value, **(2 marks)**
- Average Value. **(2 marks)**

(b) A coil of resistance 10Ω and inductance 140mH is connected in series with a capacitor of 100μF across a 230V, 50 Hz supply. Calculate;

- i. The current flowing in the circuit. **(4 marks)**
- ii. The phase difference between the supply voltage and the current. **(2 marks)**
- iii. The voltage across the coil. **(3 marks)**
- iv. The voltage across the capacitor. **(2 marks)**
- v. Sketch a phasor diagram showing all the voltages across the circuit. **(3 marks)**

4. (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) State **two** safety precautions that 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 230V and its secondary winding is supplying a load at 60V. 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)**