higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

INDUSTRIAL ELECTRONICS N4

10 APRIL 2015

This marking guideline consists of 7 pages.

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QUESTION 1

$$I = \frac{5}{4 + 10}$$

$= 0,357$ A √√ (2)

$V_{th} = I \times R_2$

$= 0,357 \times 10$

$= 3,57$ V √√ (2)

$$Rth = \frac{R_1R_2}{R_1 + R_2} + R_3$$

$$= \frac{4 \times 10}{4 + 10} + 8$$

$= 10,857\ \Omega$ √√√ (3)

$$I_L = \frac{Vth}{R_4 + Rth}$$

$$= \frac{3,57}{12 + 10,857}$$

$= 0,156$ A √√√ (3)
[10]

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QUESTION 2

2.1 $$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$1 \times 10^6 = \frac{1}{2 \times 3{,}142 \times \sqrt{100 \times 10^{-6} \times C}}$$

$$100 \times 10^{-6}\ C = 2{,}532 \times 10^{-16}$$

$$C = 253{,}2\ pF \quad \surd\surd\surd\surd\surd \qquad (5)$$

2.2 $$Z_D = \frac{L}{RC}$$

$$= \frac{100 \times 10^{-6}}{20 \times 253{,}2 \times 10^{-12}}$$

$$= 19,\ 747\ k\Omega \ \surd\surd\surd$$

$$I_T = \frac{V}{Z_D} \qquad (3)$$

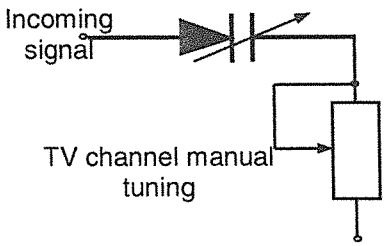
2.3 $$= \frac{5}{19{,}747 \times 10^3}$$

$$= 253\ \mu A \ \surd\surd \qquad (2)$$

[10]

QUESTION 3

3.1



√√√ (3)

- Automatic frequency control √
- Adjustable band pass filters √
- FM modulators √
- Parametric amplifiers

(Any 3 x 1) (3)

3.2 3.2.1

$$V'_{dc} = \frac{R_L}{R_L + R} \times V_{dc}$$

$$= \frac{5000}{5000 + 200} \times 15$$

$$= 14{,}423 \text{ V } √√√$$ (3)

3.2.2

$$V_{r'(rms)} = \frac{X_C}{\sqrt{R^2 + X_C^2}} \times V_{r(rms} \text{ but } X_C = \frac{1}{4\pi \times 50 \times 150 \times 10^{-6}} = 10{,}609\ \Omega$$

$$= \frac{10{,}609}{\sqrt{200^2 + 10{,}609^2}} \times 1{,}5$$

$$= 0{,}079 \text{ V } √√√√$$ (4)

3.2.3

$$r' = \frac{V_{r'(rms)}}{V'_{dc}}$$

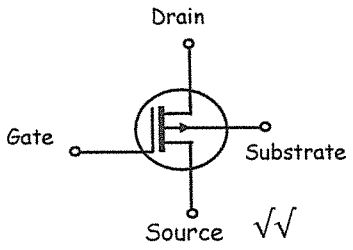
$$= \frac{0{,}079}{14{,}423}$$

$$= 0{,}006 \ √√$$ (2)

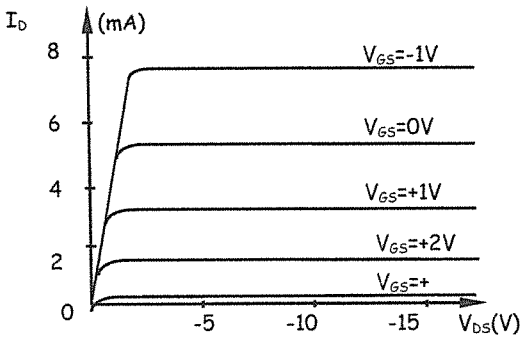
[15]

QUESTION 4

4.1



√√



√√√

(5)

4.2 4.2.1

$$Ai = \frac{\Delta I_C}{\Delta I_b} = \frac{(3-1) \times 10^{-3}}{(30-10) \times 10^{-6}}$$

$= 100$ √√ (2)

4.2.2

$$R_{in} = \frac{\Delta V_{be}}{\Delta I_b} = \frac{0{,}69 - 0{,}67}{(30-10) \times 10^{-6}}$$

$= 1\ k\Omega$ √√√ (3)

4.2.3

$$A_V = \frac{\Delta V_{be}}{\Delta V_{ce}} = \frac{0{,}69 - 0{,}67}{15-5}$$

$= 0{,}002$ √√ (2)

4.2.4

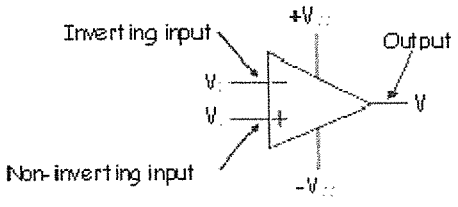
$$R_{out} = \frac{\Delta V_{ce}}{\Delta I_C} = \frac{15-5}{(3-1) \times 10^{-3}}$$

$= 5\ k\Omega$ √√√ (3)

[15]

QUESTION 5

5.1



√√ (2)

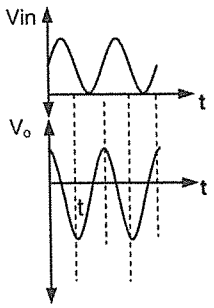
5.2 It can be changed by varying the resistance of the feedback resistor. √√ (2)

5.3
- Inverting √
- Summer √
- Integrator √
- Differentiator

(Any 3 x 1) (3)

5.4 5.4.1 Integrator √ (1)

5.4.2



√√√ (3)

5.4.3

$$\text{Rate of change} = \frac{V_{in}}{CR_{in}}$$

$$50 = \frac{10}{15 \times 10^{-6} \times R_{in}}$$

$R_{in} = 13\ k\Omega$ √√√√ (4)

[15]

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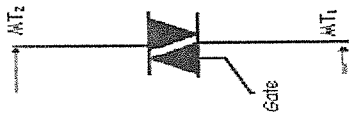
QUESTION 6

6.1 6.1.1



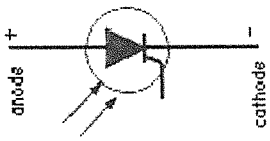
√√

6.1.2



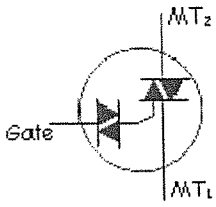
√√

6.1.3



√√

6.1.4



√√

6.1.5



√√

(5 x 2) (10)

6.2

OPEN-LOOP CONTROL SYSTEM	CLOSED-LOOP CONTROL SYSTEM
1. No feedback loop	There is feedback loop
2. No comparator	There is comparator
3. The output is not monitored	The output is monitored
4. It is manually controlled	It is automatic

(Any 3 x 1) (3)

6.3 It allows only positive pulses to the gate of an SCR and prevents negative pulses from going to the gate. √√ (2)

[15]

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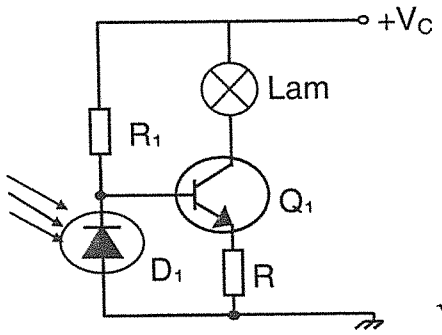
QUESTION 7

7.1



√√√√ (4)

7.2
- Mechanical to electrical √
- Light to electrical √
- Electrical to mechanical √ (3)

7.3 The resistance of a wire is changed by expansion or contraction due to an externally applied stress. √√

$$R = \frac{\rho l}{a} \surd$$

(3)
[10]

QUESTION 8

8.1 8.1.1 Horizontal and/or vertical deflecting plates √√

8.1.2 Vertical deflecting plates √√

8.1.3 Time base generator. √√

(3 x 2) (6)

8.2
$$t = \frac{1}{f} = \frac{1}{15 \times 10^3} = 66{,}667\ \mu s$$

t = scale setting x width

$$\text{width} = \frac{t}{\text{scale setting}} = \frac{66{,}667 \times 10^{-6}}{60 \times 10^{-6}} = 1{,}111\ \text{cm}\ \surd\surd\surd$$

(3)

8.3 False √ (1)
[10]

TOTAL: 100

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