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

July 2014

Paper II (Electrical Installation Technology)

Time Allowed - 3Hrs

**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.

Choose any **FIVE** questions.

1. a) The IEE wiring regulations has a dedicated section for Photovoltaic (PV) supply systems.
 - i) Draw neat and well labelled schematic diagram of a typical grid connected PV installation having six panels. **(5 marks)**
 - ii) Mention and explain the type of protection required for a PV supply system. **(5 marks)**

- b) A 1.2kWp PV system is installed on the washroom roof of a terraced house. The PV Inverter is installed in the washroom and the utility supply meter is located in the basement garage. The length of the 3-core PVC cable between the supply meter and the PV inverter is 20m. The cable will be installed with another two similar cables. The ambient temperature is expected to reach 50°C. Ignoring any diversity, calculate:
 - (i) The load current **(3 marks)**
 - (ii) The MCB rating **(2 marks)**
 - (iii) The correct cable size **(5 marks)**

Refer to Tables 1.1 to 1.4

10A	16A	20A	32A	40A
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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	15	44
1.5	19.5	29
2.5	27	18
4	36	11
6	46	7.3
10	63	4.4
16	85	2.8

2. a) Define diversity factor and maximum demand. **(4 marks)**
 b) Give two practical applications where diversity is used and explain the main reasons. **(3 marks)**
 c) A 230V single phase domestic installation consists of the following:
 (i) 6 lighting filament lamps at 100W each
 (ii) An immersion heater rated 3 kW with thermostatic control.
 (iii) A 12kW cooker controlled from a cooker unit combined with a 13A socket outlet.

Calculate the assumed current demand for the installation. **(13 marks)**

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

Purpose of the final circuit	Diversity to be applied
Lighting	66% 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
Water heater thermostatically controlled	No diversity allowed

3. The IEE regulations refer extensively to plastic or metal conduit systems. The regulations reflect the practical experience of electricians. Answer briefly and to the point the following questions:
- a) What is the main advantage of a conduit system over other systems? **(2 marks)**
 b) A conduit system should be..... and sound. **(2 marks)**
 c) What colour distinguishes a conduit system from other systems? **(2 marks)**
 d) What precaution should be taken when a conduit passes through a wall? **(2 marks)**
 e) What precaution should be taken when a conduit passes from a hot room into a cold room? **(2 marks)**
 f) When threading steel conduit what precaution should be taken to avoid damage to the cables. **(2marks)**
 g) Can steel conduit be used as an earth continuity conductor? If not how is the system earthed? **(2 marks)**
 h) Show by a simple sketch how you would terminate steel conduit to a rotating machine? **(3 marks)**
 i) Show by a simple sketch how you would terminate a conduit to a loop-in box over the ceiling slab. **(3 marks)**

4. a) Electrical installations must be inspected and tested in accordance with the local Electricity Supply Regulations (ESR) and the IEE Wiring Regulations, BS 7671. For these tests various instruments are used.
By means of neat and well labelled drawings, describe the operation and use of the following instruments:
- i) Insulation Resistance Tester (5marks)
 - ii) Low resistance ohm Tester (5marks)
 - iii) Earth electrode resistance Tester (5marks)
- b) Explain the need to calibrate test instruments and give examples how these can be calibrated. (5 marks)
5. a) Describe the special precautions to be taken in the electrical installation in bathrooms according to IEE regulations. (6 marks)
- b) Explain with the aid of diagrams each of the following protection devices:
- (i) MCB (5 marks)
 - (ii) RCD (5 marks)
- c) What are the supply voltages supplied by Enemalta and the frequency? (2 marks)
- d) Which system is used for local electrical installations?
What is the new colour code for fixed and flexible installations? (2 marks)
6. 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)

END OF PAPER