

SECTION A

*Answer any **THREE** questions in this section.*

1. (a) (i) State any **two** IEE Regulation requirements regarding temporary installations.
 (ii) Define Division 'O' area with respect to installations in hazardous areas. (4 marks)

- (b) Outline any **three** methods used to reduce the effects of electrostatic charges in hospital installations. (3 marks)

- (c) (i) Explain how diversity factor is applied in cooker final circuits.
 (ii) Describe any **four** IEE regulation requirements regarding the installation of conduit wiring systems. (13 marks)

2. (a) Explain any **three** characteristics of tariffs. (6 marks)

- (b) (i) Explain the importance of power factor improvement to the;
 (I) Consumer;
 (II) Supply Authority (7 marks)

- (ii) State any **two** advantages and **one** disadvantage of capacitors over synchronous motors when used for power factor improvement.

- (c) A synchronous motor is used to improve the power factor of a load of 200 kW from 0.8 pf lagging to 0.9 pf lagging.
 (i) sketch the phasor diagram;
 (ii) determine the:
 (I) Leading KVAR supplied by the motor;
 (II) KVA rating after power factor improvement. (7 marks)

3. (a) With aid of a circuit diagram, explain the pony motor method of starting a three phase synchronous motor. (10 marks)

- (b) (i) With the aid of a labelled diagram, explain how a volt-drop test is performed on the commutator of a d.c. motor.
 (ii) State the purpose of the test in b(i). (10 marks)

4. (a) (i) Describe the operation of a programmable logic Controller (PLC).
 (i) It is desired to operate a motor under the following conditions using the PLC system. The motor is started by pressing a start button. The start button is latched to ensure that the motor remains ON. The output remains ON until the stop button is pressed.
 (I) Write an instruction list for the operation;
 (II) Draw the ladder diagram. (14 marks)

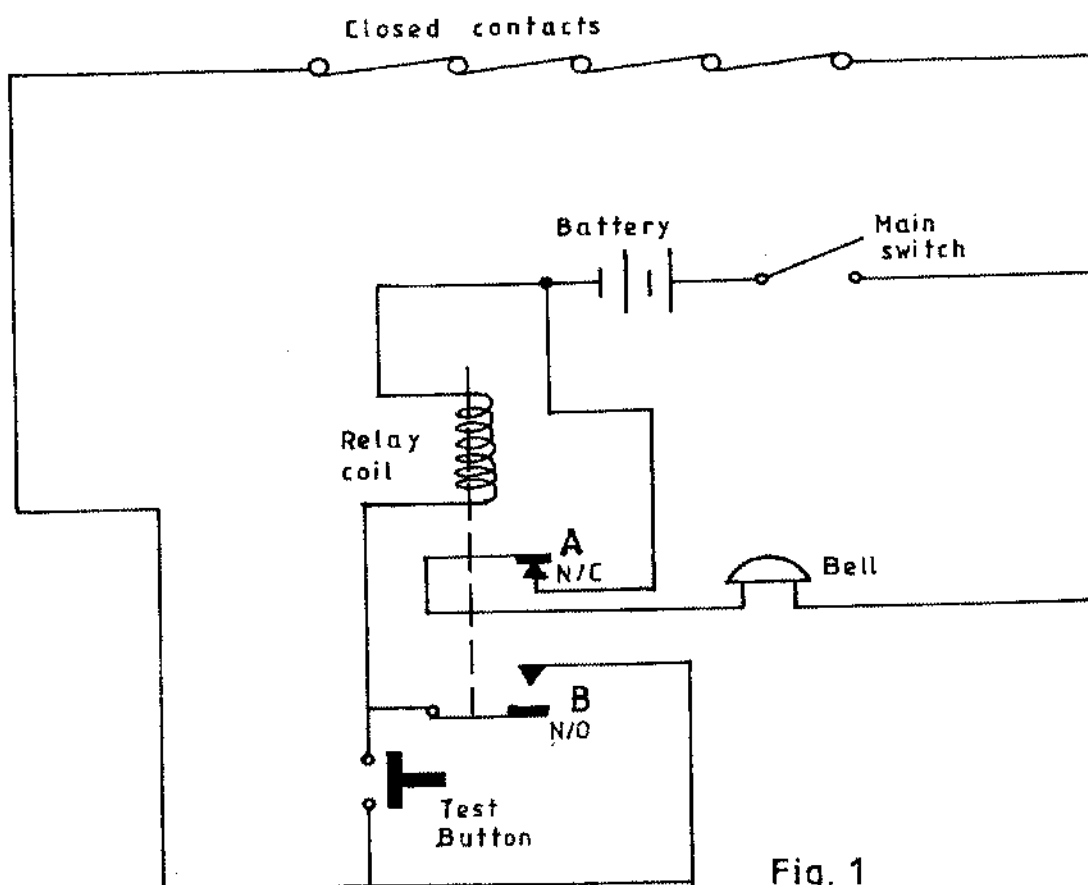
- (b) (i) State any **two** properties of an instrumentation amplifier.
- (ii) With the aid of response curves distinguish between low pass and high pass filters. (6 marks)
5. (a) (i) State any **two** types of buildings that must be provided with emergency lighting systems.
- (ii) Distinguish between maintained and Non-maintained emergency lighting systems. (4 marks)
- (b) (i) With aid of a labelled diagram explain the operation of the high pressure type sodium vapour lamp.
- (ii) State **two** areas of application of the lamp in b(i). (8 marks)
- (c) (i) Define the following terms as used in illumination engineering.
- (I) lux;
- (II) luminous Intensity.
- (ii) A lamp of 300 cp is hung at the centre of a room 8 m by 6 m at a height of 3 m from the floor. Determine the maximum illumination produced at the centre of the room. (8 marks)

SECTION B

Answer any TWO questions from this section.

6. (a) State **two** IEE Regulation requirements regarding extra-low voltage circuits. (2 marks)
- (b) With aid of a labelled diagram explain the operation of carbon microphone. (7 marks)

- (c) (i) Explain the operation of the bell circuit shown in figure 1.
(ii) State **two** merits of the circuit in c(i). (11 marks)



7. (a) (i) Explain the need for starters in d.c. motors.
(ii) With aid of labelled circuit diagram, explain how the direction of a d.c. shunt motor is reversed. (5 marks)
- (b) State any **four**;
(i) benefits of motor control panel. (8 marks)
(ii) components of a control panel.
- (c) Distinguish between manual and automatic control of motors. (7 marks)
8. (a) Explain open tendering systems in contracts. (4 marks)
- (b) (i) List **five** types of building contracts.
(ii) Outline **five** items that constitute standard forms in a tender document. (10 marks)
- (c) (i) State any **four** essential requirements for a contract to be valid.
(ii) Explain any **two** vitiating factors in a contract. (6 marks)