6. (a) Define the term Maintenance work at a factory. **(3 marks)**

(b) Describe the safety precautions to be taken before commencement of maintenance. **(4 marks)**

(c) Analyse the following and indicate in each case how they may be minimized or eliminated. Where applicable include diagrams in your answer:

i. current leakage to earth from a current carrying conductor. **(3 marks)**

ii. a newly connected a.c. induction motor fails to start rotating while a humming noise is heard from inside it. **(3 marks)**

iii. low power factor in an installation. **(4 marks)**

iv. arcing at contacts brushes of a series universal motor. **(3 marks)**

Total: 100 marks

END OF EXAMINATION PAPER

GOVERNMENT OF MALTA
MINISTRY FOR EDUCATION, SPORT, YOUTH
RESEARCH AND INNOVATION
DEPARTMENT OF EXAMINATIONS

EXAMINATION FOR AUTHORISATION B

Paper 2: Electrical Installation Technology

Date: 3rd February 2023

Time: 09:00 – 12:00 (Three hours)

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This examination paper contains six questions. Candidates are requested to answer any FIVE (5) questions. Candidates are also requested to include all their work in the booklet provided. Every answer should include all workings, any necessary diagrams and formulae. Use a fresh page for each different question. Each question carries 20 marks.

1. You are required to design an installation for a farm building which will shelter cows for milk production.

   (a) State four of the principal hazards to avoid when installing electrical services and equipment in this installation. **(8 marks)**

   (b) State four considerations which should be taken into account when selecting and installing lighting fittings in this installation. **(8 marks)**

   (c) Sketch a diagram of a suitable method of installing an earth electrode adjacent to the farm building and making the connection to it from the earth conductor. Your diagram must show what precautions you would take to prevent the animals from getting to the installation. **(4 marks)**

2. (a) Describe and illustrate by a clear well-labelled diagram a typical connection for a 2-core mineral-insulated cable. **(6 marks)**

   (b) Explain why the current rating for this type of cable is better than that of p.v.c. cables. **(6 marks)**

   (c) Give four examples of conditions where in your opinion the use of this type of cable is preferable to p.v.c cables in conduit. Give your reasons. **(8 marks)**

3. (a) Describe using clear, well-labelled diagrams a single-phase, split-phase induction motor. In the diagrams show the action of the centrifugal switch in the start and run positions. **(10 marks)**

   (b) Describe using a clear, well-labelled diagram a type of simple starter which can be used with a single-phase split-phase motor. **(5 marks)**

   (c) A 230 V, 6 kW single-phase motor has an efficiency of 85% and a power factor of 0.75 lagging. Calculate the current taken by the motor. **(5 marks)**

4. (a) Draw suitably labelled diagrams illustrating the construction and connection of a wound type and bar primary type current transformer. **(6 marks)**

   (b) Why do transformers need to be cooled? Describe the methods which are used for cooling the transformers. **(6 marks)**

   (c) Draw neat diagrams of:

   i. a Three-Phase Step-Up Transformer **(3 marks)**

   ii. a Single-Phase Step-Up Transformer with centre-tapping **(3 marks)**

   iii. a Single-Phase Step-Up Transformer auto-transformer **(2 marks)**

   Show in each case which parts of the transformer need to be earthed.

5. (a) State the purpose for using a STARTER to start a motor and explain what type of protection is normally included. **(3 marks)**

   (b) A garage door shall be operated by a small three-phase induction motor. The motor has to rotate in both directions for the door to open and close. The supply to the motor is through a three-phase 4-wire system 400 V-50 Hz.

   Draw an appropriate **Direct on Line Starter** that is able to operate the motor in both directions. Your drawing must be labelled and include the following:

   i. a power circuit including protection. **(5 marks)**

   ii. a control circuit operated from a 230v 50Hz supply. **(6 marks)**

   iii. one red lamp to indicate motor stop. **(2 marks)**

   iv. one green lamp to indicate motor up. **(2 marks)**

   v. one green lamp to indicate motor down. **(2 marks)**