higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

INDUSTRIËLE ELEKTRONIKA N5

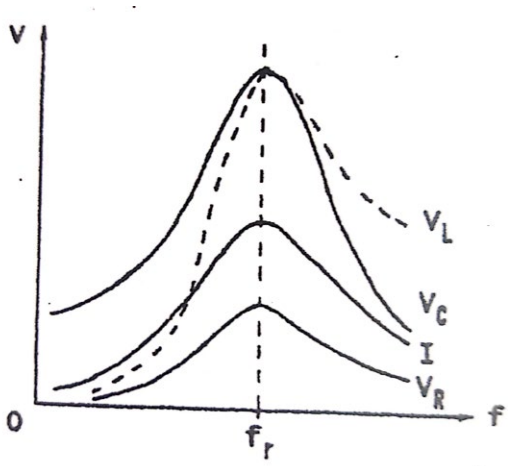
27 November 2023

Hierdie nasienriglyn bestaan uit 12 bladsye.

Kopiereg voorbehou

VRAAG 1: WISSELSTROOMTEORIE

1.1



(½ punt vir elke korrekte byskrif vir 'n totaal van 3 punte) (3)

1.2 1.2.1

$$f_r = \frac{f_1 + f_2}{2}$$

$$= \frac{(199{,}5 + 200{,}5)}{2} \text{ kHz} \checkmark$$

$$\therefore f_r = \underline{200 \text{ kHz}} \checkmark$$

Maar $$f_r = \frac{1}{2 \cdot \pi \cdot \sqrt{L \cdot C}}$$

$$(2 \cdot \pi \cdot f_r)^2 \cdot LC = 1$$

$$\therefore C = \frac{1}{4 \cdot \pi^2 \cdot f_r^2 \cdot L} \checkmark$$

$$= \frac{1}{4\pi (200 \times 10^3)^2 (0{,}015)} \checkmark$$

$$= \underline{42{,}217 \text{ pf}} \checkmark \quad (5)$$

1.2.2 $X_L = X_C$

dan $I_T = \frac{V_T}{R}$

$= \frac{20}{10}$

$= \underline{2\ A}$✓

$V_L = j.I_T.X_L$

$= j2 \times 2\pi \times 200 \times 10^3 \times 0{,}015$

$= \underline{37\,699{,}122\ \angle 90°\ V}$ ✓

$V_C = -j.I_T.X_C$

$= -j2 \times \frac{1}{2\pi \times 200 \times 10^3 \times 42{,}217 \times 10^{-12}}$ ✓

$= \underline{37\,699{,}112\ \angle 90°\ V}$ ✓

$V_R = j.I_T.R$

$= j2 \times 10$

$= \underline{20\ \angle 0^0\ V}$✓ (6)

1.2.3 Q-faktor = $\frac{X_L}{R}$

$= \frac{2 \times \pi \times 200 \times 10^3 \times 0{,}015}{10}$

$= \underline{1\,884{,}956}$✓ (2)
[16]

VRAAG 2: KRAGBRONEENHEDE

2.1 2.1.1

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

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

$$= \frac{10 + 300}{300} \times 12 \checkmark$$

$$= 12{,}4 \text{ V} \checkmark \quad (3)$$

2.1.2

$$V'_{r(rms)} = \frac{X_C}{\sqrt{R^2 + X_C^2}} \times V_{r(rms)}$$

$$\therefore V_{r(rms)} = \frac{\sqrt{R^2 + X_C^2}}{X_C} \times V'_{r(rms)} \checkmark$$

$$= \frac{\sqrt{10^2 + 8^2}}{8} \times 0{,}8 \checkmark$$

$$= 1{,}281 \text{ V} \checkmark \quad (3)$$

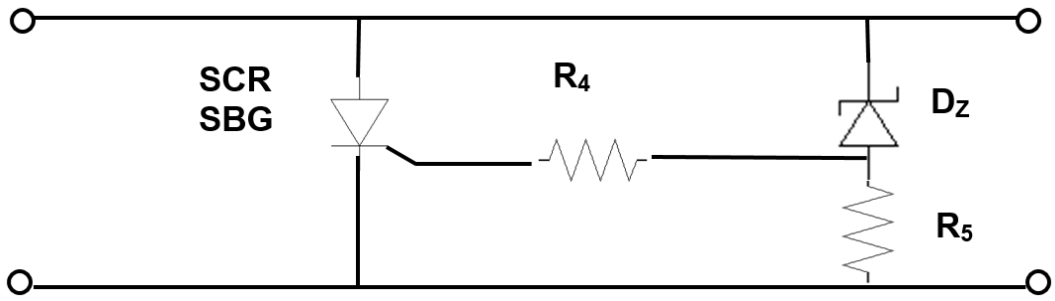
2.1.3

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

$$= \frac{0{,}8}{12} \checkmark$$

$$= 0{,}067 \checkmark \quad (2)$$

2.2



(1 punt vir SNG en D_Z; ½ punt vir R_4 en R_5 vir 'n totaal van 3 punte)

- Onder normale leweringspanning sal die spanning oor R5 laag wees en die SBG sal af wees.✓
- Wanneer die maksimum toegelate spanning oorskry word, sal spanningsval oor R5 toeneem en die SBG aangeskakel word.✓
- Die SBG veroorsaak 'n kortsluiting en die leweringspanning val na sero.✓ (6)

[14]

VRAAG 3: TRANSISTORVERSTERKERS

3.1 (a) $V_e = \frac{1}{10} \times V_{CC}$

$= \frac{1}{10} \times 12$

$= 1,2\ V$ ✓

(b) $I_C \cong I_E$

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

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

$I_C = \frac{1,2}{120}$

$= 10\ mA$ ✓

(c) $I_C = \beta . I_B$

$I_B = \frac{I_C}{\beta}$

$= \frac{10 \times 10^{-3}}{250}$

$= 40\ \mu A$ ✓

(d) $R_C = \dfrac{V_{CC} - V_{CE} - V_E}{I_C}$

$V_{CE} = V_{CC} - V_E - (I_C \,.\, R_C)$

$= 12 - 1{,}2 - (10 \times 10^{-3} \times 480)$

$\therefore V_{CE} = 6\ V$✓

OF

(e) $V_B = \dfrac{R_{B_2}}{R_{B_2} + R_{B_1}} \times V_{CC}$

$= \dfrac{3\,000}{3\,000 + 15\,947} \times 12$ ✓

$= 1{,}9\ V$✓

$V_B = V_E + V_{BE}$

$= 1{,}2 + 0{,}7$✓

$= 1{,}9\ V$✓

(5 × 2) (10)

3.2 $Z_1 = h_{ie}$

$= 1{,}2\ k\Omega$✓

Maar $Z_i = R_{BT} \,||\, Z_1$

$R_{BT} = \dfrac{R_{B_1} \times R_{B_2}}{R_{B_1} + R_{B_2}}$

$= \dfrac{15\,947 \times 3\,000}{15\,947 + 3\,000}$

$R_{BT} = 2\,524{,}991\ \Omega$✓

$Z_I = \dfrac{2\,524{,}9908 \times 1\,200}{2\,524{,}9908 + 1\,200}$

$= 813{,}42\ \Omega$✓

$Z_2 = \dfrac{1}{h_{oe}}$

$= \dfrac{1}{20 \times 10^{-6}}$

$= 50\ k\Omega$✓

$$Z_O = \frac{R_C \times Z_2}{R_C + Z_2}$$

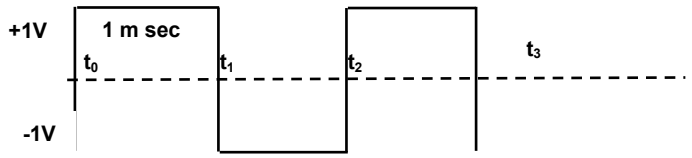
$$= \frac{480 \times 50\,000}{480 + 50\,000}$$

$$= 475{,}436\ \Omega\checkmark \qquad (5)$$

[15]

VRAAG 4: OPERASIONELE VERSTERKERS

4.1



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

$\therefore 360° = 2$ m sek dus $180^0 = 1$ m sek

$V_{O(t_1)} = -{}^{1}\!/_{RC} \int_{t0}^{t1} V dt$ + aanvanklike toestand van die kapasitor

$= -{}^{1}\!/_{RC} \int_{10}^{t1} V_i(t_1) + V_C(t_0)$ maar $t_0 = 0\checkmark$

$= \left(\frac{1}{10\times10^{6}\times0{,}01\times10^{-6}}\right) \int_{t0}^{t1} (1)(0{,}001) + 0\ \checkmark$

$= -\frac{1}{0{,}01}\int_{t0}^{t1} 0{,}001\ \checkmark$

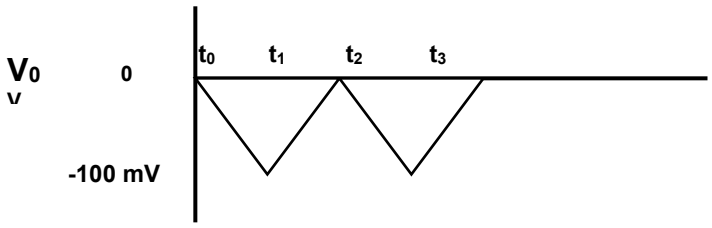
$= \quad -0{,}1\,V \quad \text{or} \quad -100\ mV$ ✓

$V_{O(t_1)} = -1/RC \int_{11}^{t2} V_i(t_2) + V_C(t_1)$

$= (-100) \int_{t1}^{t2} (-1)(0{,}001) + (-0{,}1)$ ✓

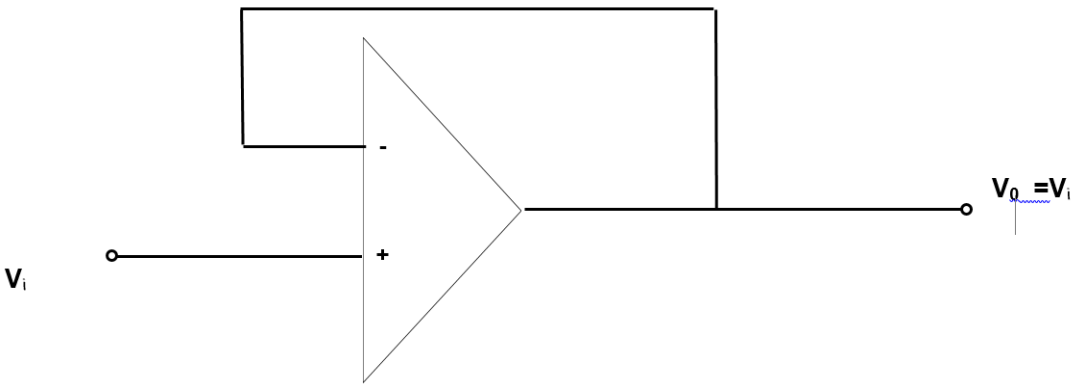
= + 0,1 - 0,1

= 0 V ✓



✓✓ (9)

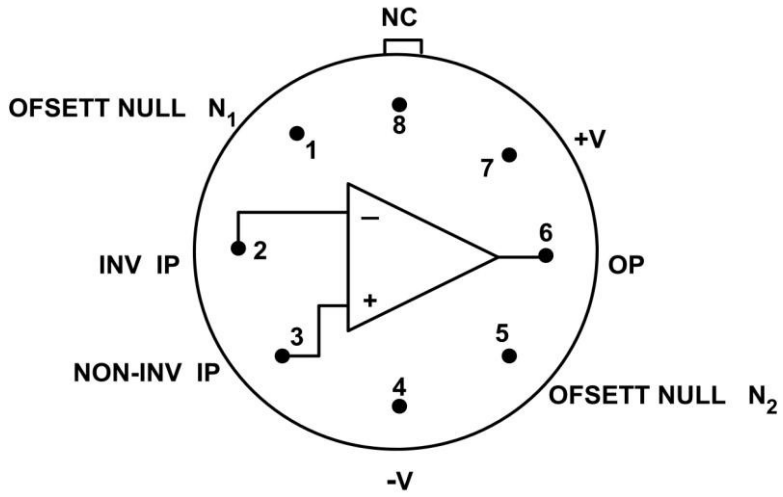
4.2



Die spanningsvolger

(1 punt vir elke korrekte byskrif vir 'n totaal van 4 punte) (4)
[13]

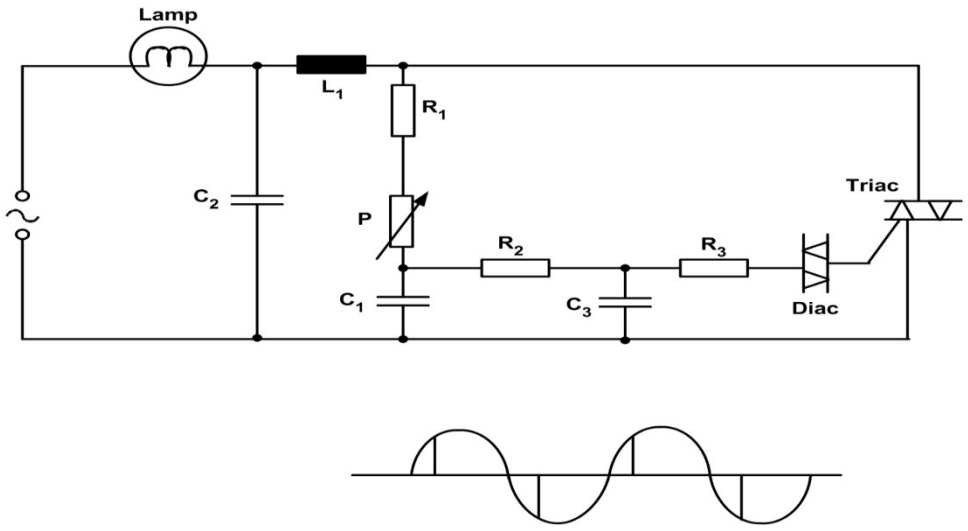
VRAAG 5: GEÏNTEGREERDE KRINGE



741-GEÏNTEGREERDE OPERASIONELE VERSTERKER IN 'N METAALHOUER

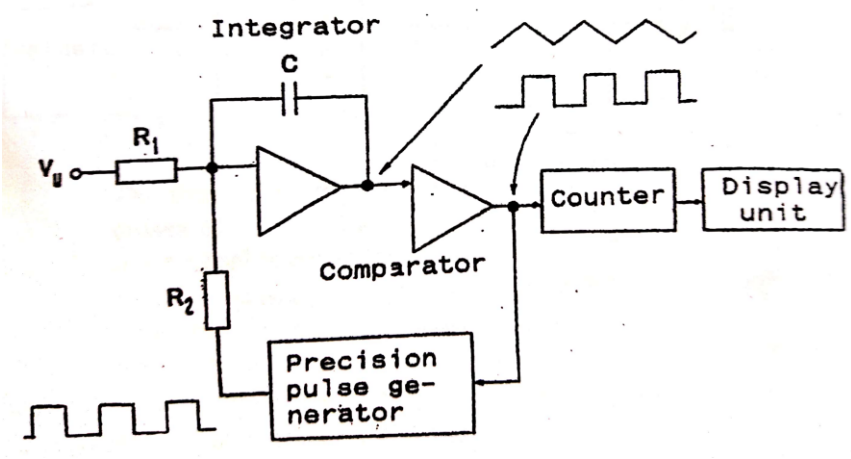
(½ punt vir elke korrekte byskrif vir 'n totaal van 4 punte)
(4 × 1) [4]

VRAAG 6: ELEKTRONIESE FASEBEHEER



(½ punt vir elke korrekte byskrif vir 'n totaal van 6 punte) [6]

VRAAG 7: TOETSTOERUSTING

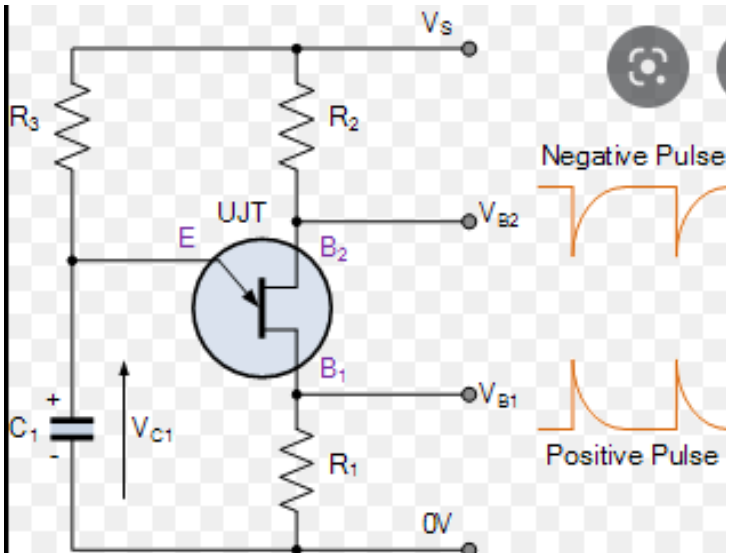


(1 punt vir die korrekte blokbyskrif en ½ punt vir die korrekte komponentbyskrifte vir 'n totaal van 6 punte) [6]

VRAAG 8: OSSILLATORS

8.1
- Variasie in die ingestemde kring of transistorparameters
- Verandering in lastoestande
- Onstabiele toevoerspanning (3)

8.2 'n Netjiese, benoemde kringdiagram van 'n enkelsperlaagtransistor-ossillator.



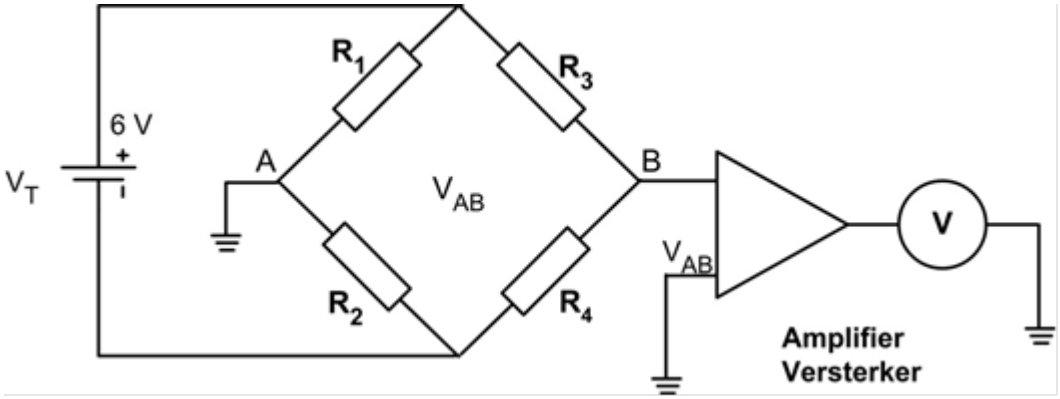
(½ punt vir elke korrekte byskrif vir 'n totaal van 4 punte) (4)

8.3
- Sinusgolfvorm✓ – word vir kragtoevoer van elektriese toerusting gebruik.✓
- Vierkantige golfvorm✓ – klokpuls vir digitale kringe, alarmstelsels, ultrasoniese toetse.✓
- Saagtandgolfvorm✓ – tydbasis in 'n ossilloskoop.✓ (Enige 3 × 2) (6)

[13]

VRAAG 9: OMSETTERS1

9.1



TERMISTORBRUG MET GS-VOORSPANNING

(½ punt vir elke korrekte byskrif vir 'n totaal van 4 punte) (4)

9.2 $T = {}^{0}C + 273$

$= 30 + 273$

$= 303\ K$✓

9.2.1 $R_t = A \cdot e^{\frac{B}{T}}$

$= 0{,}2169\ e^{\frac{3200}{303}}$

$= 8\,372{,}747\ \Omega$✓ (2)

9.2.2 $V_{AB} = V_A - V_B$

$V_A = \frac{R_2}{R_1 + R_2} \times V_T$

$= \frac{10\ k\Omega}{10\ k\Omega + 10\ k\Omega} \times 10$✓

$= 5\ V$✓

$$V_B = \frac{R_t}{R_t + R_3}$$

$$= \frac{8\,372{,}747}{8\,372{,}747 + 10\,000} \times 10 \checkmark$$

$$= 4{,}56 \text{ V} \checkmark$$

$$V_{AB} = V_A - V_B$$

$$= 5 - 4{,}56$$

$$= 0{,}44 \text{ V} \checkmark$$

$$\text{Versterkerwins (AV)} = \frac{V_O}{V_i}$$

$$= \frac{10}{0{,}44} \checkmark$$

$$= 22{,}73 \checkmark \qquad (7)$$

[13]

TOTAAL: 100

Kopiereg voorbehou