

ES19 – 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) • Current (load)
• Length of run, or similar (2 marks)
- (b) (i) Any ONE of:
• Disconnect semi-conductor devices
• Short-out the semi-conductor device. (1 mark)
- (ii) The voltage of the test instrument may be too high and may destroy or damage the electronic devices. (1 mark)
- (c) (i) $1M\Omega$ (1 mark)
- (ii) $1M\Omega$ (1 mark)
- (d) Any ONE of:
• Earth leakage current in the circuit.
• Earth leakage current in the appliance.
• An imbalance in current between phase and neutral (2 marks)
- (e) It of the metal frame keeps the frame of appliance at earth potential. (2 marks)

Question 2

- (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 working voltage the fuse can withstand without flashover. (1 mark)
- AC40. 40,000A (1/2 mark)
or
40kA category of duty (1/2 mark)
or
40kA rupturing capacity (1/2 mark)
or
40kA breaking capacity (1/2 mark)
- is the maximum prospective short circuit current the fuse can safely interrupt
- (c) To provide short-circuit protection in a circuit when another protective device has inadequate breaking capacity. (1 mark)
- (d) As current through a protective device increases, the time taken to operate decreases. (2 marks)

Question 3

(a) Visual checks

Any TWO of:

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

(2 marks)

(b) Protective earthing conductor test

- Test between the earth contact on the new socket outlet and the end of the cable
(1 mark)
- Meter: Ohmmeter or any instrument that can accurately read values of 1Ω or less.
(1 mark)

- Value 0.5Ω or 1Ω - maximum
(1 mark)

(c) Insulation Resistance

- Test Between phase/neutral and earth
(1 mark)
- Meter: Insulation resistance tester
($\frac{1}{2}$ mark)
- Voltage: 500V d.c.
($\frac{1}{2}$ mark)
- Value $1M\Omega$ - minimum
(1 mark)

(d) Correct circuit connections (or polarity)

Check visually and with instruments that the:

- The phase conductor is switched at the socket outlet.
($\frac{1}{2}$ mark)
- The neutral and earth are connected to the correct terminals
($\frac{1}{2}$ mark)
- Meter: Ohmmeter or any instrument that can accurately read values of 1Ω or less.
($\frac{1}{2}$ mark)

Question 4

(a) The sequence of actions has to show:

- Removal of the cord 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)
- Ensure there is no damage to the conductor cores (½ mark)
 - Ensure the basic insulation is up to the terminals. (½ mark)
 - Ensure the clamp secures the sheath of the cord and not the conductors (½ mark)
 - Ensure the conductors are terminated to the correct terminals. (½ mark)
 - Ensure that the protective earthing conductor is longer than the other conductors. (½ mark)

(c) Ensure there are no exposed conductors or basic insulation. (½ mark)

- (d)
- Protective earthing conductor test. (½ mark)
 - An ohmmeter
or
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)
 - $1M\Omega$ 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 5

(a) Any TWO of:

- Each conductor must be insulated and made electrically safe.
- Protect the cables to prevent damage
- Take steps to prevent access to the cables.

(2 marks)

(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:

- Attach a safety warning tag to the permanent connection unit.
- Attach a safety warning tag to the MCB.
- Disconnect the circuit supplying the security control panel at the switchboard.
- Disconnect the security control panel cord from the permanent connection unit.

(3 marks)

(d) • To ensure that the test meter/instrument - is operating correctly.

- To ensure that the circuit has been isolated before it is worked on.

(2 marks)

Question 6

(a) 0.4 seconds (400 milliseconds)

ER 64 (3)
(2 marks)

(b) (i) From AS/NZS 3000:2000: 3.8.1 or Table 3.5

Red or any colour except black, light blue, green or green/yellow.

or

From AS/NZS 3000:2007: 3.8.1 or Table 3.4

Any colour other than green, yellow, green/yellow, black or light blue

(1 mark)

(ii) Green or Green/Yellow combination.

AS/NZS 3000:2000: 3.8.1 or Table 3.5

AS/NZS 3000:2007: 3.8.1 or Table 3.4

(1 mark)

(c) Any TWO of:

- 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)

(2 marks)

(d) Any TWO of:

From AS/NZS 3000:2000

- Automatic disconnection of the supply in accordance with clause 1.7.4.3
- The use of Class II equipment or equivalent insulation, in accordance with clause 1.7.4.4
- Electrical separation in accordance with clause 1.7.4.5
AS/NZS 3000: 1.7.4.2
- Protection may be provided by the use of separated extra-low voltage (SELV)
- Protection may be provided by the use of protected extra-low voltage (PELV)
AS/NZS 3000: 1.7.2

From AS/NZS 3000:2007: 1.5.5.2

- Automatically disconnect the supply on the occurrence of a fault likely to cause a current flow through a body in contact with exposed conductive parts.
- Prevent a fault current from passing through a body by use of Class II equipment or equivalent insulation.
- Prevent a fault current from passing through a body by electrical separation of the system.
- Limit the fault current that can pass through a body to a value lower than the shock current.
(2 marks)

(e) • The cords must be of a heavy-duty type or a non-heavy duty type installed in a suitable wiring enclosure.
AS/NZS 3000:2000: 3.9.8.4

or

- Shall be of a heavy-duty sheathed type and installed in the same manner as insulated sheathed cables.
AS/NZS 3000:2007: 3.9.7.4
(2 marks)

Question 7

(a) (i) Protective earthing conductor test
AS/NZS 3760: 2.3.3.1
(½ mark)

(ii) Any test instrument that can accurately read values of 1 ohm or less.
(½ mark)

(iii) 1Ω - maximum
AS/NZS 3760: 2.3.3.1
(1 mark)

(b) (i)

- Insulation resistance test
- Earth leakage test

AS/NZS 3760: 2.3.3.2
(1 mark)

(ii) (1) Insulation resistance tester
(½ mark)

(2) 1 MΩ - minimum
AS/NZS 3760: 2.3.3.2
(1 mark)

(iii) (1) Ammeter or PAT tester
(½ mark)

(2) 5 mA - maximum
AS/NZS 3760: 2.3.3.2
(1 mark)

(c) Any TWO of:

- 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.

AS/NZS 3760: 2.3.2
(2 marks)

(d) Any TWO of:

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.
- AS/NZS 3760: 2.3.2

Or

From AS/NZS 3760:2003

- 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.

AS/NZS 3760: 2.3.2
(2 marks)

Question 8

- (a) (i) A practising licence
EA 95(1)
(1 mark)
- (ii) 30 June of the year it is stated to expire.
(also accept 1 July)
EA 100
(1 mark)
- (iii) The Registrar
100(4)
(1 mark)
- (b) • Safe working practices
• Testing
• CPR
• Basic first aid
ER 25
(4 marks)
- (c) 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)
(3 marks)

Question 9

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

- 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.

(4 marks)

(ii) Any TWO of:

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

AS/NZS 3000:2000: 1.7.3.4.1

AS/NZS 3000:2007: 1.5.4.4(a)

(2 marks)

- (iii) • The use of a key or tool
- An interlocking device is fitted
 - An intermediate barrier is provided

AS/NZS 3000:2000: 1.7.3.4.3

AS/NZS 3000:2007: 1.5.4.4(b)

(3 marks)

(b) Two

(1 mark)

Question 10

(a) Any FOUR of:

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

(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 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(2 marks)

(c) 500 V d.c.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(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 Ω on the 500 V d.c. range or 10 M Ω on the 1000 V d.c. range.

AS/NZS 3000:2000: 6.3.3.3.1

AS/NZS 3000:2007: 8.3.6.1

(1 mark)

(e) Any ONE of:

From AS/NZS 3000:2000

- 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)

or

From AS/NZS 3000:2007: 8.3.8.1

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

(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 3000:2000: 6.3.3.2.1

AS/NZS 3000:2007: 8.3.5.1

(2 marks)