higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

INDUSTRIAL ELECTRONICS N4

3 APRIL 2013

This marking guideline consists of 8 pages.

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QUESTION 1

$$V_{AC} = \frac{8}{8+6}\sqrt{}$$

$$= 7{,}999\ V\ \sqrt{}$$

$$V_{BC} = \frac{6}{6+4}\ \sqrt{}$$

$$= 6\ V\ \sqrt{}$$

$$Vth = V_{AC} - V_{BC}$$
$$= 7{,}999 - 6\ \sqrt{}$$
$$= 1{,}999\ V\ \sqrt{}$$

$$Rth = \frac{6\times 8}{6+8} + \frac{4\times 6}{4+6}$$

$$= 3{,}429 + 2{,}4$$

$$= 5{,}829\ \Omega\ \sqrt{}$$

$$I = \frac{Vth}{Rth + 10}$$

$$= \frac{1{,}999}{5{,}829+10}\ \frac{1{,}999}{5{,}829+10}\quad \sqrt{}$$

$$= 0{,}126\ A\ \sqrt{}$$

[10]

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QUESTION 2

2.1 2.1.1 Q-factor is the ratio of the reactance of the inductor or capacitor to its equivalent resistance. √√ (2)

2.1.2 Band width is the range of frequencies centered around f_r , between f_H and f_L. √√ (2)

2.2

$$Z_A = \frac{V_T}{I_A}$$

$$= \frac{120\angle 0^0}{8\angle 0^0} \surd$$

$$= 15\angle 0^0 \text{ A } \surd$$

$$Z_B = \frac{V_T}{I_B}$$

$$= \frac{120\angle 0^0}{12{,}32\angle -52^0} \surd$$

$$= 9{,}74\angle 52^0 \text{ A } \surd$$

$$Z_C = \frac{V_T}{I_C}$$

$$= \frac{120\angle 0^0}{3{,}12\angle 60^0} \surd$$

$$= 38{,}462\angle -60^0 \text{ A } \surd$$

(6)
[10]

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QUESTION 3

3.1 3.1.1 D √

3.1.2 A √

3.1.3 C √

3.1.4 B √ (4)

3.2 $i = \frac{KT}{Rq}$

$= \frac{1,38 \times 10^{-23} \times 303}{0,11 \times 1,6 \times \times 10^{-19}}$ √√

= 0,238 V √ (3)

3.3 3.3.1 $Vm = 12 + \frac{2(p-p)}{2}$

= 13 V √√ (2)

3.3.2 Wave = 0,318 × Vm

= 0,318 × × 13

= 4,134 V √√ (2)

3.3.3 Vrms = 0,707 × Vm

= 0,707 × 13

= 9,191 V √√ (2)

3.4 $V'dc = \frac{R_L}{R_L + R} \times Vdc$

$= \frac{1500 \times 200}{1500 + 200}$

= 176,471 V √√ (2)
[15]

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QUESTION 4

4.1 4.1.1 False √

4.1.2 False √

4.1.3 True √

4.1.4 True √

4.1.5 True √

(5 × 1) (5)

4.2 4.2.1 $hie = \frac{\Delta Vbe}{\Delta Ib} = \frac{0,69 - 0,67}{(30 - 10) \times 10^{-6}}$

= 1 kΩ √√√

Δ Vbe 0,69 – 0,67 (3)

4.2.2 $hre = \frac{\Delta Vbe}{\Delta Vce} \frac{0,69 - 0,67}{7,5 - 2,5}$

= 0,004 √√ (2)

4.2.3 $hfe = \frac{\Delta Ic}{\Delta Ib} = \frac{(3 - 1) \times 10^{-3}}{(30 - 10) \times 10^{-6}}$

= 100 √√ (2)

4.2.4 $\frac{1}{hoe} = \frac{\Delta Vce}{\Delta Ic} = \frac{7,5 - 2,5}{(3 - 1) \times 10^{-3}}$

= 2 500 Ω √√√ (3)

[15]

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QUESTION 5

5.1 Infinite input impedance √
Zero output impedance √
Infinite bandwidth √
Infinite voltage increase √ (4 × 1) (4)

5.2 It can be changed by changing the value of a feedback resistor. √√ (2)

5.3 Rate of change $= \frac{Vin}{CRin}$

$= \frac{3}{0{,}0001 \times 15\,000}$

$= 2$ V/sec √√√ (3)

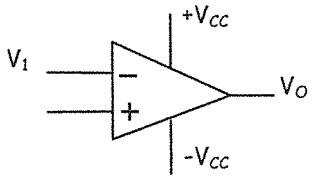
5.4 $\text{gain} = \frac{Rf}{Rin}$

$= \frac{100 \times 10^3}{200 \times 10^3}$

$= 0{,}5$ √√

$Vo = \text{gain} \times Vin$
$= 0{,}5 \times 20 \times 10^{-3}$
$= 1$ mV √√ (4)

5.5 Comparator



√√ (2)
[15]

QUESTION 6

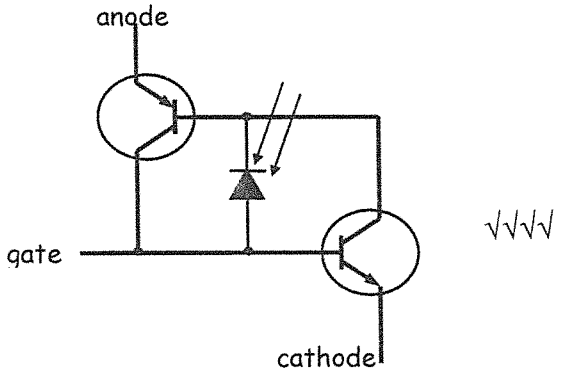
6.1 SCR conducts during one half cycle while a TRIAC conducts during both cycles. √

SCR controls a small DC motor while a TRIAC controls a small AC motor. √

(2 × 1) (2)

6.2 The anode must be connected to the positive terminal. √
The cathode must be connected to the negative terminal. √
The gate must be exposed to light. √ (3)

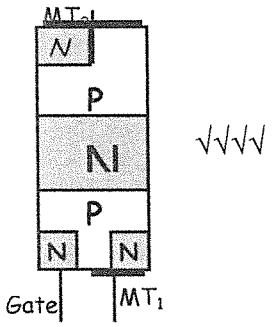
6.3



√√√√

(4)

6.4



√√√√

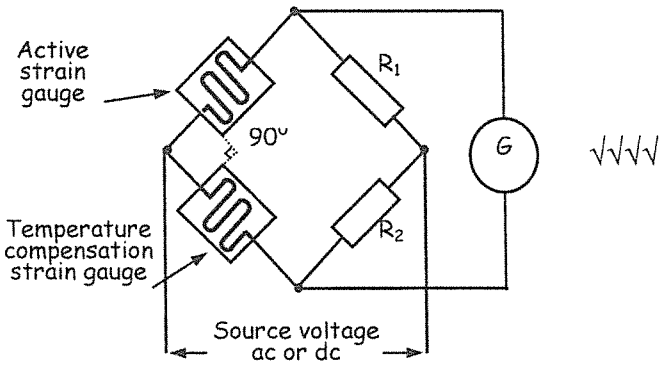
(4)

6.5 True – It will operate the same way as the triac and diac separately, therefore it has the same characteristics as the triac and diac. √√ (2)
[15]

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QUESTION 7

7.1



√√√√

- If there is no pressure applied in the active gauge, the bridge is balanced and there is a zero in the galvanometer. √
- If pressure is applied, the bridge will be out of balance. √
- The small change in resistance will be amplified and the reading will appear in the galvanometer. √
- The compensation gauge will prevent false observation due to temperature variation. √ (4 × 2) (8)

7.2 $R = \frac{pl}{A}$ √√ (2)

[10]

QUESTION 8

8.1 Cathode-ray oscilloscope is a type of electronic test instrument that allows observation of constantly varying signal voltages using the vertical axis, plotted as a function of time on the horizontal axis. √√ (2)

8.2 Time-base generator controls the rate at which the spot travels across the screen. √√ (2)

8.3 8.3.1 Square wave √ (1)

8.3.2 Sine wave √ (1)

8.4 8.4.1 Amplitude = no. of div × v/div
= 3 × 2
= 6 V √√ (2)

8.4.2 Period = no. of div × sec/div
= 4 × 15 × 10^{-6}
= 60 µs/v √√ (2)

[10]

TOTAL: 100

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