

EXAMINATION: AUTHORISATION B

Paper II (Electrical Installation Technology)

Time Allowed: 3 Hrs

July 2015

WRITE ALL YOUR WORK ON THE ANSWER BOOK PROVIDED. EVERY ANSWER SHOULD INCLUDE ALL WORKINGS, NECESSARY DIAGRAMS AND FORMULAE.

START EACH ANSWER ON A FRESH PAGE.

Answer any **FIVE** Questions

1. (a) Draw a simple labelled circuit diagram of a maintained emergency lighting system and explain briefly how the system operates. **(5 marks)**
- (b) A small stand-by generator besides other essential equipment is to supply the emergency lighting system. Explain the important aspects of this type of installation such as segregation of circuits, type of material to be used and the control gear required for such a system. **(7 marks)**
- (c) Describe briefly where emergency lighting should be installed in a small hotel. **(4 marks)**
- (d) What are the advantages of a central battery supply system compared to a stand-by generator? **(4 marks)**

Refer to Figure 1

2. (a) For a DC machine and with the aid of figures draw the following connections:
 - (i) shunt wound machine **(6 marks)**
 - (ii) series wound machine
- (b) For (a) (i) & (ii) above give a brief description and an application for each. **(4 marks)**
- (c) A DC motor is connected as shown in figure 1. For some reason a problem has developed in this motor circuit. Once the switch is turned "ON", the motor does not turn. However, it does draw a lot of current (several times the normal operating current) as indicated by the ammeter: Explain what is wrong and the action to be taken to repair the motor circuit. **(4 marks)**

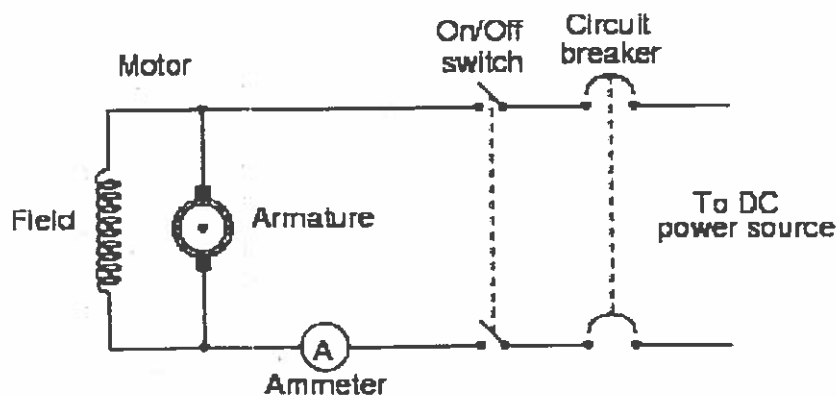


Fig. 1

- (d) A DC motor is running and sparks are seen where the carbon brushes make contact with the "commutator" segments.
 - (i) Explain why this sparking occurs.
 - (ii) Define the word "commutation" in its electrical usage.
 - (iii) List the type of routine maintenance required on DC motors. **(6 marks)**

3. (a) In A.C. circuits, measuring instruments are not always connected directly into the circuit, but are supplied by means of instrument transformers. This is especially the case when heavy currents need to be measured. State the advantages of using such instrument transformers to measure both the current and voltage. (6 marks)
- (b) What precautions need to be observed when using current and voltage transformer? (4 marks)
- (c) Explain with the aid of diagrams, the construction and connections of a wound type and bar type current transformer. (4 marks)
- (d) Draw a circuit diagram to show how voltage and current transformers can be used to extend the ranges of two wattmeters to measure the power in a three phase 3 wire system. (6 marks)
4. (a) State the diagnosis and rectification to be carried out on the following faults:
- (i) A Direct-on-line starter remains switched-on although the stop button is pressed but switches off when the main switch is switched-off. (5 marks)
- (ii) A humming noise coming from the 3-phase squirrel cage rotor induction motor. (5 marks)
- (b) State the electrical planning and routine testing Report Sheets which eventually is copied in a computer programme for the maintenance engineer to monitor the following:
- (i) Diesel-driven emergency generator (A.C) (5 marks)
- (ii) D.C. hoist motor installed on tower crane serving a strict planned programme to complete the six storey shopping complex. (5 marks)
5. The total power load in a factory consists of ten 10 hp motors and four 5 hp motors. The overall efficiency of the motors is 87 per cent and the power factor measured at the main busbar is 0.78 lagging. The supply is three phase 230/400volts, 50 Hz.
- (a) What is the KVA loading of the installation before applying power factor correction? (5 marks)
- (b) Describe one method which could be used to raise the power factor of the installation. (7 marks)
- (c) What are the advantages and disadvantages of applying this correction at the main busbar or at the load. (8 marks)

6. An electrical installation in a hotel is fed from its own 11,000/415 Volts substation. The installation's switchboard is split in two, one part for the essential load and the other part for the non-essential load.

The installation is supplied with a back-up generator system.

The installation for the rooms are supplied from a rising mains system.

The load consists of the following:

- (a) 100 rooms on five floors.
- (b) two lifts.
- (c) laundry room on ground floor.
- (d) central heating system on ground floor.
- (e) reception hall and offices.
- (f) restaurant and kitchen.
- (g) air conditioning on ground floor.

Draw a schematic drawing of the installation showing:

- i. The sub-station layout. (transformer, essential and non-essential switchboards, interlocking, and overload devices etc.) (5 marks)
- ii. Standby generation, change-over switching etc. (5 marks)
- iii. Load distribution on essential and non-essential boards (draw up to distribution boards only). (5 marks)
- iv. Rooms and lifts installation to rising mains system. (draw up to distribution boards only). (5 marks)

Cable sizing is not required.

END OF PAPER