

## ES11 – Security Theory/Regulations Answer Schedule

- Notes:
- (1 mark) means that the preceding statement/answer earns 1 mark.
  - 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.
  - Symbols and terms - alternatives  
Power W or P  
Voltage V or E or U  
Phase Active
  - 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) To ensure it has not frozen closed ( $\frac{1}{2}$  mark if the term "frozen" is only used)  
or  
To ensure trip mechanism operates (2 marks)
- (b) (i)  $1\text{ M}\Omega$  minimum (1 mark)
- (ii)  $1\Omega$  maximum (1 mark)
- (c) • Current (load)  
• Length of run or volt drop (2 marks)
- (d) As current through the protective device increases the time taken to operate decreases.
- Note: A drawn representation of the characteristic is acceptable. (2 marks)
- (e) 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)

## Question 2

- (a) • Neutral current out of balance with the phase current. (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 trips in milliseconds (2 marks)
- (d) Any ONE of:
- A phase to neutral fault.
  - Overcurrent.
  - Short-circuit.
- (1 mark)
- (e) • In the event of failure of the supply the PRCD will trip.
- The PRCD will not reliven when supply is restored. (2 marks)

### Question 3

- (a) • Overload caused by too many appliances in use.  
• A faulty appliance  
• A faulty circuit.

(3 marks)

- (b) (i) Overload caused by too many appliances in use.

Action taken to establish that this is the cause

- Total up the rating of appliances from their name-plates (1 mark)

Remedial action taken or recommended

- Use fewer appliances. (1 mark)

- (ii) A faulty appliance.

Action taken to establish that this is the cause

- Carry out an insulation resistance test of the security alarm panel (1 mark)

Remedial action taken or recommended

- Repair the security alarm panel (if this is the cause of the fault).  
or
- Send appliance for repair (if one of these is the cause of the fault) (1 mark)

- (iii) A faulty circuit.

Action taken to establish that this is the cause

- Disconnect circuit at switchboard. (1 mark)
- Carry out an insulation resistance test of the circuit to establish fault. (1 mark)

Remedial action taken or recommended

- Call in an electrician if the fault is between the switchboard and the first termination point  
or
- Repair or replace the faulty circuit component if the fault is beyond the first termination point past the switchboard. (1 mark)

#### QUESTION 4

(a) Any FOUR of:

- Isolate and tag circuit
- Each conductor must be insulated and made electrically safe.
- Each conductor should be marked and labelled to permit reconnection to the correct terminals.
- Protect the cables to prevent damage
- Take steps to prevent access to the cables.

(4 marks)

(b) Isolation – means deliberately disconnected from the electricity supply and precautions taken to prevent reconnection  
Switched off means that the electricity ceases to be supplied to the appliance

(3 marks)

(c) Any THREE of:

- Attach a safety warning tag
- Lock open the isolating switch.
- Lock open the circuit breaker controlling the circuit supplying the security control panel.
- Move the fuse carriers of the fuses controlling the circuit supplying the security control panel to a safe location.
- Use an access permit or "hold card" system.
- Disconnect the circuit supplying the security control panel at source.

(3 marks)

## Question 5

(a) Carrying out a checking or testing procedure with or without test instruments in order to prove that it is safe and has been wired correctly  
(2 marks)

(b) (i) Insulation Resistance

- Test between phase/neutral and earth
- Meter: Insulation resistance tester 500V d.c.
- Minimum reading  $1\text{M}\Omega$

(3 marks)

(ii) Polarity  
Check visually and with instruments that all phase conductors are switched and that all conductors go to the right terminals  
(1 mark)

(iii) Protective earth continuity

- Test between the earth contact on the new socket outlet and the end of the cable
- Meter: Any instrument that can accurately read values of  $1\Omega$  or less.
- Acceptable reading:  $0.5\Omega$  or  $1\Omega$

(3 marks)

(iv) Visual check

Any ONE of:

- No access to live parts without the use of a tool
- Covers are all on
- Connections properly terminated
- Correct colour code

(1 mark)

## Question 6

- (a) (i) Effectively connected to the general mass of Earth  
(1 mark)
- (ii) In relation to fittings or electrical appliances, means that the fittings or appliances are deliberately disconnected from any source of electricity.  
(1 mark)  
ER2

- (b) (i) Red and any colour except Black, Light Blue, Green or Green/Yellow.  
AS/NZS 3000: 3.8.1  
AS/NZS 3000: Table 3.5  
(1 mark)

- (ii) Green or Green/Yellow combination.  
AS/NZS 3000: 3.8.1  
AS/NZS 3000: Table 3.5  
(1 mark)

- (c) Any TWO of:

- Provided with adequate mechanical protection to prevent damage.  
AS/NZS 3000: 3.9.4.6
- Provided with earthed metallic armouring, screen, covering or enclosure.  
AS/NZS 3000: 3.9.4.6
- Protected by an RCD with a maximum rated residual current of 30 mA.  
AS/NZS 3000: 3.9.4.6

- (d) Any FOUR of:

- Registered electricians
- Registered line mechanics
- Registered electrical inspectors
- Registered electrical service technicians
- Persons who are authorised to carry out such work under a provisional licence
- Trainees
- Qualified engineers

EA 108 (2)  
(2 marks)

- (e) Any TWO of:

- Repair/replacement of faulty/damaged conductor
- Replacement of fuse carrier with appropriate circuit breaker
- Replacement of a fitting in accordance with ER 39(2)(c)
- Installation of revenue metering/associated load control equipment of mains.

ER 39(2)

(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) (i) 1 ohm

AS/NZS 3760:2001: 2.3.3.1

AS/NZS 3760:2003: 2.3.3.1

(1 mark)

(ii) 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.

(iii) The method has to show:

- Testing to detect source of high resistance. (1 mark)
- Repair faulty terminations or replace faulty cord or replacement of faulty plug. (1 mark)
- Re-testing of the protective earthing conductor to ensure resistance is less than 1  $\Omega$ , (1 mark)

(b)

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

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

(3 marks)

(c) Two

(1 mark)

## Question 9

(a) Any FOUR of:

- Continuity of the earthing system
- Insulation resistance
- Polarity
- Correct circuit connections

AS/NZS 3000: 6.3.3.1  
(2 marks)

(b) To ensure that the insulation resistance between all live conductors and earth and all live parts and earth is adequate.

AS/NZS 3000: 6.3.3.3.1  
(2 marks)

(c) 500 V d.c.

AS/NZS 3000: 6.3.3.3.1  
(1 mark)

(d) Maintain its terminal voltage with +20%, -10% of the nominal open circuit terminal voltage.

(1 mark)

When measuring a resistance of 1 M $\Omega$  on the 500 V d.c. range or 10 M $\Omega$  on the 1000 V d.c. range.

(1 mark)

AS/NZS 3000: 6.3.3.3.1

(e) Any ONE of:

- To ensure protective earthing conductors do not normally carry current.

AS/NZS 3000: 6.3.3.5.1(a)

- To ensure no short circuit exists

AS/NZS 3000: 6.3.3.5.1(b)

AS/NZS 3000: 6.3.3.4.1(a)

- To ensure no conductive parts become energised.

AS/NZS 3000: 6.3.3.5.2(b)

AS/NZS 3000: 6.3.3.4.1(b)

- To ensure there is no interconnection of conductors between different circuits

AS/NZS 3000: 6.3.3.4.1(b)

- To prevent the connection of switches in neutral conductors.

AS/NZS 3000: 6.3.3.4.1(c)

(1 mark)

- (f)
- To ensure that the earthing systems has been installed in a manner that will cause circuit protective devices to operate if there is a fault between live parts, other than the neutral, and the mass of earth.
  - Will ensure that electrical equipment parts that are earthed do not reach dangerous voltages when earth faults occur.

AS/NZS 3000 6.3.3.2.1  
(2 marks)

## Question 10

- (a) (i) Certificate of compliance (CoC) (1 mark)  
ER 39(1)
- (ii) Any ONE of:
- Within 1 day of the completion of the work
  - Within 1 day of the termination of the contract
- (1 mark)  
ER 39(5)
- (iii) The owner of the fittings or the occupier of the premises (1 mark)  
ER 40(2)
- (iv) Within 20 working days of completion (1 mark)  
ER 40(2)
- (v) 3 years (1 mark)  
ER 40(4)
- (vi) Copies of the certificate can be returned to the Board (1 mark)  
ER 40(5)
- (vii) Any ONE of:
- A registered electrical inspector:
  - A registered line mechanic:
  - A qualified engineer:
  - A provisional licence holder:
  - A person authorised to certify the prescribed electrical work under an employer licence.
- (1 mark)  
ER 39(4)
- (b) (i) Section 6 of AS/NZS 3000 (1 mark)  
ER 37(3)
- (ii) After the work is completed and before connection to the supply (2 marks)  
ER 37(3)