higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N5

8 AUGUSTUS 2019

Hierdie nasienriglyn bestaan uit 10 bladsye.

Kopiereg voorbehou

VRAAG 1

Nr.	Toestand	Rat A	Rat P	Rat S	Arm L
1	Maak arm L vas en roteer rat A +1 rev	+1	$\frac{T_A}{T_P}=\frac{100}{40}=2,5$	$\frac{T_A}{T_P}x\frac{T_P}{T_S}=\frac{100}{40}x\frac{40}{20}=-5$	0
2	Maal met x en tel y by	$x+y$	$2,5x+y$	$-5x+y$	$+y$
3	NS = 300 NA = 0 NL = ?	0		300	NL = ?
4	NL = 10 NS = 300 NA = ?	NA = ?		300	10

1.1 $T_A = 2T_p + T_s$

$= 2(40) + 20$ ✓

$= 100$ kamme ✓

Bepaal x en y:

$x + y = 0$

$x = -y$ ✓

Maar: $-5x + y = 300$

$-5(-y) + y = 300$ ✓

$6y = 300$

$y = \frac{300}{6}$ ✓

$y = 50$

$N_L = y$

$N_L = 50$ r/min ✓

∴ Die spoed van die leweringsas = 50 r/min (6)

Commented [EM1]: Where possible, I have added text boxes to give translations of the most significant phrases (if they could fit), but as in the question paper, I've left most of the formulas as they are.

1.2 $P_{in} = \dfrac{2\pi N T_{in}}{60}$

$T_{in} = \dfrac{60 \times P_{in}}{2\pi N}$

$T_{in} = \dfrac{60 \times 4\,000}{2\pi \times 300}$ ✓

$T_{in} = 127{,}324 \text{ N.m}$ ✓

$(T_{in} \times N_{in}) + (T_{out} \times N_{out}) + (T_{hold} \times N_{hold}) = 0$

$(127{,}324 \times 300) + (T_{out} \times 50) + 0 = 0$ ✓

$T_{out} = \dfrac{-38\,197{,}2}{50}$

$T_{out} = -763{,}944 \text{ N.m}$ ✓

$T_{out} = -763{,}944 \times \dfrac{86}{100}$ ✓

$T_{out} = -656{,}992 \text{ N.m}$ ✓ (6)

1.3 $y = 10$

Maar: $-5x + y = 300$

$-5x + 10 = 100$

$-5x = 290$

$x = \dfrac{290}{-5}$ ✓

$x = -58$ ✓

$N_A = x + y$

$N_A = -58 + 10$ ✓

$N_A = -48 \text{ r/min}$ ✓ (4)

[16]

VRAAG 2

2.1
- 6: diameter
- 19: getal stringe
- 12.6: getal drade per string
- 12.1.1: getal drade in elke laag (begin aan die buitekant)

(Enige 3 × 1) (3)

2.2 2.2.1

$$v = \frac{\pi(D+t)N}{60}$$
$$= \frac{\pi(1{,}6 + 0{,}014)230}{60} \checkmark$$
$$= 19{,}437 \text{ m/s} \checkmark$$

(2)

2.2.2

$$p = \frac{m}{v}$$
$$m = p \times w \times t \div l$$
$$= 800 \times 1 \times 0{,}014 \times 1 \checkmark$$
$$m = 11{,}2 \text{ kg/m} \checkmark$$

(2)

2.2.3

$$\frac{T_1 - T_C}{T_2 - T_C} = e^{\mu\theta}$$
$$T_C = mv^2$$
$$T_C = 11{,}2 \times (19{,}437)^2 \checkmark$$
$$= 4\,231{,}341 \text{ N}$$
$$T_C = 4{,}231 \text{ kN} \checkmark$$

$$T_1 = w \times n \times ft$$
$$= 1 \times 4 \times 14 \times 10^3 \checkmark$$
$$T_1 = 56\,000 \text{ N} \checkmark$$

$$\frac{T_1 - T_c}{T_2 - T_c} = e^{\mu\theta}$$
$$\frac{5\,600 - 4\,231{,}341}{T_2 - 4\,231{,}341} = e^{0{,}4 \times 3{,}051} \checkmark$$
$$3{,}397T_2 - 14{,}37 \times 10^3 = 51{,}769 \times 10^3 \checkmark$$
$$T_2 = 11\,008{,}44 \text{ N} \checkmark$$

(7)

2.2.4

$$P = (T_1 - T_2)v$$
$$= (56 \times 10^3 - 11 \times 10^3)437 \checkmark$$
$$P = 874{,}665 \text{ kW} \checkmark$$

(2)

2.2.5
$$Bandwydte = \frac{P_{total}}{P/_{m\ width}}$$
$$= \frac{50}{874,665} \checkmark$$
$$Bandwydte = 0,057 \text{ m}$$
$$= 57 \text{ mm} \checkmark$$
(2)
[18]

VRAAG 3

3.1
- Foutwerking van ketting- en bandspanners wat slapheid in die ketting en band veroorsaak
- Wansporing van kettingratte en katrolle wat onegalige slyting veroorsaak op kettingrat, ketting en aslaers
- Oorlading van bakke
- Oneweredige spasiëring van bakke op ketting of band
- Oormatige bakspoed wat lei tot foutiewe lading en ontlading van bakke

(Enige 3 × 2) (6)

3.2 3.2.1 Die volume van elke bak
$$= \frac{300 \times 10}{3\,600}$$
$$= 83,333 \text{ kg/s} \checkmark$$
$$V_{delivered} = \frac{m_n}{P}$$
$$= \frac{83,333}{800} \checkmark$$
$$V_{delivered} = 0,104 \text{ m}^3/\text{s} \checkmark$$
$$B/s = \frac{0,4}{1}$$
$$= 0,4 \text{ s} \checkmark$$
$$V = \frac{V_{delivered}}{B/s}$$
$$= \frac{0,104}{0,4} \checkmark$$
$$V = 0,26 \text{ m}^3/\text{s} \checkmark$$
(6)

3.2.2 $P_g = mgh$

$= 83{,}333 \times 9{,}81 \times 60$ ✓

$= 49{,}05$ kW ✓

$\eta = \frac{P_{out}}{P_{in}}$

$P_{in} = \frac{P_{out}}{\eta}$

$P_{in} = \frac{49{,}05 \times 10^3}{0{,}88}$ ✓

$P_{in} = 55{,}739$ kW ✓ (4)

[16]

VRAAG 4

4.1 $M_r = 1\,000 - 250$

$= 750$ kg

$Bakke/_h = \frac{750}{8 \times 0{,}8}$

$= 117{,}118$ ✓

$T_{space} = \frac{3{,}5 \times 103}{117{,}188}$

$= 29{,}87$ ✓

$T_{number} = \frac{800}{29{,}87}$ ✓

$= 26{,}78$

dus $= 27$ ✓ (4)

4.2 $M_{rope} = 2 \times 900 \times 3$
$= 5\,400 \text{ kg} \checkmark$

$M_{ft} = 1\,000 \times 27$
$= 27\,000 \text{ kg} \checkmark$

$M_{gm} = 250 \times 27$
$= 6\,750 \text{ kg} \checkmark$

$M_{total} = 6\,750 + 27\,000 + 5\,400 \checkmark$
$= 39\,150 \text{ kg}$
$= 39{,}15 \text{ tons} \checkmark$ (5)

4.3 $F_R = M_T + T_R$
$= 70{,}6 + 200$
$F_R = 14\,120 \text{ N} \checkmark$
$L_{balance} = 27 \times 180$
$= 4\,860 \text{ kg}$
$F_{rope} = 4\,860 \times 9{,}81 \sin 12^\circ$
$F_{rope} = 9\,912{,}522 \text{ N}$
$F_{total} = 14\,120 + 9\,912{,}522$
$= 24\,32{,}522 \text{ N} \checkmark$
$F_{total} = 24{,}033 \text{ kN} \checkmark$
$W_{d/s} = F_T \times v$
$W_{d/s} = 24{,}033 \times 10^3 \times \left(\frac{3{,}5 \times 10^3}{3\,600}\right) \checkmark$
$W_{d/s} = 23{,}365 \text{ kJ/s}$
$= 23{,}365 \text{ kW} \checkmark$
$\eta = \frac{P_{out}}{P_{in}}$
$P_{in} = \frac{P_{out}}{\eta}$
$P_{in} = \frac{23{,}365 \times 10^3}{0{,}82} \checkmark$
$P_{in} = 28{,}494 \text{ kW} \checkmark$ (7)
[16]

VRAAG 5

5.1 **Goederehysers**

- Hysbakke word sterk gebou en die kante mag omhul wees met afskortkleed of sierroosterwerk.
- Deure mag vertikaal oopmaak.
- Hysbakke het slegs 'n dak nodig oor die deel van die hysbak wat deur die operateur in beslag geneem word. (Enige TWEE)

Personehysers

- Hysbakke moet aan al die kante deur panele toegemaak wees.
- Deure moet horisontaal oopmaak.
- Hysbakke moet met 'n stewige dak sonder glaspanele bedek wees.

(Enige TWEE)
(2 + 2) (4)

5.2 5.2.1

$$T_1 = M_1(g + a) + F_v$$
$$= 1\,500(9{,}81 + 1{,}9) + 60$$
$$T_1 = 18\,165 \text{ N}$$

$$T_2 = M_2(g - a) - F_v$$
$$= 500(9{,}81 - 1{,}9) - 600$$
$$T_2 = 3\,355 \text{ N} \checkmark$$

Wringkrag om lading te versnel $= (T_1 - T_2)R$
$= (18\,165 - 3\,355)0{,}8$
$= 11\,848 \text{ N.m} \checkmark$

Wringkrag om trommel te versnel $= I \times a$
$= Mk^2 \times \frac{a}{r}$
$= (700)(0{,}6)^2 \times \frac{1{,}9}{0{,}6} \checkmark$
$= 798 \text{ N.m} \checkmark$

$$T_{total} = T_{load} + T_{drum}$$
$$= 11\,848 + 798 \checkmark$$
$$T_{total} = 12\,646 \text{ N.m} \checkmark$$
$$P_m = T_{total} \times \frac{v}{r}$$
$$12\,646 \times \frac{2{,}4}{0{,}8} \checkmark$$
$$P_m = 37{,}938 \text{ kW} \checkmark$$

(8)

5.2.2

$$a = \frac{v^2}{2s}$$

$$a = \frac{5^2}{2 \times 4} \checkmark$$

$$a = 3{,}125 \text{ m/s}^2 \checkmark$$

$$T_1 = M_1(g - a) + F_v$$

$$= 1\,500(9{,}81 - 3{,}125) + 600 \checkmark$$

$$T_1 = 10\,627{,}5 \text{ N} \checkmark$$

$$T_2 = M_2(g + a) - F_v$$

$$= 500(9{,}81 - 3{,}125) - 600 \checkmark$$

$$T_2 = 5\,867{,}5 \text{ N} \checkmark$$

(6)
[18]

VRAAG 6

6.1

$$\omega_1 = \frac{2\pi \times 120}{60} \checkmark$$

$$= 12{,}566 \text{ rad/s} \checkmark$$

$$\omega_2 = \frac{2\pi \times 160}{60} \checkmark$$

$$= 16{,}755 \text{ rad/s} \checkmark$$

$$a = \frac{\omega_2 - \omega_1}{t}$$

$$= \frac{16{,}755 - 12{,}566}{40} \checkmark$$

$$a = 0{,}105 \text{ rad/s}^2 \checkmark$$

$$T = m.k^2.a$$

$$= 1\,200.(0{,}8)^2.0{,}105 \checkmark$$

$$T = 80{,}64 \text{ N.m} \checkmark$$

(8)

6.2 6.2.1

$$\omega = \frac{2\pi \times N}{60}$$

$$\omega = \frac{2\pi \times 110}{60}$$

$$= 11{,}519 \text{ rad/s} \checkmark$$

$$E_k = \frac{1}{2}.m.k^2.\omega^2$$

$$= \frac{1}{2} \times 580 \times (0{,}81)^2.(11{,}519)^2$$

$$E_k = 25{,}264 \text{ kJ} \checkmark$$ (2)

6.2.2

$$\theta = 2.\pi.(\omega_2 - \omega_1)$$

$$= 2.\pi.(110 - 56)$$

$$\theta = 339{,}292 \text{ rads} \checkmark$$

$$E_k = T \times \theta$$

$$T = \frac{E_k}{\theta}$$

$$= \frac{25\,246}{339{,}292}$$

$$T = 74{,}408 \text{ N.m} \checkmark$$ (2)

6.2.3

$$T = I \times a$$

$$a = \frac{T}{m.k^2}$$

$$a = \frac{74{,}408}{580.(0{,}81)^2} \checkmark$$

$$a = 0{,}196 \text{ rad/s}^2 \checkmark$$

$$\omega_2 = \omega_1 + a.t$$

$$t = \frac{\omega_2 - \omega_1}{a}$$

$$t = \frac{\left(\frac{2\pi \times 110}{60}\right) - \left(\frac{2\pi \times 56}{60}\right)}{0.196} \checkmark$$

$$t = 28{,}85 \text{ sekondes} \checkmark$$ (4)

[16]

TOTAAL: 100

Kopiereg voorbehou