higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INDUSTRIËLE ELEKTRONIKA N5

30 JULIE 2018

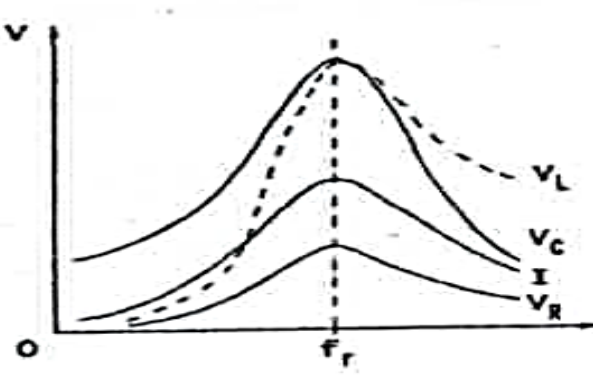
Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

VRAAG 1: WISSELSTROOMTEORIE

1.1 Sodra die perfekte reghoekgolfvorm deur 'n foutiewe stroombaan gestuur word, sal die teenwoordigheid van 'n fout asook 'n aanduiding van die soort fout wat bestaan gegee word, terwyl sinusgolwe dikwels slegs die bestaan van 'n fout aandui. (3)

1.2



(3)

1.3 $Z_1 = 120 - j21{,}21\ \Omega = 121{,}86\ \angle -10{,}02^o\ \Omega$

$Z_2 = 180 + j25{,}31\ \Omega = 181{,}77\ \angle 8^o\ \Omega$

$Z_3 = 100 + j47{,}31\ \Omega = 110{,}627\ \angle 5{,}32^o\ \Omega$

$$= \frac{121{,}86\angle -10{,}02^0 \times 181{,}77\angle 8^0}{120 - j21{,}21 + 180 + j25{,}31}$$

$$= \frac{22150{,}584\angle -2{,}02^0}{300 + j4{,}1}$$

$$= \frac{22150{,}584\angle -2{,}02^0}{300{,}03\angle 0{,}78^0}$$

$$= 72{,}828\angle -2{,}8^0\ \Omega$$

$$= 73{,}74 - j\,3{,}606\ \Omega$$

$$Z_T = Z_{//} + Z_3$$

$$= 73{,}74 - j\,3{,}606 + 100 + j\,47{,}31$$

$$= 173{,}74 + j\,43{,}7\ \Omega$$

$$= 179{,}152\angle 14{,}12^0\ \Omega$$

(8)
[14]

VRAAG 2: KRAGVOORSIENING

2.1 2.1.1

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

$$V_{DC} = \frac{R + R_L}{R_L} V'_{DC} \checkmark$$

$$= \frac{100+1\,000}{1\,000} \times 26{,}4 \checkmark$$

$$= 29{,}04 \text{ V} \checkmark \longrightarrow \quad (3)$$

2.1.2

$$V'_{R(RMS)} = \frac{V_{R(RMS)}}{(4\pi f)^2 LC}$$

$$V_{R(RMS)} = V'_{R(RMS)}(4\pi f)^2 LC \checkmark$$

$$= 2{,}5\ ((4.\pi.50))^2.0{,}2.100 \times 10^{-6} \checkmark$$

$$= 19{,}73 \text{ V} \checkmark \longrightarrow \quad (3)$$

2.1.3

$$r = \frac{V_{R(RMS)}}{V_{DC}}$$

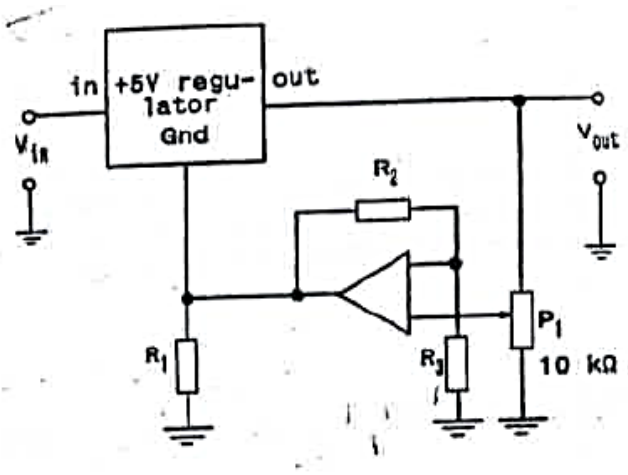
$$= \frac{19{,}73}{29{,}04} \checkmark$$

$$= 0{,}67 \checkmark \longrightarrow \quad (2)$$

2.2 Dit word gebruik as 'n hoër stroomspanning van 'n transformator sekondêre stroomspanning nodig is. (2)

2.3 Potensiometer P_2 word aangepas tydens 'n normale lasstroom sodat transistor T_1 nie voldoende skuins vorentoe is nie en dus af is nie.✓ 'n Toename in lasstroom sal 'n toename in stroomspanningdaling oor P_2 veroorsaak.✓ Tydens toestande van oorbelasting sal die verhoogde stroomspanning oor P_2 transistor T_2 aanskakel om 'n deel van die basisstroom van transistor T_1 te gelei en om die toename in lasstroom tot 'n veilige waarde te beperk. ✓ (3)

2.4



(½ vir elke komponent) (5)
[18]

VRAAG 3: TRANSISTORVERSTERKERS

3.1 3.1.1

$$R_E = \frac{V_E}{I_E}$$

$$\therefore \quad V_E = I_C.R_E$$

$$= 20 \times 10^{-3} \times 250 ✓$$

$$= 5\ V ✓$$

$$V_{CC} = 10.V_E$$

$$= 10 \times 5 ✓$$

$$= 50\ V ✓ \longrightarrow$$ (4)

3.1.2

$$C_e = \frac{10}{2\pi F R_e}$$

$$f = \frac{10}{2\pi R_e C_e} ✓$$

$$= \frac{10}{2.\pi.250.20 \times 10^{-6}} ✓$$

$$= 318{,}31\ Hz ✓ \longrightarrow$$ (3)

3.2 3.2.1

$$Z_1 = h_{ie} - \frac{h_{fe}\ h_{re} Z_L}{1 + h_{oe} Z_L}$$

$$= 2\,200 - \frac{100 \times 2 \times 10^{-4} \times 10\,000}{1 + 20 \times 10^{-6} \times 10\,000} \checkmark$$

$$= 2\,200 - 198{,}8$$

$$= 2\,001{,}2 \checkmark$$

$$R_{bt} = R_{b1} // R_{b2}$$

$$= \frac{65\,000 \times 6\,500}{65\,000 + 6\,500} \checkmark$$

$$= 5\,909{,}1\ \Omega \checkmark$$

$$A_i = \left(\frac{h_{fe}}{1 + h_{oe} Z_L}\right)\left(\frac{R_{bT}}{R_{bT} + z_1}\right)$$

$$= \left(\frac{100}{1 + 20 \times 10^{-6}.10\,000}\right)\left(\frac{5\,909{,}1}{5\,909{,}1 + 2\,001{,}2}\right) \checkmark$$

$$= (83{,}333)(0{,}747) \checkmark$$

$$= 98{,}6 \checkmark \longrightarrow \quad (7)$$

3.2.2

$$Z_i = R_{bt} // Z_1$$

$$= \frac{5\,909{,}1 \times 2\,001{,}2}{5\,909{,}1 + 2\,001{,}2} \checkmark$$

$$= 1\,494{,}92\ \Omega \checkmark \longrightarrow \quad (2)$$

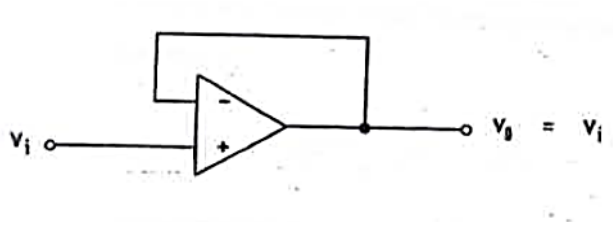
3.3 Die versterkte uitsetsein van 'n versterker behoort soortgelyk te wees aan die insetsein; dus, indien die uitsetsein nie die formaat van die insetsein aanneem nie, sal die uitsetsein gewronge wees. (2)

[18]

VRAAG 4: OPERASIONELE VERSTERKERS

4.1
- Baie hoë insetimpedansie wat veroorsaak dat daar byna geen stroomlading vir die stroombane is nie
- Baie hoë stroomspanningwins geskik om baie klein seine te versterks
- Baie lae uitsetimpedansie wat nie maklik deur ander ladings geaffekteer word nie (3)

4.2



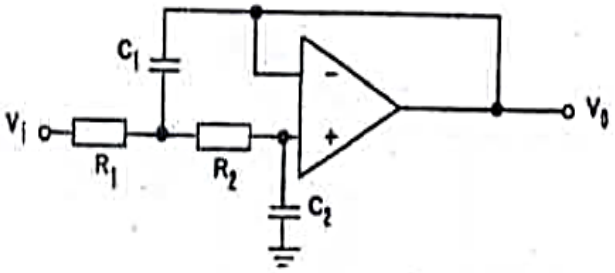
(stroomspanningnavolger ½ vir inset + ½ vir uitset + ½ vir komponente + ½ vir koppeling) (2)

4.3 $V_O = \frac{R_f}{R_{in}}(V_2 - V_1)$

$= \frac{200 \times 10^3}{200 \times 10^3}(5 - 4)$✓✓

$= 1\text{ V}$✓➡ (3)

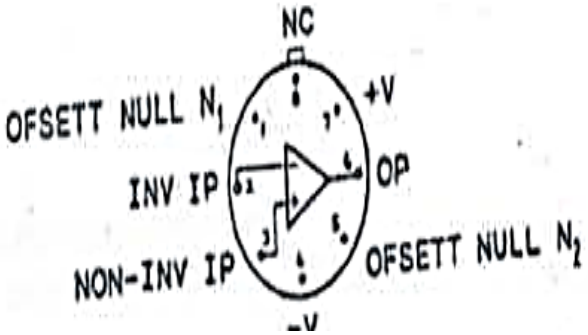
4.4



(½ punt vir elke komponent) (3)
[11]

VRAAG 5: GEÏNTEGREERDE STROOMBANE

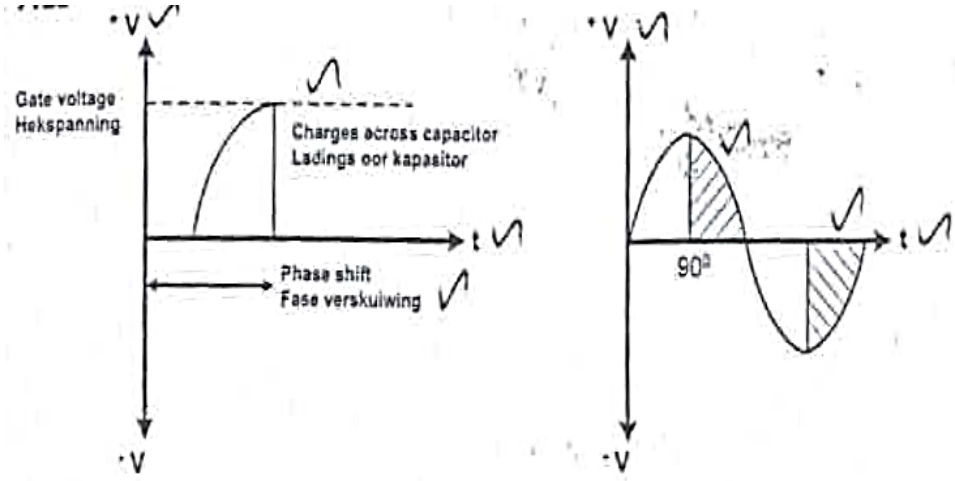
5.1



(4)

5.2 5 V (1)
[5]

VRAAG 6: ELEKTRONIESEFASEBEHEER



[4]

VRAAG 7: TOETSTOERUSTING

Begin 1: 0000✓

Stap 1: 1000 (8V) V_r< Vu: stel 1 ✓

Stap 2: 1101 (13V) V_r< Vu: stel 1✓

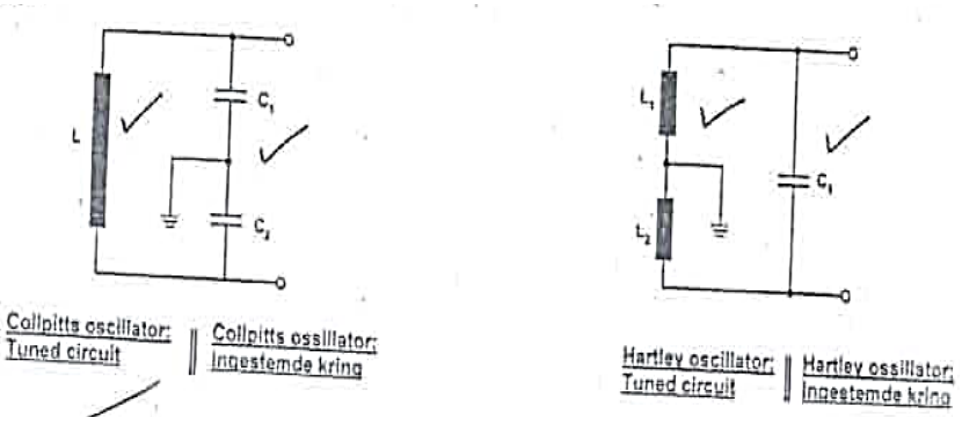
Stap 3: 1100 (12V) V_r< Vu: stel 1✓

Stap 4: 1111 (15V) V_r>Vu: herstel 1 tot 0✓ **[5]**

VRAAG 8: OSSILLATORS

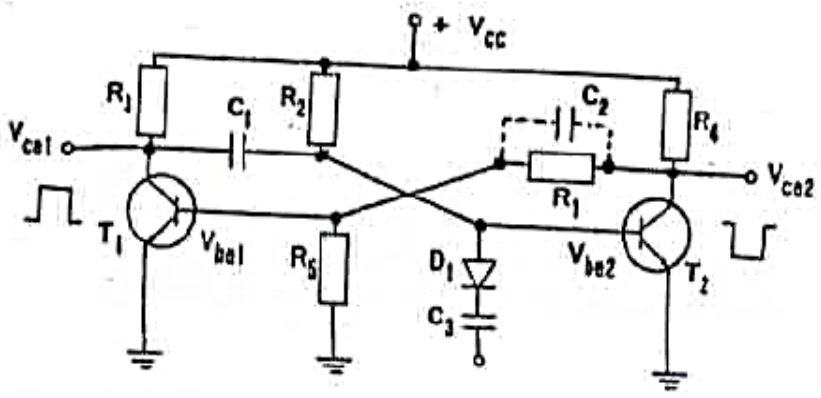
8.1
- Positiewe terugvoering
- Resonansiefrekwensie en terugvoeringsein moet in fase wees
- Konstante kragvoorsiening nodig
- Wins van stroombaan moet groter as een wees (Enige 2 × 1) (2)

8.2



(4)

8.3



(4)

8.4 $f_O = \frac{1,443}{(R_A + 2R_B)C}$

$= \frac{1,443}{(100 \times 10^3 + 2,80 \times 10^3) \times 5 \times 10^{-6}}$ ✓✓

$= 1,11$ Hz✓ (3)

[13]

VRAAG 9: OORVORMERS

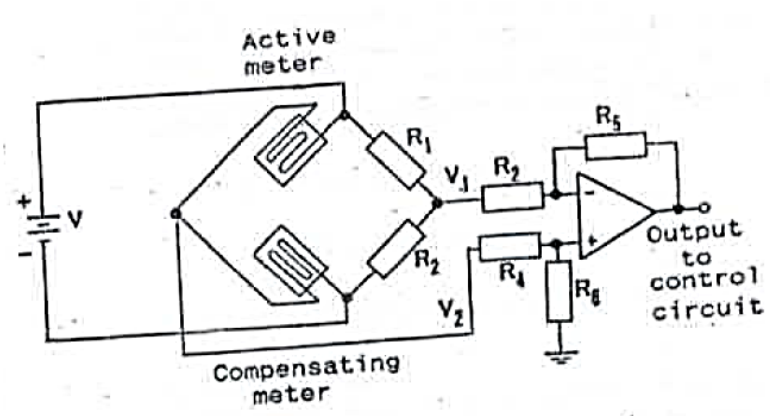
9.1 $$\text{Resolusie} = \frac{\text{Stroomspanningafname oor twee aangrensende draaie}}{\text{Totale stroomspanningafname}}$$

$$\frac{2}{100} = \frac{10 \times 10^{-3}}{\text{Totael stroomspanningafname}}\checkmark$$

$$\text{Totale stroomspanningafname} = \frac{10 \times 10^{-3}}{0{,}02}\checkmark$$

$$= 0{,}5\ \text{V}\checkmark\longrightarrow$$ (3)

9.2



(5)

9.3 $$\frac{R_{t_1}}{R_{t_2}} = \frac{Ae^{B/T_1}}{Ae^{B/T_2}}$$ $T_1 = 273 + 10 = 283\ \text{K}$
$T_2 = 273 + 30 = 303\ \text{K}$

$$\frac{12 \times 10^3}{2 \times 10^3} = \frac{Ae^{B/283}}{Ae^{B/303}}$$

$$6 = e^{B/283 - B/303}\checkmark$$

$$6 = e^{B(1/283 - 1/303)}\checkmark$$

$$\ln 6 = B\,(2{,}33 \times 10^{-4})\checkmark$$

$$B = 7\,686{,}66\checkmark\longrightarrow$$ (4)

[12]

TOTAAL: 100

Kopiereg voorbehou