

6. (a) One of the tests required in an electrical installation is to test the continuity of a ring final circuit conductors.
- (i) Explain why this test is required, (3 marks)
 - (ii) what instrument is used to carry out the above mentioned test? (1 mark)
 - (iii) with the aid of diagrams describe in detail the three (3) tests required. (9 marks)
- (b) With the aid of a diagram explain how an earth electrode is tested and state the maximum resistance reading that is allowed. (7 marks)



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

February 2015

Paper II (Electrical Installation Technology)

Time Allowed - 3Hrs



END OF PAPER

**WRITE ALL YOUR WORK ON 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) In a building site there are four lighting points which need to be controlled from three (3) different positions along the corridor. Describe, with the aid of a circuit diagram how to achieve the above. **(5 marks)**
- (b) Stroboscopic effect can cause dangerous situations. What do you understand by this term in relation to fluorescent lamps? **(5 marks)**
- (c) Consider a single phase supply and draw a circuit diagram to minimize the stroboscopic effect in fluorescent lamps and explain how this could be reduced. **(10 marks)**

2. (a) What is meant by the following terms related to an electrical installation:
 - (i) Exposed conductive parts, **(2 marks)**
 - (ii) Extraneous conductive parts, **(2 marks)**
 - (iii) Circuit protective conductor, **(2 marks)**
 - (iv) Earthing conductor. **(2 marks)**
- (b) Explain how earthing provides protection of circuits and personnel? **(5 marks)**
- (c) With the aid of a diagram explain the operation of a single phase residual current device (RCD) **(7 marks)**

3. (a) Describe the IEE regulations relating to domestic ring circuits using BS1363 socket-outlets. **(5 marks)**
- (b) Draw a neat circuit diagram to show the connections, polarity, size of cables and rating of circuit protective devices of a domestic ring circuit consisting of:
 - (i) four 13A socket outlets on the ring, **(5 marks)**
 - (ii) two 13A socket outlets connected on the ring as spur, **(5 marks)**
 - (iii) one 1.5kW fixed appliance connected to the ring by a switched fused spur box. **(5 marks)**

4. In Europe 44% of electricity use in office buildings is consumed for lighting.
 - (a) Place the following lamps in decreasing values of luminous efficacy: fluorescent tube T5, tungsten halogen, LED, high pressure sodium (i.e. highest luminous efficacy first). **(4 marks)**
 - (b) Define 'colour rendering' and discuss its importance in specific rooms such as the kitchen and the bedroom. **(4 marks)**
 - (c) A 4W LED lamp is a direct replacement for a 40W halogen bulb. The cost of the LED lamp is €6 with a lifetime of 15,000h, whilst the cost of the halogen lamp is €1.50 with a lifetime of 3,000h. Determine which lamp is the more cost-effective over its lifetime, assuming the cost of electricity is 0.14€/kWh. **(8 marks)**
 - (d) Suggest the diversity factor to be used for lighting circuits in an office building. **(2 marks)**
 - (e) What is the voltage drop allowed by the IEE Wiring Regulations in a lighting circuit? **(2 marks)**

5. The design of an electrical distribution system should take into account the materials used in cables, and their installation method.
 - (a) For the following materials used in cables, explain their properties and highlight the advantages and disadvantages in their application.
 - (i) Copper **(2 marks)**
 - (ii) Aluminium **(2 marks)**
 - (iii) PVC **(2 marks)**
 - (iv) XLPE **(2 marks)**
 - (b) Explain by using a circuit diagram, what is a ring and a radial circuit. **(2 marks)**
 - (c) When considering a typical residential dwelling such as an apartment, explain the type of circuit you would use for:
 - (i) Lighting **(1 mark)**
 - (ii) Socket outlets **(1 mark)**
 - (iii) An electric oven **(1 mark)**
 - (d) A 230V, 50Hz, 3kW electric kettle is supplied off a ring circuit 50m in length and placed in conduit in an insulated wall. Determine the cross-sectional area of PVC insulated copper wire suitable for the application, using the tables shown below. Assume that a 5% voltage drop is allowed, and that the correction factor for a conductor in a conduit in a plastered wall is 0.5. The number of circuits in the conduit is 2. **(7 marks)**

Table 1 – PVC insulated copper wire

| 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 |

Table 2 – Grouping correction factor

| | | | |
|--------------------|-----|-----|-----|
| Number of circuits | 1 | 2 | 3 |
| Correction factor | 1.0 | 0.8 | 0.7 |