

**EXAMINATION FOR THE ISSUE OF A LICENCE
TO ACT AS WIREMAN - LICENCE 'B'**

Paper II (Electrical Installation Technology)

Time Allowed: 3 Hrs

July 2014

**WRITE ALL YOUR WORK IN 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) What are the safety requirements when switching-off a machine for mechanical maintenance? (4 marks)
- (b) List the maintenance requirements for:
- (i) Hi bay SON floodlights. (4 marks)
 - (ii) Oil-immersed, air cooled step down power double wound transformer. (4 marks)
 - (iii) Motor Starting Switch-gear operated frequently. (4 marks)
 - (iv) A wound rotor induction used for speed control of a cement conveyor. Three resistor banks connected star are used. (4 marks)
2. (a) State, with the aid of circuit diagrams the advantages and disadvantages of earthing the star point of a distribution transformer. (5 marks)
- (b) The load of a small factory, which is supplied by a 250 kVA, 415 Volts three phase transformer consists of the following:
- a 20 kW discharge lighting load at 0.46 pf lagging.
 - a 50 kVA load of three-phase motors having an overall efficiency of 93.25 per cent and 0.8 pf.
 - a 60 kW heating load at unity pf.
 - a 50 kVA load consisting of welding sets operating at 0.6 pf lagging.
 - a 50 kW synchronous motor operating at 0.5 pf leading.
- Calculate:
- (i) the total load in kVA and the overall power factor. (5 marks)
 - (ii) the total line current. (5 marks)
- (c) List the factors you would take to calculate the size of the main cable connecting the transformer and the switch board. (5 marks)

3. (a) Describe using diagrams the construction and operation of:
- (i) a Double Wound single phase transformer. **(7 marks)**
 - (ii) a single-phase auto transformer. **(7 marks)**
- (b)
- (i) The volts per turn of a simple transformer is 1.8V. Calculate the respective number of turns in each winding of a single phase transformer with a step-up ratio of 1 to 30, and a primary voltage of 100 volts. Ignore transformer losses. **(3 marks)**
 - (ii) A single phase step-down transformer has a transformation ratio of 15 to 1. The primary winding supplied at 3000 volts has 1650 turns. Ignoring the losses, calculate the secondary voltage and the number of secondary turns. **(3 marks)**
4. (a) Explain the construction and operation of a current transformer. **(9 marks)**
- (b) A **factory** is provided by a low voltage supply with a peak load of 130kW at a power factor of 0.75 lagging.
- (i) Calculate the CT ratio required for each phase to measure the energy consumption. Give the Class rating of this CT. **(5 marks)**
 - (ii) Draw a circuit diagram for the energy meter using the current transformer ratio calculated in (b)(i). **(6 marks)**
5. (a) Define the term Maintenance work. **(3 marks)**
- (b) Describe what safety precautions are to be taken before commencement of maintenance on electric motors. **(4 marks)**
- (c) Describe three (3) maintenance activities to be carried out on electric motors. **(9 marks)**
- (d) Mention and describe the necessary tests required on an electric motor. **(4 marks)**

6. A meat factory still under construction requires to be supplied with hot water heated by an *electrode boiler*. The electrode boiler room is located at minus one level (i.e. underground level).
- (a) Outline the I.E.E regulations for the installation of electrode boiler. **(6 marks)**
 - (b) The factory may be provided with 3 phase a.c. 50Hz or with d.c. supply. What is the type of supply you strongly recommend and explain why? **(4 marks)**
 - (c) Since the meat factory is still under construction, temporary installation is required for the installation of the electrode boiler. No neutral is available in this area.
 - (i) Draw circuit diagram of a transformer having a three phase, 400V, 50Hz primary and three phase 110V, 50Hz secondary. You are expected to show clearly the type of transformer used. **(5 marks)**
 - (ii) Show by simple calculation the expected voltage to earth from the secondary side of the transformer. **(1 mark)**
 - (iii) Mention two types of fault protection and their respective disconnection time? **(2 marks)**
 - (iv) According to I.E.E. regulations, what is the preferred voltage used for portable hand tools in confine and damp locations. **(2 marks)**

END OF PAPER