Licensed Electrical Inspector RE Class Theory Assessment

Sample Paper Marking Guide Applicable from December 2023

Questions 1-11: Standards & Regulations

Q.1

Answer: AS/NZS 5033 (2 marks)

Reference document: Electricity Safety (General) Regulations (1 mark)

Clause number: 243 (2 marks)

Q.2

Answer:

- ✓ Bedroom
- ✓ Cinema / home theatre room
- × Laundry
- ✓ Kitchen
- × Garage
- ✓ Childrens playroom
- × Workshop
- ✓ Study

All must be correct to be awarded the marks (2 marks)

Reference document: AS/NZS 5139 (1 mark)

Clause number: 1.3.42 (2 marks)

Q.3

Answer: all live conductors (2 marks)

Reference document: AS/NZS 4777.1 (1 mark)

Clause number: 3.4.5 (a) (2 marks)

Q.4

No. (2 marks)

Reference document: AS/NZS 3000 (1 mark)

Clause number: 6.3.4.7 (2 marks)

Q.5

Yes. (2 marks)

Clause number: 1.4.29 (2 marks)

Q.6

6mm^2 (2 marks)

First Reference Document: AS/NZS 5033 (1 mark)

Clause Number: 4.6.5 (2 marks)

Second Reference Document: AS/NZS3000 (1 mark)

Clause/Table number: Table 5.1 (1 mark)

Q.7

Answer: the wiring system shall be identified by distinctive labels marked with the word 'SOLAR' on the exterior surface of the wiring system over the length of the enclosure at intervals not exceeding 2m.

(2 marks)

Reference document: AS/NZS 5033: (1 mark)

Clause number: 5.3.1.1(a) (2 marks)

Q.8

Any four of the below:

1. The electrical installation main switchboard
2. Stand alone power system switchboard
3. System shutdown procedure sign
4. The battery bank
5. Fuel tanks and storage for the generator set (petrol, diesel and/or LP Gas)
6. Other flammable or explosive substances relevant to the stand-alone system
7. The photovoltaic array and associated isolating switch(es)
8. All sources of renewable energy (2 marks)

All four must be correct to obtain the marks for this question.

Reference document: AS/NZS 4509.1 (1 mark)

Clause number: 2.4 (2 marks)

Q.9

Answer: True (2 marks)

Reference document: AS/NZS 1170.2 (1 mark)

Clause number: Figure 3.1(A) (2 marks)

Q.10

Answer: MAIN ISOLATOR (NORMAL SUPPLY) (2 marks)

Reference document: AS/NZS 4777.1 (1 mark)

Clause number: 6.2(d) (2 marks)

Q.11

Answer: In an area where an authorised person will be aware of the signal. (2 marks)

Reference document: AS/NZS 5139 (1 mark)

Clause number: 4.3.8 (2 marks)

Q.12 Voltage Rise

Inverter current I=P/V I = 10,000/(400x√3) = 14.43A. (1 mark)

1. Solar mains
   Cable size 4mm^2
   Cable Type: V90 multi core
   Table 42 Vc = 9.71 mV/A.m (1 mark)
   Vd = (20 x 14.43 x 9.71)/1000 = 2.80V (2 marks)
   Percentage = 2.80/400x100 = 0.7%
2. 3 phase sub mains
   Cable size 10mm^2
   Cable Type: V90 multi core
   Table 42 Vc = 3.86 mV/A.m (1 mark)
   Vd = (30 x 14.43 x 3.86)/1000 = 1.67V (2 marks)
   Percentage = 1.67/400x100=0.42%
3. 3 phase consumers mains
   Cable size 35mm^2
   Cable Type: X90 SDI Table 41 Vc = 1.18 mV/A.m (1 mark)
   Vd = (35 x 14.43 x 1.18)/1000 = 0.60V (2 marks)
   Percentage = 0.15%

   Total voltage rise = 2.80 + 1.67 + 0.60 = 5.07V (2 marks*)
   Total voltage rise percentage = 0.7 + 0.42 + 0.60 = 1.27%
   The voltage rise value must be <2% = 8V max

   *Note: this answer shows the voltage rise in voltages and as a percentage. Only one of these is required (candidate may choose their preferred option). Marks only allocated once in each section.

   Yes, the installation complies (2 marks)

***Note:** Questions 13-1 and 13-2 are provided on this sample paper to show the type of questions that may be supplied. Only one of these will appear on the assessment. Marks for Qu 13 should only be counted for one version of this question.

Q.13-1 PV module maximum voltage calculation – Method A*

AS/NZS 5033 clause 4.2.1.2 (a)

PV Panel Voc = 45V

T_{min} = 1.5°C (value from question information)

T_{stc} = 25°C (value from question information)

a) Calculate: Yv = Voltage temperature co-efficient V per °C of the module.

PV panel temperature coefficient of Voc = -0.28%/°C

PV Panel Voc = 45 Volts

Formula: Yv = PV panel temp coefficient x Panel Voc

Yv = -0.28%/ºC x 45 = -0.126 (2 marks)

Formula: Vmod max = Voc mod + Yv (Tmin - Tstc)

Vmod max = 45 + -0.126 (1.5 – 25)

= 45 + -0.126 x -23.5

= 45 + 2.97

Vmod max = 47.97 V dc (3 marks)

b) Using your answer in question 1. How many modules in a single string can be connected to the inverter specified above?

Formula: Modules/string = Inverter Vmax ÷ Vmod max

Therefore: Modules/string = 600 / 47.97 = 12.51

Answer: 12 Modules (2 marks)

Q.13-2 PV module maximum voltage calculation – Method B*

AS/NZS 5033 clause 4.2.1.2 (b)

a) Determine panel Voc

Determining V / ºC from %

V/°C = Off load Voltage (Volts) x Temperature Coefficient (%)

V/°C = 46.29 x -0.37% = 46.29 x -0.37/100

V/°C = 46.29 x -0.0037 = -0.17 V/°C

V/°C = - 0.17 V/°C (2 marks)

Calculate the difference from STC (25 ºC)

Melbourne min. temp.= - 3.3ºC

Calculate the difference from STC (25 ºC)

Diff = Tmin – Tstc

-3.3 - 25 = -28.3 ºC (1 mark)

Determine the voltage of the panel at -3.3 ºC

Voc + (V / ºC X Temp diff)

46.29 + (-0.17 X -28.3) =

46.29 + (4.81V) =

V mod max = 51.1V (2 marks)

b). Calculate the maximum number of panels that can be installed

Panels = 600Vmax / 51.1 Vmod max = 11.74

Therefore = 11 panels (2 marks)

Q.14 PV module maximum voltage calculation – Method C

AS/NZS 5033 clause 4.2.1.2 (c)

a) Calculate the PV module maximum voltage (Vmod max)

Formula: Voc mod corrected = Voc mod x correction factor from table 4.1

From AS/NZS 5033 Table 4.1, correction factor is 1.10 (1 mark)

Therefore: Vmod max = 47 x 1.10 = 51.70 V dc (1 mark)

b) Using your answer in part a). How many modules in a single string can be connected to the inverter specified above?

Formula: Modules/string = Inverter Vmax ÷ Voc corrected

Therefore: Modules/string = 600 VDC / 51.70 = 11.6 (2 marks)

Answer: 11 Modules Maximum

Q.15 String Current

a) Istring max = 1.25 x Ki x Isc mod

= 1.25 x 1 x 10.31 (1 mark)

= 12.89 A (1 mark)

Standard: AS/NZS 5033 Clause: 3.3.3.1

b) If string = (Sa-1) x Istring max

= (3-1) x 12.89 (1 mark)

= 2 x 12.89

= 25.78 A (1 mark)

Standard: AS/NZS 5033 (1 mark)

Part a) Clause: 3.3.3.1 (1 mark)

Part b) Clause 3.3.3.2 (1 mark)

Q.16

Answer: Not less than two openings or doorways, spaced well apart, shall be provided (2 marks)

Reference document: AS/NZS 3010: 2017 (1 mark)

Clause number: 3.2.3.2 (2 marks)

Q.17

Answer: No (2 marks)

Reference document: AS/NZS 3010: 2017 (1 mark)

Clause number: 2.7.9 (2 marks)

OR

Reference document: AS/NZS 3000: 2018 (1 mark)

Clause number: 2.3.3.4(b) (2 marks)

Either Standard is acceptable, marks only awarded once.

Q.18

Answer: the requirements for synchronization shall be obtained from the electricity distributor. (2 marks)

Reference document: AS/NZS 3010 (1 mark)

Clause number: 2.4.3 (2 marks)

Q.19a

Answer: C (2 marks)

Reasoning: *Fault occurs on Generator active to frame that is at earth potential, fault current must flow through generator earth and then submain earth conductor to MEN connection at main Switchboard and then return via submain Neutral and the Generator Neutral to generator windings to operate protective device.*

Q.19b

Part i) Calculate conductor impedances:

Table 34

Rc = 0.668 Ω/km for 35mm^2 cables (1 mark)

Rc = 2.33 Ω/km for 10mm^2 cables (1 mark)

Generator internal cabling

Active: 35mm^2 Table 34	1m x 0.668/1000 = 0.00067Ω	(1 mark)
Neutral: 35mm^2 Table 34	1m x 0.668/1000 = 0.00067Ω	(1 mark)

Generator Mains (Consumer mains).

Active: 35mm^2 Table 34	25m x (0.668/1000) = 0.01670Ω	
Neutral: 35mm^2 Table 34	25m x (0.668/1000) = 0.01670Ω	(1 mark)
Earth: 10mm^2 Table 34	27m x (2.33/1000) = 0.06291Ω	(1 mark)

Tenancy Submains

Active: 35mm^2 Table 34	35m x (0.668/1000) = 0.02338Ω	
Neutral: 35mm^2 Table 34	35m x (0.668/1000) = 0.02338Ω	(1 mark)
Earth: 10mm^2 Table 34	35m x (2.33/1000) = 0.08155Ω	(1 mark)

Fault current path impedance

Generator Active internal + Generator Mains Earth + Submains Earth + Submains Neutral + Generator mains Neutral + Generator Neutral Internal

0.00067Ω + 0.06291Ω + 0.08155Ω + 0.02338Ω + 0.01670Ω + 0.00067Ω =

Total fault current path impedance = 0.18588 Ω (1 mark)

Part ii) Calculate Generator internal impedance

Z int = Uo / Ia = 230V/3250A = 0.07077 Ω (1 mark)

The installation is not compliant. Fault loop impedance fails as the fault loop cable resistances are greater than the internal resistance of the Generator and will not provide enough fault current to the Generator protective device to operate in the fault condition. (1 mark)

Q.20

Is this compliant? No (2 marks)

Clause No. 2.7.1 and Figure 2.1 note 1. (1 mark)