higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N6

22 November 2022

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1

$$T = RC$$
$$= 10 \times 10^3 \times 100 \times 10^{-6}$$
$$= 1\ S\checkmark$$

$$I_M = \frac{V_S}{R}$$
$$= \frac{15}{10 \times 10^3}$$
$$= 1.5\ mA\checkmark$$

At t = 5

$$V_C = V_M\left(1 - e^{\frac{-t}{T}}\right)$$
$$= 15\left(1 - e^{\frac{-5}{1}}\right)\checkmark$$
$$= 15\ V\checkmark \quad (4)$$

1.1.2

$$V_R = V_S \times e^{\frac{-t}{T}}$$
$$= 15 \times e^{\frac{-5}{1}}\checkmark$$
$$= 0.1011\ V\checkmark$$
$$= 0\ V \quad (2)$$

1.1.3

$$i = I_M \times e^{\frac{-t}{T}}$$
$$= 1.5 \times 10^{-3} \times e^{\frac{-5}{1}}\checkmark$$
$$= 0\ A\checkmark \quad (2)$$

1.2 1.2.1 Exponential laws
1.2.2 Kirchhoff's voltage law

(2 × 1) (2)
[10]

QUESTION 2

2.1
- Feedback resistor✓
- Input resistor✓

Relation: The two resistors must have equal resistance values under unity gain conditions.✓ (3)

2.2
2.2.1 True (2)
2.2.2 True (2)
2.2.3 True (1)
2.2.4 False (1)
2.2.5 False (1)

2.3
$$V_i = \frac{I_L \times R_1 \times R_D}{R_2}$$
$$\therefore R_2 = \frac{I_L \times R_1 \times R_D}{V_i} \checkmark$$
$$= \frac{20 \times 10^{-3} \times 20 \times 10^{-3} \times 2 \times 10^{-3}}{5} \checkmark$$
= 160 kΩ✓ (3)

[13]

QUESTION 3

3.1
3.1.1 False
3.1.2 True
3.1.3 False
3.1.4 False
3.1.5 False

(5 × 1) (5)

3.2
3.2.1 B
3.2.2 D
3.2.3 C
3.2.4 A

(4 × 1) (4)

3.3
- Cleaning tub
- Cleaning fluid
- Ultrasonic transducers/Ultrasonic generator/Power supply unit (3)

[12]

QUESTION 4

4.1 $$\lambda = \frac{h \times V}{E \times q}$$

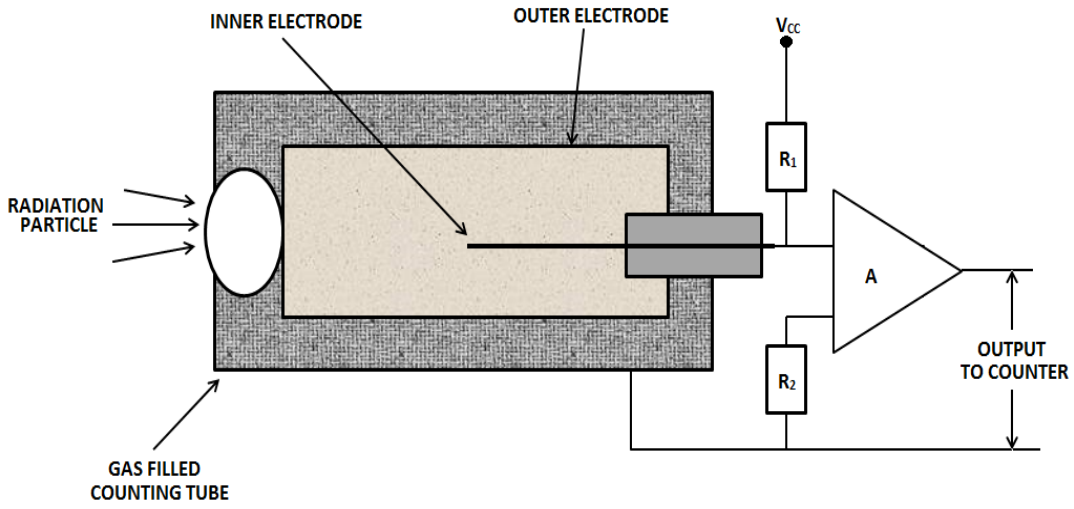
$$\lambda = \frac{6.626\times10^{-35}\times2.997\times10^{8}}{90\times10^{3}\times1.602\times10^{-19}}$$ ✓✓

$$\lambda = 1.377 \times 10^{-11} M$$ ✓ (3)

4.2
4.2.1 A vacuum
4.2.2 Soft X-rays
4.2.3 Hard X-rays
4.2.4 Atomic weight
4.2.5 Inner atoms

(5 × 1) (5)

4.3



(6)
[14]

QUESTION 5

5.1
5.1.1 Reflectoscope
5.1.2 Sonar method
5.1.3 Radar method
5.1.4 Sonar method
5.1.5 Resonance method

(5 × 1) (5)

5.2
- Search coil oscillator
- Mixer
- Filter
- Rectifier
- Reference oscillator

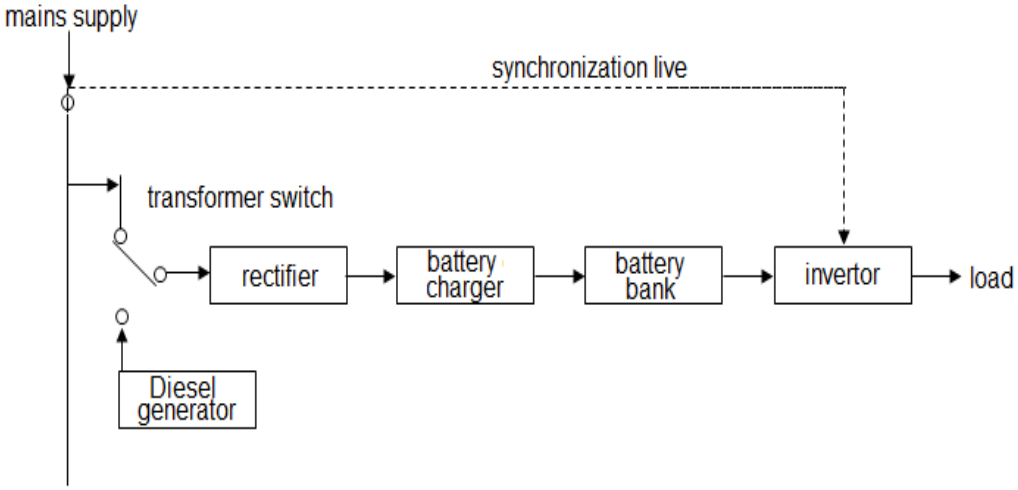
(5)
[10]

QUESTION 6

6.1 6.1.1 D
6.1.2 B
6.1.3 C
6.1.4 A

(4 × 1) (4)

6.2



(7)
[11]

QUESTION 7

7.1 7.1.1 Photoconductive cell (2)

7.1.2
- Optical fibres
- Mirrors
- Lenses
- Prisms (4)

7.2
- Medium for transmission
- Optical receiver (2)

7.3
- Series protective elements
- Shunt protective elements
- Series shunt protective elements (3)

[11]

QUESTION 8

8.1 8.1.1 Half controlled three-phase bridge (1)

8.1.2 Star connection (1)

8.1.3 $V_{MEAN} = \frac{3\times\sqrt{3}\times\sqrt{2}}{2\pi} \times V_{PHASE} \times (1 + \cos\alpha)$✓

$= \frac{3\times\sqrt{3}\times\sqrt{2}}{2\pi} \times 180 \times (1 + \cos 90^{\circ})$✓

$= 210.518\ V$✓

LESS SCR VOLT DROP✓

$= 210.518 - 1.5$✓

$= 209.018\ V$✓ (6)

8.1.4 $PIV = \sqrt{2} \times V_{LINE}$✓

$but\ V_{LINE} = \sqrt{3} \times V_{PHASE}$

$PIV = \sqrt{2} \times \sqrt{3} \times V_{PHASE}$✓

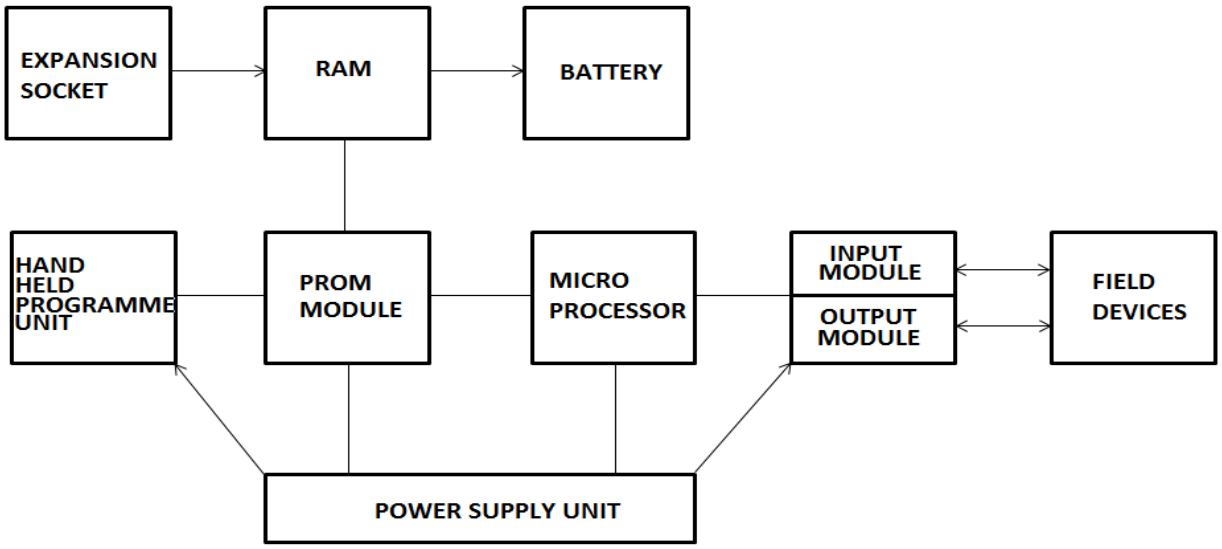
$= \sqrt{2} \times \sqrt{3} \times 180$✓

$= 441\ V$✓ (4)

8.2
- Constant voltage AC drive
- Constant current AC drive
- Frequency-controlled AC drive (Any 2 × 1) (2)

[14]

QUESTION 9



(½ mark for each block) **[5]**

TOTAL: 100

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