higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N5

28 November 2022

Hierdie nasienriglyn bestaan uit 10 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1 $T_C = 2T_B + T_A$

$120 = 2T_B + 18$ ✓

$T_B = 51\ teeth$ ✓ (2)

1.2

Toestand	Rat A	Rat B	Rat C	Rat D	Rat E	Arm F
Bevestig arm F en draai rat C +1 rev	$N_A = \frac{N_B \times T_B}{T_A}$ $N_A = \frac{2{,}353 \times 51}{-18}$ $N_A = -6{,}667$	$N_B = \frac{N_B \times T_B}{T_A}$ $N_B = \frac{1 \times 120}{51}$ $N_B = 2{,}353$	+1	$N_D = 2{,}353$	$N_E = \frac{N_D \times T_D}{T_E}$ $N_E = \frac{2{,}353 \times 40}{100}$ $N_E = 0{,}941$	*0*
Vermenig-vuldig met x en tel y by	$-6{,}667x + y$ ✓	$2{,}353x + y$ ✓	$x + y$	$2{,}353x + y$ ✓	$0{,}941x + y$ ✓	$+ y$
$N_C = 0$ $N_A = 1500r/\text{mi}$ $N_E = ?$	$N_A = 1500$		*0*		$N_E = ?$	

$N_E = 0{,}941x + y$

$-6{,}667x + y = 1500 \ldots\ldots\ldots\ldots 1$

$x + y = 0$

$x = -y \ldots\ldots\ldots\ldots\ldots 2$

sub.....2..in....1

$-6{,}667x + y = 1500$

$-6{,}667(-y) + y = 1500$

$y = \frac{1500}{7{,}667}$

$y = 195{,}644$ ✓

but $x = -y$

$\therefore x = -195{,}644$ ✓

$N_E = 0{,}941x + y$

$N_E = 0{,}941(-195{,}644) + 195{,}644$ ✓

$N_E = 11{,}543r/\text{min}$ ✓ (8)

[10]

VRAAG 2

2.1
- Uitlegruimte word beperk.
- Daar is geen verstrooiing, lekkasie of val van materiaal nie.
- Struktuur het 'n lang lewe met goeie vermoeidheidsweerstand en elastisiteit.
- Materiaal word deur 'n pyp omsluit en geen vreemde materiaal kom van buite af in nie.
- Die uitleg is maklik en ekonomies aangesien die vervoerlyn maklik ontwerp word en uitlegkoste laag is.
- Dit voorkom aanpaksels as gevolg van drupping op die band.
- Nuwe ontwerpe bied behoorlike buigvasheid. (Enige 3 × 1) (3)

2.2 2.2.1

$$W_{D_\mu} = F_\mu \times v$$
$$= 4200 \times \frac{95}{60} \checkmark$$
$$= 6650J$$
$$= 6{,}650kJ \checkmark$$

(2)

2.2.2

$$\sin\varphi = \frac{h}{l}$$
$$h = 124 \times \sin 16° \checkmark$$
$$= 34{,}179m \checkmark$$
$$W_{D_L} = F_{/S} \times S$$
$$= \frac{290 \times 10^3 \times 9{,}81}{3600} \times 34{,}179 \checkmark$$
$$= 27009{,}955J$$
$$= 27{,}010kJ \checkmark$$

(4)

2.2.3

$$W_{D_{TOTAL}} = (T_1 - T_2) \times v$$
$$(T_1 - T_2) = (6650 + 27009{,}955) \times \frac{60}{95} \checkmark$$
$$= 21258{,}919N$$
$$= 21{,}259kN \checkmark$$

(2)

2.2.4
$$\frac{T_1}{T_2} = e^{\mu\theta}$$
$$\frac{T_1}{T_2} = e^{0,3\times\frac{220°}{57,3}} \checkmark$$
$$T_1 = 3,164T_2 \checkmark$$

$$T_1 - T_2 = 21258,919$$
$$3,164T_2 - T_2 = 21258,919 \checkmark$$
$$T_2 = \frac{21258,919}{2,164} \checkmark$$
$$T_2 = 9823,900N \checkmark$$

$$T_1 = 3,164 \times T_2$$
$$= 3,164 \times 9823,9 \checkmark$$
$$= 31082,820N$$
$$T_1 = 31,083kN \checkmark$$ (7)

2.2.5
$$P = W_{D/S}$$
$$P = W_{D_\mu} + W_{D_L}$$
$$P = 6650 + 27009,955 \checkmark$$
$$P = 33659,995W$$
$$P = 33,660kW \checkmark$$ (2)

[20]

VRAAG 3

3.1 Spanningstellers kompenseer vir veranderinge in lengte van die ketting of die band as gevolg van temperatuurveranderinge, atmosferiese toestande of slytasie. (1)

3.2 3.2.1
$$v = \frac{80}{60}$$
$$v = 1,333\ m/s$$
$$v = \sqrt{g\cos\phi \times r}$$
$$r = \frac{v^2}{g \times \cos\phi}$$
$$r = \frac{1,333^2}{9,81 \times \cos 43^\circ} \checkmark$$
$$r = 0,248m \checkmark$$
$$r = 248mm$$
$$d = 248 \times 2$$
$$d = 496\ mm \checkmark$$ (3)

3.2.2 $L = 2(\pi \times r) + 2C$
$L = 2(\pi \times 0,248) + (2 \times 90)$
$L = 1,558 + 180$ ✓
$L = 181,558m$
$say\ L = 182m$ ✓ (2)

3.2.3 $B/_s = \dfrac{v}{spacing}$
$B/_s = \dfrac{1,333}{0,794}$ ✓
$B/_s = 1,679$ ✓ (2)

3.2.4 $m_s = \dfrac{1300 \times 10^3}{7,5 \times 3600}$
$m_s = 48,148kg/s$ ✓
$m/_b = \dfrac{m/_s}{B/_s}$
$m/_b = \dfrac{48,148}{1,679}$ ✓
$m/_b = 28,677kg/b$ ✓ (3)

3.2.5 $h = \dfrac{L}{2}$
$h = \dfrac{182}{2}$
$h = 91m$ ✓

$P_g = mgh$
$P_g = 48,148 \times 9,81 \times 91$ ✓
$P_g = 42,982kW$ ✓

$P_i = \dfrac{P_g}{\eta}$
$P_i = \dfrac{42982,333}{0,76}$
$P_i = 56,556kW$ ✓ (4)
[15]

VRAAG 4

4.1
- Kabelspore kan meer ekonomies wees as om paaie of spoorweë te bou.
- Dit is meer doeltreffend aangesien op- en aflaai ten volle geoutomatiseer kan word.
- Vervoer is moontlik waar geen spore of spoorlyne verskaf kan word nie.
- Kabelspore meng nie in met ander vervoermetodes soos paaie of spoorlyne nie.
- Dit is onafhanklik van probleme ten opsigte van die terrein.
- Die kortste roete tussen twee terminale kan geneem word. (Enige 5 × 1) (5)

4.2 4.2.1

$$\sigma = \frac{stekte}{A_{kabel}}$$

$$\sigma = \frac{sterkte}{0{,}55D^2}$$

$$D^2 = \frac{sterkte}{0{,}55 \times \sigma}$$

$$D = \sqrt{\frac{720 \times 10^3}{0{,}55 \times 1465 \times 10^6}} \checkmark$$

$$= 0{,}02989\ m \checkmark$$

$$= 29{,}89\ mm \checkmark$$

$$sê\ D = 30\ mm \checkmark$$ (4)

4.2.2

$$M_{r/m} = \frac{d^2}{195}$$

$$= \frac{(30)^2}{195} \checkmark$$

$$= 4{,}615 kg/m \checkmark$$ (2)

4.2.3

$$T_{gewig} = \frac{m_1 \times g \times s^3}{8 \times h}$$

$$= \frac{4{,}615 \times 9{,}81 \times (115)^2}{8 \times 2{,}2} \checkmark$$

$$= 34019{,}171N \checkmark$$ (2)

4.2.4

$$T_{las} = \frac{m_2 \times g \times s}{4 \times h} \checkmark$$

$$= \frac{660 \times 9{,}81 \times 115}{4 \times 2{,}2} \checkmark$$

$$= 84611{,}25N \checkmark$$ (3)

4.2.5 $$f.o.s = \frac{\sigma}{T_{gewig} + T_{las}}$$
$$= \frac{720 \times 10^3}{34019{,}171 + 84611{,}25} \checkmark\checkmark$$
$$= \frac{720 \times 10^3}{118630{,}421} \checkmark$$
$$= 6{,}069 \checkmark$$
(4)
[20]

VRAAG 5

5.1 $$F_R = F_\mu \times m \times g$$
$$= \frac{0{,}9}{100} \times 330 \times 10^3 \times 9{,}81 \checkmark$$
$$= 29135{,}7N \checkmark$$
(2)

5.2 $$F_g = m \times g \times h$$
$$= 330 \times 10^3 \times 9{,}81 \times {}^{1}\!/_{125} \checkmark$$
$$= 25898{,}4N \checkmark$$
(2)

5.3 $$F_a = m \times a$$
$$= 330 \times 10^3 \times 0{,}065 \checkmark$$
$$= 21450N \checkmark$$
(2)

5.4 $$T_E = F_R + F_g + F_a$$
$$= 29135{,}7 + 25898{,}4 + 21450 \checkmark$$
$$= 76484{,}1N \checkmark$$
$$P_L = T_E \times v$$
$$= 76484{,}1 \times \frac{65 \times 10^3}{3600} \checkmark$$
$$= 1380{,}963kN \checkmark$$
(4)
[10]

VRAAG 6

6.1

$$w_1 = \frac{2 \times \pi \times N_1}{60}$$
$$= \frac{2 \times \pi \times 95}{60}$$
$$= 9{,}948 rad/s \checkmark$$
$$w_2 = \frac{2 \times \pi \times N_2}{60}$$
$$= \frac{2 \times \pi \times 120}{60}$$
$$= 12{,}566 rad/s \checkmark$$
$$\alpha = \frac{w_2 - w_1}{t}$$
$$= \frac{12{,}566 - 9{,}948}{25}$$
$$= 0{,}105 rad/s^2 \checkmark$$

(3)

6.2

$$T = m \times \alpha \times k^2$$
$$= 825 \times 0{,}105 \times 0{,}5^2 \checkmark$$
$$= 21{,}656 N.m \checkmark$$

(2)
[5]

VRAAG 7

7.1 500 draaie van die wurmrat sal $500 \times 2 = 1000$ tande verplaas ✓

$$Omwentelings\ van\ die\ wurmrat = \frac{1000}{Aantal\ tande\ van\ die\ wurmrat} \checkmark$$

$$Omwentelings\ van\ die\ wurmrat, N_A = \frac{1000}{50} \checkmark$$
$$= 20\ r/min \checkmark$$

$$\frac{Ingangsnelheid}{Uitgangsnelheid} = \frac{Aantal\ tande\ van\ die\ gedrewe\ ratte}{Aantal\ tande\ van\ die\ dryfratte}$$

$$\frac{20}{N_E} = \frac{55 \times 80}{20 \times 25} \checkmark$$

$$\frac{20}{N_E} = \frac{55 \times 80}{20 \times 25} \checkmark$$

$$N_E = \frac{20 \times 20 \times 25}{55 \times 80}$$

$$N_E = 2{,}27\ r/min \checkmark$$

(7)

7.2 $$snelheidsverhouding = \frac{wurmsnelheid}{leweringsnelheid}$$ ✓

$$= \frac{500}{2,27}$$ ✓

$= 220,26:1$ ✓ (3)

[10]

VRAAG 8

8.1 $T_1 = m_1(g + a) + F_\mu$
$= 1500(10 + 2) + 500$
$= 18500\ N$ ✓

$T_2 = m_2(g - a) - F_\mu$
$= 600(10 - 2) - 500$
$= 4300\ N$ ✓ (2)

8.2 Wringkrag om dooie las te hou
$T_{las} = (T_1 - T_2) \times r$
$= (18500 - 4300) \times 0,8$
$= 11360\ N$ ✓

Wringkrag om drom te versnel
$T_{kabel} = I \times \alpha = m \times k^2 \times \frac{a}{r}$
$= 800 \times 0,5^2 \times \frac{2}{0,8}$
$= 500\ N.m$ ✓ (2)

8.3 Vermoë van die motor

$T_{totaal} = (T_{las} + T_{kabel})$
$= 11360 + 500$
$= 11860\ N.m$ ✓
$T_{kabel} = I \times \alpha = m \times k^2 \times \frac{a}{r}$ ✓
$= 11860 \times \frac{2,8}{0,8}$
$= 41510\ W$ ✓ (3)

8.4 $a = \frac{u^2 - v^2}{2 \times s} = \frac{0 - 4^2}{2 \times 2} = -4\ m/s^2$ ✓

$T_1 = m_1(g + a) + F_\mu$
$= 1500(10 - 4) + 500$
$= 9500\ N$ ✓

$T_2 = m_2(g - a) - F_\mu$
$= 600(10 + 4) - 500$
$= 8900$ ✓

(3)
[10]

TOTAAL: 100

Kopiereg voorbehou