higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N6

7 APRIL 2020

This marking guideline consists of 6 pages.

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QUESTION 1: TRANSIENTS

1.1 $i = I_m\left[1 - e^{\frac{-t}{T}}\right]$

$\therefore I_m = \frac{i}{1-e^{\frac{-t}{T}}}$ ✓

$= \frac{0.15}{1-e^{\frac{-1\times10^{-3}}{1.5\times10^{-3}}}}$ ✓✓

$= 308.272\ mA$ ✓ (4)

1.2 $R = \frac{V_{SUPPLY}}{I_M}$ ✓

$= \frac{100}{308.272\times10^{-3}}$ ✓

$= 324.389\ \Omega$ ✓ (3)

1.3 $L = R \times T$ ✓

$= 324.389 \times 1.5 \times 10^{-3}$ ✓

$= 486.583\ mH$ ✓ (3)

1.4 $\omega = \frac{1}{2}L(I_L)^2$

$= 0.5(486.583 \times 10^{-3})(308.272 \times 10^{-3})^2$ ✓

$23.120\ mJ$ ✓ (2)

[12]

QUESTION 2: TRANSDUCERS

$\Delta R = R_{TH} \times \Delta t \times \alpha$

$= 50 \times [100 - 0]$ ✓ $\times 0.00193$ ✓

$= 9.65\Omega$ ✓

$\therefore R_{TH}\ at\ 100° = R_{TH} + \Delta R$ ✓

$= 50 + 9.65$ ✓

$= 59.65\Omega$ ✓

$\therefore\ V_D = V_S\left[\frac{R_1}{R_1+R_2} - \frac{R_3}{R_3+R_{TH}}\right]$

$= 2.5\left[\frac{50}{50+50} - \frac{50}{50+59.65}\right]$ ✓✓

$= 110mV$ ✓✓ **[10]**

QUESTION 3: ULTRASONICS

3.1 3.1.1 False
3.1.2 True
3.1.3 False
3.1.4 False
3.1.5 True
3.1.6 True

(6 × 1) (6)

3.2 3.2.1 To prevent redepositing of dirt on surface of article being cleaned

3.2.2 To ensure thorough physical contact with surfaces to be cleaned

3.2.3 To ensure easier cavitation

(3 × 1) (3)
[9]

QUESTION 4: X – RAYS AND RADIO ACTIVITY

4.1

$$f = \frac{C}{\lambda}$$
$$= \frac{3\times10^{8}}{325\times10^{-9}} \checkmark$$
$$= 923.077\,THz \checkmark$$

Also

$$f = \frac{E \times q}{h}$$
$$E = \frac{f.h}{q} \checkmark$$
$$= \frac{923.077\times10^{12}\times6.63\times10^{-34}}{1.602\times10^{-19}} \checkmark$$
$$= 3.820\,J \checkmark$$

(5)

4.2 4.2.1 Category: Gas-filled detectors
Detector: Geiger-Muller counter (2)

4.2.2 a – Gas-filled counting tube
b – Radiation particles
c – Inner electrode
d – Outer electrode
e – VDC
f – R_1
g – Inverting input
h – Noninverting input
i – R_2
j – Output signal (10 × ½) (5)
[12]

QUESTION 5: AUTOMATIC INSPECTION, TESTING AND NDT

5.1 a – Raw material receiving
b – Quality acceptance
c – Bulk storage
d – Production line
e – Inspection and testing
f – Alternative runs
g – Recycle
h – Waste
i – Rejected items
j – Grading
k – Sorting
l – Counting, packaging, storage and dispatch (12 × ½) (6)

5.2 5.2.1 Hi-go-low
5.2.2 Search coil
5.2.3 Sonar method
5.2.4 Direct-viewing method
5.2.5 Reflection
(5 × 1) (5)
[11]

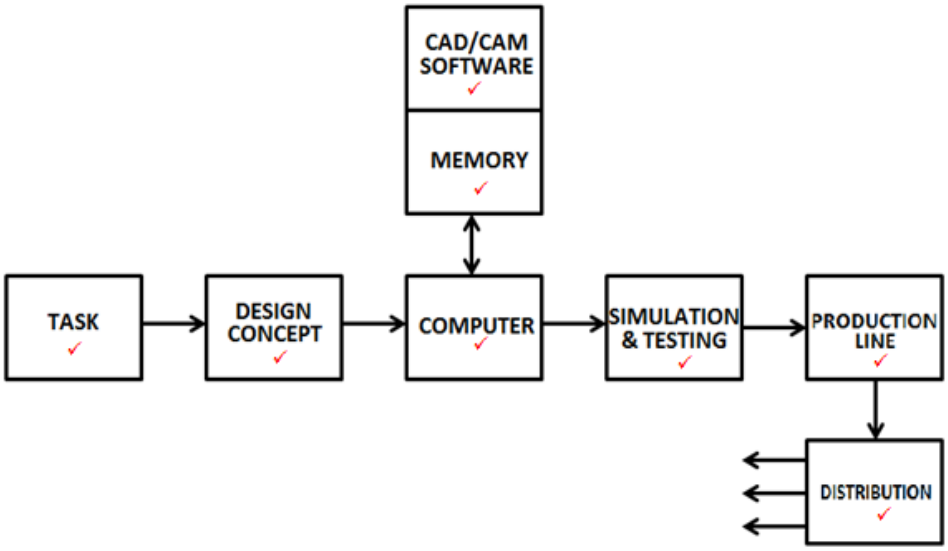
QUESTION 6: ELECTRONIC SAFETY DEVICES

6.1 C
6.2 A
6.3 A
6.4 D
6.5 A
6.6 B
(6 × 2) **[12]**

QUESTION 7: ELECTRONIC POWER CONTROL

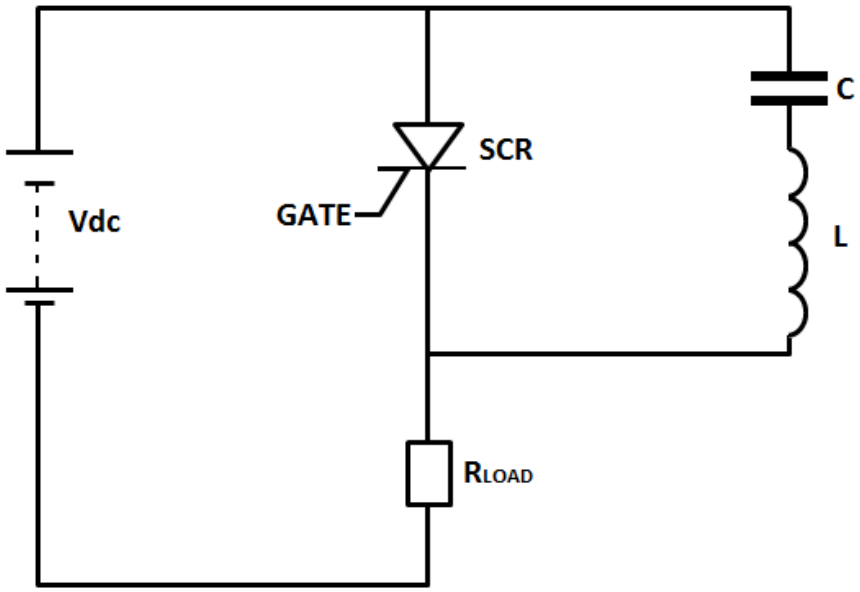
7.1
- Process control
- Servo mechanism
- Sequential control
- Numeric control (4)

7.2

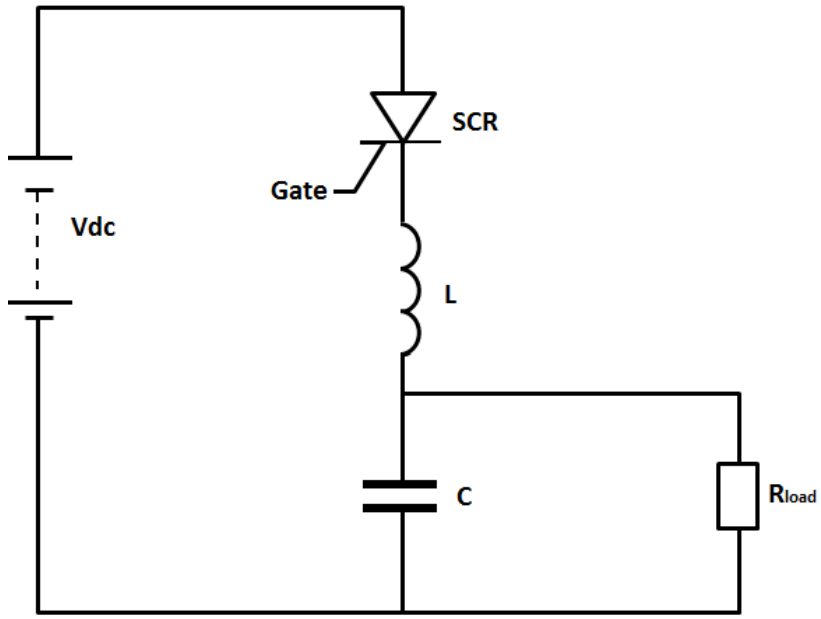


(8)
[12]

QUESTION 8: THYRISTOR DEVICES AND SCR SPEED CONTROL



SERIES RESONANCE COMMUNICATION



PARALLEL RESONANCE COMMUTATION **[12]**

QUESTION 9: PROGRAMMABLE LOGIC CONTROLLERS

9.1 To modify the user in a PLC intentionally

9.2 Any of the symbols used in a PLC program

9.3 One line of ladder diagram containing relevant programming information

9.4 Location in a PLC memory accessible by the program

9.5 Standard industrial method of representing electrical control schematic diagrams

(5 × 2) **[10]**

TOTAL: 100

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