



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N6

1 April 2025

Hierdie nasienriglyn bestaan uit 10 bladsye.

VRAAG 1: KOPPELAARS

1.1

$$w_1 = \frac{2\pi N}{60}$$

$$= \frac{2\pi \times 750}{60}$$

$$= 78,54 \text{ rad/s}$$

$$w_2 = \frac{2\pi N}{60}$$

$$= \frac{2\pi \times 500}{60}$$

$$= 52,34 \text{ rad/s} \checkmark \text{ 1/2 punt vir elk} = 1 \text{ punt}$$

$$T = \mu \times (Fc - S) \times R \times n$$

$$Fc - S = \frac{T}{m \times R \times n}$$

$$= \frac{250}{0,3 \times \left(\frac{0,28}{2}\right) \times 4} \checkmark$$

$$= 1488,1 \text{ N} \checkmark$$

$$(Fc - S) = [m(w_1)^2 r] - [m(w_2)^2 r]$$

$$1488,1 = [m(78,54)^2 \times 0,12] - [m(52,34)^2 \times 0,12] \checkmark$$

$$1488,1 = 740,22 m - 328,74 m$$

$$= \frac{1488,1}{411,8}$$

$$= 3,62 \text{ kg} \checkmark$$

(5)

1.2

$$T = \mu \times (Fc - s) \times R \times n$$

$$= 0,3 \times [(740 \times 3,62) - 1500] \times \left(\frac{0,28}{2}\right) \times 4 \checkmark$$

$$= 198 \text{ Nm} \checkmark$$

$$P = \frac{2\pi NT}{60}$$

$$= 2\pi \times \left(\frac{600}{60}\right) \times 198 \checkmark$$

$$= 12,44 \text{ kW} \checkmark$$

(4)

[9]

VRAAG 2: REMME

$$2.1 \quad \frac{T_1}{T_2} = e^{\mu\theta}$$

$$= e^{0,27 \times 4,71}$$

$$\frac{T_1}{T_2} = 3,568 \checkmark$$

$$T_1 = 1427,551 \text{ N} \checkmark$$

$$T_2 = 400 \text{ N}$$

$$T_{\text{brake}} = (T_1 - T_2) \times r$$

$$= (1427,551 - 400) \times 0,35 \checkmark$$

$$= 359,64 \text{ Nm} \checkmark$$

(4)

$$2.2 \quad P = T_{\text{brake}} \times w_{\text{mean}}$$

$$P = T_{\text{brake}} \times \left[\frac{w_2 + w_1}{2} \right]$$

$$P = 359,64 \times \left(\frac{58,64 + 0}{2} \right) \checkmark$$

$$= 10544,64 \text{ W} \checkmark$$

$$P = \frac{E_k}{t} = \frac{0,5 \times 80 (58,64^2 - 0^2)}{10544,64} \checkmark \checkmark$$

$$E_k = \frac{1}{2} I (w_1^2 - w_2^2)$$

$$t = 13,045 \checkmark$$

(5)

[9]

VRAAG 3: HOOFDRYFASTE

- 3.1
- Normaalkrag
 - Tangensiale krag
 - Radiale krag

(3)

$$3.2.1 \quad P = \frac{2\pi NT}{60}$$

$$T_p = \frac{40000 \times 60}{2\pi \times 1500} \checkmark$$

$$T_p = 254,65 \text{ Nm} \checkmark$$

$$\begin{aligned}
 3.2.2 \quad T_s &= \frac{T_p \times PCD_w}{PCD_v} \\
 &= \frac{254,65 \times 360}{170} \checkmark \\
 &= 539,26 \text{ Nm} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3.2.3 \quad F_t &= \frac{T_p \times 2}{PCD} \\
 &= \frac{254,65 \times 2}{0,17} \checkmark \\
 &= 2996 \text{ N} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 3.2.4 \quad F_r &= F_t \cdot \tan \theta \\
 &= 2996 \tan 20^\circ \checkmark \\
 &= 1090 \text{ N} \checkmark
 \end{aligned}$$

(4 × 2) (8)
[11]

VRAAG 4: REDUKSIERATKASTE EN VLEGWIELE

$$\begin{aligned}
 4.1 \quad 4.1.1 \quad W_1 &= 0 \\
 W_2 &= \frac{2\pi \times 420}{60} \\
 &= 43,982 \checkmark \\
 \alpha_B &= \frac{W_2 - W_1}{t} \\
 &= \frac{43,982 - 0}{35} \checkmark \\
 &= 1,257 \text{ rad/S}^2 \checkmark \\
 T_B &= I_B \times \alpha_B \\
 &= 500 \times 1,257 \checkmark \\
 &= 628,5 \text{ Nm} \checkmark
 \end{aligned}$$

(5)

$$\begin{aligned}
 4.1.2 \quad \frac{N_A}{N_B} &= \frac{\alpha_A}{\alpha_B} \\
 \alpha_A &= \frac{1,257 \times 1200}{420} \checkmark \\
 &= 3,591 \text{ rad/s}^2 \checkmark \\
 T_A &= I_A \times \alpha_A \\
 &= 215 \times 3,591 \checkmark \\
 &= 772 \text{ Nm} \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 4.1.3 \quad k &= \frac{0,6}{2} = 0,3 \checkmark \\
 I &= m \times k^2 \\
 &= 300 \times 0,3^2 \\
 &= 27 \text{ Kg.m} \checkmark \\
 V_R &= \frac{N_B}{N_A} \\
 &= \frac{420}{1200} \\
 &= 0,35 \checkmark \\
 I_{TOT} &= I_A + (I_B + I)VR^2 \checkmark \\
 &= 215 + (500 + 27)(0,35)^2 \checkmark \\
 &= 279,558 \text{ kg.m}^2 \checkmark
 \end{aligned} \tag{6}$$

$$\begin{aligned}
 4.1.4 \quad E_k \text{ TOTAL} &= \frac{1}{2} I_{TOTAL} \times \omega^2 \\
 &= 0,5 \times 279,558 \times 125,664 \checkmark \\
 &= 2207 \text{ KJ} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.2 \quad 4.2.1 \quad T &= I \times \alpha \\
 1500 &= (2500 \times 1) \times \alpha \checkmark \\
 \alpha &= 0,6 \text{ rad/s}^2 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 4.2.2 \quad E_k &= \frac{1}{2} I \omega^2 \\
 &= \frac{1}{2} (2500 \times 6^2) \\
 &= 45 \text{ kJ} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 \omega_2 &= \omega_1 + \alpha \times t \\
 &= 0 + 0.6 \times 10 \\
 &= 6 \text{ rad/s} \checkmark
 \end{aligned}$$

(2 × 2) (4)
[21]

VRAAG 5: SPOORTREKKRAG EN VOERTUIGDINAMIKA

$$\begin{aligned}
 5.1 \quad F_g &= m \times \sin \theta \\
 &= 480 \times 10^3 \times 9,8 \times \frac{1}{140} \checkmark \\
 &= 33634 \text{ N} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 F_R &= m \times R \\
 &= 480 \times 136 \checkmark \\
 &= 65280 \text{ N} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 T_E &= F_g + F_a - F_r \checkmark \\
 &= 33634 + 590000 - 65280 \checkmark \\
 &= 558,354 \text{ N} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 E_{\text{dissipation}} &= (T_e + T_R) \times s \checkmark \\
 &= (558354 + 65280) \times 140 \checkmark \\
 &= 87,3 \text{ MJ} \checkmark
 \end{aligned}$$

(10)

$$5.2 \quad N_F = 1100 \times 9,81 \times 0,35$$

$$= 3777 \text{ N} \checkmark$$

$$N_R = 1100 \times 9,81 \times 0,65$$

$$= 7014 \text{ N} \checkmark$$

$$w = T.E \times \frac{h}{d}$$

$$= \mu(N_F - w) \times \frac{h}{d}$$

$$= 0,45(3777 - w) \times \frac{0,69}{2,6} \checkmark$$

$$= 451 - 0,119 w \checkmark$$

$$w = \frac{451}{1,119} = 403 \text{ N} \checkmark$$

$$T.E = \mu(N_F - w)$$

$$= 0,45(3777 - 403)$$

$$= 1518 \text{ N} \checkmark$$

$$T.E = F_a = m_a \checkmark$$

$$a = \frac{1518}{1100}$$

$$= 1,38 \text{ m/s}^2 \checkmark$$

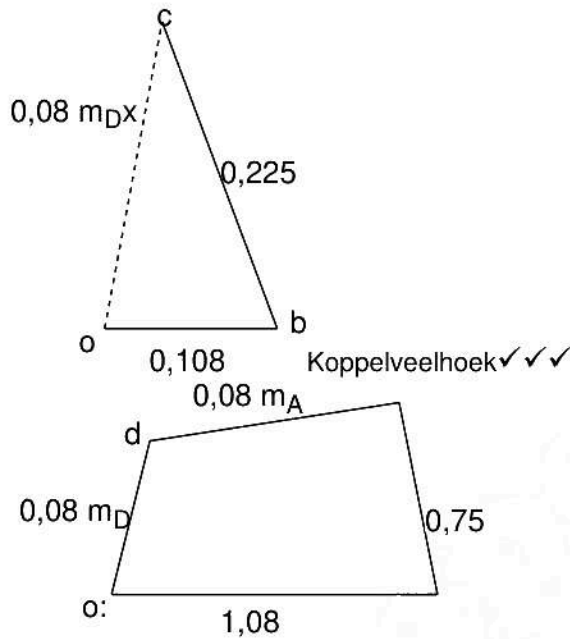
(8)
[18]

VRAAG 6: BALANSERING

6.1

Plek	Massa(kg)	r(m)	mr(kg.m)	l(m)	mrl(kg.m ²)
A	M _A	0,08	0,08 M _A	0	0
B	18	0,06	1,08	0,1	0,108
C	12,5	0,06	0,75	0,3	0,225
D	M _D	0,08	0,08 M _D	x	0,08 M _D .x

✓✓✓✓



Kragteveelhoek ✓✓✓

(10)

6.2

Volgens afmeting

$$0,08 M_A = 0,77 \text{ kg.m}$$

$$M_A = 9,625 \text{ kg} \checkmark$$

Proporsioneel tot 0,8 M_D volgens afmeting

$$0,08 M_D = 0,65$$

$$M_D = 8,125 \text{ kg} \checkmark$$

Vanaf koppelveelhoek

$$0,08 M_{Dx} = 0,235 \text{ kg.m}^2 \checkmark$$

$$x = 0,3615 \text{ m} \checkmark$$

(4)

6.3

Grafies of volgens afmeting is die hoekposisie van massa D vanaf massa B in die antiklosgewys rigting

$$\hat{D} = 251^\circ \checkmark \checkmark$$

(2)

[16]

VRAAG 7: KINEMATIKA

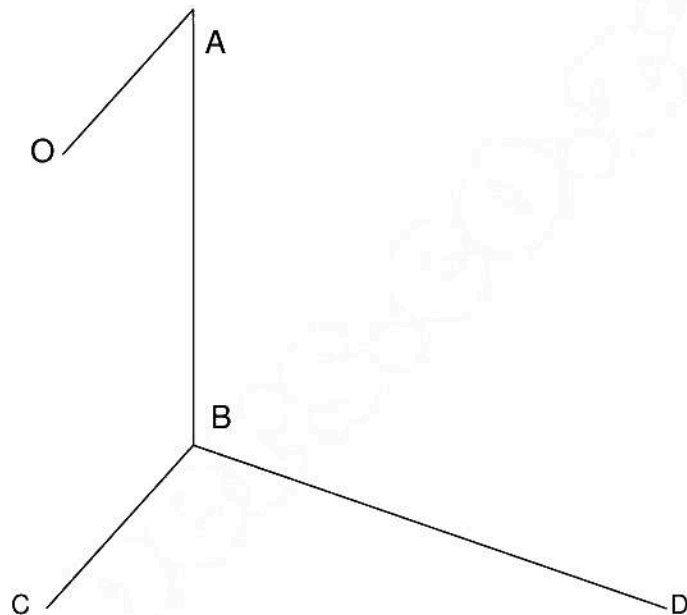
7.1 $V_{OA} = w \cdot r$

$$= \left(\frac{2\pi N}{60} \right) (0,18) \checkmark$$

$$= 3,39 \text{ m/s} \checkmark$$

(2)

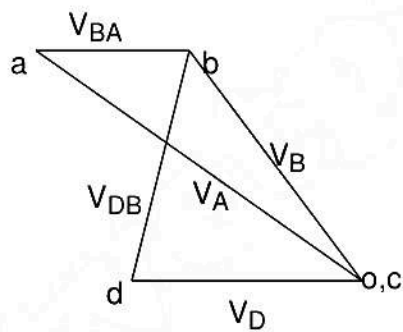
7.2 Skaal 1:6



Ruimtediagram ✓✓✓✓

(4)

7.3



Snelheidsdiagram ✓✓✓✓

(4)

- 7.4 7.4.1 $V_d = 1,98 \text{ m/s} \checkmark \checkmark$
- 7.4.2 Tangensiale versnelling

$$\begin{aligned} &= \alpha \times OC \\ &= 50 \times 0,18 \checkmark \\ &= 9 \text{ m/s}^2 \checkmark \end{aligned}$$

7.4.3

$$\begin{aligned} \alpha &= \frac{(V_{CA})^2}{B_A} \\ &= \frac{(1)^2}{0,36} \checkmark \\ &= 31,97 \text{ m/s}^2 \checkmark \end{aligned}$$

(3 × 2) (6)
[16]

TOTAAL: 100