higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N6

28 November 2023

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 6,32 V = 63,2% or 10 V✓

It takes one time constant (the first one) for the capacitor voltage to reach 63,2% of the value of the supply to the circuit.✓

Therefore:

$1T = RC$
$= 100 \times 10^3 \times 22 \times 10^{-9}$
2,2 ms✓ (3)

1.2 $Solution$: $\frac{1}{LC} = \frac{R^2}{4L}$✓

$4L = R^2.LC$

$C = \frac{4L}{R^2}$ ✓

$= \frac{4 \times 2}{10^2}$

$= 0{,}08\ F$✓ (3)

1.3.1 85% of full brightness = 85% maximum current✓

$\therefore i = \frac{85}{100} \times I_{max}$✓

$But\ I_{max} = \frac{V}{R} = \frac{120}{15} = 8\ A$✓

$\therefore i = \frac{85}{100} \times 8 = 6{,}8\ A$✓ (4)

1.3.2 $T = \frac{L}{R} = \frac{3}{15} = 0{,}2\ S$✓

$i = I_M\left(1 - e^{\frac{-t}{T}}\right)$

$= 8\left(1 - e^{\frac{-0{,}3}{0{,}2}}\right)$✓
$= 6{,}125\ A$✓ (3)
[13]

QUESTION 2

2.1 Step 1: Calculate the value of the input voltage of the signal conditioning system.

$C_{max} = V_{i(max)} \div \frac{V}{°C}$

$\therefore V_{i(max)} = °C_{max} \times \frac{V}{°C}$✓

$= 500 \times \frac{1 \times 10^{-3}}{10}$✓

$= 50\ mV$✓

Step 2: Calculate the value of the metering resistor.

$V_i = \frac{V_O.R_M}{R_M+R_F}$✓

$V_i(R_M + R_F) = V_O.R_M$

$V_i.R_M + V_iR_F = V_O.R_M$✓

$V_i.R_M - V_O.R_M = -V_iR_F$

$R_M(V_i - V_O) = -V_iR_F$ ✓

$R_M = \frac{-V_iR_F}{(V_i-V_O)}$✓

$= -\frac{50 \times 10^{-3} \times 100 \times 10^3}{50 \times 10^{-3}-5}$✓

$= -(-1{,}01 \times 10^3)$✓

$= 1{,}01\ K\Omega$✓ **[10]**

QUESTION 3

3.1 Oxide film
3.2 Acoustic energy
3.3 Feedback circuit
3.4 Nodal line
3.5 Magnetostriction
3.6 Converse piezoelectric effect
3.7 Cavitation
3.8 Direct piezoelectric effect
3.9 Soft tool tip
3.10 Heated tool tip

(10 × 1) **[10]**

QUESTION 4

4.1 $Amplification = S^n$

$= 4^6$✓

$= 4\,096$✓ (2)

4.2 $Supply\ rating = volts\ per\ stage \times no.of\ stages$

$= 165\ \times 6$✓

$= 990\ V$✓ (2)

4.3 $Tube\ sensetivity = cathode\ sensitivity\ \times A$

$= 33\ \times 10^{-6} \times 4096$✓

$= 135{,}168\ mA/\ lumen$ ✓ (2)

4.4 $I_{max} = \max safe\ illumination\ \times tube\ sensitivity$

$\max safe\ illumination = \frac{I_{max}}{tube\ sensitivity}$✓

$= \frac{3{,}3 \times 10^{-3}}{135{,}168 \times 10^{-3}}$✓

$= 24{,}4\ lumen$✓ (3)

[9]

QUESTION 5

5.1
5.1.1 B
5.1.2 B
5.1.3 D
5.1.4 A
5.1.5 C

(5 × 1) (5)

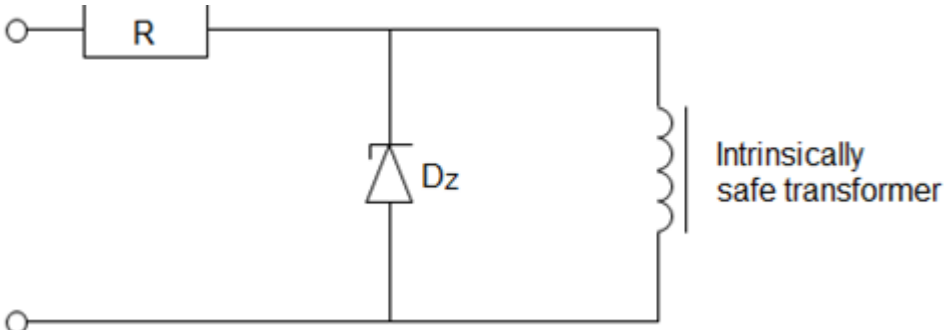
5.2
- To prevent damage to machinery
- To prevent contamination of processed foods

(2)

[7]

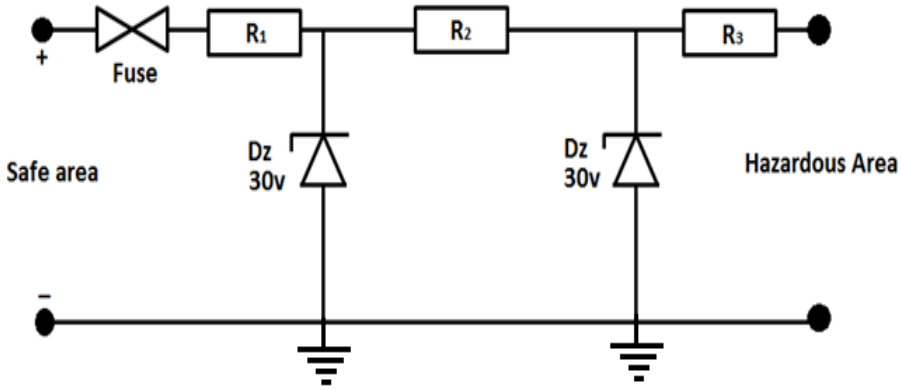
QUESTION 6

6.1



Allocate one full mark for each correct label (3)

6.2



Allocate one full mark for each correct label and symbol (9)
[12]

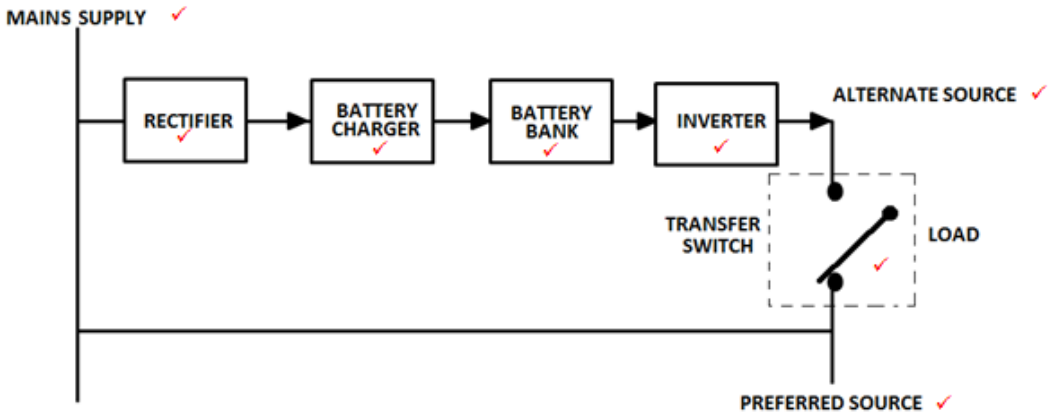
QUESTION 7

7.1 Rectifier (1)

7.2 Inverter (1)

7.3 7.3.1 True
7.3.2 True
(2 × 1) (2)

7.4 Name of UPS system: Transfer type
Standby type
Off-line type (Any ONE) (1)



(8)
[13]

QUESTION 8

$At\ switch-on\ i(t) = I_M\left[1 - e^{\frac{-t}{T}}\right]$ ✓✓

$But\ I_M = \frac{V}{R} = \frac{200}{40} = 5A$ ✓

$And\ T = \frac{L}{R} = \frac{1}{40} = 25\ ms$✓

$And\ t = pulse\ width = 100\ \mu S$ ✓

$\therefore i_{(t)} = I_M\left[1 - e^{\frac{-t}{T}}\right]$

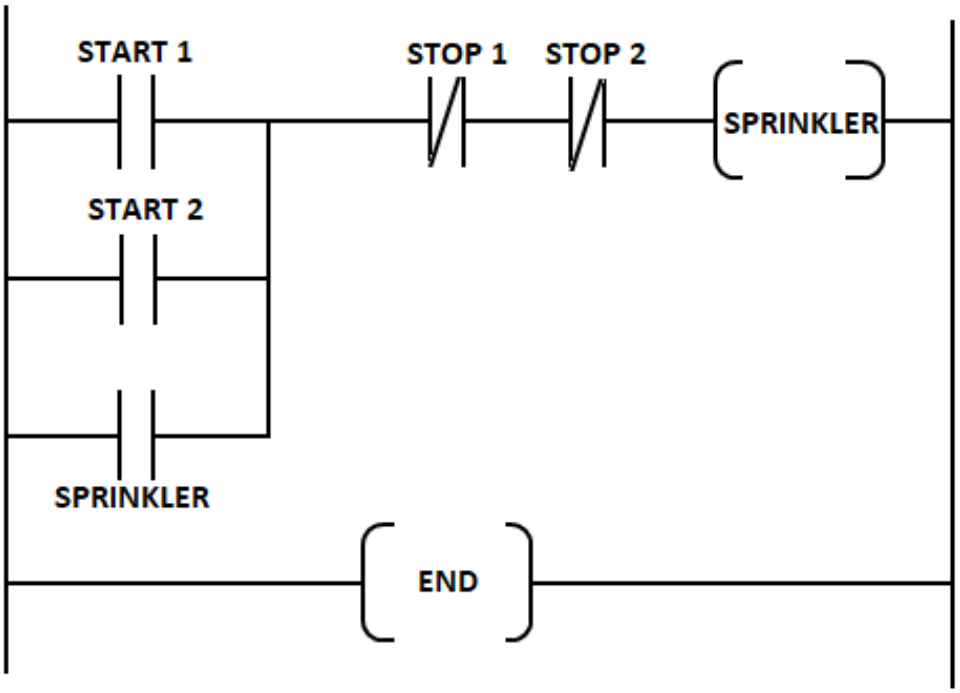
$= 5\left[1 - e^{-\frac{100 \times 10^{-6}}{25 \times 10^{-3}}}\right]$✓✓

$= 19{,}96\ mA$✓

Logical reasoning and conclusion:

- The current at the end of the trigger pulse is 19,96 mA, while the latching current is 40 mA.✓
- For the SCR to trigger, the current value at the end of the trigger pulse must either be equal to or greater✓✓ than the latching current. Therefore, the SCR will NOT be triggered at the end of the supplied pulse.✓ **[12]**

QUESTION 9



Allocate TWO full marks for each correct label and symbol **[14]**

TOTAL: 100

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