

6. An office building supplied with a 415 Volts, 50 Hz 3-phase supply has the following installed loads:
- (i) Two hundred and forty, 85 Watts twin fluorescent luminaires
 - (ii) One, 21 KW underfloor heating system
 - (iii) Twelve, 32A ring final circuits
 - (iv) Three, 3-phase 20 KW, induction motors each having an efficiency of 90% a power factor of 0.75 lagging
 - (v) Six, 12 KW, single-phase cooking appliances
 - (vi) Twelve, 2 KW thermostatically controlled water-heaters.
- (a) Calculate the maximum demand of each load. (5 marks)
- (b) Divide each load over the three phases of the supply to obtain as far as possible balanced load over the whole installation. (4 marks)
- (c) Calculate the type and size of switchgear required for each circuit. (5 marks)
- (d) Show in a line diagram the layout of the switchboard and switchgear. (6 marks)
- (e) Calculate the size of Busbar Chamber and Main Switchgear. (5 marks)

END OF PAPER

EXAMINATION: AUTHORISATION B

Paper II (Electrical Installation Technology)

Time Allowed: 3 Hrs

July 2017

**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) Explain briefly why temporary electrical installation on building sites should be designed to at least the same standard as a permanent installation. **(10 marks)**
- (b) For temporary installations on building sites, state the main safety requirements regarding supplies rated at:
- (i) 25 volts
 - (ii) 110 volts
 - (iii) 240 volts **(5 marks)**
- (c) Give examples of equipment which can be connected to the following single phase supply voltages:
- (i) 25 volts
 - (ii) 110 volts
 - (iii) 240 volts **(5 marks)**
2. (a) State the purpose for using a motor starter and explain what type of protection is normally included. **(3 marks)**
- (b) Describe the following tests that should be carried out in order to ensure the correct operation of:
- (i) The under-voltage release **(6 marks)**
 - (ii) The over current release **(7 marks)**
 - (iii) The time delay feature in a push-button type starter for a 3-phase, three wire, cage-type motor **(4 marks)**
3. Describe briefly, giving sketches if required, of the following types of motor enclosures. State in each case where the enclosure is used and state its advantages.
- (i) Open type machine **(4marks)**
 - (ii) The protected type machine **(4 marks)**
 - (iii) The drip proof machine **(4 marks)**
 - (iv) Totally enclosed machine **(4 marks)**

What type of motor enclosure would you suggest for a fireworks factory? Give reasons for your answer. **(4 marks)**

4. (a) Explain what is meant by the terms 'Maximum Demand' and 'Diversity Factor' as applied to industrial installations. **(4 marks)**
- (b) An electrical installation of a restaurant consists of:
- one 60 Amp, TP main MCB
 - four 32 Amp, SP MCBs
 - three 16 Amp, SP MCBs
 - one 32 Amp, TP MCB for a lift.

The following load is to be added:

- Nine ring circuits feeding 13 A sockets,
 - Six x 3 KW thermostatically controlled water heaters,
 - Two x 12 KW 3-phase motors 0.8 p.f., 0.9 efficiency,
 - One 3-phase, 32 kVA microwave heating system.
- (i) List the modifications necessary to be carried out on the main distribution board. **(8 marks)**
- (ii) Assuming a 3-phase 400/230 V supply, explain with the aid of a diagram how the additional load is to be incorporated. **(8 marks)**
5. Many industrial installations require some means of maintaining the electricity supply if the fixed supply fails.
- (a) Show by means of a well-labelled diagram the fully maintained battery emergency system. Your diagram must show:
- (i) required transformer
 - (ii) change-over switching
 - (iii) trickle and quick charging system
 - (iv) supervisory alarm system **(10 marks)**
- (b) Show by means of a well-labelled diagram a stand-by generator system. Your diagram must show:
- (i) non-essential loads Busbars
 - (ii) essential loads Busbars
 - (iii) generator set and controls
 - (iv) change-over system. **(10 marks)**