higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

MEGANOTEGNIEK N5

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Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

VRAAG 1

1.1 $T_C = 2T_B + T_A$

$120 = 2T_B + 18$ ✓

$= 51\ Tande$ ✓ (2)

1.2

Toestand	Rat A	Rat B	Rat C	Rat D	Rat E	Arm F
Maak arm F vas en draai Rat C +1 rev	$\frac{TC}{TA} = \frac{120}{-18}$ $\frac{120}{-18} = -6.667$	$\frac{TC}{TB} = \frac{120}{51}$ $\frac{120}{51} = 2.353$	+1	*2.353*	$\frac{TC}{TB} X \frac{TD}{TE}$ $\frac{2.353X40}{100} = 0.941$	*0*
Vermenigvuldig 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*		$N_E = ?$	

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

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

$x + y = 0$

$x = -y$.....2

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

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

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

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

$y = 195{,}644$ ✓

but $x = -y$

$\therefore x = -195{,}644$ ✓

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

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

$N_E = 11{,}543r/\min$ ✓ (8)

[10]

VRAAG 2

2.1
- Spasie vir uitleg word geminimeer.
- Geen materiaal word rondgestrooi, lek of val nie.
- Langlewestruktuur met goeie vermoeidheidsweerstand en elastisiteit.
- Materiaal word in die pyp toegemaak en geen vreemde materiaal kom van buite in nie.
- Uitleg is eenvoudig en ekonomies, aangesien die vervoerlyn maklik ontwerp kan word en die uitlegkoste laag is.
- Dit voorkom dat neerslae op die band val.
- Nuwe ontwerp verskaf behoorlike weerstand teen buiging. (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

$$\sin\varphi = \frac{h}{l}$$
$$h = 124 \times \sin 16°$$
$$= 34{,}179m \checkmark$$

$$W_{D_L} = F_{/S} \times S$$
$$= \frac{290 \times 10^3 \times 9{,}81}{3600} \times 34{,}179 \checkmark$$
$$= 27009{,}955J$$
$$= 27{,}010kJ \checkmark$$

(3)

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

$\frac{T_1}{T_2} = e^{0,3\times\frac{220°}{57,3}}$ ✓

$T_1 = 3,164T_2$ ✓

$T_1 - T_2 = 21258,919$

$3,164T_2 - T_2 = 21258,919$

$T_2 = \frac{21258,919}{2,164}$ ✓

$T_2 = 9823,900N$ ✓

$T_1 = 3,164 \times T_2$

$= 3,164 \times 9823,9$ ✓✓

$= 31082,820N$

$T_1 = 31,083kN$ ✓✓ (8)

2.2.5 $P = W_{D/S}$

$P = W_{D_\mu} + W_{D_L}$

$P = 6650 + 27009,955$ ✓

$P = 33659,995W$

$P = 33,660kW$ ✓ (2)

[20]

VRAAG 3

3.1 $v = \frac{80}{60}$

$v = 1,333m/s$

$v = \sqrt{g\cos\phi \times r}$

$r = \frac{v^2}{g \times \cos\phi}$

$r = \frac{1,333^2}{9,81 \times \cos 43^\circ}$ ✓

$r = 0,248m$ ✓

$r = 248mm$

$d = 248 \times 2$ ✓

$d = 496mm$ ✓ (4)

3.2 $L = 2(\pi \times r) + 2C$

$L = 2(\pi \times 0,248) + (2 \times 90)$

$L = 1,558 + 180$ ✓

$L = 181,558m$

$say\ L = 182m$ ✓ (2)

3.3
$$B/_s = \frac{v}{spacing}$$
$$B/_s = \frac{1{,}333}{0{,}794} \checkmark$$
$$B/_s = 1{,}679 \checkmark$$
(2)

3.4
$$m_s = \frac{1300 \times 10^3}{7{,}5 \times 3600}$$
$$m_s = 48{,}148 kg/s \checkmark$$
$$m/_b = \frac{m/_s}{B/_s}$$
$$m/_b = \frac{48{,}148}{1{,}679} \checkmark$$
$$m/_b = 28{,}677 kg/b \checkmark$$
(3)

3.5
$$h = \frac{L}{2}$$
$$h = \frac{182}{2}$$
$$h = 91m \checkmark$$

$$P_g = mgh$$
$$P_g = 48{,}148 \times 9{,}81 \times 91 \checkmark$$
$$P_g = 42{,}982 kW \checkmark$$

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

VRAAG 4

4.1
- Die snelheid waarteen die vervoerstelsel beweeg of moet beweeg
- Die toestand van die baan se oppervlak
- Die gradiënt van die baan
- Die krag wat beskikbaar is om die las te sleep
- Die sterkte van die tou wat gebruik word
- Die soorte aanhegsels wat gebruik word
- Die beskikbaarheid en bereikbaarheid van die baan
- Die begroting beskikbaar vir instandhouding
- Bekommernisse oor veiligheid wat in ag geneem moet word (5)

(Enige 5 × 1)

4.2 4.2.1

$$\sigma = \frac{strngth}{A_{rope}}$$

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

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

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

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

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

$$say\ D = 30mm \checkmark$$

(5)

4.2.2

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

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

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

(2)

4.2.3

$$T_{weight} = \frac{m_1\ X\ g\ X\ S^2}{8\ X\ h}$$

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

$$= 34019{,}171N \checkmark$$

(2)

4.2.4

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

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

$$= 84611{,}25N \checkmark$$

(2)

4.2.5

$$f.o.s = \frac{\sigma}{T_{weight} - T_{load}}$$

$$= \frac{720 \times 10^3}{34019{,}171 + 84611{,}25} \checkmark$$

$$= \frac{720 \times 10^3}{118630{,}421} \checkmark$$

$$= 6{,}069 \checkmark$$

(4)

[20]

VRAAG 5

5.1 $F_R = F_\mu \times m \times g$

$= \frac{0,9}{100} \times 330 \times 10^3 \times 9,81$ ✓

$= 29135,7N$ ✓ (2)

5.2 $F_g = m \times g \times h$

$= 330 \times 10^3 \times 9,81 \times {}^{1}\!/_{125}$ ✓

$= 25898,4N$ ✓ (2)

5.3 $F_a = m \times a$

$= 330 \times 10^3 \times 0,065$ ✓

$= 21450N$ ✓ (2)

5.4 $T_E = F_R + F_g + F_a$

$= 29135,7 + 25898,4 + 21450$ ✓

$= 76484,1N$ ✓

$P_L = T_E \times v$

$= 76484,1 \times \frac{65 \times 10^3}{3600}$ ✓

$= 1380,963kN$ ✓ (4)

[10]

VRAAG 6

$w_1 = \frac{2 \times \pi \times N_1}{60}$

$= \frac{2 \times \pi \times 95}{60}$ ✓

$= 9,948rad/s$ ✓

$w_2 = \frac{2 \times \pi \times N_2}{60}$

$= \frac{2 \times \pi \times 120}{60}$ ✓

$= 12,566rad/s$ ✓

$\alpha = \frac{w_2 - w_1}{t}$

$= \frac{12,566 - 9,948}{25}$

$= 0,105rad/s^2$ ✓

[5]

VRAAG 7

7.1

$$T_d = I \times \alpha$$

$$T_d = 100 \times \frac{1,7}{0,55} \checkmark$$

$$T_d = 309,091 N.m \checkmark$$

$$T_{load} = load \times radius$$

$$= 1,2 \times 10^3 \times 9,81 \times 0,55 \checkmark$$

$$T_{load} = 6474,6 N.m \checkmark$$

$$T_{cage} = m_1 \times a \times r$$

$$= 1,2 \times 10^3 \times 1,7 \times 0,55 \checkmark$$

$$T_{cage} = 1122 N.m \checkmark$$

(6)

7.2

$$v = u + at$$

$$= 0 + (1,7 \times 3,5) \checkmark$$

$$= 5,95 m/s \checkmark$$

$$P = \frac{T_{total} \times v}{\eta \times r}$$

$$= \frac{(309 + 6474,6 + 1122)5,95}{0,85 \times 0,55} \checkmark$$

$$P = 100,617 kW \checkmark$$

(4)
[10]

VRAAG 8

8.1 *Spoed van wurmrat* N_E

Een draai van wurm beweeg rat $= \frac{3}{36} = \frac{1}{12}$✓

$$N_E = 1000 \times \frac{1}{12} \checkmark$$

$$N_E = 83{,}333 r/\min \checkmark$$

$$\therefore N_E = N_A = 83{,}333 r/\min \checkmark$$

OF

1 000 draaie van wurmas sal 1 000 × 3 = 3 000 tande verplaas✓✓
NE 3 000/36 = 86,333 r/m✓
NE = NA = 86,333 r/min✓

$$N_A \times T_A \times T_C = N_D \times T_B \times T_D$$

$$83{,}333 \times 20 \times 28 = N_D \times 40 \times 60 \checkmark\checkmark$$

$$N_D = \frac{46666{,}667}{2400} \checkmark$$

$$N_D = 19{,}444 r/\min \checkmark$$

(8)

8.2

$$V_R = \frac{N_{worm}}{N_D}$$

$$= \frac{1000}{19{,}444} \checkmark$$

$$= 51{,}428 \checkmark$$

(2)
[10]

TOTAAL: 100

Kopiereg voorbehou