

ES9 – Security Theory/Regulations Answer Schedule

- Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.
2. This schedule sets out the expected answers to the examination questions. The marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.
3. Symbols and terms - alternatives
Power W or P
Voltage V or E or U
Phase Active
4. Key to abbreviated terms:
EA Electricity Act 1992
ER Electricity Regulations 1997
AS/NZS Australia and New Zealand Joint Standard
NZS New Zealand Standard
AS Australian Standard
ECP New Zealand Electrical Code of Practice
GK General Knowledge

Question 1

- (a) Any TWO of:
- Voltage applied.
 - Current level .
 - Contact duration.
 - Skin dryness.
 - Current path.
- (2 marks)
- (b) (i) Decrease
(ii) Decrease
- (2 marks)
- (c) Any ONE of:
- Ohmmeters do not apply sufficient voltage to stress the insulation.
 - Does not have an output of 500V d.c. or 250V d.c.
- (2 marks)
- (d) It must be connected to the main earthing terminal in the main switchboard
- (2 marks)
- (e) Under fault conditions the earthing of the metal frame:
- Keeps the frame of appliance at earth potential.
 - And ensures the operation of protective devices
- (2 marks)

Question 2

(a) (i) Any ONE of:

- Ensures adequate earthing connections
 - To test the impedance of the fault circuit
 - Determine if the protection will operate within the required time.
- (1 mark)

(ii) Any ONE of:

- A single-phase plug from the tester is plugged into a socket outlet.
- Phase is connected to phase, neutral is connected to neutral and earth is connected to earth.
- Phase is connected to phase and earth is connected to earth.

(1 mark)

(b) (i) To prove the RCD operates within the specified current and time limits.

(1 mark)

(ii) Plug the RCD into a socket outlet and the RCD tester into the RCD being tested.

(1 mark)

(c) Both tests are carried out on live circuits

(1 mark)

(d) (i) Prove the meter works on a known source

(1 mark)

Test the circuit for isolation

(1 mark)

Prove the meter works on a known source

(1 mark)

(Total 3 marks)

(ii) Because it proves the meter works before and after testing for isolation

(1 mark)

and that the circuit is isolated

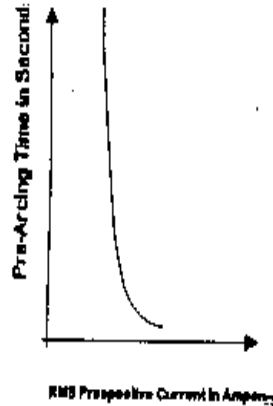
(1 mark)

Question 3

- (a) (i) As current through the protective device increase, the time taken to operate decreases.

(1 mark)

(ii)



(1 mark)

- (b) When a protective device cannot withstand the prospective short circuit current, it must be backed-up by a device which can.

(2 marks)

- (c) Discrimination means that:

- When two or more protective devices protect a circuit and
- A short circuit or overcurrent occurs on that circuit,
- The protective device nearest the fault operates,
- Before any other protective device begins to clear the fault.

(4 marks)

- (d) (i) The current rating is too low for the circuit, and could blow for no apparent reason well below the circuit full-load current.

(1 mark)

- (ii) The current rating is too large, and the circuit current could increase to a high level causing damage, before the fuse blows.

(1 mark)

QUESTION 4

(a) The isolation method has to show:

- Identification of the correct MCB. (1 mark)
- Securing of the isolation (tag, lock etc.). (1 mark)
- Proving the isolation (prove-test-prove method etc.). (2 marks)

Note: Repeated use of a protective device to locate a fault is hazardous.

(b) 1. Conduct an insulation resistance test and protective earthing conductor test on the security alarm panel. (2 marks)

2. If the tests confirm that no fault exists disconnect the circuit from the switchboard and test to locate the fault. (1 mark)

(c) 1. If the fault is in the permanent-connection circuit, repair or replace the cable or socket outlet. (1 mark)

2. If the fault is in the security alarm unit, repair and retest to ensure it is operationally safe. (2 marks)

Question 5

- (a) • Imbalance between the phase and neutral currents. (1 mark)
- A magnetic field is induced into the iron core. (1 mark)
- The induced magnetic field induces a current in the sensing coil (1 mark)
- The tripping coil is energised, isolating the circuit (1 mark)
- (b) 30 milliamps (1 mark)
- (c) Because the RCD limits the time a current can flow through a body. (2 marks)
- (d) The RCCB does not provide overcurrent or short-circuit protection. (1 mark)
- (e) • The PRCD will switch off when the supply is turned off.
- The PRCD will not reliven when supply is restored. (2 marks)

Question 6

(a) (i) Lodge a written complaint with the Registrar

EA 119
(1 mark)

(ii) Any TWO of:

- Remove the name from the register
- Suspend registration–subject to conditions
- Restrict work/premises/employer
- Fine up to \$5,000
- Censure

EA: 127(2)
(1 mark)

(b) Any TWO of:

- The appliance is a fixed wired appliance connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 230 volts.
- The appliance is supplied with electricity from a safety extra-low voltage source.
- The appliance is double insulated and is supplied with electricity from a residual current device (RCD) complying with Regulation 75 (b).

ER 77 (3) (a) (b) (c)
(2 marks)

(c) (i) A supervisor of electrical work

EA 109(b)
(1 mark)

(ii) Any ONE of:

- The work must be within limits set in the regulations. EA 109(a)
- The work is not connected to a power supply. EA 109(c)
- The work must be tested in accordance with the regulations EA 109(d)
- The work must be tested by a supervisor of electrical work EA 109(d)
- The work must be connected by a supervisor of electrical work. EA 109(d)

EA 109(d)
(1 mark)

(d) Any FOUR of:

- Earth electrode.
- Main earthing conductor.
- Main earthing terminal/connection or bar.
- MEN link.
- Protective earthing conductors.
- Equipotential bonding.

AS/NZS 3000: 5.6.1

(e) (i) Means fittings or appliances are deliberately disconnected from any source of electricity

(ii) Means those fittings forming part of an electrical installation that are used for the supply of electricity to the main switchboard of that installation

ER2
(2 marks)

Question 7

- (a) (1) Safe working practices appropriate to the work being undertaken.
(2) Testing to ensure safety before/during and after completion of the work.
(3) Basic first aid
(4) CPR

ER 26(2)
(2 marks)

- (b) At intervals not exceeding 24 months.

ER 26(3)
(2 marks)

- (c) Must take all practicable steps to:
- Ensure employees are competent to do the work
 - or
 - Are under the supervision of a person competent to do that work

ER 25(3)
(2 marks)

- (d) The owner or occupier of the property and the Secretary of Commerce

ER 50
(2 marks)

- (e) Any TWO of:

- The name of the person so notifying and the place at which that person may be contacted (including where possible a telephone number and facsimile number):
- The place, date, and time of the accident:
- A complete description of the accident:
- A description of any injuries, damage, or losses resulting from the accident:
- Where known, the names and contact information of any witness, investigator at the scene, or other person who could provide cogent information on the accident:
- Possible causative factors (if any are known):
- Any resuscitation applied, including the method, the length of time applied, the reason for discontinuing, and the person that applied the resuscitation:
- Any associated equipment involved, including the type, whether or not it operated correctly, and any reasons why it did not operate correctly:
- The condition of the associated equipment involved, including its age:
- Where known, the name, age, sex, occupation, and residential address of the victim.

ER 106(1)
(2 marks)

Question 8

(a) AS/NZS 3760

(1 mark)

(b)

Type of test	(i) Type of instrument required	(ii) Test result
Earthing continuity	<i>Ohmmeter or other instrument with a low reading ohms scale</i>	<i>Max 1 ohm resistance</i>
Insulation resistance test	<i>Insulation resistance tester</i>	<i>min 1 Mohm</i>

AS/NZS 3760: Table 2

(c) Any **FIVE** of – from AS/NZS 3760:2001:

- Check for obvious damage or defects in the accessories, connectors, or plugs.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or insulation tape are not in evidence.
- Check that any controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.
- Check that safety facilities and devices are in good working order.

AS/NZS 3760: 2.3.2

(5 marks)

Or

Any **FIVE** of – from AS/NZS 3760:2003:

- Check for obvious damage or defects in the accessories, connectors or plugs and for discolouration that may indicate exposure to heat, chemicals and moisture.
- Check that flexible cords are effectively anchored to equipment and plugs.
- Check that the inner cores of flexible supply cords are not exposed or twisted;
- Check that the external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Check that unprotected conductors or banding insulation tape are not in evidence.
- Check that any operating controls are in good working order i.e. they are secure, aligned and appropriately identified.
- Check that covers, guards and the like are secured in the manner intended by the manufacturer or supplier.

AS/NZS 3760: 2.3.2

Question 9

(a) 1 ohm

AS/NZS 3760:2001: 2.3.3.1

AS/NZS 3760:2003: 2.3.3.1

(1 mark)

(b) Any ONE of:

- The resistance to earth from protectively earthed parts in Class I equipment must be low enough to permit adequate fault current to flow to earth thereby ensuring that the overcurrent protective device opens quickly.

AS/NZS 3760:2001: Foreword

- To ensure that the resistance of the protective conductor is sufficiently low to ensure the operation of the circuit protecting the equipment.

AS/NZS 3760:2003: 2.3.3.1

(2 marks)

- Holds the frame of the appliance at earth potential under fault conditions.

(c) The method has to show:

- The checking of the terminations.

(1 mark)

- The checking of the cord.

(1 mark)

- Retesting the appliance.

(1 mark)

(d)

- | | |
|-------------|-------------------------|
| (i) Red | (i) Brown |
| (ii) Black | (ii) Light Blue or Blue |
| (iii) Green | (iii) Green/Yellow |

Accept answers from AS/NZS 3000 or AS/NZS 3760

(3 marks)

(e) Two

(1 mark)

Question 10

- (a) (i) The neutral bar associated with the RCD for the sockets outlets. GK
(1 mark)
- (ii) MCBs or HRC fuses GK
(1 mark)
- (b) (i) Any TWO of:
- Where socket-outlets are added to a final subcircuit, provided that the existing subcircuit is not RCD protected.
 - Where socket-outlets are added to a final subcircuit, provided that the existing socket-outlets on the circuit are not RCD protected.
 - Where points are added to a final subcircuit in a domestic or residential-type area of an electrical installation, provided that the existing final subcircuit is not RCD protected.
 - Where socket-outlets or points that are not RCD protected are replaced.
 - In New Zealand, where all points on a new final subcircuit are protected by an RCD installed at the first point of that new final subcircuit.
- AS/NZS 3000: 2.5.3.2
(2 marks)
- (ii) A socket-outlet, or a connecting device installed in accordance with Clause 4.11 (c), for the connection of fixed or stationary electric cooking appliances, such as ranges, ovens or hotplates. AS/NZS 3000: 2.5.3.1
(1 mark)
- (iii) 30 mA AS/NZS 3000: 2.5.3.1
(1 mark)
- (c)
- Current rating (1 mark)
 - Voltage rating (1 mark)
 - Category of duty (Rupturing Capacity) (1 mark)
 - Utilisation category (fusing factor) (Class) (1 mark)