

6. (a) Double-insulated equipment does not have an earth connection and must not be connected to earth. Name **THREE** power tools that use double-insulated protection. (6 marks)
- (b) Calculate the resistance of 50 m of 6 mm<sup>2</sup> line and 1.5 mm<sup>2</sup> circuit protective conductor (cpc) at 20°C.  
Assume that the **Resistance** ( $r_1 + r_2$ ) mΩ/m for copper conductor to be 12.1 and 3.08 respectively. (3 marks)
- (c) (i) Why are bathrooms and other areas where water and steam are present considered to be so dangerous? (3 marks)  
(ii) Which are the **TWO** most significant factors that determines the severity of an electric shock? (2 marks)
- (d) What are the requirements of BS 7671 regarding repairing holes made in walls for the passage of cables? (6 marks)



**EXAMINATION: AUTHORISATION A**

**JULY 2017**

**Paper II (Electrical Installation Technology)**

**Time Allowed - 3Hrs**

**END OF PAPER**



**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.**

Choose any **FIVE** questions.

1. (a) With the aid of a diagram explain what is meant by the term “**Discrimination**”. Explain how discrimination is achieved in an electrical installation. **(5 marks)**
- (b) What is meant by “**diversity factor**” and state its importance. **(5 marks)**
- (c) A bakery shop is supplied from a single phase 230V, 50Hz supply. The load connected to the installation consists of the following items:
  - (i) 15 lighting filament lamps at 100W each
  - (ii) 8 twin, 13Amp socket outlets (2 ring circuits)
  - (iii) An 8 kW cooker unit, combined with a 13A socket outlet.

Calculate the assumed current demand for the installation by applying the diversity factor as provided in the table below. State your recommendations to the owner. **(10 marks)**

The following table gives the necessary diversity information that must be applied.

Purpose of the final circuit	Diversity to be applied
Lighting	90% of the total current demand
Cooking appliance	10 amperes + 30% full load of the connected cooking appliance in excess of 10 amperes + 5 amperes if a socket outlet is incorporated
Heating and Power	100% of largest appliance + 50% of second largest appliance.

2. (a) What is the purpose of ‘**earth fault loop impedance**’ testing? **(3 marks)**
  - (b) Show by means of a diagram the whole of the loop. Include in your diagram the instrument used for the test. **(10 marks)**
  - (c) Describe briefly how this test is performed. **(5 marks)**
  - (d) State **TWO** conditions which might lead to high test figures. **(2 marks)**
3. (a) Describe, using a neat and well-labelled diagram, one form of thermostat suitable for controlling small heating loads. **(12 marks)**
  - (b) Show by a diagram how this thermostat is connected in a heater circuit. **(5 marks)**
  - (c) What is the purpose of the accelerating element in the thermostat? **(3 marks)**
4. (a) The **employer** has a duty to care for the health and safety of employees. List **FIVE** examples what the employer has to do to fulfill the above. **(5 marks)**
  - (b) The **employees** have a duty to care for their own health and safety and that of others. The latter may be affected by their negligence. List **THREE** examples of what is expected from the employees to satisfy health and safety and avoid creating dangerous situations. **(3 marks)**
  - (c) Mention at least **SIX risks** which may require a formal assessment in the electrical installation industry. **(6 marks)**
  - (d) Personal Protective Equipment (PPE) nowadays due to insurance guarantee is being respected and properly used. Describe what is meant by PPE and with the aid of at least **THREE** practical examples explain how this could be achieved at the place of work. **(6 marks)**
5. (a) Explain the importance of an earthing system in an electrical installation. **(5 marks)**
  - (b) Explain why we must have earth electrodes in electrical installations. **(4 marks)**
  - (c) The supply voltage for a domestic installation is measured to be 230V and the external earth loop impedance  $Z_e$  is  $0.7\Omega$ . A fault develops in the electrical installation and the resistance of the phase conductor from the fault up to the supply point was measured to be  $0.09\Omega$ . Also the fault resistance was measured to be  $2.8\Omega$ . Find the value of :
    - (i) The total earth fault loop impedance( $Z_s$ ) **(3 marks)**
    - (ii) The fault current **(3 marks)**
  - (d) What factors need to be considered when selecting a protective device to protect a given circuit? **(5 marks)**