



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N5

11 April 2025

Hierdie nasienriglyn bestaan uit 9 bladsye.

VRAAG 1

1.1 $T_B = 22 \quad T_C = 33 \quad T_D = 26 \quad T_E = 28 \quad T_F = 30 \quad T_G = 24 \quad T_H = 40$
 $T_I = 15$

$$\frac{N_A}{N_J} = \frac{T_C \times T_D \times T_G \times T_H}{T_B \times T_E \times T_F \times T_I}$$

$$\frac{700}{N_J} = \frac{33 \times 26 \times 24 \times 40}{22 \times 28 \times 30 \times 15}$$

$$\frac{700}{N_J} = \frac{823680}{277200}$$

$$\frac{N_J}{700} = \frac{277200}{823680}$$

$$N_J = 235,58 \text{ rpm}$$

(6)

- 1.2
- Ratreduseerders verhoog die hefvermoë van die enjin oor die dryfas.
 - Deur gebruik te maak van ratverhoudings kan die enjin vinniger draai en meer krag opwek om die las meer effektief vanuit rus te dra.
 - Dit verskaf die medium waardeur die enjin van die dryfas ontkoppel kan word en kan luier terwyl die voertuig stilstaan.
 - Die ratkas bied 'n trurat wat die enjin in staat stel om in dieselfde rigting aan te hou loop.

(4)

[10]

VRAAG 2

- 2.1
- Gruis
 - Meel
 - Suiker
 - Kunsmis
 - Kalk
 - Kooks
 - Sand

(Enige 5 × 1)

(5)

2.2 2.2.1

$$m = \frac{120 \times 10^3}{3600}$$

$$m = \boxed{33,333 \text{ kg/s}} \checkmark$$

Krag teen swaartekrag

$$P_g = mgh$$

$$P_g = 33,333(9,81)(15) \checkmark$$

$$P_g = 4904,95 \text{ W}$$

$$P_g = \boxed{4,905 \text{ kW}} \checkmark$$

Krag om wrywing te oorkom

$$P_\mu = P_g \times 0,45$$

$$P_\mu = 4,905 \times 0,45 \checkmark$$

$$P_\mu = \boxed{2,207 \text{ kW}} \checkmark$$

Krag om las te skuif

$$P_L = P_g + P_\mu$$

$$P_L = 4,905 + 2,207$$

$$P_L = \boxed{7,112 \text{ kW}} \checkmark$$

$$P_m = \frac{P_L}{\eta}$$

$$P_m = \frac{7,112}{0,75}$$

$$P_m = \boxed{9,5 \text{ kW}} \checkmark$$

(7)

2.2.2

$$\theta = \frac{225^\circ}{57,3} = \boxed{3,927 \text{ rad}} \checkmark$$

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

$$\frac{T_1}{T_2} = e^{0,21(3,927)}$$

$$T_1 = 2,281T_2 \checkmark$$

$$T_L = (T_1 - T_2)v$$

$$T_1 - T_2 = \frac{P_L}{v}$$

$$2,281 T_2 - T_2 = \frac{7,112}{1,5} \checkmark$$

$$2,281 T_2 = 4,741,33$$

$$T_2 = \boxed{3,701 \text{ kN}} \checkmark$$

$$T_1 = 2,281T_2$$

$$T_1 = 2,281(3701)$$

$$T_1 = \boxed{8,442 \text{ kN}} \checkmark$$

$$\begin{aligned}
 2.2.3 \quad T_1 &= w \times n \times ft \\
 n &= \frac{T_1}{w \times ft} \\
 n &= \frac{8442}{0,7 \times 2,5 \times 10^3} \checkmark \\
 n &= 4,8 \checkmark \\
 &= \boxed{5 \text{ Lae}} \checkmark
 \end{aligned}$$

(3)
[15]

VRAAG 3

$$\begin{aligned}
 3.1 \quad T_d &= I \times \alpha \\
 T_d &= 100 \times \frac{1,7}{0,55} \checkmark \\
 T_d &= \boxed{309,091 \text{ N.m}} \checkmark \\
 T_{load} &= \text{load} \times \text{radius} \\
 T_{load} &= 1,2 \times 10^3 \times 9,81 \times 0,55 \checkmark \\
 T_{load} &= \boxed{6474,6 \text{ N.m}} \checkmark \\
 T_{cage} &= m_1 \times a \times r \\
 T_{cage} &= 1,2 \times 10^3 \times 1,7 \times 0,55 \checkmark \\
 T_{cage} &= \boxed{1122 \text{ N.m}} \checkmark
 \end{aligned}$$

(6)

$$\begin{aligned}
 3.2 \quad v &= u + at \\
 v &= 0 + (1,7 \times 3,5) \checkmark \\
 v &= \boxed{5,95 \text{ m/s}} \checkmark \\
 P &= \frac{T_{total} \times v}{\eta \times r} \\
 P &= \frac{(309 + 6474,6 + 1122) \checkmark \times 5,95}{0,85 \times 0,55} \\
 P &= 100617,886 \text{ W} \\
 P &= \boxed{100,617 \text{ kW}} \checkmark
 \end{aligned}$$

(4)
[10]

VRAAG 4

$$I = m \cdot k^2$$

$$I = 60 \cdot (0,3)^2 \checkmark$$

$$I = \boxed{5,4 \text{ kg} \cdot \text{m}^2} \checkmark$$

$$\omega^2 = \left(\frac{2\pi N}{60} \right)^2$$

$$\omega^2 = \left(\frac{2\pi \times 110}{60} \right)^2 \checkmark$$

$$\omega^2 = \boxed{132,69} \checkmark$$

$$E_k = \frac{1}{2} \times I \times \omega^2$$

$$E_k = \frac{1}{2} \times 5,4 \times 132,69$$

$$E_k = \boxed{358,3 \text{ J}} \checkmark$$

[5]

VRAAG 5

5.1

$$\text{Massa van las} = \frac{350}{3,6} \checkmark \checkmark$$

$$\text{Massa van las} = 97,22 \text{ kg/s} \checkmark$$

$$\text{Volume gelewer} = \frac{\text{massa van las}}{\text{digtheid van las}}$$

$$\text{Volume gelewer} = \frac{97,22}{850} \checkmark$$

$$\text{Volume gelewer} = \boxed{0,114 \text{ m}^3/\text{s}} \checkmark$$

$$\text{Aantal bakke/s} = \frac{v}{s}$$

$$\text{Aantal bakke/s} = \frac{0,6}{1} \checkmark$$

$$\text{Aantal bakke/s} = \boxed{0,6 \text{ bakke/s}} \checkmark$$

$$\text{Volume van bakke} = \frac{\text{volume gelewer}}{\text{aantal bakke/s}}$$

$$\text{Volume van bakke} = \frac{0,114}{0,6} \checkmark \checkmark$$

$$\text{Volume van bakke} = \boxed{0,19 \text{ m}^3} \checkmark$$

(10)

$$\begin{aligned}
 5.2 \quad P_g &= mgh \\
 P_g &= 97,22(9,81)(70) \checkmark \\
 P_g &= \boxed{66760,974 \text{ W}} \checkmark \\
 \eta &= \frac{P_o}{P_i} \times 100 \% \\
 85 &= \frac{66760,974}{P_i} \times 100 \% \checkmark \checkmark \\
 P_i &= \boxed{78542,32 \text{ W}} \checkmark
 \end{aligned}$$

(5)
[15]

VRAAG 6

- 6.1
- Swaaistoptoestel: dit is so tussen die spore of aan hul buitekant geïnstalleer dat die vragmotors dit uit hul pad stoot wanneer hulle opklim.
 - Deacon-ontsporingstoestel: relings word met 50 mm tot 75 mm na die buitekant van die spoor afgewyk en 'n bult van ongeveer dieselfde hoeveelheid word in die relings gerangskik.
 - Sperrat-en-klinkterughoutoestelle: dit is in die dryfrat opgeneem om te verhoed dat die vervoertoerusting agteruitry.
 - Selfsluitwurmratte: Hulle is so ontwerp dat hulle nie deur 'n hysmasjien omgekeer kan word nie.
 - Uitsnyrelings: Wanneer 'n vragmotor agteruit ry, ontspoor 'n uitsnyreling dit en laat dit teen 'n betonblok loop. (Enige 3 × 2)
- (6)

6.2 6.2.1 vir 6/7 konstruksie – tou – oppervlakte = $0,36 D^2$

$$S_{ultimate} = \frac{Strength_{ultimate}}{A_{rope}}$$

$$S_{ultimate} = \frac{Strength_{ultimate}}{0,36 D^2}$$

$$D^2 = \frac{Strength_{ultimate}}{0,36 \times Stress_{ultimate}} \checkmark$$

$$D^2 = \frac{640 \times 10^3 \checkmark}{0,36 \times 1400 \times 10^6 \checkmark}$$

$$D = 0,03563 \text{ m}$$

$$D = \boxed{35,63 \text{ mm}} \checkmark$$

Strength ultimate =
Breeksterkte

Stress ultimate =
breekspanning

(4)

$$\begin{aligned}
 6.2.2 \quad T_{\text{oumassa}}/m &= \frac{d^2}{250} \\
 T_{\text{oumassa}}/m &= \frac{(35,63)^2}{250} \checkmark \\
 T_{\text{oumassa}}/m &= \boxed{5,078 \text{ kg/m}} \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 6.2.3 \quad \text{Spanning weens selfgewig} &= \frac{m_1 \times g \times S^2}{8h} \\
 \text{Spanning weens selfgewig} &= \frac{5,078 \times 9,81 \times (98)^2}{8(2)} \checkmark \\
 \text{Spanning weens selfgewig} &= 29901,56 \text{ N} \\
 \text{Spanning weens selfgewig} &= \boxed{29,9 \text{ kN}} \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 6.2.4 \quad \text{Spanning weens een las} &= \frac{m_2 \times g \times S}{4h} \\
 \text{Spanning weens een las} &= \frac{520 \times 9,81 \times 98}{4(2)} \checkmark \\
 \text{Spanning weens een las} &= 62489,7 \text{ N} \\
 \text{Spanning weens een las} &= \boxed{62,49 \text{ kN}} \checkmark \quad (2)
 \end{aligned}$$

$$\begin{aligned}
 6.2.5 \quad \text{Veiligheidsfaktor} &= \frac{U_{\text{ltimate}_s}}{T_{\text{sw}} + T_L} \\
 \text{Veiligheidsfaktor} &= \frac{640 \times 10^3}{29901,56 + 62489,7} \checkmark \checkmark \\
 \text{Veiligheidsfaktor} &= \frac{640 \times 10^3}{92391,26} \checkmark \\
 \text{Veiligheidsfaktor} &= \boxed{6,927} \checkmark \quad (4)
 \end{aligned}$$

[20]

VRAAG 7

$$7.1 \quad u = \frac{27}{3,6} = 7,5 \text{ m/s} \quad v = \frac{72}{3,6} = 20 \text{ m/s} \checkmark \quad (\text{Half elk})$$

$$\begin{aligned}
 v &= u + at \\
 a &= \frac{v - u}{t} \\
 a &= \frac{20 - 7,5}{20} \\
 a &= \boxed{0,625 \text{ m/s}^2} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F &= ma \\
 F &= 2000(0,625) \checkmark \\
 F &= 1250 \text{ N} \\
 F &= \boxed{1,25 \text{ kN}} \checkmark
 \end{aligned}$$

$$\begin{aligned}7.2 \quad v^2 &= u^2 + 2as \\ s &= \frac{v^2 - u^2}{2a} \\ s &= \frac{(20)^2 - (7,5)^2}{2(0,625)} \checkmark \\ s &= \boxed{275 \text{ m}} \checkmark\end{aligned}$$

$$\begin{aligned}WD &= F \times s \\ WD &= 1250 \times 275 \checkmark \\ WD &= 343750 \text{ J} \\ WD &= \boxed{343,75 \text{ kJ}} \checkmark\end{aligned}$$

(4)

$$\begin{aligned}7.3 \quad P &= \frac{WD}{t} \\ P &= \frac{343750}{20} \checkmark \\ P &= 17187,5 \text{ W} \\ P &= \boxed{17,2 \text{ kW}} \checkmark\end{aligned}$$

(2)

[10]

VRAAG 8

Toestand	A	B	C	Arm L
Maak arm L vas en draai A +1 draai ('rev')	+1	$\frac{T_A}{T_B} = \frac{130}{40} = 3,25\checkmark$	$\frac{T_A}{T_B} \times \frac{T_B}{T_C} = \frac{130}{40} \times \frac{40}{-50} = -2,6\checkmark$	0
Vermenigvuldig met X en voeg Y by	$x + y$	$3,25x + y\checkmark$	$-2,6x + y\checkmark$	y
$N_L = 50$ $N_A = 0$	$0\checkmark$		$N_C = ?$	$50\checkmark$

(6)

Los op vir x & y

$$\begin{array}{rcl}
 y & = & 50 \dots\dots\dots 1 \\
 x + y & = & 0 \dots\dots\dots 2 \\
 (1 - 2) & & x = -50\checkmark \dots\dots\dots 3
 \end{array}$$

$$\begin{aligned}
 N_C &= -2,6x + y \\
 N_C &= -2,6(-50) + 50
 \end{aligned}$$

$$N_C = \boxed{180 \text{ rpm}}\checkmark$$

vervang x in vergelyking 2

$$\begin{aligned}
 x + y &= 0 \\
 -48 + y &= 0 \\
 y &= 48\checkmark \\
 \therefore N_L &= \boxed{48 \text{ rpm}}\checkmark (\text{kloksgewys})
 \end{aligned}$$

(4)

[10]

TOTAAL: 100