higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

RENEWABLE ENERGY TECHNOLOGIES
NQF LEVEL 2

17 November 2022

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 1.1.1 True
1.1.2 False
1.1.3 True
1.1.4 False
1.1.5 True
1.1.6 True
1.1.7 True
1.1.8 True

(8 × 1) (8)

1.2 1.2.1 **Advantages:**

- Predictable 24/7 power can provide base, intermediate or peak load for demand
- Can expand irrigation
- Can provide drinking water

Disadvantage:

- Limited locations are available
- Restricts areas with flowing water and create environmental stress on water ecosystems
- Can destabilise relations between regions or neighbouring countries
- Dam building is very costly
- Often people have to be relocated

1.2.2 **Advantage:**

- Can provide electrical energy on a decentralised scale (small scale to medium size installations) potentially benefitting local communities
- Some used land can be utilised simultaneously, both to produce electrical energy and for agriculture

Disadvantages:

- Dam building is very costly
- Often people have to be relocated
- Variation of power density and duration can be a problem without modern forecasting and smart-grid technology
- Can be noisy
- Can endanger biodiversity: moving turbine blades are a serious threat to birds and bats

1.2.3 **Advantages:**

- Predictable 24/7 power can provide base, intermediate or peak load for demand due to unique storage option
- CSP-plants can be placed in dry inhospitable locations

Disadvantages:

- Limited locations are available
- High water demand in arid or semi-arid environments
- Can endanger biodiversity: CSP facilities are a 'No Fly Zone', lethal to essentially all the birds, bats, and insects that have the misfortune of entering the airspace

1.2.4 **Advantages**:

- Electrical energy generation without mechanically moving parts in a totally silent mode, a perfect solution for urban areas and for residential applications
- Residential solar panels (rooftop) are easy to install without any interference to residential lifestyle
- Electrical energy generation via PV coincides with energy needs for cooling and PV can provide an effective solution to energy demand peaks, especially in hot summer months were energy demand is high for cooling
- Operation and maintenance costs are low (almost negligible)

Disadvantages:

- Intermittency issues, no or limited generation at night and on cloudy or rainy days
- Land-mounted PV panel installations require relatively large areas for deployment
- Further research is required for recycling of PV modules

ONE mark for any advantage and ONE mark for any disadvantage (4 × 2) (8)

1.3

$$E_V = \frac{P \times K_\lambda}{A} \checkmark$$
$$= \frac{60 \times 15}{18} \checkmark\checkmark$$
$$= 50 \text{ lux} \checkmark$$

(4)

1.4

- The latitude
- The time of the year (2)

1.5

- The earth's distance from the sun
- The earth's tilt (2)

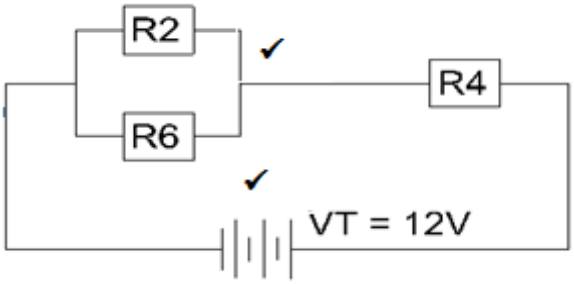
[24]

QUESTION 2

2.1
- Understanding energy costs (the why, when, how and where energy flows)
- Identifying potential savings
- Proposing cost benefit recommendations (3)

2.2
A: Fluorescent tube
B: Power supply
C: Starter
D: Switch
E: Capacitor
F: Filaments
G: Ballast (7)

2.3 2.3.1



(2)

2.3.2

$$R_p = \frac{R_2 \times R_6}{R_2 + R_6}$$
$$= \frac{2 \times 6}{2+6} \checkmark$$
$$= 1.5\,\Omega \checkmark$$

$$R_T = R_p + R_4$$
$$= 1.5 + 4$$
$$= 5.5\Omega \checkmark$$

(3)

2.3.3

$$I_T = \frac{V_T}{R_T}$$
$$= \frac{12}{5.5} \checkmark$$
$$= 2.182\,A \checkmark$$

(2)

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2.3.4

$$V_p = I_T \times R_p$$
$$= 2.182 \times 1.5$$
$$= 3.273\,V \checkmark$$
$$V_{2\Omega} = V_{6\Omega} = V_p = 3.273\,V \checkmark$$

$$V_{4\Omega} = I_T \times R_4$$
$$= 2.182 \times 4 \checkmark$$
$$= 8.728\,V \checkmark$$

(4)

2.3.5

$$I_{2\Omega} = \frac{V_p}{R_2}$$
$$= \frac{3.273}{2} \checkmark$$
$$= 1.637\,A \checkmark$$

$$I_{6\Omega} = \frac{V_p}{R_6}$$
$$= \frac{3.273}{6} \checkmark$$
$$= 0.546\,A \checkmark$$

(4)
[25]

QUESTION 3

3.1

- Good housekeeping: Keep the working environment clean and tidy, with floors and access routes kept clear of obstacles
- Remove rubbish regularly so it does not build up
- Cleaning and maintenance: Remove rubbish regularly and keep work areas clear
- Cleaning methods and equipment must be suitable for the surface being treated.
- Good lighting levels: Position lights to ensure all floor areas are evenly lit and all potential hazards, obstructions and spills can be clearly seen
- Floors should be checked for damage regularly and maintenance carried out when necessary. Potential hazards include holes, cracks, or loose carpets and mats.
- Floor surfaces should be suitable for the work carried out, for example, it may need to be resistant to oil and chemicals used in production processes. Coating or chemically treating existing floors can improve their slip-resistant properties.
- Handrails on stairs, slip-resistant covers for steps, high visibility and non-slip markings of the front edges of steps and good lighting can all help to prevent slips and trips on stairs

- Clean up spills immediately using an appropriate cleaning method. Use warning signs where the floor is wet and arrange alternative routes.
- Remove obstructions. If this is not possible, then suitable barriers and warning notices should be used. (Any 4 × 1) (4)

3.2
- Notify others that the equipment will be shut down.
- Perform a controlled shutdown to power down the equipment.
- Open all of the energy isolating devices identified on the equipment's specific LOTO procedure.
- Lock and tag all energy isolating devices.
- Dissipate or restrain stored or residual energy.
- Verify that the equipment is completely de-energised by attempting to cycle it. (Any 4 × 1) (4)

3.3
- Physical hazards
- Chemical hazards
- Biological hazards
- Electrical hazards
- Slip hazards
- Trip and fall hazards (Any 4 × 1) (4)

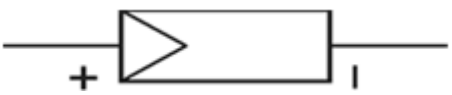
[12]

QUESTION 4

4.1
4.1.1 E
4.1.2 D
4.1.3 H
4.1.4 F
4.1.5 G
4.1.6 I
4.1.7 J
4.1.8 B
4.1.9 C
4.1.10 A

(10 × 1) (10)

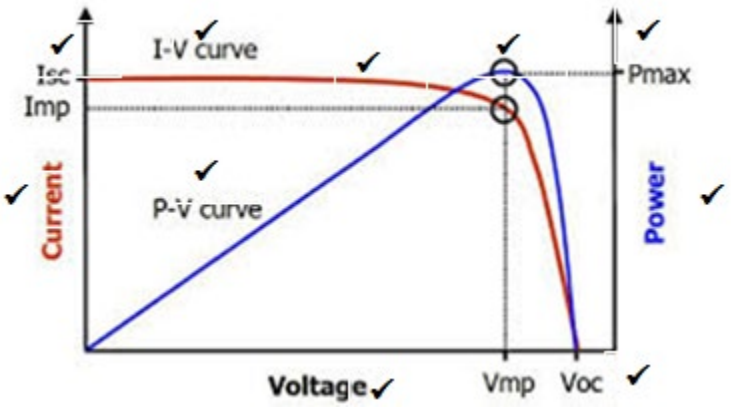
4.2
4.2.1 

4.2.2 

4.2.3 

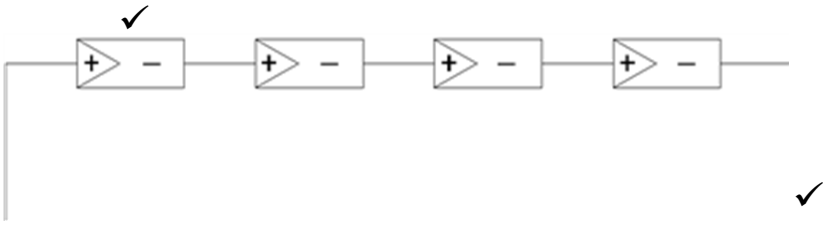
(3 × 1) (3)

4.3



(10)

4.4 4.4.1



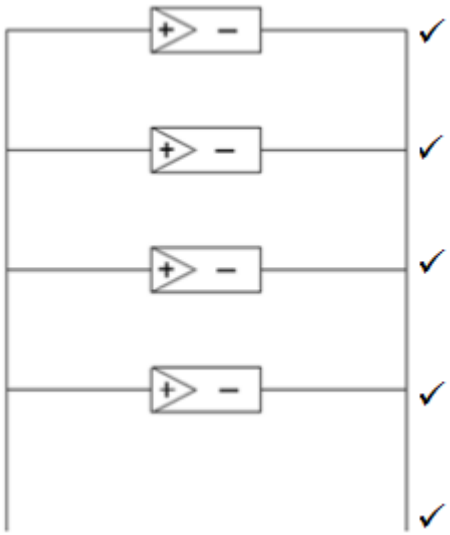
(5)

4.4.2

$$V_T = V_{mp1} + V_{mp2} + V_{mp3} + V_{mp1}$$
$$= 17.5 + 17.5 + 17.5 + 17.5$$
$$= 70\text{V}$$

(3)

4.4.3



(5)

4.4.4

$$I_T = I_{mp1} + I_{mp2} + I_{mp3} + I_{mp1}$$
$$= 5 + 5 + 5 + 5$$
$$= 20\text{A}$$

(3)
[39]

TOTAL: 100

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