

6. (a) A 230 V 50 Hz single-phase supply extractor fan has a rating of 4.5 kW at 0.75 p.f. lagging and is protected by a BS 88 Part 2 fuse. The distribution board is distant 35m away from the extractor fan. The cables used to supply the extractor fan are to be single core cables, PVC insulated, installed in steel trunking with two similar circuits. Assume an ambient temperature of 40°C and that the voltage drop in the cables is limited to 2.5%. Using the below tables and ignoring any diversity, calculate:
- the full load current of the motor (I_L) (4 marks)
 - the rating of the fuse (I_n) (4 marks)
 - minimum current rating of cables (4 marks)
 - minimum cable c.s.a. (4 marks)
 - actual voltages drop in the cable. (4 marks)

Refer to Tables 6.1 to 6.4

6A	10A	16A	20A	32A	50A
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No of Circuits	1	2	3	4	5	6	7
C_g	1.0	0.8	0.7	0.65	0.6	0.57	0.54

Ambient temperature (°C)	25	30	35	40	45	50	55	60
C_a	1.03	1.0	0.94	0.87	0.79	0.71	0.61	0.50

Cross Sectional Area mm ²	Current carrying capacity (A)	Voltage drop mV/A/m
1	13.5	38
1.5	17.5	25
2.5	24	15
4	32	9.5
6	41	6.4
10	57	3.8
16	76	2.4
25	96	0.145

Total: 100 marks



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

EXAMINATION FOR AUTHORISATION A

Paper 2: Electrical Installation Technology

Date: 2nd February 2023

Time: 09:00 – 12:00 (Three hours)

END OF EXAMINATION PAPER

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. (a) Explain the importance of an earthing system in an electrical installation. **(5 marks)**
 - (b) Explain why we must have earth electrodes in an electrical installation. **(4 marks)**
 - (c) The supply voltage for a domestic installation is measured to be 230 V and the external earth loop impedance (Z_e) is 0.7 Ω . 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 Ω . Also the fault resistance was measured to be 2.8 Ω . 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)**
2. (a) Draw a neat and well-labelled diagram of a type of thermostat used in an electric iron. **(5 marks)**
 - (b) Draw a neat and well-labelled diagram showing all the parts of type of thermostat used in a water-heater. **(5 marks)**
 - (c) Describe in detail the construction and operation of a thermostat used in a water heater. **(10 marks)**
3. (a) Explain with the aid of diagrams the construction and operation of a single-phase auto-transformer. **(12 marks)**
 - (b) Give four examples where it is permissible to use an auto-transformer. **(4 marks)**
 - (c) Give four examples where it is not permissible to use an auto-transformer. **(4 marks)**

4. (a) Refer to 'Fault diagnosis and rectification in Electrical Installation'.

Explain what is meant by the following conditions reported in a maintenance inspection schedule and state the type of remedial action required:

- i. an acceptable condition
 - ii. an unacceptable condition
 - iii. an improvement is recommended **(6 marks)**
- (b) List three causes of electrical faults. **(3 marks)**
 - (c) State the steps to be followed for a successful electrical installation fault finding. **(5 marks)**
 - (d) Explain why there is a need to inspect and test an electrical installation. **(6 marks)**
5. (a) Draw a diagram for the following:
 - i. TWO-WAY switch control. **(4 marks)**
 - ii. TWO-WAY INTERMEDIATE switch control. **(5 marks)**
 - iii. RING CIRCUIT. Please specify the floor area and the cable size to wire the ring circuit. **(6 marks)**
 - (b) A large machine shop is to be illuminated by discharge lamps. Explain what is meant by the stroboscopic effect and how it can be eliminated in a machine shop. **(5 marks)**