

ES21 – 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

Question 1

Marks

Marking notes

(a) Any TWO of:-

(2 marks)

- It will safely interrupt short circuit currents of much higher values or higher rupturing capacity.
- It eliminates arcing because the fuse element is sealed.
- It is obtainable in a range of Utilisation categories (fusing factors).
- Current rating is clearly marked.
- Reliable operation within prescribed limits.
- Good discrimination.
- Constant fusing characteristics.
- Faster operation/acting.
- Doesn't deteriorate over time.

(b) (i) A short circuit

(1 mark)

(ii) A sustained overload

(1 mark)

(c) • The words "Class II"

(2 marks)

- The symbol of a "square within a square"

Question 1*Marks**Marking notes*

(d) Any ONE of:

(2 marks)

- Earth leakage current in the circuit.
- Earth leakage current in the appliance.
- An imbalance in current between phase and neutral

(e) • Under fault conditions the earthing of the metal frame keeps the frame of appliance at earth potential.

(1 mark)

- This ensures the operation of protective device

(1 mark)

Question 2

Marks

Marking notes

(a) The sequence of actions has to show:

- Removal of the cable sheath. (½ mark)
- Removal of the basic insulation from conductors. (½ mark)
- Applying cord clamp to sheath (½ mark)
- Terminating conductors at terminals. (½ mark)

(b) Any FIVE of:

(2½ marks)

- Ensure there is no damage to the conductor cores
- Ensure the basic insulation is up to the terminals.
- Ensure the clamp secures the sheath of the cable and not the conductors
- Ensure the conductors are terminated to the correct terminals.
- Ensure that the protective earthing conductor is longer than the other conductors.
- Ensure the plug is not damaged.

(c) Any ONE of:

(½ mark)

- Ensure there are no exposed conductors or basic insulation.
- Ensure plug fits correctly

Question 2

Marks

Marking notes

- | | |
|---|----------|
| (d) • Protective earthing conductor test. | (½ mark) |
| - Any instrument that can accurately read values of less than 1Ω. | (½ mark) |
| - 1Ω maximum | (½ mark) |
| - Test between the earth pin of the plug and the frame of the appliance. | (½ mark) |
| • Insulation resistance test. | (½ mark) |
| - Insulation resistance tester | (½ mark) |
| - 500V d.c | (½ mark) |
| - 1 MΩ minimum | (½ mark) |
| - Bridge out the phase and neutral pins of the plug and test between that bridge and the earth pin. | (1 mark) |

Question 3

Marks

Marking notes

- (a) Any TWO of: (2 marks)
- Each conductor must be insulated and made electrically safe.
 - Protect the cables to prevent damage
 - Take steps to prevent access to the cables.
- (b) • "Isolating" means that the panel has been deliberately disconnected from the electricity supply and precautions taken to prevent reconnection (2 marks)
- "Switched off" means that the electricity ceases to be supplied to the appliance (1 mark)
- (c) Any THREE of: (3 marks)
- 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.
- (d) • To ensure that the test meter/instrument - is operating correctly. (2 marks)
- To ensure that the circuit has been isolated before it is worked on.

Question 4*Marks**Marking notes*

- (a) The protective device nearest the fault operates, before any other protective device. (2 marks)
- (b) 60A Is the maximum current the fuse can continuously carry (1/2 mark)
- without deterioration. (1/2 mark)
- 440V is the maximum voltage the fuse can withstand (1/2 mark)
- without flashover. (1/2 mark)
- 80kA. 80,000A (1/2 mark)
is the maximum (1/2 mark)
- prospective short circuit current (1/2 mark)
- the fuse can safely interrupt (1/2 mark)
- (c) To provide short-circuit protection in a circuit (1/2 mark)
- when another protective device has inadequate breaking capacity (1/2 mark)
- (d) As current through a protective device increases, the time taken to operate decreases. (1 mark)

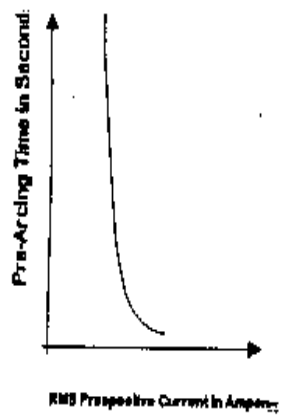
Question 4

Marks

Marking notes

(e)

(2 marks)



Question 5

Marks

Marking notes

(a) (i) Earthed security alarm panel

(A) 3

(1/2 mark)

(B) Brown Phase

(1 mark) If more than one set provided, mark the first set only

Light blue or Blue Neutral

(1 mark) Must get colours/polarity totally correct to gain marks

Green/Yellow Earth
Or

(1 mark)

Red Phase
Black Neutral
Green Earth

Accept green/yellow as a colour

(C) Protective earthing conductor test
Insulation resistance test

(1/2 mark)

(1/2 mark)

(ii) Double insulated security alarm panel

(A) 2

(1/2 mark)

(B) Brown Phase

(1 mark) If more than one set provided, mark the first set only

Light blue or Blue Neutral

(1 mark) Must get colours/polarity totally correct to gain marks

Or

Red Phase
Black Neutral

Question 5

Marks

Marking notes

- | | | |
|--|------------|--|
| (C) Insulation resistance test | (½ mark) | |
| (b) Voltage is dropped as the load current passes through the conductor resistance | (1½ marks) | |
| (c) It is the maximum current that a flexible cord is designed to carry safely | (1 mark) | |

Question 6*Marks**Reference**Marking notes*

- | | | | |
|--|-----------|--------------|--|
| (a) Any ONE of: | (2 marks) | ER 23(a),(b) | |
| • <u>A supervisor of electrical work</u> whose registration allows that supervisor to do the work | | | |
| • <u>A registered person</u> whose registration allows that person to do the work, where the registered person is <u>under the supervision of a supervisor of electrical work</u> whose registration allows that supervisor to do the work | | | |
| (b) (1) Before beginning the work, to check that any associated equipment and personal protective equipment to be used by that person is in good order and condition, and is safe for its intended use | (1 mark) | ER 36(2)(a) | |
| (2) To use the associated equipment and the personal protective equipment provided in a competent manner. | (1 mark) | ER 36(2)(c) | |
| (c) (i) 3 years | (1 mark) | ER 40(4) | |
| (ii) Return it to the Board | (1 mark) | ER 40(5) | |
| (d) • Where the work does not require certification under regulation 39(2). | (2 marks) | | |
| • To enable testing to be carried out under regulation 45 | | | |

Question 6*Marks**Reference**Marking notes*

(e) Any TWO of:

(2 marks)

- Fittings that in normal use, or in the event of abnormal operation, function unsafely so as to cause danger to persons, property, or animals. ER76A (1)(a)
- Fittings that have inadequate protection against direct contact or indirect contact. ER76A (1)(b)
- Fittings that have unearthed conductive parts separated from live parts only by basic insulation. ER76A (1)(c)
- Fittings that are installed in such a way that any designed cooling conditions are impaired. ER87(1)(d)
- Fittings which cause or are subject to high temperatures or electric arcs are placed in such a position or are unguarded so as to create a risk of ignition of flammable materials or of injury to persons or damage to property. ER87(1)(e)

Question 7*Marks**Reference**Marking notes*

(a) (i) From AS/NZS 3000:2000: 1.7.3.2

(4 marks)

- Insulation, in accordance with Clause 1.7.3.3.
- Barriers or enclosures, in accordance with Clause 1.7.3.4.
- Obstacles, in accordance with Clause 1.7.3.5.
- Placing out of reach, in accordance with Clause 1.7.3.6.

Or

From AS/NZS 3000:2007: 1.5.4.2

- Insulation, in accordance with Clause 1.5.4.3.
- Barriers or enclosures, in accordance with Clause 1.5.4.4.
- Obstacles, in accordance with Clause 1.5.4.5.
- Placing out of reach, in accordance with Clause 1.5.4.6.

(ii) Any TWO of:

(2 marks)

AS/NZS 3000
2000: 1.7.3.4.1
2007: 1.5.4.4(a)

- IPXXB
- IP2X.
- IP4X for horizontal top surfaces that are readily accessible.

Question 7*Marks**Reference**Marking notes*

- | | | | |
|---|-----------|--|--|
| (iii) • The use of a key or tool
• An interlocking device is fitted
• An intermediate barrier is provided | (3 marks) | AS/NZS 3000
2000: 1.7.3.4.3
2007: 1.5.4.4(b) | |
| (b) A part preventing unintentional direct contact, but not preventing direct contact by deliberate action. | (1 mark) | AS/NZS 3000
2000: 1.4.64
2007: 1.4.68 | |

Question 8*Marks**Reference**Marking notes*

(a) Any FOUR of:

(2 marks)

From AS/NZS 3000:2000: 6.3.3.1

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

or

From AS/NZS 3000:2007: 8.3.3

- Continuity of the earthing system
- Insulation resistance
- Polarity
- Correct circuit connections
- Verification of impedance required for automatic disconnection of supply
- Operation of RCDs

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

(2 marks)

AS/NZS 3000
2000: 6.3.3.3.1
2007: 8.3.6.1

(c) 500 V d.c.

(2 marks)

AS/NZS 3000
2000: 6.3.3.3.1
2007: 8.3.6.1

Question 8*Marks**Reference**Marking notes*

(d) Any TWO of:

(2 marks)

From AS/NZS 3000:2000

- To ensure protective earthing conductors do not normally carry current. 6.3.3.5.1(a)
- To ensure no short circuit exists 6.3.3.5.1(b)
6.3.3.4.1(a)
- To ensure no conductive parts become energised. 6.3.3.5.2(b)
6.3.3.4.1(b)
- To ensure there is no interconnection of conductors between different circuits 6.3.3.4.1(b)
- To prevent the connection of switches in neutral conductors. 6.3.3.4.1(c)

or

From AS/NZS 3000:2007:

- To ensure protective earthing conductors do not normally carry current. 8.3.8.1
- To ensure no short circuit exists 8.3.8.1

Question 8*Marks**Reference**Marking notes*

- (e) • 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.

(2 marks)

AS/NZS 3000
2000: 6.3.3.2.1
2007: 8.3.5.1

Question 9	<i>Marks</i>	<i>Reference</i>	<i>Marking notes</i>
(a) (i) Protective earthing conductor test	(½ mark)	AS/NZS 3760: 2.3.3.1	
(ii) Any test instrument that can accurately read values of 1 ohm or less.	(½ mark)		
(iii) 1Ω - maximum	(1 mark)	AS/NZS 3760: 2.3.3.1	
(b) (i) <ul style="list-style-type: none"> • Insulation resistance test • Earth leakage test 	(1 mark)	AS/NZS 3760: 2.3.3.2	
(ii) (1) Insulation resistance tester	(½ mark)	AS/NZS 3760: 2.3.3.2	
(2) 1 MΩ - minimum	(1 mark)	AS/NZS 3760: 2.3.3.2	
(iii) (1) Earth leakage tester	(½ mark)	AS/NZS 3760: 2.3.3.2	
(2) 5 mA - maximum	(1 mark)	AS/NZS 3760: 2.3.3.2	

Question 9*Marks**Reference**Marking notes*

(c) Any TWO of:

(2 marks)

AS/NZS 3760:
2.3.2

- They are effectively anchored.
- The inner cores are not exposed or twisted;
- The external sheaths are not cut, abraded, twisted, or damaged to such an extent that the insulation of the inner cores is visible
- Unprotected conductors or insulation tape are not in evidence.

Question 9*Marks**Reference**Marking notes*

(d) Any TWO of:

(2 marks)

2.3.2

From AS/NZS 3760:2001

- 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.
- Check that ventilation inlets and exhausts are unobstructed.

Or

From AS/NZS 3760:2003

2.3.2

- 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.
- Check that ventilation inlets and exhausts are unobstructed.

Question 10	<i>Marks</i>	<i>Reference</i>	<i>Marking notes</i>
(a) (i) A practising licence	(1 mark)	EA 95(1)	
(ii) 30 June of the year it is stated to expire. (also accept 1 July)	(1 mark)	EA 100	
(iii) The Registrar	(1 mark)	EA 100(4)	
(b) <ul style="list-style-type: none"> • Safe working practices • Testing • CPR • Basic first aid 	(4 marks)	ER 25	
(c) Any TWO of: <ul style="list-style-type: none"> • 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: 	(3 marks)	ER 106(1)	

Question 10*Marks**Reference**Marking notes*

- 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.