higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N6

2 August 2021

This marking guideline consists of 6 pages.

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QUESTION 1: TRANSIENTS

$$T = RC$$
$$= 20 \times 10^3 \times 50 \times 10^{-6} = 1\ S\checkmark$$

$$V_C@t = 0\ S = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-0}{1}} = 100\ V\checkmark$$

$$V_C@t = 1 = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-1}{1}} = 36{,}788\ V\checkmark$$

$$Vc@t = 2 = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-2}{1}} = 13{,}534\ V\checkmark$$

$$Vc@t = 3 = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-3}{1}} = 4{,}979\ V\checkmark$$

$$Vc@t = 4 = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-4}{1}} = 1{,}832\ V\checkmark$$

$$Vc@t = 5 = E_M \times e^{\frac{-t}{T}}$$
$$= 100 \times e^{\frac{-5}{1}} = 0{,}674\ V\checkmark$$



Mark allocation:
Allocate ONE mark each for the following: horizontal axes, vertical axes.
Allocate TWO marks for the curve. **[11]**

QUESTION 2: TRANSDUCERS

2.1
- Transducers
- Signal conditioners
- Visual display units
- Graphic recording instruments
- Computer systems (5)

2.2
- Transducer
- Signal conditioner
- Scanner or multiplexer
- Signal converter
- A/D converter
- Digital recorder
- Auxiliary equipment and system programmer (7)

[12]

QUESTION 3: ULTRASONICS

3.1
- Power supply
- Ultrasonic generator
- Feedback winding
- Exciter winding
- DC bias winding
- Coupling cone (6)

3.2
3.2.1 D
3.2.2 C
3.2.3 B
3.2.4 A

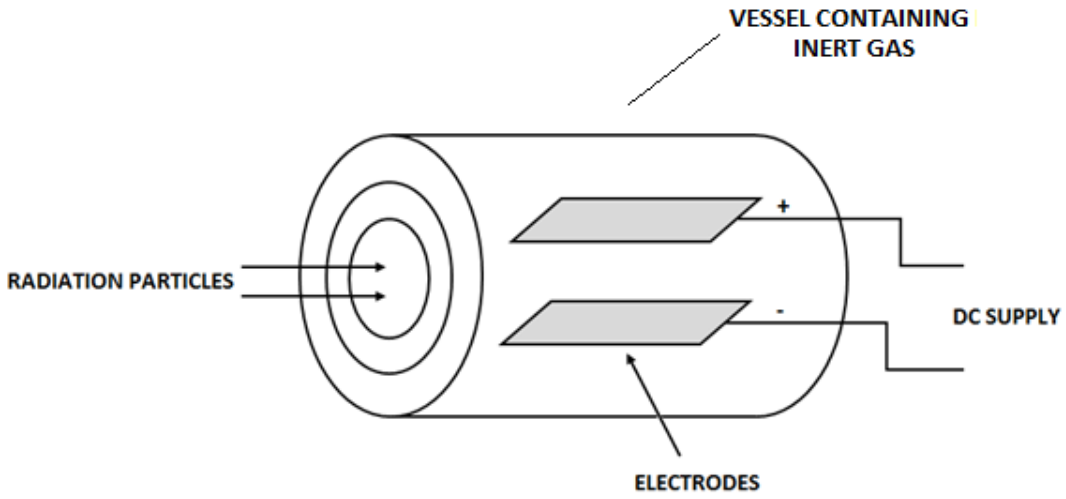
(4 × 1) (4)

[10]

QUESTION 4: X-RAYS AND RADIO-ACTIVITY

4.1
- Gas-filled counting tube
- Window for radiation particles
- Inner electrode
- Outer electrode
- Output operational amplifier (5)

4.2



Mark allocation:
Allocate ONE mark for each correct label and ONE mark for the diagram. (5)
[10]

QUESTION 5: AUTOMATIC INSPECTION, TESTING AND NDT

5.1 5.1.1

$$t = \frac{2 \times d}{\text{V}}$$
$$= \frac{2 \times 0{,}125}{1{,}5 \times 10^{6}} \checkmark$$
$$= 166{,}667 \text{ nS} \checkmark$$
$$\therefore \text{PRR} = \frac{1}{\text{t}} = \frac{1}{166{,}667 \text{ nS}} \checkmark = 6 \text{ kHz} \checkmark$$

(4)

5.1.2

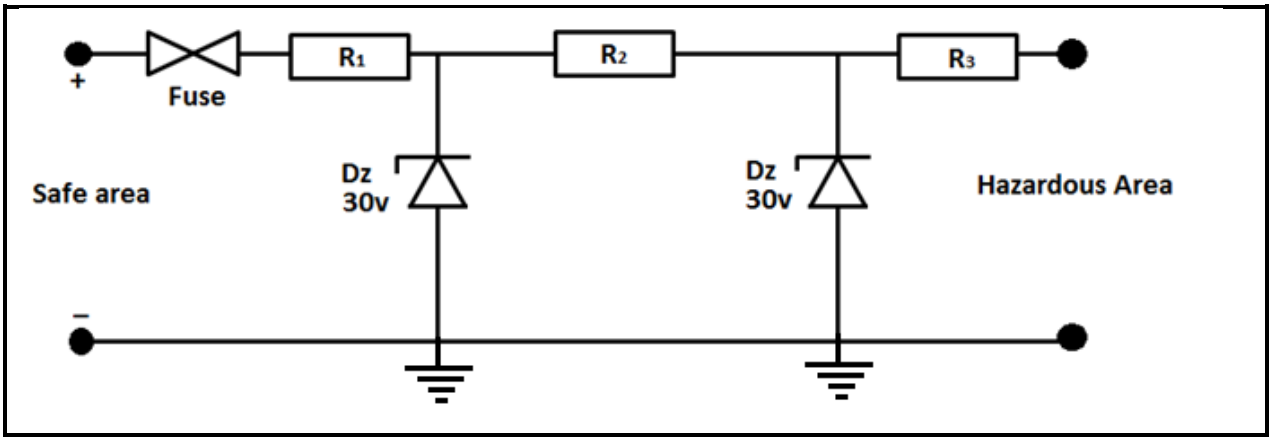
$$d = \frac{v \times t}{2}$$
$$= \frac{6 \times 10^{3} \times 12{,}5 \times 10^{-6}}{2} \checkmark$$
$$= 37{,}5 \text{ mm} \checkmark$$

(2)

5.2
- Production line
- Feedback line
- Display unit
- Inspection and testing
- Sorting
- Approved products
- Rejected products (7)

[13]

QUESTION 6: ELECTRONIC SAFETY DEVICES



Mark allocation:
Allocate ONE full mark for each correct label and ONE half mark for each ground terminal. **[9]**

QUESTION 7: ELECTRONIC POWER CONTROL

7.1
- Products can be modified on the production line by making changes to the CAD system.
- The CAM system will automatically reproduce design changes on the production line.
- Twenty-four-hour productive production without skilled supervision is possible. (3)

7.2
- Electronic engineering:✓ IC design✓
- Electrical engineering:✓ Transformer design✓
- Civil engineering:✓ Architectural design✓
- Mechanical engineering:✓ Sheet metal work design✓ (4 × 2) (8)

[11]

QUESTION 8: THYRISTOR DEVICES AND SCR SPEED CONTROL

8.1
$$V_{PEAK} = \sqrt{2} \times V_{RMS}\checkmark$$
$$= \sqrt{2} \times 24\checkmark$$
$$= 33{,}941\ V\checkmark$$

$$I_{PEAK} = I_{MAX}\checkmark$$
but $I_{MAX} = 1{,}5\ A$ given✓
$$I_{PEAK} = 1{,}5\ A\checkmark$$ (3 × 2) (6)

8.2
- High efficiency
- Low motor cost
- Light weight
- High torque
- Low maintenance
- Wide range of motor designs

(6)
[12]

QUESTION 9: PROGRAMMABLE LOGIC CONTROLLERS

9.1
- Input module
- Input buffer
- Parallel-to-serial converter
- Central processing unit
- Serial-to-parallel converter
- Expansion socket
- Output buffer
- Output module

(8)

9.2
- Programmer
- Programmable controller
- Expansion units

(3)

9.3 Complementary metal oxide semiconductor (1)
[12]

TOTAL: 100