



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INDUSTRIËLE ELEKTRONIKA N4

2 April 2025

Hierdie nasienriglyn bestaan uit 7 bladsye.

VRAAG 1

$$\begin{aligned}
 1.1 \quad V_{CE} &= 40 / (40 + 10) \times 20 = 16 \text{ V} \checkmark \checkmark \\
 V_{DE} &= 25 / (25 + 20) \times 20 = 11.111 \text{ V} \checkmark \checkmark \\
 V_{th} = V_{CD} = V_{CE} - V_{DE} &= 16 - 11.111 = 4.889 \text{ V} \checkmark \checkmark \\
 R_{th} = R_{CD} &= \frac{10 \times 40}{10 + 40} + \frac{20 \times 25}{20 + 25} = 8 + 11.111 = 19.111 \Omega \checkmark \checkmark \\
 I &= V_{th} / (V_{th} + 30) = 4.889 / (4.889 + 30) = 0.14 \text{ A} \checkmark \checkmark \quad (10)
 \end{aligned}$$

1.2 Kortsluiting V1

$$\begin{aligned}
 R_{ser} &= \frac{40 \times 20}{40 + 20} + 25 \\
 R_{ser} &= 38.333 \Omega \checkmark \\
 R_T &= \frac{R_{ser} \times 15}{R_{ser} + 15} + 8 \\
 R_T &= \frac{38.333 \Omega \times 15}{38.333 \Omega + 15} + 35 \\
 R_T &= 45.781 \Omega \checkmark \\
 I_{TA} &= \frac{5}{45.781} \\
 I_{TA} &= 0.109 \text{ A} \checkmark
 \end{aligned}$$

Kortsluiting V2

$$\begin{aligned}
 R_{ser} &= \frac{35 \times 15}{35 + 15} + 25 \\
 R_{ser} &= 35.5 \Omega \checkmark \\
 R_T &= \frac{R_{ser} \times 20}{R_{ser} + 20} + 40 \\
 R_T &= \frac{35.5 \times 20}{35.5 + 20} + 40 \\
 R_T &= 52.793 \Omega \checkmark
 \end{aligned}$$

$$I_{TB} = \frac{10}{52.793}$$

$$I_{TB} = 0.189A \checkmark$$

$$I_N = I_{TA} - I_{TB}$$

$$I_N = 0.189 - 0.109$$

$$I_N = 0.08A \checkmark$$

$$R_N = \frac{20 \times 40}{20 + 40} + \frac{15 \times 35}{15 + 35}$$

$$R_N = 23.833\Omega \checkmark$$

$$I_{RL} = \frac{23.833}{23.833 + 25} \times 0.08$$

$$I_{RL} = 0.039A \checkmark \checkmark$$

(10)
[20]

VRAAG 2

2.2	2.1.1	$Z_1 = 8 + j15$	$Z_2 = 6 - j10$	$Z_S = 0 - j12$
		$= 17 \angle 61.9^\circ$	$= 11.662 \angle -59^\circ \checkmark$	$= 12 \angle 90^\circ$
		$Z_T = \frac{Z_1 Z_2}{Z_1 + Z_2} + Z_S$		
		$= \frac{17 \angle 61.9^\circ \times 11.662 \angle -59^\circ}{8 + j15 + 6 - j10} + 0 - j12 \checkmark \checkmark$		
		$= \frac{198.254 \angle 2.9^\circ}{14.866 \angle 19.7^\circ} + 0 - j12 \checkmark$		
		$= 13.336 \angle -16.8^\circ + 0 - j12 \checkmark$		
		$= 12.767 - j3.855 + 0 - j12 \checkmark$		
		$= 12.767 - j15.855$		
		$= 20.356 \angle -52^\circ \Omega \checkmark$		

$$\begin{aligned}
 2.1.2 \quad I_T &= \frac{V_T}{Z_T} \\
 &= \frac{200 \angle 0^\circ}{20 \angle -52^\circ} \\
 &= 9,825 \angle 52^\circ \text{ A} \checkmark \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 2.2 \quad 2.2.1 \quad I_R &= \frac{V}{R} = \frac{230}{30} = 7.667 \text{ A} \checkmark \checkmark \\
 X_L &= 2\pi f l = 2\pi \times 50 \times 0.16 = 50.265 \Omega \checkmark \\
 I_L &= \frac{V}{X_L} = \frac{230}{50.265} = 4.576 \text{ A} \checkmark \\
 X_C &= \frac{1}{2\pi f C} = \frac{1}{2\pi \times 50 \times 200 \times 10^{-6}} = 15.915 \Omega \checkmark \\
 I_C &= \frac{V}{X_C} = \frac{230}{15.915 \Omega} = 14.452 \text{ A} \checkmark
 \end{aligned} \tag{6}$$

$$\begin{aligned}
 2.2.2 \quad I_T &= \sqrt{I_R^2 + (I_C - I_L)^2} = \sqrt{7.667^2 + (14.452 - 4.576)^2} \\
 &= 12.503 \text{ A} \checkmark \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 2.2.3 \quad \cos \theta &= \frac{I_R}{I_T} \\
 \theta &= \cos^{-1} \left(\frac{I_R}{I_T} \right) = \cos^{-1} \left(\frac{7.667}{12.503} \right) = 52.178^\circ \checkmark \checkmark
 \end{aligned} \tag{2}$$

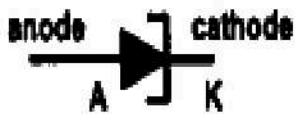
[20]

VRAAG 3

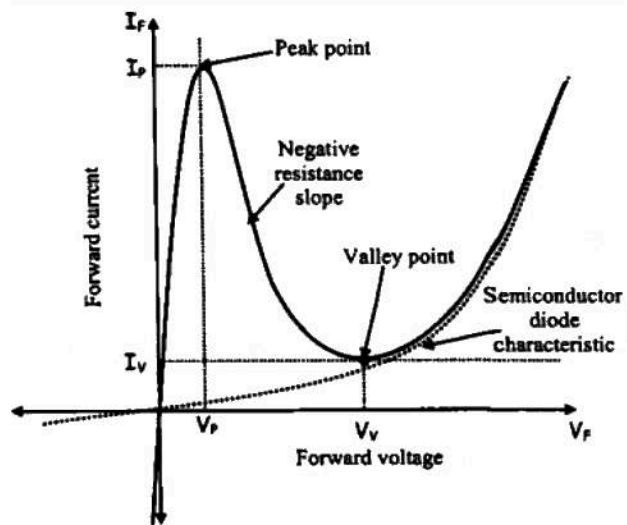
$$3.1 \quad v = \frac{kT}{q} \ln \left(\frac{i}{I_S} + 1 \right) = \frac{1.38 \times 10^{-23} \times 300}{1.6 \times 10^{-19}} \ln \left(\frac{5 \times 10^{-3}}{25 \times 10^{-6}} + 1 \right) = 0.137 \text{ V} \checkmark \checkmark \checkmark \checkmark \tag{4}$$

$$3.2 \quad i = \frac{kT}{Rq} = \frac{1.38 \times 10^{-23} \times 313}{0.306 \times 1.6 \times 10^{-19}} = 88.22 \text{ mA} \checkmark \checkmark \checkmark \tag{3}$$

3.3



Simbool✓



kenkromme✓✓✓

(4)

3.4

- Instemstroombaan
- FM-modulators
- Outomatiese frekwensiebeheertoestelle
- Verstelbare banddeurlaatfilters

(Enige 2 × 1)

(2)

3.5

- Daar is nie enige vergelyking tussen werklike en gewenste waardes nie.
- 'n Ooplusstelsel beskik nie oor selfregulering of beheerwerking oor die leweringswaarde nie.
- Elke insetverstelling bepaal 'n vaste bedryfsposisie vir die beheerder.
- Veranderinge of versteurings in eksterne toestande lei nie tot 'n direkte verandering in lewering nie.

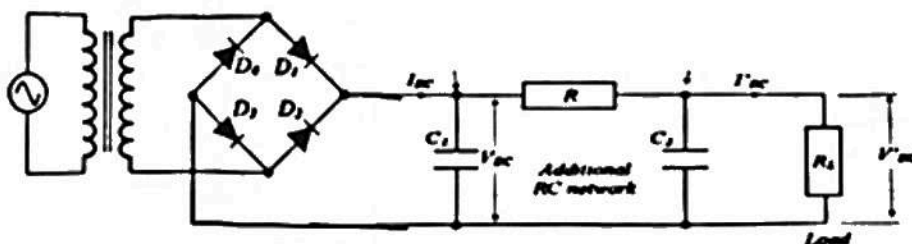
(Enige 2 × 1)

(2)

[15]

VRAAG 4

4.1



✓✓✓✓

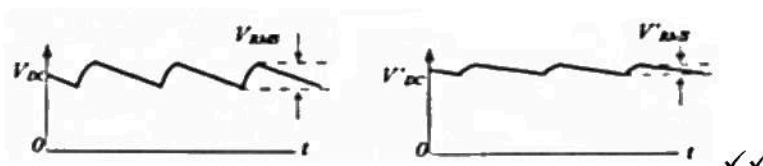
(4)

4.2.1

Heelgolfgelykrichter

(1)

4.2.2



✓✓

(2)

- 4.2.3
- Rimpel verhoog met lasstroom.
 - Laer leweringspanning as gevolg van spanningsval oor die resistor.
 - Leweringspanning daal met 'n toename in las. (Enige 2 × 1) (2)

4.2.4 $X_C = \frac{1}{4\pi fC} = \frac{1}{4\pi \times 60 \times 120 \times 10^{-6}} = 11.05 \Omega \checkmark$

$$V'_{r(RMS)} = \frac{X_C}{\sqrt{R^2 + X_C^2}} \times V_{r(RMS)} = \frac{11.05}{\sqrt{240^2 + 11.05^2}} \times 3 = 0.136V \checkmark \checkmark \checkmark$$

$$r = \frac{V_{r(RMS)}}{V_{DC}} = \frac{3}{27} = 0.111 \text{ volt} \checkmark \checkmark$$

(6)
[15]

VRAAG 5

5.1 5.1.1 Onwaar (1)

5.1.2 $h_{fe} = \frac{\Delta I_{out}}{\Delta I_{in}} = \frac{4 \times 10^{-3}}{4 \times 10^{-6}} = 1000 \checkmark \checkmark$ (2)

5.1.3 $h_{ie} = \frac{V_{in}}{I_{in}} = \frac{0.3 \times 10^{-3}}{6 \times 10^{-6}} = 50 \Omega \checkmark \checkmark$

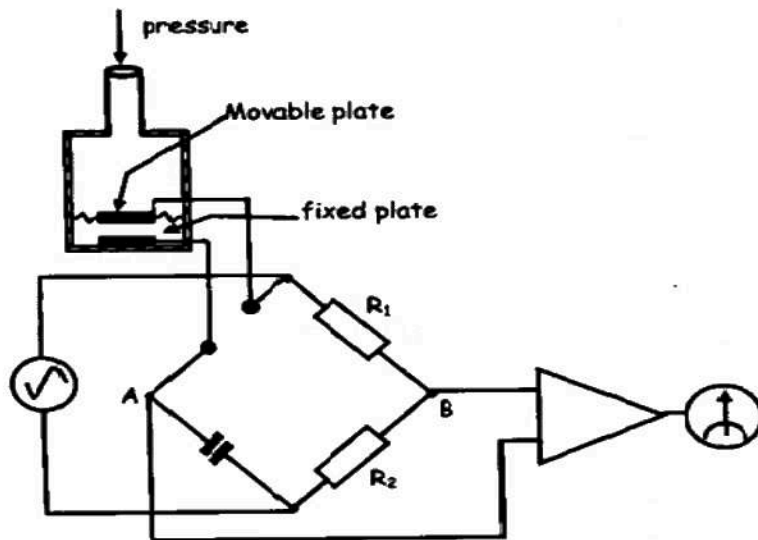
$$1/h_{oe} = \frac{V_{ce}}{I_c} = \frac{6}{6 \times 10^{-3}} = 1 \text{ k}\Omega \checkmark \checkmark$$
 (4)

5.2 $R_{in} = \frac{-V}{\text{veranderingstempo} \times C} = \frac{-5}{-3.5 \times 15 \times 10^{-6}} = 95 \text{ k}\Omega \checkmark \checkmark \checkmark$ (3)

- 5.3
- Klein
 - Goedkoop
 - Lae kragverbruik
 - Uitiers stabiel
 - Uitiers betroubaar
- (5)
[12]

VRAAG 6

6.1



(5)

6.2



✓✓✓✓✓✓

(6)

6.3

- Gedraaide vloeikristal
- Vlaskakeling
- Gevorderde randveldskakeling
- Vertikale belyning

(4)

[15]

TOTAAL: 100