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

EXAMINATION FOR THE ISSUE OF A LICENCE TO ACT AS WIREMAN

Authorization B

Sample Paper I **Time: 2 Hours**

This examination paper contains ten (10) questions. Candidates are requested to answer ALL questions. They are also requested to include all their work in the booklet provided. All answers should include all workings, any necessary diagrams, and formulae. Use a fresh page for each different question. Each question carries 10 marks.

1. a. Define temperature Coefficient of resistivity (α). **(3 marks)**
   b. A car headlight filament is made of tungsten and has a cold resistance of 0.350 Ω. If the filament is a cylinder 4.0 cm long (it may be coiled to save space), calculate its diameter. **(3 marks)**
   c. Calculate for the above example the resistance of the tungsten filament if its temperature is increased from room temperature (20^{o}C) to an operating temperature of 2850^{o}C. **(4 marks)**

   Assume Resistivity $\boldsymbol{\rho}$*, for tungsten: 5.6 x* 10^{-8} **Ω** *m temperature Coefficient of resistivity (α): Tungsten 4.5 x* $10^{-3}/^{o}C$.

2. a. With the aid of a diagram explain the term **Power-factor**. **(4 marks)**
   b. What are the causes with a poor power-factor? Explain at least three causes developed by a poor power-factor. **(6 marks)**

3. a. A power factor improvement capacitor is required to take a current of 10 A from a 230 V 50 Hz supply. Determine the value of this capacitor. **(5 marks)**
   b. A coil passes a current of 20 A when connected to a 230 V d.c. supply but only 10 A when connected to 230 V 50 Hz a.c. supply. Calculate the inductance of the coil. **(5 marks)**

4. Refer to Figure 1a and 1b:

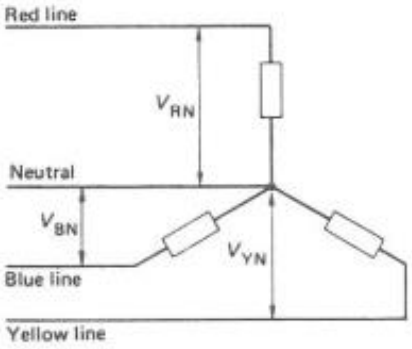

Fig. 1 a

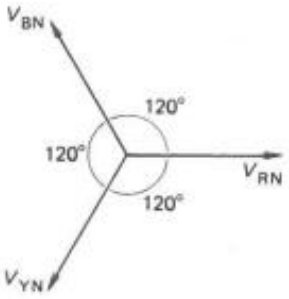

Fig. 1 b

An inductor of 0.3 H and resistance 60 Ω is connected between each line and the neutral of a 50 Hz three-phase. The voltage between pairs of lines is 415 V.

Calculate:
   a. the current in each line **(5 marks)**
   b. the total power in the system. **(5 marks)**

5. a. Draw the circuit diagram of a three-phase four wire induction type energy meter for a load current up to 100 Amp. **(5 marks)**

   b. If the load current is 300 Amp, therefore it exceeds the input current rating of the energy meter, describe how you can still read the energy consumed by the load. **(5 marks)**

6. Briefly describe the system of wiring you would adopt for the following installations and conditions. In your answer give reasons for your selection of the type of installation used.
   a. a Boiler house with high ambient temperature **(5 marks)**
   b. a Petrol store. **(5 marks)**

7. a. Describe the method of installing and testing an earth electrode system for a block of six flats. Draw a sketch of the system. **(5 marks)**

   b. What is the difference between earth fault loop impedance (Ze) external to the installation and (Zs) the total earth loop impedance? **(5 marks)**

8. a. Explain the scope of the Electrical Installation Regulations, S.L.545.24. **(5 marks)**
   b. Explain the responsibilities of a Distribution System Operator. **(5 marks)**

9. a. Mention and explain **three** methods to control three phase motors. **(5 marks)**
   b. Show and explain how a three-phase system is balanced when all downstream equipment are single phase loads to ensure that the three-phase installation is covered at law. This as per the Electricity Supply Regulations, S.L.545.01. **(5 marks)**

10. a. Explain the requirements of the Electrical Installation Regulations, S.L.545.24, regulation 14, in relation to the tests on completion of a three-phase electrical installation. **(5 marks)**

    b. Explain why an authorised person must be able to the read and understand switchgear, transformers and electrical machines manuals and apply recommended maintenance routine. **(5 marks)**

Total: 100 marks