GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION, SPORT, YOUTH
RESEARCH AND INNOVATION
DEPARTMENT OF EXAMINATIONS

EXAMINATION FOR AUTHORISATION A

Paper 1

Date: **2nd July 2024**

Time: **9.00 – 11:00 (Two hours)**

This examination paper includes ten questions. Candidates are requested to answer ALL 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 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 10 marks.

1. Consider an electric circuit having a load supplied from a battery. The circuit potential difference is 9 V when a current of 0.85 A is drawn by the load. The internal resistance of the battery is 0.8 ohms.

   (a) Calculate the battery EMF. **(5 marks)**

   (b) Calculate the power dissipated by a resistor of 10 ohms when a current of 2 amps flows through it. **(5 marks)**

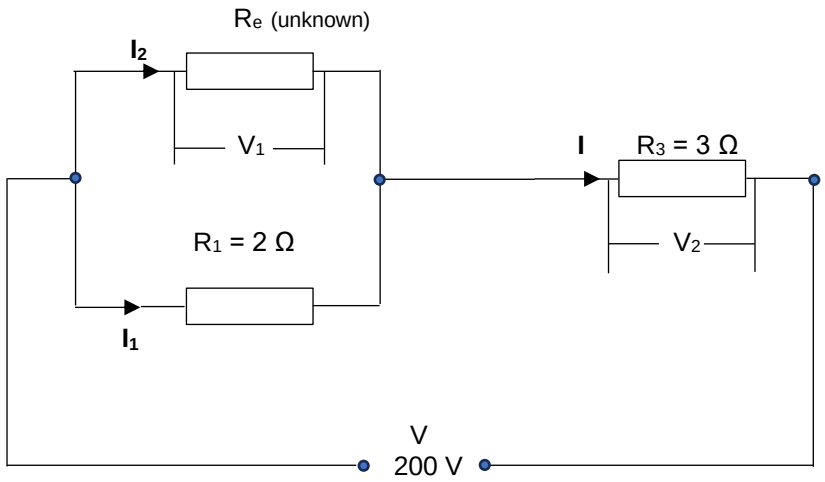
   (10 marks)

2. A small factory uses **two** 3 kW heaters for an average of 25 hours each per week, and **six** 150 W lighting luminaries for 30 hours each per week. The cost of electricity is 6.5 cents per unit. Determine the weekly cost of electricity to the factory. **(10 marks)**

3. Name **FOUR** types of injuries that may occur from faulty or mishandled electrical equipment and briefly explain each type. **(10 marks)**

4. Refer to Figure 4.1 below.

   A further resistance (R_e) is to be connected in parallel with the 2-ohm resistance (R_1), so that the voltage across it will be 20 V. Assume that the terminal voltage remains constant and the total resistance of the parallel branch is 3 ohms. Calculate the value of the further resistance (R_e) required to be connected in parallel with resistance R_1.



(10 marks)

Figure 4.1

5. Three single-phase (230 V) flats are separately fed from a three-phase (400 V, 50 Hz) main switchboard located at the ground floor entrance to the block of flats. Each flat diversified load is calculated to be 7 kW at a power factor of 0.8. The cables route length and voltage drop between the main switchboard and the flats are listed in the table below.

Flat	Cables route length	Voltage Drop
first flat	15m	2.51 V
second flat	20m	3.34 V
third flat	25m	4.18 V

Calculate:

(a) The design current of each flat. **(2 marks)**

(b) The maximum ***mV/A/m*** rating of each flat. **(6 marks)**

(c) State the rating of the type C circuit breaker to BS EN60898. **(1 mark)**

(d) For the result obtained in (a) above, state the practical size of the cable. **(1 mark)**

(10 marks)

6. **On the provided answer booklet, copy and complete** the following table showing the symbol and rating factor identification used in BS7671. The first one is done for you as an example.

Symbol	*Description*
I_z	*Value current capacity ambient temperature for single circuit*
	The design current
I_n	
	Operating current
C_a	
	Circuit buried in the ground
C_d	
	Grouping
C_f	
	Thermal insulation
C_s	

(10 marks)

7. (a) Draw the circuit diagram according to IET regulations showing clearly the energy source system and the earthing system connection used in Malta. **(5 marks)**

(b) A tourist from USA is visiting Malta. He brought his hairdryer and intended to use it in his rented flat.

List **FIVE** precautions required to connect the hairdryer to the local electricity supply safely.

(5 marks)

(10 marks)

8. (a) Distinguish between the term “Direct contact” and “Indirect contact”. You may use diagrams to explain the difference. **(4 marks)**

(b) The circuits listed below are to be tested for insulation resistance.
State the recommended test voltage to be applied and the minimum expected acceptable resistance for each test.

(i) SELV **(2 marks)**

(ii) LV circuit to 500 V **(2 marks)**

(iii) LV circuit over 500 V. **(2 marks)**

(10 marks)

9. (a) List the zones in a bathroom and state the recommended related distances assigned for for each zone. **(4 marks)**

(b) Socket outlets are to be used within a bathroom. State the type of power supply and the zone where it should be installed. **(3 marks)**

(c) Explain the term “exposed conductive part”. Give an example and state one requirement associated with this part. **(2 marks)**

(d) Explain the term “extraneous conductive part”. **(1 mark)**

(10 marks)

10. (a) State the maximum recommended frequency of inspections for the following sites:

(i) Construction sites **(1 mark)**

(ii) Agricultural and horticultural **(1 mark)**

(iii) Domestic **(1 mark)**

(iv) Commercial **(1 mark)**

(v) Caravan parks. **(1 mark)**

(b) What type of portable equipment and tools are recommended for construction sites and what is the colour code for the supplies socket outlets? **(2 marks)**

(c) Maintenance work is going to be carried out in a very damp underground reservoir with possibility of patches of water on the ground in certain locations. Ventilation and lighting are required for the workers.

Describe the power to be used when an electrical authorised person is conducting such maintenance works. **(3 marks)**

(10 marks)

END OF EXAMINATION PAPER