



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

ELECTRICAL WORKERS REGISTRATION BOARD
ELECTRONIC SECURITY THEORY/REGULATIONS
EXAMINATION
9 September 2006
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. Show answers to TWO decimal places.

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 or The Electricity Act 1992 reprint dated 19 August 2005.
- 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 or
The Electricity Regulations 1997 reprint dated 5 September 2005.
- AS 60529 or 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) State **ONE** reason why is it essential to consider prospective-short-circuit current when choosing a fuse or circuit breaker?

(2 marks)

- (b) You are carrying out an insulation resistance test on a security alarm panel that has semi-conductor devices used in the internal circuitry. The semi-conductor devices cannot be disconnected.

State **TWO** methods of carrying out the insulation resistance test that will not cause damage to the semi-conductor devices.

(2 marks)

(1) _____

(2) _____

- (c) List **TWO** hazards that can occur where high prospective short-circuit fault currents are present

(2 marks)

(1) _____

(2) _____

(turn over)

Question 1 continued

(d) Draw circuit symbols illustrating:

(i) A single pole switch in the **on** position.

(1 mark)

(ii) A double pole switch in the **off** position.

(1 mark)

(e) What is meant by the term "peak inverse voltage" as applied to semi-conductor devices?

(2 marks)

(turn over)

Question 2

- (a) (i) What does the term "current rating" mean when applied to an HRC fuse?
(2 marks)

- (ii) A HRC fuse has a gG Utilisation Category (fusing factor) and a fusing current of 22.5 amps. Calculate the current rating of the fuse.
(2 marks)

- (b) State **TWO** reasons why it is important to thread the fuse wire from terminal to terminal through the **tortuous path** in the fuse carrier when reloading a rewirable fuse.
(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

(c) State **TWO** risks involved with the use of rewirable fuses.

(2 marks)

(1) _____

(2) _____

(d) Briefly state **TWO** reasons why it is not permitted to bridge the terminals of HRC fuse carriers with fuse wire of the same current rating as the blown cartridge.

(2 marks)

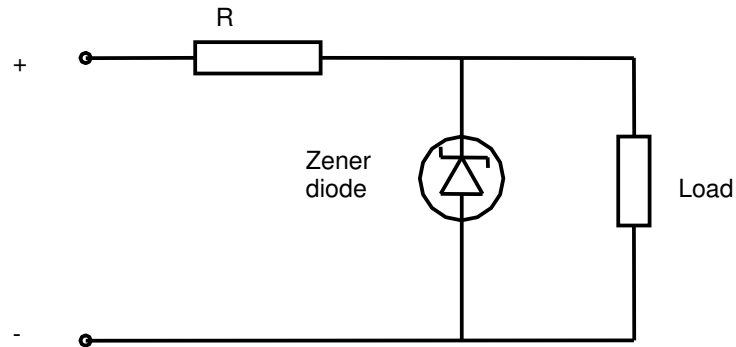
(1) _____

(2) _____

(turn over)

Question 3

(a) The figure below shows a shunt regulator supplied by a rectified d.c. supply.



(i) What is the purpose of the Zener diode?

(1 mark)

(ii) What main advantage does a Zener diode have over a normal rectifier diode?

(1 mark)

(turn over)

Question 3 continued

(iii) What is the purpose of the resistance in the circuit?

(4 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)

Question 4

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

(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 4 continued

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

(i) Sustained small overload

(2 marks)

(ii) Short circuit

(2 marks)

(turn over)

Question 5

(a) What is meant by the term "testing" when applied to electrical work?

(1 mark)

(b) A single phase socket outlet and circuit wiring has been installed. Describe in detail how each of the following tests/checks should be carried out. Include in your answer, where applicable, the type of meter used and any minimum or maximum values that are acceptable.

(i) Protective earth continuity

(3 marks)

(ii) Insulation resistance

(3 marks)

(iii) Polarity

(2 marks)

(turn over)

Question 5 continued

- (c) State **ONE** item in the single phase socket outlet and circuit wiring that should be visually inspected

(1 mark)

(turn over)

SECTION 2 – SAFETY AND LEGISLATION

Question 6

- (a) Refer to the Electricity Regulations and state what is meant by each of the following terms.

(i) Isolated

(1 mark)

Ref:

(ii) Mains

(1 mark)

Ref:

- (b) Refer to AS/NZS 3000 and why **safety** precautions shall be taken when testing a low voltage electrical circuit?

(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:

(turn over)

Question 6 continued

(d) Refer to the Electricity Regulations and calculate the maximum voltage drop allowed between the point of supply and any fixed wired appliance or socket outlet within any electrical installation operating at:

(2 marks)

(i) Standard Low Voltage Single Phase

(ii) Standard Low Voltage Multiple Phase.

Ref:

(e) Refer to the Electricity Regulations and state which of the following types of work is **not** prescribed electrical work.

- A. The switching of electrical installations
- B. The maintenance of electrical appliances
- C. The rewinding of armatures.
- D. The installation of conductors.

(2 marks)

Ref:

(turn over)

Question 7

(a) 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. Refer to AS/NZS 3760 and answer the following:

(i) State the maximum resistance value permissible for the protective earthing conductor of a Class I plug-in security alarm panel. (1 mark)

Ref:

(ii) State **ONE** reason why the resistance of the protective earthing conductor must be no greater than the value stated in (a)(i) (2 marks)

Ref:

(iii) Briefly describe the corrective action or procedure you would take to ensure the resistance of the protective earthing conductor of the security alarm panel complies with AS/NZS 3760. (3 marks)

(turn over)

Question 7 continued

(b) 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:

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

(turn over)

Question 8

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 includes three neutral bars and two RCDs (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 protective device 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 8 continued

- (c) State **TWO** factors that should be taken into account when selecting a new cable to provide the electricity supply to a security alarm panel.

(2 marks)

(1) _____

(2) _____

- (d) State **TWO** actions that will ensure connections are safe and reliable when terminating conductors in a security alarm panel.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 9

A registered security alarm installer has completed the installation of a security alarm system which included the installation of a 1.5 mm² twin and earth TPS cable between the switchboard and the security alarm control 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) 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 9 continued

(e) Name **ONE** other person who can issue this type of document. (1 mark)

Ref:

(f) (i) The testing of this work must be carried out in accordance with which section of which Standard? (1 mark)

Ref:

(ii) When must this testing be carried out? (1 mark)

Ref:

(iii) On which document should the test results be recorded? (1 mark)

(turn over)

Question 10

Refer to AS/NZS 3000 and answer the following:

- (a) State the reason why it is necessary to carry out an insulation resistance test using test instruments on a circuit prior to livening.

(2 marks)

Ref:

- (b) State the **THREE** situations an acceptable insulation test result is designed to prevent.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref:

- (c) (i) State the specified test voltage for an insulation resistance test of a low voltage circuit.

(1 mark)

Ref:

- (ii) State the performance criteria for an insulation resistance tester.

(1 mark)

Ref:

(turn over)

Question 10 continued

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

(1) _____

(2) _____

Ref:

(e) State **ONE** situation a test for correct circuit connections is designed to prevent. (1 mark)

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		
3		
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TOTAL		