higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# MARKING GUIDELINE

## NATIONAL CERTIFICATE

## APRIL EXAMINATION

## INDUSTRIAL ELETRONICS N4

## APRIL 2016

**This marking guideline consists of 7 pages.**

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## QUESTION 1

Consider loop ABDEFA

$20 = 20 (I_1 – I_2) + 25 [(I_1 – I_2) + I_3]$
$20 = 20I_1 – 20I_2 + 25I_1 – 25I_2 + 25I_3$
$20 = 45I_1 – 45I_2 + 25I_3$ …… [1]✓

Consider loop ABCEFA

$20 = 10I_2 + 40 (I_2 – I_3)$
$20 = 50I_2 – 40I_3$ ----------[2]✓

Consider loop ABCDEFA

$20 = 10I_2 + 30I_3 + [25 (I_1 – I_2) + I_3]$
$20 = 10I_2 + 30I_3 + 25I_1 – 25I_2 + 25I_3$
$20 = 25I_1 – 15I_2 + 55I_3$ ----------[3]✓

[1] × 5: $100 = 225I_1 – 225I_2 + 125I_3$ ----------[4]✓
[3] × 9: $180 = 225I_1 – 135I_2 + 495I_3$ ----------[5]✓
[5] – [4]: $80 = 90I_2 + 370I_3$ ----------[6]✓
[2] x [9]: $180 = 450I_2 – 360I_3$ ----------[7]✓
[6] x [5]: $400 = 450I_2 + 1850I_3$ ----------[8]✓
[8] – [7]: $220 = 2210I_3$✓
$\therefore I_3 = 0,1A$✓ **[10]**

## QUESTION 2

2.1 $IR = \frac{V_T}{R}$

$= \frac{100}{50}$

$= 2\ A$✓ (1)

2.2 $I_L = \frac{V_T}{X_L}$

$= \frac{100}{75,408}$

$= 1,326\ A$✓

$XL = 2\pi fL$
$= 2 \times 3,142 \times 60 \times 0,2$
$= 75,408\ \Omega$✓

2.3 $IC = \frac{VT}{XL}$ $XC = \frac{1}{2\pi fC}$

$= \frac{100}{26,522}$ $= \frac{1}{2 \times 3,142 \times 60 \times 100 \times 10^{-6}}$

= 3,77 A✓ = 26,522 Ω✓ (2)

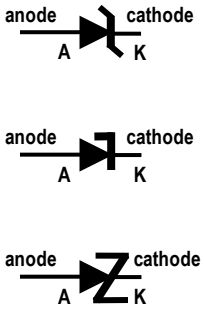
2.4 $IT = \sqrt{I_T + (I_C - I_C)}$

$= \sqrt{2 + (377 - 1,326)}$ ✓
= 2,108 A✓ (2)

2.5 Power = VIR✓
= 100 x 2✓
= 200 W✓ (3)
**[10]**

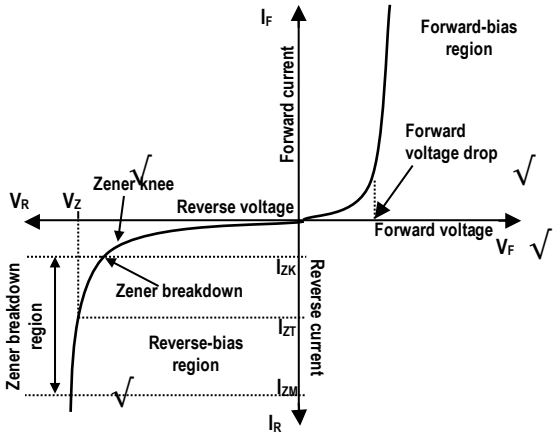
**QUESTION 3**

3.1




(✓ for any 1)

Symbol




Characteristic curve (3)

There is an increase in reverse bias voltage, the width of the depletion region increases and the capacitance decreases.✓✓ (2)

3.2 3.2.1 $I_P = \frac{P}{V_P} = \frac{150 \times 10^3}{2\,200}$ ✓

= 68,182 A ✓

3.2.2 $I_S = \frac{P}{V_S} = \frac{150 \times 10^3}{400}$ ✓

= 375 A ✓

3.2.3 $$N_P = \frac{N_S V_P}{V_S} = \frac{100 \times 2200}{400}$$ ✓

= 550 turns✓ (2)

3.3 It is the degree to which its output voltage remains constant despite changes in the amount of current drawn from the supply by the load. (2)

3.4 It is to reduce the amount of unwanted ripple voltage to the steady DC voltage. (2)

**[15]**

**QUESTION 4**

4.1 4.1.1 $$hib = \frac{\Delta Vbe}{\Delta Ie} = \frac{4}{5 \times 10^{-6}}$$ ✓

= 800 kΩ ✓

4.1.2 $$hoe = \frac{\Delta Ic}{\Delta Vce} = \frac{6 \times 10^{-3}}{8}$$ ✓

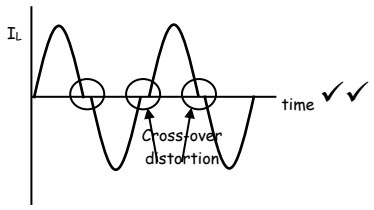
= 0,75 mΩ ✓

4.1.3 $$hfe = \frac{\Delta Ic}{\Delta Ie} = \frac{6 \times 10^{-3}}{5 \times 10^{-6}}$$ ✓

= 1 200 ✓

(3 x 2) (6)

4.2



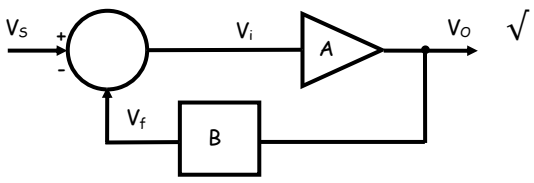

✓✓

(2)

The transistor is biased slightly above the cut-off value.✓✓ (2)

4.3 True (1)

4.4




√ ✓ ✓ √

✓

(4)

**[15]**

## QUESTION 5

5.1 $$g = -\frac{R_f}{Rin}$$

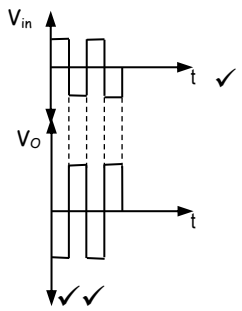
$$= -\frac{10 \times 10^{-3}}{1 \times 10^{-3}} \checkmark$$

$$= -10 \checkmark$$

Vo = gain x Vin
= - 10 x 0,4✓
= 4 V✓ (4)

5.2 5.2.1 Inverter amplifier (1)

5.2.2




✓✓ (3)

5.3.3 $$Vo = \frac{R_f}{Rin} \times Vin$$

$$5 = \frac{1\,000}{Rin} \times 2 \checkmark\checkmark$$

Rin = 400 Ω ✓ (3)

5.4
- Infinite input impedance
- Zero output impedance
- Infinite band width
- Infinite voltage gain
- Perfect balanced or zero offset voltage
- Its characteristics do not drift with temperature (Any 4 x 1) (4)

**[15]**

## QUESTION 6

6.1 6.1.1 C
6.1.2 A
6.1.3 A
6.1.4 B
6.1.5 A

(5 x 1) (5)

6.2 6.2.1 A DC motor
B Variable resistor
C Capacitor
D Diode
E SCR

(5 x 1) (5)

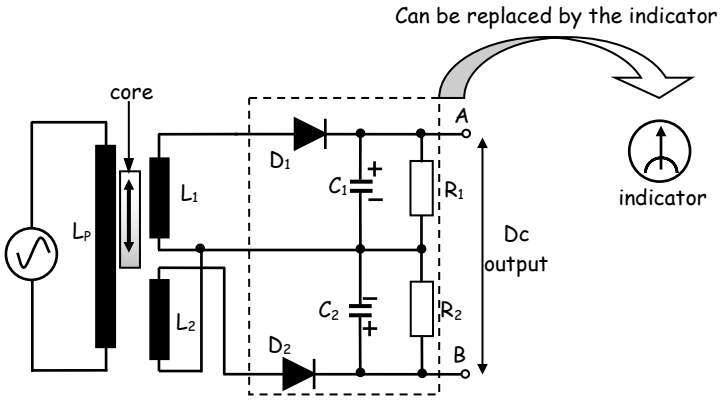
6.2.2
- During positive half cycle, the SCR will turn on and the motor will run.✓✓
- During negative half cycle, the SCR will be off and there is no output in the load.✓✓
- This results in half wave control through the load.✓ (5)

**[15]**

## QUESTION 7

7.1
- Accuracy
- Reliability
- Stability
- Reproducibility (Any 3 x 1) (2)

7.2



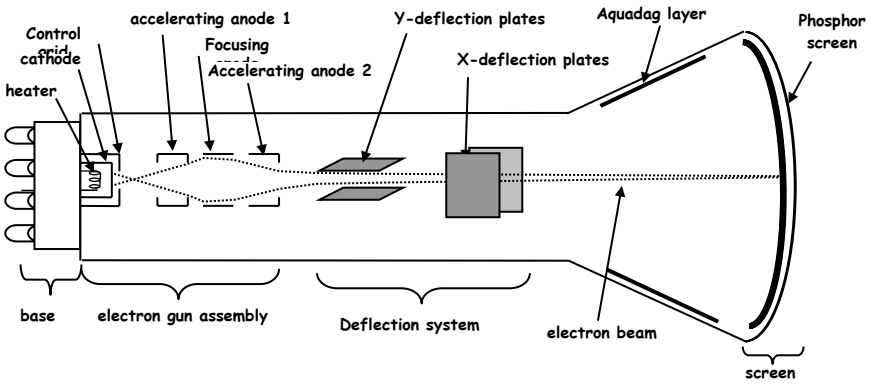

✓ mark for transformer
√ mark for all other components (4)

- When the core is in the centre of L1 and L2, the induced voltage in the secondary will be zero and there is no output.
- When the core moves either up or down, there will be more induced voltage in that secondary coil.
- The magnitude of the output voltage is proportional to the core displacement. (3)

**[10]**

## QUESTION 8

8.1




Half mark for each correct labeling (7)

8.2
- Timing circuit for electronic applications
- Audio frequency generation
- Scanning circuits in oscilloscope (3 x 1) (3)

**[10]**

**TOTAL: 100**

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