



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

EXAMINATION FOR AUTHORISATION A

Paper 1

Date: 5th February 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. You are required to copy and complete the following table on the provided answer booklet. The table shows the derived quantity, name, and symbol according to the SI units. The **first one** is done as an example. Each answer in the table carries **1 mark**.

	Derived quantity	Name	Symbol
<i>Example</i>	<i>Frequency</i>	Hertz	<i>Hz</i>
1	Power		W
2	Capacitance	Farad	
3	Inductance		H
4	Electric charge		C
5	Electro motive force		V
6	Magnetic flux	Weber	
7	Energy		J
8	Magnetic flux density		T
9	Temperature	Kelvin	
10	Electric current		A

(10 marks)

2. A laptop computer battery is charged in 2 hours. The charging current flowing is 2.37A. Calculate the following:
- The quantity of electricity in coulombs **(3 marks)**
 - The power in kVA if the battery charger voltage is 19V **(3 marks)**
 - The internal resistance of the battery, if the e.m.f. is 19.24V. **(4 marks)**
3. A company is to store hazardous chemicals in a safe manner in a storeroom. The room is designed so that it can withstand any leakages if there is a leak from the chemical container. List five precautions that are recommended to manage safely the hazardous chemical container. **(10 marks)**
4. A cable construction consists of a conductor, the insulation, and the mechanical protection.
- What is the recommended conductor material if a lightweight cable is required? **(2 marks)**
 - List two commonly used insulation materials for cables. **(2 marks)**
 - List two types of armour to provide mechanical protection for a cable. **(2 marks)**
 - If the conductor maximum working temperature is 70-degree Celsius, what type of material is used to insulate the conductor? **(2marks)**
 - List two insulation types of cables commonly used in electrical installations. Give the most commonly used Cross Sectional Area, when drawn through the 20mm diameter conduit installations. **(2 marks)**

5. (a) Explain why the Electrical Installation Regulations, S.L.545.24 shall ensure that an electrical installation is divided into circuits. **(5 marks)**
- (b) What is meant by Basic Protection (also known as direct contact) and Protection under fault condition (also known as indirect contact)? **(5 marks)**
6. (a) Describe the following terms related to an electrical installation:
- (i) Exposed conductive parts **(2 marks)**
 - (ii) Extraneous conductive parts **(2 marks)**
 - (iii) Circuit protective conductor **(2 marks)**
 - (iv) Earthing Conductor **(2 marks)**
 - (v) Supplementary bonding. **(2 marks)**
7. (a) Outline five IEE regulations related to domestic ring circuits using BS1363 socket-outlets. **(5 marks)**
- (b) Draw a neat circuit diagram to show the connections, polarity, size of cables and rating of circuit protective devices of a domestic ring circuit consisting of:
Four 13Amp socket outlets on the ring. **(5 marks)**
8. (a) The tests listed in the box below are conducted on a domestic electrical installation. Write down the **correct sequence** for the tests to be conducted on the installation.

Earth fault loop impedance

RCD operation

Continuity of protective conductors

Insulation resistance

(4 marks)

- (b) An electrician conducts an insulation resistance test. Describe how the electrician prepares the insulation resistance instrument leads prior to the test. **(2 marks)**
- (c) A test for continuity of a main protective bonding conductor requires its disconnection at one end to eliminate certain effects. Explain why this is required. **(2 marks)**
- (d) State what must be done with the earthing conductor of the installation, when conducting an **earth fault loop impedance test** on a radial circuit. **(2 marks)**

9. (a) The following values are insulation resistance test readings for individual circuits of an electrical installation.

10M Ω , 15M Ω , 25M Ω , 45M Ω

Calculate the overall insulation resistance value for the electrical installation.

(4 marks)

- (b) The earthing conductor, main protective bonding conductor and circuit protective conductor should all be connected during the **prospective fault current tests**. Explain why.

(2 marks)

- (c) Work out the resistance of an earth electrode if the test results gave values of 127 Ω , 129 Ω and 122 Ω .

(2 marks)

- (d) Consider a TT-system protected by an RCD. State the test to be performed.

(2 marks)

10. List the **five** key steps to approach and diagnose the cause of an electrical installation fault.

(10 marks)

END OF EXAMINATION PAPER