higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N6

26 November 2024

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1

$$i = I_M \left[1 - e^{\frac{-t}{T}}\right] \checkmark$$

$$I_M = \frac{i}{\left[1 - e^{\frac{-t}{T}}\right]} \checkmark$$

$$= \frac{0.425}{1 - e^{\frac{-5.25 \times 10^{-3}}{4.25 \times 10^{-3}}}} \checkmark\checkmark$$

$$= 0.599\ A \checkmark \quad (5)$$

1.1.2 $V_S = I_M \times R \checkmark$

$$\therefore R = \frac{V_S}{I_M} \checkmark$$

$$= \frac{120}{0.599} \checkmark$$

$$200.334\ \Omega \checkmark \quad (4)$$

1.1.3 $T = \frac{L}{R}$

$$L = T \times R \checkmark$$

$$= 4.25 \times 10^{-3} \times 200.334 \checkmark$$

$$= 851.419\ mH \checkmark \quad (3)$$

1.2 Advantage
The effect of resonance is put to good use in radio communication.

Disadvantage
Ringing RLC circuits produce undesirable voltage and current peaks on power supply circuits. (2)

[14]

QUESTION 2

2.1 2.1.1 Microphones
2.1.2 Amplifier
2.1.3 Loudspeakers
2.1.4 Connecting cables

(4 × 1) (4)

2.2 2.2.1 Microphone:
Input energy = Sound Energy✓
Output Energy = Electronic Energy✓ (current signal)

2.2.2 Amplifier:
Input energy = Electrical Energy✓ (current signal)
Output Energy = Electronic Energy✓ (current signal; amplified version)

2.2.3 Loudspeaker:
Input energy = Electrical Energy✓ (current signal)
Output Energy = Sound Energy✓ (amplified version)

(3 × 2) (6)

2.3 It compares two analogue signals on the input✓ and generates a digital output signal of the relative states of the inputs.✓ (2)

[12]

QUESTION 3

3.1 3.1.1 Oscillating force
3.1.2 Crystal
3.1.3 Electrodes
3.1.4 Output voltage

(3 × 1) (3)

3.2 3.2.1 Short
3.2.2 Abrasive particles
3.2.3 Heated
3.2.4 Plastic
3.2.5 Perforated

(5 × 1) (5)

[9]

QUESTION 4

4.1
- Density
- Atomic Weight (2)

4.2
- Step-up transformer
- Autotransformer
- Voltage multiplier circuit
- Voltage rectifier circuit (4)

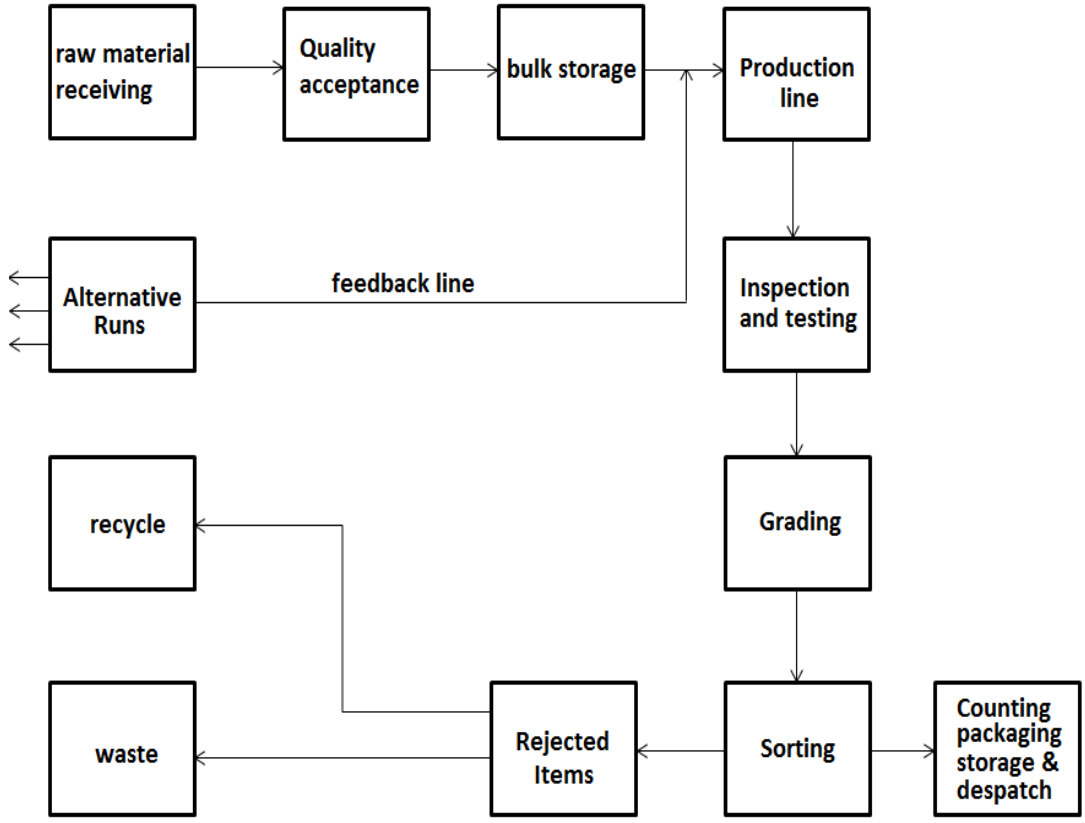
4.3
- Atomic number
- Number of electrons penetrating the target
- Applied Voltage (3)

4.4
- Cathode sensitivity
- Emission factor of each stage
- Number of stages (3)

[12]

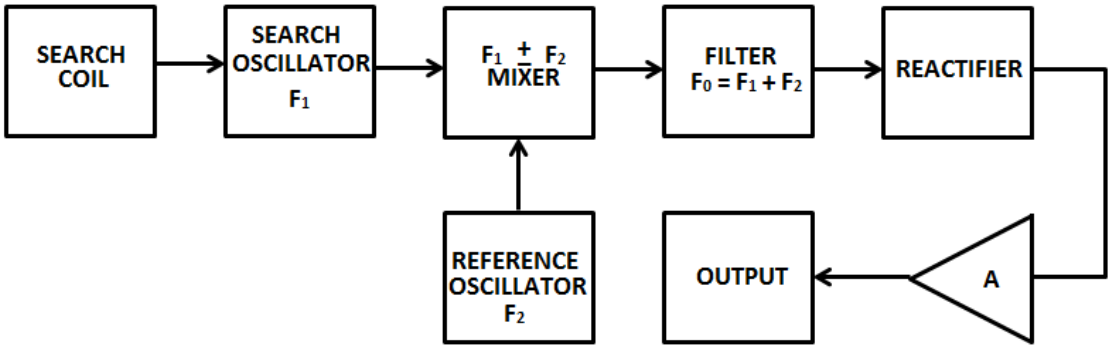
QUESTION 5

5.1



(Allocate ½ a mark for each of the blocks) (7)

5.2



(Allocate ½ a mark for each of the blocks, including the Op-Amp) (4)

[11]

QUESTION 6

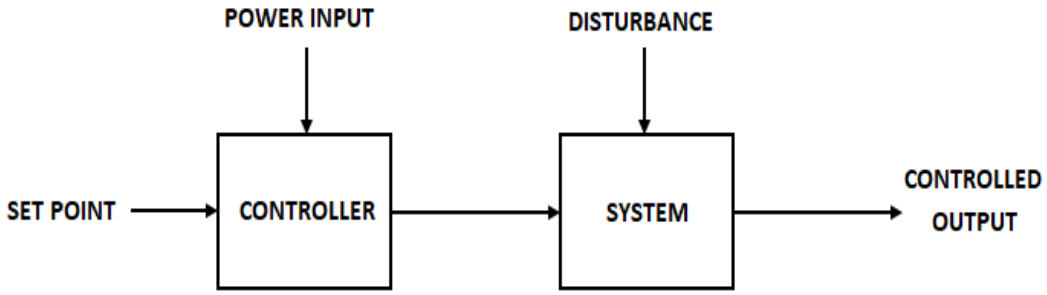
6.1
- Circuit analysis
- Evaluation
- Construction review
- Transformer construction
- Isolation by encapsulation (5)

6.2
- Diodes
- Resistors
- Capacitors (3)

[8]

QUESTION 7

7.1



Open-loop control system ✓

(Mark Allocation
(Allocate one full mark for each block and each label) (7)

7.2
- Critical damping
- Under-damping
- Over-damping (3)

[10]

QUESTION 8

8.1 8.1.1 $R_{TH} = \frac{T_1 - T_2}{P}$ ✓

$= \frac{125-30}{40.25}$ ✓

$= 2.36\,^{\circ}\frac{C}{W}$ ✓

8.1.2 $R_{HS} = R_{TH} - R_J$ ✓

$= 2.36 - 1.08$ ✓

$= 1.28\ ^{\circ}C/w$ ✓

8.1.3 Base temperature

$T_b = T_a + (P \times R_{HS})$ ✓

$= 30 + (40.25 \times 1.28)$ ✓

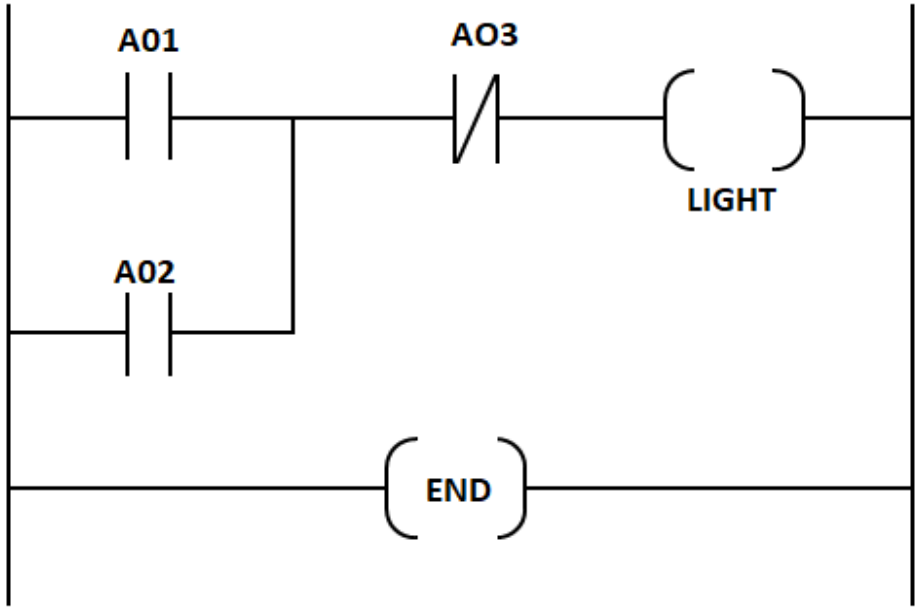
$= 81.52\ ^\circ C$ ✓

(3 × 3) (9)

8.2
- Dynamic braking
- Regenerative braking
- Plugging (3)

[12]

QUESTION 9



(Mark Allocation:
(Allocate two full marks for each labelled symbol and one full mark for each rung) **[12]**

TOTAL: 100

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