



# higher education & training

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **NASIENRIGLYN**

**NATIONALE SERTIFIKAAT**

**MEGANOTEGNIEK N6**

**4 APRIL 2018**

**Hierdie nasienriglyn bestaan uit 6 bladsye.**

## VRAAG 1

$$1.1 \quad 1.1.1 \quad T = \frac{P \times 60}{2\pi N}$$

$$T = \frac{25\,000 \times 60}{2\pi \times 1200} \checkmark$$

$$= 198,94 \text{ Nm} \checkmark \quad (2)$$

$$1.1.2 \quad R_f = \frac{100 + 75}{2}$$

$$= 87,5 \text{ mm} \checkmark$$

$$T = \frac{\mu \times F_A \times R_f}{\sin \theta}$$

$$F_A = \frac{198,94 \times \sin 15^\circ}{0,28 \times 0,0875} \checkmark$$

$$= 2\,101 \text{ N} \checkmark \quad (3)$$

$$1.1.3 \quad F_{eng} = F_A \left(1 + \frac{\mu}{\tan \theta}\right)$$

$$= 2\,101 \left(1 + \frac{0,4}{\tan 15^\circ}\right) \checkmark$$

$$= 5\,237 \text{ N} \checkmark \quad (2)$$

$$1.2 \quad \frac{T_1}{T_2} = \left[\frac{1 + \mu \tan \theta}{1 - \mu \tan \theta}\right]^n$$

$$= \left[\frac{1 + 0,35 \tan 5^\circ}{1 - 0,35 \tan 5^\circ}\right]^{15} \checkmark$$

$$= 2,51 \checkmark$$

$$P = (T_1 - T_2) \times v$$

$$T_1 - T_2 = \frac{200 \times 10^3 \times 60}{\pi \times 0,6 \times 650} \checkmark$$

$$= 9794 \text{ N} \checkmark$$

$$\therefore 2,51 T_2 - T_2 = 9794 \checkmark$$

$$T_2 = 6486 \text{ N} \checkmark$$

$$T_1 = 16280 \text{ N} \checkmark$$

$$\sum \circlearrowleft M = \sum \circlearrowright M$$

$$F \times 550 + T_2 \times 50 = T_1 \times 150 \checkmark$$

$$\therefore F \times 550 + 16280 \times 50 = 6486 \times 150 \checkmark$$

$$\therefore F = 288,9 \text{ N} \checkmark \quad (10)$$

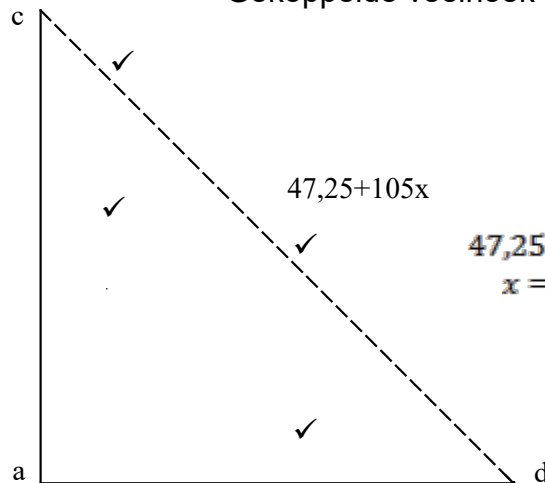
**[17]**

**VRAAG 2**

2.1

Vlak	$m$ (kg)	$r$ (m)	$mr$ (kg.m)	$l$ (m)	$mrl$ (kg.m <sup>2</sup> )
A	6	30	180	-0,4	0
B	$m$	42	$42m$	0	$0,375$
C	4	40	160	0,45	$0,844$
D	3	35	105	$0,45 + x$	$47,25 + x$

Gekoppelde veelhoek



(9)

2.2 2.2.1

$$P = (T_1 - T_2) \times v$$

$$T_1 - T_2 = \frac{35 \times 10^3 \times 60}{\pi \times 0,9 \times 600}$$

$$T_1 - T_2 = 1238 \text{ N}\checkmark$$

$$2,19T_2 - T_2 = 1238 \text{ N}$$

$$T_2 = 1040 \text{ N}\checkmark$$

$$T_1 = 2278 \text{ N}\checkmark$$

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

$$= e^{0,25\pi}$$

$$= 2,19\checkmark$$

(4)

2.2.2

$$T_s = \frac{P \times 60}{2 \times \pi \times N}$$

$$= \frac{35\,000 \times 60}{2 \times \pi \times 600}\checkmark$$

$$= 557 \text{ Nm}\checkmark$$

(2)

2.2.3

$$T_p = \frac{35\,000 \times 60}{2 \times \pi \times 1500}$$

$$= 222,8 \text{ Nm}\checkmark$$

(1)

2.2.4

$$F_t = \frac{T \times 2}{PCD}$$

$$= \frac{222,8 \times 2}{0,12}$$

$$= 3713 \text{ N}\checkmark$$

$$F_r = F_t \sec\phi\checkmark$$

$$F_r = 3713 \sec 20^\circ$$

$$= 3951 \text{ N}\checkmark$$

(3)

[19]

**VRAAG 3**

$$\begin{aligned}
 3.1 \quad m &= \rho \times V \\
 &= \rho \times \pi(R^2 - r^2) \times w \checkmark \\
 &= 7\,300 \times \pi(0,45^2 - 0,3^2) \times 0,2 \checkmark \\
 &= 516 \text{ kg} \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.2 \quad I &= mk^2 \\
 &= 1/2m(R^2 + r^2) \checkmark \\
 &= 1/2 \times 516(0,45^2 + 0,3^2) \checkmark \\
 &= 75,465 \text{ kgm}^2 \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.3 \quad \omega_1 &= \frac{2\pi \times 210}{60} & \omega_2 &= \frac{2\pi \times 132}{60} \\
 &= 21,99 \text{ rad/s} \checkmark & &= 13,82 \text{ rad/s} \checkmark \\
 E_k &= \frac{1}{2}I(\omega_1^2 - \omega_2^2) \\
 E_k &= \frac{1}{2} \times 75,465(21,99^2 - 13,82^2) \checkmark \\
 &= 11,039 \text{ kJ} \checkmark
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 3.4 \quad t_\alpha &= \frac{60}{12} - 1,2 \\
 &= 3,8 \text{ seconds} \checkmark \\
 \alpha &= \frac{\omega_1 - \omega_2}{t} \\
 &= \frac{21,99 - 13,82}{3,8} \checkmark \\
 &= 2,15 \text{ rad/s}^2 \checkmark \\
 T &= I \times \alpha \\
 &= 75,465 \times 2,15 \checkmark \\
 &= 162,2 \text{ Nm} \checkmark
 \end{aligned} \tag{5}$$

$$\begin{aligned}
 3.5 \quad P_m &= E_k \times n/s \\
 &= 11,039 \times 12/60 \checkmark \\
 &= 2,21 \text{ kW} \checkmark
 \end{aligned} \tag{2}$$

**[17]****VRAAG 4**

$$\begin{aligned}
 4.1 \quad \tan \theta &= \frac{p \times n}{\pi \times D_m} \\
 &= \frac{15 \times 2}{\pi \times 75} \\
 &= 0,1273 \checkmark \\
 \therefore \theta &= 7,26^\circ \checkmark \\
 \emptyset &= \tan^{-1} \mu \checkmark \\
 &= \tan^{-1} 0,03 \checkmark \\
 &= 1,72^\circ \checkmark \\
 \eta &= \frac{\tan 7,26}{\tan(7,26 + 1,72)} \times 100 \checkmark \\
 &= 80,6 \% \checkmark
 \end{aligned} \tag{7}$$

$$\begin{aligned}
 4.2 \quad P_w &= \frac{P_o \times 100}{\eta} \\
 P_w &= \frac{20 \times 100}{80,6} \checkmark \\
 &= 24,8 \text{ kW} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.3 \quad 1 \text{ rev of worm} &= 2 \times 15 = 30 \text{ mm} \checkmark \\
 1200 \text{ r/m} &= 20 \text{ r/s} \checkmark \\
 v &= 20 \times 30 = 600 \text{ mm/s} \checkmark \\
 &= 0,6 \text{ m/s} \\
 P_o &= F_w \times v \checkmark \\
 20 &= F_w \times 0,6 \checkmark \\
 F_w &= 33,33 \text{ kN} \checkmark
 \end{aligned} \tag{6}$$

**[15]**

**VRAAG 5**

$$\begin{aligned}
 5.1 \quad TE &= mg \sin \theta \\
 &= 1500 \times 9,81 \sin 20^\circ \checkmark \\
 &= 5032,8 \text{ N} \checkmark \\
 W &= \frac{TE \times h}{d} \checkmark \\
 &= \frac{5032,8 \times 0,8}{2,8} \checkmark \\
 &= 1438 \text{ N} \\
 N_R &= \frac{mg \times y}{d} \checkmark \\
 &= \frac{1500 \times 9,81 \times 1,2}{2,8} \checkmark \\
 &= 6306 \text{ N} \quad \checkmark
 \end{aligned}$$

Lading op agterwiele

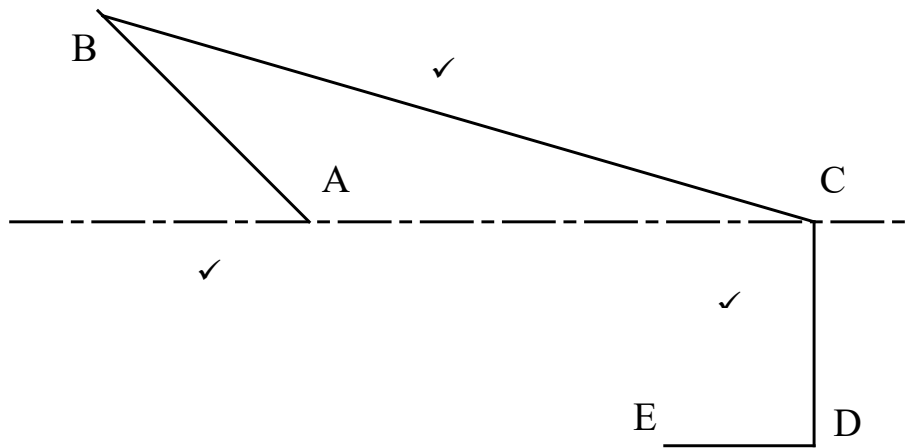
$$\begin{aligned}
 &= 6306 + 1438 \checkmark \\
 &= 7744 \text{ N} \quad \checkmark \\
 TE &= \mu N \checkmark \\
 \mu &= \frac{5032,8}{7744} \checkmark \\
 &= 0,65 \checkmark
 \end{aligned} \tag{12}$$

$$\begin{aligned}
 5.2 \quad P &= TE \times v \times \frac{100}{\eta} \checkmark \\
 &= 5032,8 \times \frac{25}{3,6} \times \frac{100}{52} \checkmark \\
 &= 67,212 \text{ kW} \checkmark
 \end{aligned} \tag{3}$$

**[15]**

**VRAAG 6**

6.1



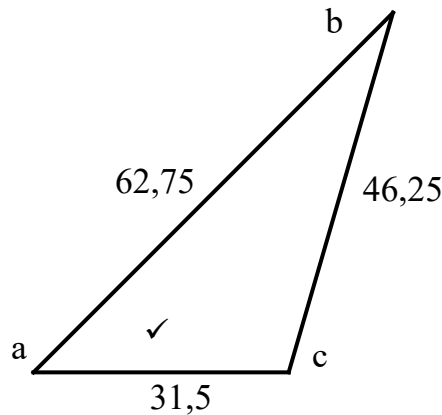
(3)

6.2

$$\begin{aligned} v_B &= 2\pi RN/60 \\ &= 2\pi \times 0,1 \times 240/60 \\ &= 2,51 \text{ m/s} \checkmark \end{aligned}$$

(1)

6.3



(3)

6.4

6.4.1  $v_{BtoC} = 46,25 \times 0,04 = 1,85 \text{ m/s} \checkmark$   
 $\omega_{BC} = \frac{v_{BtoC}}{BC} = \frac{1,85}{0,3} \checkmark$   
 $= 6,17 \text{ rad/s at } 73,83^\circ \checkmark$

(3)

6.1.2  $v_{CtoD} = 31,5 \times 0,04 = 1,26 \text{ m/s} \checkmark$   
 $\omega_{CD} = \frac{v_{BtoC}}{BC} = \frac{1,26}{0,1} \checkmark$   
 $= 12,6 \text{ rad/s at } 73,83^\circ \checkmark$

(3)

6.4.3 Sentripetale versnelling B tot C  
 $= \omega_{BC}^2 \times BC$   
 $= 6,17^2 \times 0,3 \checkmark$   
 $= 11,42 \text{ m/s}^2 \checkmark$

(2)

6.4.4 Sentripetale versnelling C tot D  
 $= \omega_{CD}^2 \times CD$   
 $= 12,6^2 \times 0,1 \checkmark$   
 $= 15,88 \text{ m/s}^2 \checkmark$

(2)

[17]

**TOTAAL: 100**