higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INDUSTRIËLE ELEKTRONIKA N5

21 November 2022

Hierdie nasienriglyn bestaan uit 10 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1 1.1.1 $T = \frac{L}{R}$

$\therefore L = T \times R$

$= 2 \times 10^{-6} \times 150 \times 10^{3}$ ✓

$= 0{,}3\ H$ ✓ → (2)

1.1.2 $I_T = \frac{V}{R}$

$= \frac{5}{150 \times 10^{3}}$ ✓

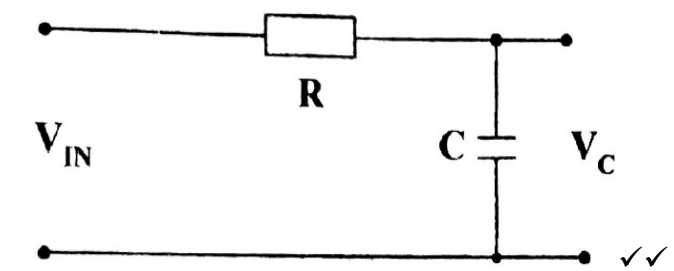
$= 33{,}33\ \mu A$

$I_L = 0{,}632 \times I_T$ ✓

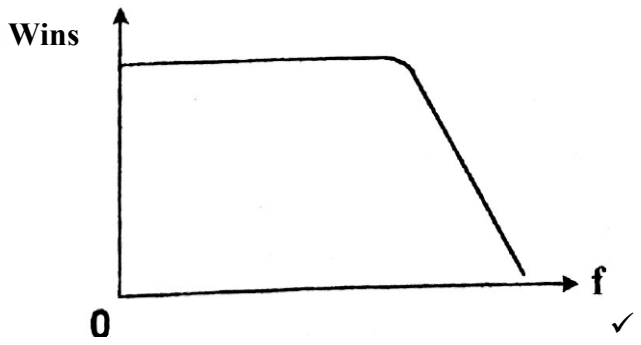
$= 0{,}632 \times 33{,}33 \times 10^{-6}$

$= 21{,}06\ \mu A$ ✓ → (3)

1.2



✓✓



✓ (3)

1.3 $Z_1 = 120 - j\,21{,}21\ \Omega = 121{,}86\ \angle -10{,}02^0\ \Omega$

$Z_2 = 180 + j\,25{,}31\ \Omega = 181{,}77\ \angle 8^0\ \Omega$

$Z_3 = 100 + j\,47{,}31\ \Omega = 110{,}627\ \angle 25{,}32^0\ \Omega$

$$Z_p = \frac{Z_1 \times Z_2}{Z_1 + Z_2}$$

$$= \frac{121{,}86\ \angle -10{,}02^0 \times 181{,}77\ \angle 8^0}{120 - j\,21{,}21 + 180 + j\,25{,}31}\ \checkmark\checkmark$$

$$= \frac{22150{,}492\ \angle -2{,}02^0}{300 + j\,25{,}31}\ \checkmark$$

$$= \frac{22150.492\ \angle -2{,}02^0}{301{,}065\ \angle 4{,}8^{\ 0}}\ \checkmark$$

$= 73{,}573\ \angle -6{,}8^0\ \Omega\ \checkmark = 73{,}05 - j\,8{,}711\Omega$

$$Z_T = \frac{Z_P \times Z_3}{Z_P + Z_3}$$

$$= \frac{73{,}573\ \angle -6{,}8^0 \times 110{,}627\ \angle 25{,}32^0}{73{,}05 - j\,8{,}711 + 100 + j\,47{,}31}\ \checkmark$$

$$= \frac{8139{,}160\ \angle 18{,}52^0}{173{,}74 + j\,38{,}599}\ \checkmark$$

$$= \frac{8139{,}160\ \angle 18{,}52^0}{177{,}976\ \angle 12{,}53}\ \checkmark$$

$= 45{,}73\ \angle 5{,}99^{\ 0}\ \Omega\ \checkmark$ ⟶ (9)

[17]

VRAAG 2

2.1 $$I_Z = \frac{P_Z}{V_Z}$$

$$= \frac{750 \times 10^{-3}}{12} \checkmark$$

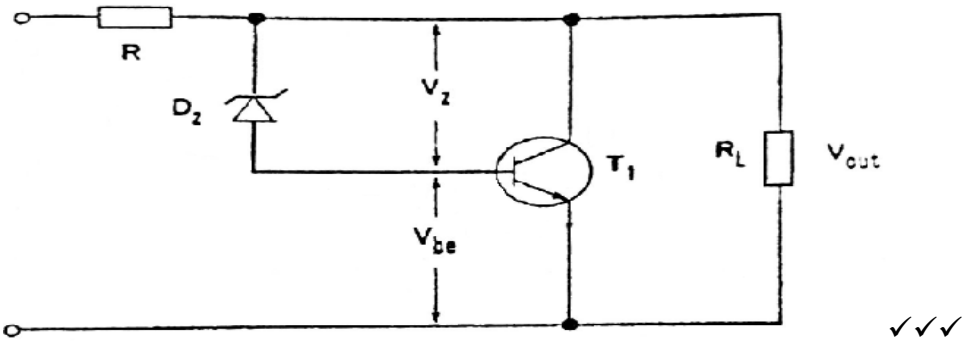
$$= 62{,}5\ \text{mA} \checkmark$$

$$R_S = \frac{Vi_{(MAKS)} - V_Z}{I_Z}$$

$$= \frac{20 - 12}{62{,}5 \times 10^{-3}} \checkmark$$

$$= 128\ \Omega \checkmark$$ (4)

2.2

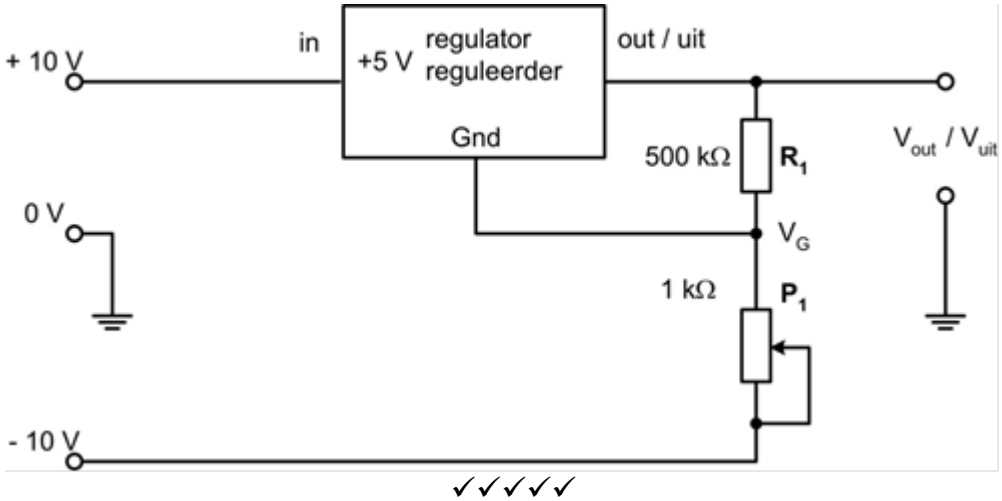


✓✓✓

Hoe die toevoerspanning gereguleer word:

Die waarde van die Zenerdiode (D_Z) word op so 'n manier geselekteer dat die voorspanning (V_{BE}) van die transistor✓ (T_1) laag genoeg is om die transistor in 'n onversadigde toestand te hou. Indien die toevoerspanning styg,✓ veroorsaak dit dat die transistor tot meer versadiging gedryf word ten einde die kollektorspanning te laat daal.✓ Hierdie val kompenseer vir die toename in toevoerspanning en op hierdie manier word die leweringspanning gestabiliseer.✓ (7)

2.3



✓✓✓✓✓ (5)

[16]

VRAAG 3

3.1 3.1.1

$$V_E = \frac{V_{CC}}{10}$$

$$\therefore V_{CC} = 10 \times V_E$$

$$= 10 \times 1{,}5$$

$$= 15\ V \checkmark$$

$$I_C = \beta x I_B$$

$$= 250 \times 40 \times 10^{-6} \checkmark$$

$$= 10\ mA$$

$$R_C = \frac{V_{CC} - V_{CE} - V_E}{I_C}$$

$$\therefore V_{CE} = V_{CC} - V_E - R_C . I_C \checkmark$$

$$= 15 - 1{,}5 - 750 \times 10 \times 10^{-3} \checkmark$$

$$= 6\ 1{,}5V \checkmark \longrightarrow$$ (5)

3.1.2

$$R_{B2} = \frac{1}{10}\beta R_e$$

$$= \frac{1}{10} \times 250 \times 120 \checkmark$$

$$= 3\ k\Omega \checkmark$$

$$R_{B1} = \frac{R_{B2}(V_{CC} - V_B)}{V_B}$$

$$= \frac{3\ 000(15 - 0{,}6)}{0{,}6} \checkmark$$

$$= 72\ k\Omega \checkmark \longrightarrow$$ (4)

3.2 $$Z_2 = \frac{1}{h_{oe} - \frac{h_{fe}.h_{re}}{h_{ie}+R_S}}$$

$$= \frac{1}{20 \times 10^{-6} - \frac{100 \times 2 \times 10^{-4}}{12000+0}}$$ ✓

$$= 54{,}55\ \text{k}\Omega$$ ✓

Maar $$Z_0 = \frac{R_C \times Z_2}{R_C + Z_2}$$

$$\therefore Z_0(R_C + Z_2) = R_C \times Z_2$$

$$2\,500(R_C + 54\,550) = R_C \times 54\,550$$

$$2\,500R_C + 136375000 = 54550R_C$$ ✓

$$R_C(54550 + 2500) = 136375000$$

$$R_C = \frac{136375000}{57050}$$

$$= 2390{,}447\ \Omega$$ ✓

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

$$= 1\,200 - \frac{100 \times 2 \times 10^{-4} \times 2390{,}447}{1 + 20 \times 10^{-6} \times 2390{,}477}$$ ✓

$$= 1199{,}80\ \Omega$$ ✓

$$Z_i = \frac{R_B \times Z_1}{R_B + Z_1}$$

$$\therefore (R_B + Z_1) = \times Z_1$$

$$2\,000(R_B + 1199{,}80) = R_B \times 1199{,}80$$

$$2000R_B + 2399{,}600 = 1199{,}80R_B$$

$$R_B(1199{,}80 + 2000) = 2399{,}600$$ ✓

$$R_B = \frac{2399{,}600}{3199{,}8}$$

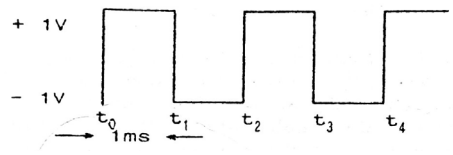
$$= 0{,}749\ \Omega$$ ✓ (8)

[17]

VRAAG 4

4.1 Dit is die vermoë van 'n versterker om gemeenskaplikemodusseine te verwerp. (2)

4.2



$$t = {}^{1}/_{f} = {}^{1}/_{500} = 2 \text{ m sek}$$

$$\therefore 360^0 = 2 \text{ m sek} \quad \text{dus } 180^0 \quad 1 \text{ m sek} ✓$$

$$= {}^{-1}/_{RC} \int_{t_0}^{t_1} V_{dt} + \textit{aanvanklike toestand van kapasitor}$$

$$V_{O(t_1)} = {}^{-1}/_{RC} \int_{t_0}^{t_1} V_{i(t_1)} + V_{C(t_0)} \quad maar \ t_0 = 0 ✓$$

$$= \left(\frac{1}{10\times10^{-6}\times0{,}01\times10^{-6}}\right) \int_{t_0}^{t_1} (1).(0{,}001) + 0 ✓$$

$$= -\frac{1}{0{,}01} \int_{t_0}^{t_1} 0{,}001 ✓$$

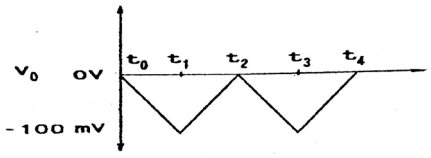
$$= -0{,}1\text{V} \text{ or } -100 \text{ mV} ✓$$

$$V_{O(t_2)} = {}^{-1}/_{RC} \int_{t_1}^{t_2} V_{i(t_2)} + V_{C(t_1)}$$

$$= (-100) \int_{t_1}^{t_2} (-1).(0{,}001) + (-0\,,1) ✓$$

$$= +0{,}1 - 0{,}1 \text{ V} ✓$$

$$= 0 \text{ V} ✓ \longrightarrow$$



✓ (9)

[11]

VRAAG 5

5.1
- Vaste positiewespanningsreëlaars
- Vaste negatiewespanningsreëlaars
- Stelbare spanningsreëlaars
- Dubbelvolgende ('dual-tracking') spanningsreëlaars (4)

5.2 As 'n elektriese lading wat veroorsaak word deur 'n wanbalans van elektrone op die oppervlak van 'n materiaal. (2)

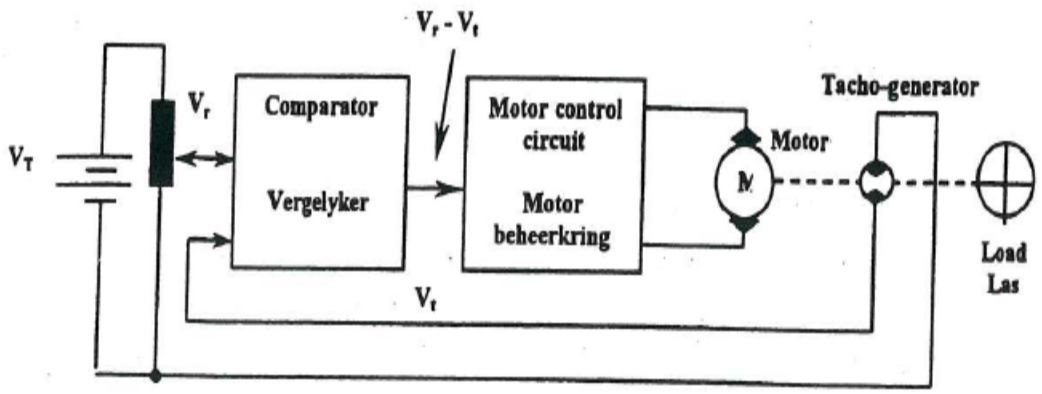
[6]

VRAAG 6

6.1 6.1.1 Waar
6.1.2 Waar
6.1.3 Waar

(3 × 1) (3)

6.2

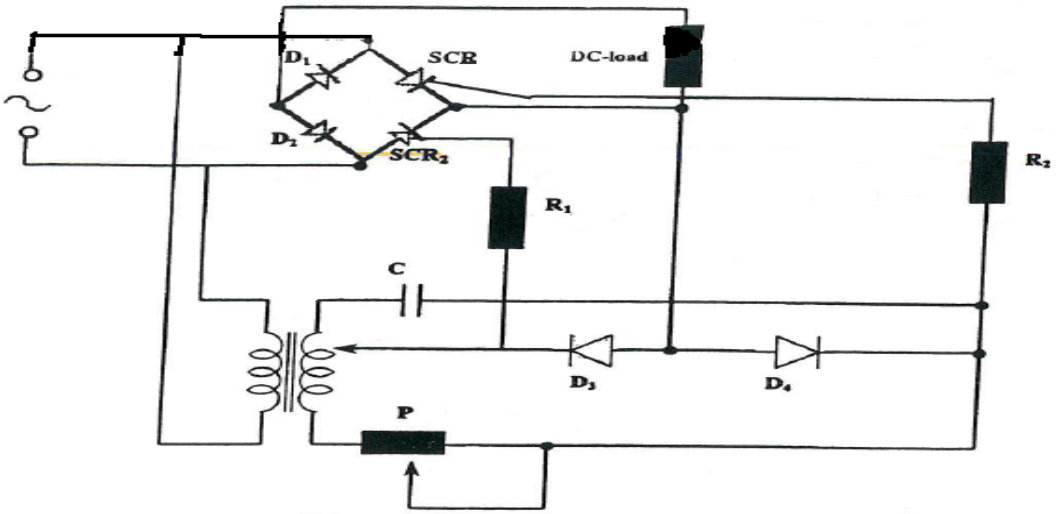


✓✓✓✓ (4)

6.3 'n Infrarooistraal is 'n onsigbare straal wat ingeroep kan word deur 'n infrarooi-uitstraaldiode met 'n ingeboude lens om die energie in 'n nou straal te konsentreer.✓ Die straal word waargeneem deur 'n fotodiode met 'n infrarooifilter daarvoor om normale lig af te hou.✓Die sein word versterk en kan gebruik word om 'n relê te beheer.✓ Hierdie beginsel kan in alarmstelsels, deurklokkies, outomatiese deuroopmakers en ligskakelaars, die deteksie van mense se bewegings, afstandbeheerkringe, ens. gebruik word.✓ (4)

[11]

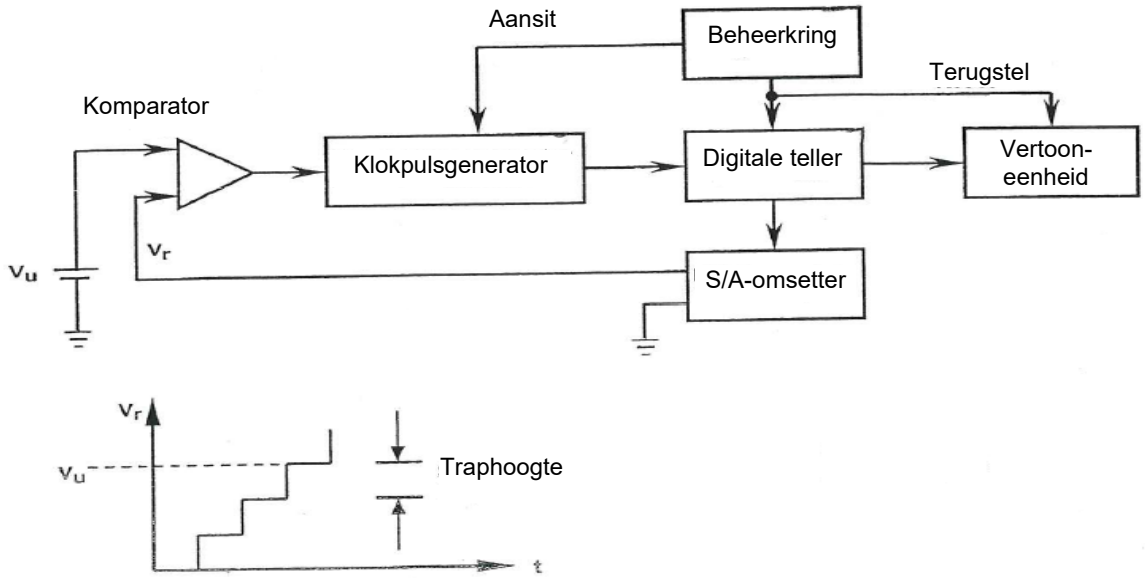
VRAAG 7



Heelgolfbeheerkring vir 'n GS-las met twee SBG's✓✓✓✓✓✓

IGNOREER INGEKLEURDE RESISTORS EN BESKOU HULLE AS NORMALE RESISTORS **[6]**

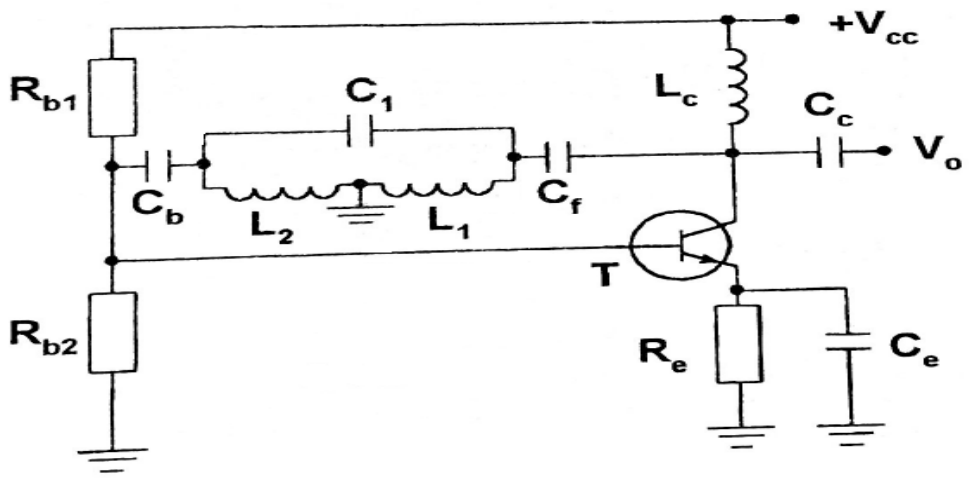
VRAAG 8



Trap-S/A-voltmeter✓✓✓✓✓✓ **[6]**

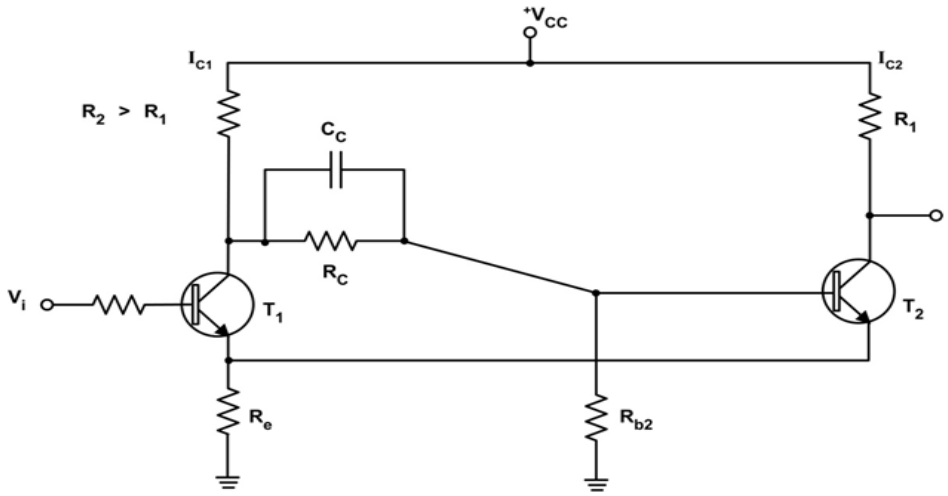
VRAAG 9

9.1



✓✓✓✓ (4)

9.2



✓✓✓✓

½ punt vir elke komponent

(4)

9.3 Rozner-wysiging is ’n metode wat gebruik word om die stygtyd by die kollektor van ’n transistor, T_1, te verhoog. (2)

[10]

TOTAAL: 100

Kopiereg voorbehou