



Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICAL WORKERS REGISTRATION BOARD ELECTRONIC SECURITY THEORY/REGULATIONS EXAMINATION

10 September 2005

QUESTION AND ANSWER BOOKLET

Time Allowed: 3 Hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until instructed to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use a pencil or a red pen.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated on the basis of correctness.

Do not use correcting fluid or correcting tape.

Non-programmable calculators may be used.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code. However, just stating a reference only will earn no marks.

For calculation questions all workings, including formulae, must be shown to gain full marks.

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

You may need to use the following documents in this examination:

- The Electricity Act 1992 and amendments.
- The Electricity Regulations 1997 and the Electricity Amendment Regulations 1999, Electricity Amendment Regulations 2002 and the Electricity Amendment Regulations 2003; or
The Electricity Regulations Compilation 2003 and the Electricity Amendment Regulations 2003; or
The Integrated Electricity Regulations 1997 and the Electricity Amendment Regulations 2003.
- AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, 3 and A); NZS 3019 (Int):2002 or NZS 3019:2004; AS/NZS 3760:2001 or AS/NZS 3760:2003.

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

SECTION 1 – THEORY

Question 1

- (a) Briefly describe how earthing the metal frame of a Class I electrical appliance prevents electric shock hazards under fault conditions.

(2 marks)

- (b) State the **TWO** types of operation employed by most miniature circuit-breakers.

(2 marks)

(1) _____

(2) _____

- (c) What is meant by the term current rating when associated with a fuse?

(2 marks)

- (d) What is the purpose of a residual current device?

(2 marks)

- (e) What type of document is required to be issued by a security alarm installer after the completion and testing of the wiring for a new electronic security system?

(2 marks)

(turn over)

Question 3

- (a) State **FOUR** technical advantages which HRC fuses have over rewirable fuses. (4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

- (b) What is meant by the term inverse time-current characteristic in relation to fuses and circuit breakers? (2 marks)

(turn over)

Question 3 continued

(c) Explain the internal operation of a miniature circuit breaker when the following situations occur.

(i) Sustained small overload

(2 marks)

(ii) Short circuit

(2 marks)

(turn over)

Question 4

- (a) When connecting test instruments to measure voltage and current values on a 230 V electrical circuit, it is important to follow set procedures to ensure personal safety. Briefly describe **THREE** important precautions that will promote **personal safety**.

(3 marks)

- (1) _____

- (2) _____

- (3) _____

- (b) Describe **THREE** different ways of safely ensuring the continued isolation of a security control panel.

(3 marks)

- (1) _____

- (2) _____

- (3) _____

- (c) What is the essential safety difference between switching off a security control panel and isolating a security control panel?

(3 marks)

(turn over)

Question 4 continued

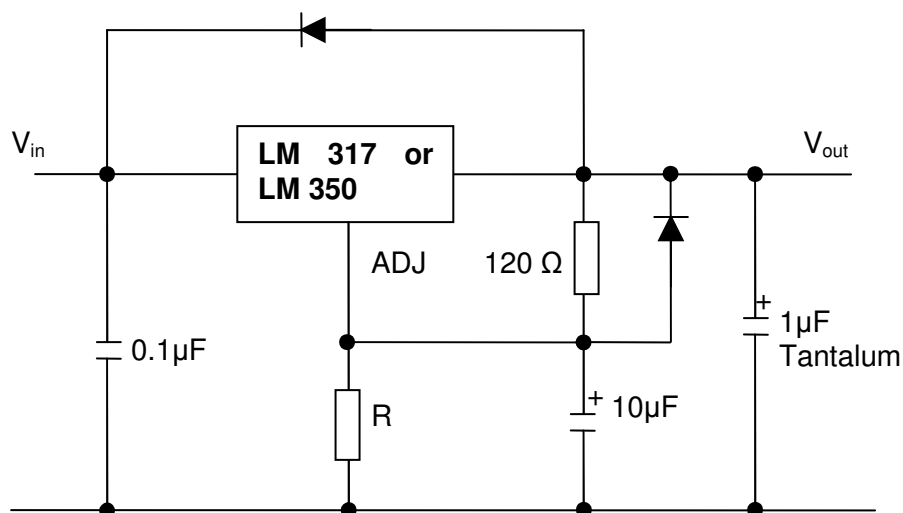
- (d) Rewirable fuses and HRC fuses may be found on switchboards. It is important to replace a blown fuse with one of the correct current rating.

What would be the overall effect on a subcircuit if you used a replacement fuse that had an under-rated current rating, compared to the fuse that had blown?

(1 mark)

(turn over)

Question 5



1. Choose Resistor R as follows:
 $R = (96 \times V_{out}) - 120$
 Where R is in ohms and V_{out} is in volts.
2. V_{in} should be at least 2.5 volts greater than V_{out} .
3. Capacitor voltage ratings must be chosen appropriately.
4. The protection diodes shown will be necessary if the input or output of the regulator is shorted to ground. 1 amp types should be adequate.

(a) Using the information from the sketch above:

- (i) Calculate the regulator output voltage (V_{out}) if R has been determined to be 1032Ω.

(2½ marks)

- (ii) Calculate a suitable minimum regulator input voltage (V_{in}).

(1½ marks)

(turn over)

Question 5 continued

- (iii) Select a suitable minimum voltage rating for the regulator input capacitor ($0.1\mu\text{F}$).
(2 marks)

- (b) State **TWO** components that may be used as part of a circuit to filter a rectifier output.
(2 marks)

(1) _____

(2) _____

- (c) State **TWO** factors that will cause an SCR to be turned off once it has been triggered (turned on).
(2 marks)

(1) _____

(2) _____

(turn over)

SECTION 2 – SAFETY AND LEGISLATION

Question 6

- (a) Refer to AS/NZS 3000 and state **TWO** situations where the protection disconnection time for a final subcircuit must not exceed 0.4 seconds.

(2 marks)

(1) _____

(2) _____

Ref:

- (b) A 230 v security alarm panel is located 12 metres from the MEN switchboard and the voltage at the point of supply is 230 V. Refer to the Electricity Regulations and calculate the minimum voltage permitted at the terminals of the alarm panel.

(2 marks)

Ref:

- (c) Refer to AS/NZS 3000 and state the colours that may be used to identify the phase conductor of a single-phase circuit?

(2 marks)

Ref:

- (d) Refer to AS/NZS 3000 and state **TWO** protection methods for the mechanical protection of wiring systems.

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 6 continued

(e) Refer to AS/NZS 3760 and state:

- (i) The maximum resistance between exposed metal parts of Class I equipment and earth.

(1 mark)

Ref:

- (ii) The minimum insulation resistance between live supply conductors and external metal parts in Class II equipment.

(1 mark)

Ref:

(turn over)

Question 7

RCD protection is required to be installed on socket outlet and lighting final subcircuits in domestic installations.

- (a) You are required to wire a new final subcircuit for a socket outlet in a domestic residence. The switchboard has two RCDs on it; one for the socket outlets and one for the lighting.

(i) To which neutral bar would you connect the socket outlet circuit? (1 mark)

(ii) What other electrical protection is required on the circuits protected by the RCDs (1 mark)

- (b) Refer to AS/NZS 3000 and state:

(i) **TWO** situations where RCDs do not need to be installed after alterations, additions or repairs have been carried out in domestic installations. (2 marks)

(1) _____

(2) _____

Ref:

(ii) The **ONE** situation where an RCD does not need to be installed on a socket outlet final subcircuit in a new domestic installation. (1 mark)

Ref:

(iii) The maximum rated residual current of an RCD installed to protect socket outlet and lighting final subcircuits in domestic installations. (1 mark)

Ref:

(turn over)

Question 7 continued

- (c) When an HRC fuse is replaced, the replacement must have similar characteristics to the original. State **FOUR** electrical characteristics to be checked for similarity. (4 marks)

- (1) _____
- (2) _____
- (3) _____
- (4) _____

(turn over)

Question 8

A registered security alarm installer has installed a security alarm system which included the installation of a 1.5 mm² twin and earth TPS cable between the switchboard and a new socket outlet for the alarm panel. With reference to the Electricity Regulations answer the following:

- (a) What is the name of the document the security alarm installer is required to complete. (1 mark)

Ref:

- (b) When must this document be completed? (1 mark)

Ref:

- (c) (i) To whom must a copy of this document be given? (1 mark)

Ref:

- (ii) When must the document be given to that person? (1 mark)

Ref:

- (d) (i) For how long must the security alarm installer retain a copy of this document? (1 mark)

Ref:

- (ii) What action must be taken if the security alarm installer does not wish to retain the copy of the document? (1 mark)

Ref:

(turn over)

Question 8 continued

(e) Name **ONE** other person who can issue this type of document.

(1 mark)

Ref:

(f) (i) The testing of this installation must be carried out in accordance with which section of which document?

(1 mark)

Ref:

(ii) When must this testing be carried out?

(2 marks)

Ref:

(turn over)

Question 9

You have repaired a Class I plug-in security alarm panel. You have carried out a protective earthing (earth continuity) test and the result is 15Ω .

- (a) State the maximum resistance value permissible for the protective earthing conductor of a Class I plug-in security alarm panel.

(1 mark)

Ref:

- (b) State the reason why the resistance of the protective earthing conductor must be no greater than the value stated in (a)(i).

(2 marks)

Ref:

- (c) Briefly describe the corrective action or procedure you would take to ensure the resistance of the protective earthing conductor complies with AS/NZS 3760.

(3 marks)

(turn over)

Question 9 continued

(d) The flexible cord has been replaced on a single phase 230V Class I, plug-in security alarm panel. State the colour coding which applies to the cord conductors. (3 marks)

(i) Phase (Active) _____

(ii) Neutral _____

(iii) Earth _____

Ref:

(e) What is the minimum number of conductors required in a flexible cord supplying a Class II electrical appliance? (1 mark)

(turn over)

Question 10

Refer to section 6 of AS/NZS 3000 and answer the following:

- (a) List **FOUR** mandatory checks, using test instruments that are required for the testing of electrical work carried out on a low voltage electrical installation (2 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref:

- (b) State **TWO** reasons for carrying out insulation resistance tests in an electrical installation. (2 marks)

(1) _____

(2) _____

Ref:

- (c) State the required voltage of the insulation resistance tester when testing a standard low voltage electrical installation. (1 mark)

Ref:

- (d) State the performance criteria for an insulation resistance tester. (2 marks)

Ref:

(turn over)

Question 10 continued

(e) State **ONE** reason why it is necessary to ensure correct circuit connections. (1 mark)

Ref:

(f) State the **TWO** reasons for testing the continuity of a protective earthing conductor. (2 marks)

(1)

(2)

Ref:

For Candidate's Use

In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

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Questions Answered	Marks	
1		
2		
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TOTAL		