higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NASIENRIGLYN

NASIONALE SERTIFIKAAT

FLUÏEDMEGANIKA N6

1 Desember 2023

Hierdie nasienriglyn bestaan uit 9 bladsye.

Kopiereg voorbehou

INSTRUKSIES AAN NASIENERS

1. Sien al die vrae na.
2. Volg die antwoorde volgens die nommeringstelsel wat in die vraestel gebruik is.
3. Gebruik slegs ’n rooi pen.
4. Maak netjiese en leesbare regmerkies en kruisies.

VRAAG 1

1.1 1.1.1

$$h_f = \frac{4fLv^2}{2gd}$$
$$9 = \frac{4 \times 0{,}01 \times 100 \times v^2}{2 \times 9{,}81 \times 0{,}6} \checkmark$$
$$v = 4{,}202\ m/s \checkmark \quad (2)$$

1.1.2

$$Q_A = VA$$
$$Q = 4{,}202\ \times \frac{\pi}{4} \times (0{,}6)^2 \checkmark$$
$$Q = 1{,}188\ m^3/s \checkmark \quad (2)$$

1.1.3

$$Q_B = VA$$
$$Q = 3{,}5\ \times \frac{\pi}{4} \times (0{,}4)^2 \checkmark$$
$$Q_A = 0{,}4398\ m^3/s \checkmark$$

$$Q_A = Q_B + Q_C$$
$$1{,}188 = 0{,}4398 + Q_C$$
$$Q_C = 0{,}7483 m^3/s \checkmark \quad (3)$$

1.1.4

$$h_f = \frac{fLQ^2}{3d^5}$$
$$= \frac{0{,}01 \times 1\,125 \times (0{,}4398)^2}{3 \times (0{,}4)^5} \checkmark$$
$$= 5{,}038\ m \checkmark \quad (2)$$

1.1.5

$$f = 0{,}005\left(1 + \frac{1}{40d}\right)$$
$$\mathrm{f} = 0{,}005\left(1 + \frac{1}{40 \times \frac{1}{3} \times 0{,}6}\right) \checkmark$$
$$= 0{,}00563 \checkmark \quad (2)$$

1.2 Die benatte omtrek is die deel van 'n pyp wat in kontak met die fluïed is. (1)

1.3 1.3.1 Die verhouding van twee hoeveelhede wat in dieselfde eenhede uitgedruk is (1)

1.3.2 1.3.2.1

$$\rho = 0{,}8\ \times 1\,000$$
$$= 800\ kg/m^3 \checkmark \quad (1)$$

1.3.2.2

$$h_f = \frac{fLQ^2}{3d^5}$$
$$9 = \frac{f \times 1\,125\ \times \left(\frac{1\,240}{3\,600}\right)^2}{3 \times (0{,}925)^5} \checkmark$$
$$f = 0{,}137 \checkmark \quad (2)$$

1.3.2.3 $A = \frac{\pi}{4} \times (0{,}925)^2$
$= 0{,}672\ m^2$

$C = \sqrt{\frac{2g}{f}}$
$= \sqrt{\frac{2 \times 9{,}81}{0{,}137}}$ ✓
$= 11{,}967$ ✓

$m = \frac{d}{4}$
$= \frac{0{,}925}{4}$
$= 0{,}23125\ m$ ✓

$Q = AC\sqrt{mi}$
$0{,}344 = 0{,}672 \times 11{,}967\sqrt{0{,}23125 \times i}$ ✓
$i = 0{,}00793$ ✓ (5)

1.3.2.4 $Q = VA$
$0{,}344 = V \times \frac{\pi}{4} \times (0{,}925)^2$ ✓
$V = 0{,}513\ m/s$ ✓

$h_L = \frac{0{,}5V_1^2}{2g}$
$= \frac{0{,}5(0{,}513)^2}{2 \times 9{,}81}$ ✓
$= 0{,}0067\ m$ ✓ (4)
[25]

VRAAG 2

2.1 2.1.1 $x = \frac{4}{\tan 29^0}$✓
$= 7{,}216\ m$✓ (2)

2.1.2
$A = \{[(7{,}216 \times 2) + 5] \times w\} + \{[(7{,}216 + 5)] \times 4\}$✓

$= 19{,}432w + 48{,}865$✓

$P = 2w + \left[\left(\frac{4}{\sin 29^0}\right) \times 2\right] + 5$✓

$= 2w + 21{,}501$✓

$2{,}3 = \frac{19{,}432w + 48{,}865}{2w + 21{,}501}$✓

$w = 0{,}03966\ m$✓ (6)

2.1.3 $Q = AC\sqrt{mi}$
$= \{(19{,}432 \times 0{,}03966) + 48{,}86\} \times 65\sqrt{2{,}3 \times \frac{4}{1000}}$ ✓
$= 309{,}456\ m^3/s$✓ (2)

2.2 $A = d^2$
$P = 3d$

$m = \frac{d^2}{3d}$✓
$= 0{,}333\ d$✓

$Q = AC\sqrt{mi}$
$20 = d^2 \times 50\sqrt{0{,}333\ d \times 1{,}235 \times 10^{-3}}$✓
$d = 3{,}295\ m$✓

$Afmetings = 3{,}295\ m \times 3{,}295\ m$ (4)

2.3 'n Kerf is 'n opening in die kant van 'n reservoir wat bo die vry oppervlak uitsteek en 'n geskikte geometriese vorm het. (1)

2.4 $Q = C_d\ \frac{8}{15}\sqrt{2g}\ \tan\frac{\theta}{2}\ H^{2,5}$✓
$1{,}5 = C_d\ \frac{8}{15}\sqrt{2 \times 9{,}81}\ \tan\frac{90}{2} \times 0{,}9^{2,5}$✓

$C_d = 0{,}826$✓ (3)

2.5 2.5.1

$A_{th} = \frac{\pi}{4} \times (0{,}04)^2$
$= 1{,}257 \times 10^{-3}\ m^2$✓

$A_A = A_{th} \times C_c$
$A_A = 1{,}257 \times 10^{-3} \times 0{,}81$✓
$= 1{,}0179 \times 10^{-3}\ m^2$✓

$V_A = \frac{Q_A}{A_A}$
$C_v\sqrt{2gh} \times A_A = Q_A$
$0{,}83 \times \sqrt{2 \times 9{,}81 \times h} \times 1{,}0179 \times 10^{-3} = \frac{0{,}2}{60}$ ✓
$\mathrm{h} = 0{,}793\ \mathrm{m}$✓

(5)

2.5.2

$\mathrm{h_L} = \mathrm{h}(1\text{-}\ \mathrm{C_v^2})$

$= 0{,}793(1\text{-}\ 0{,}83^2)$✓
$= 0{,}247\ m$✓

(2)

2.5.3

$V_A = \sqrt{\frac{gx^2}{2y}}$
$0{,}83 \times \sqrt{2 \times 9{,}81 \times 0{,}793}$✓ $= \sqrt{\frac{9{,}81 \times x^2}{2 \times (4 - 0{,}793)}}$✓
$x = 2{,}648\ m$✓

(3)
[28]

VRAAG 3

3.1 3.1.1

$H_{pre} = H_{at} - h_s - h_{as}$
$3{,}5 = 12 - 6 - h_{as}$✓
$h_{as} = 2{,}5\ m$✓

$h_{as} = \frac{l}{g} \times \left(\frac{D}{d}\right)^2 \times \omega^2 R$
$2{,}5 = \frac{l}{9{,}81} \times \left(\frac{0{,}2}{0{,}1}\right)^2 \times \left(\frac{2\pi \times 40}{60}\right)^2 \times \frac{0{,}3}{2}$✓
$l = 2{,}3296\ m$✓

(4)

3.1.2

$5 = \frac{4 \times f \times 40}{2 \times 9{,}81 \times 0{,}1}\left(\left(\frac{0{,}2}{0{,}1}\right)^2 \frac{2\pi \times 40}{60} \times \frac{0{,}3}{2}\right)^2$ ✓
$\mathrm{f} = 0{,}167$✓

(2)

3.1.3 3.1.3.1 $h_{ad} = \frac{9}{9,81} \times \left(\frac{0,2}{0,1}\right)^2 \times \left(\frac{2\pi \times 40}{60}\right)^2 \times \frac{0,3}{2}$✓
$= 9,659\ m$✓

$H_{pre} = H_{at} + h_d + h_{ad}$
$= 12 + 7 + 9,658$

$\mathrm{h_{pre}} = 28,658\ \mathrm{m}$✓

(3)

3.1.3.2 $h_{fd} = \frac{4 \times 0,02 \times 9}{2 \times 9,81 \times 0,1}\left(\left(\frac{0,2}{0,1}\right)^2 \frac{2\pi \times 40}{60} \times \frac{0,3}{2}\right)^2$✓
$h_{fd} = 2,318\ m$✓

$H_{pre} = H_{at} + h_d + h_{fd}$
$= 12 + 7 + 2,318$
$= 21,318\ m$✓ (3)

3.1.3.3 $H_{pre} = H_{at} + h_d - h_{ad}$
$= 12 + 7 - 9,658$
$h_{pre} = 9,342\ m$✓ (1)

3.1.4 $Q = ALSEN/60$
$= \frac{\pi}{4}(0,2)^2 \times 0,\ 3 \times 2 \times 3 \times \frac{N}{60}$✓
$= 0\ ,0377 \times \mathrm{m^3/s}$✓ (2)

3.1.5 $H_{mano} = H_f + H_s$
$= 5 + 2,318 + 6 + 7 + 9,659 + 2,3296$✓
$= 32,3066\ \mathrm{m}$✓

$P = \rho g Q H_m$
$= 10^3 \times 9,81 \times 0\ ,0377 \times 32,3066$✓

$= 11,948\ \mathrm{kW}$✓

(4)

3.2 3.2.1 $\tan \emptyset = \frac{V_{fo}}{x}$
$\tan 29^0 = \frac{V_{fo}}{3,5}$
$V_{fo} = 1,94\ m/s$✓

$Q = V_{fo} \times a$
$= 1,94 \times \frac{\pi}{4} \times (0,2)^2$
$= 0,061\ m^3/s$✓

$Q = \frac{\pi}{4} \times (d)^2 \times w \times V_{fo}$
$0,261 = \frac{\pi}{4} \times (0,4)^2 \times \mathrm{w} \times 1\ 94$✓
$\mathrm{w} = 250\ \mathrm{mm}$✓

(4)

3.2.2 $U_o = \frac{\pi DN}{60}$
$= \frac{\pi \times 0,4 \times 1500}{60}$
$= 31,415\ m/s$✓

$x = U_o - V_{wo}$
$V_{wo} = 31,415 - 3,5$
$= 27,916\ m/s$✓

$\eta_m = \frac{gH}{U_o V_{wo}}$
$75 = \frac{9,81 \times H}{31,415 \times 27,916} \times 100$✓
$H = 67,049\ m$✓ (4)

3.2.3 $T = \rho Q V_{fo} \times stuwerradius$
$= 10^3 \times 0,061 \times 27,916 \times \frac{0,4}{2}$✓
$= 340,292\ Nm$✓ (2)
[29]

VRAAG 4

4.1 $P = \rho g Q H_e$
$= \frac{42 \times 10^3}{10^3 \times 9,81 \times 0,3}$ ✓
$H_e = 14,271\ m$✓

$V_1 = \frac{0,3 \times 4}{\pi \times (0,31)^2}$
$= 3,974\ m/s$✓

$V_2 = \frac{0,3 \times 4}{\pi \times (D)^2}$
$= \frac{0,382}{D^2}$ ✓

$\frac{P_{r1}}{\rho g} + \frac{V_1^2}{2g} + z_1 - H_e = \frac{P_{r2}}{\rho g} + \frac{V_2^2}{2g} + z_2$
$\frac{150}{9,81} + \frac{(3,974)^2}{2 \times 9,81} + 2 - 14,271$✓ $= \frac{-35}{9,81} + \frac{0,382^2}{D^4 \times 2 \times 9,81} + 0$✓

$D^4 = 0,00100595$
$D = 178,0921\ mm$✓ (7)

4.2 Waar (1)

4.3 4.3.1 $V_i = C_v\sqrt{2gh}$

$= 0{,}9\sqrt{2 \times 9{,}81 \times 350 \times 0{,}89}$ ✓

$= 70{,}359\ m/s$✓

$U = \frac{\pi DN}{60}$

$= \frac{\pi \times 1{,}5 \times 345}{60}$ ✓

$= 27{,}096\ m/s$✓

$P = \rho QU\ (V - U)[1 + cos(180^0 - y)]$

$Q = \frac{P}{\rho U\ (V-U)[1 + cos(180^0 - y)]}$

$= \frac{5\ 000 \times 10^3}{10^3 \times 27{,}096\ (70{,}359 - 27{,}096)[1 + cos(180^0 - 160^0)]}$✓

$= 2{,}2934\ m^3/s$✓

$\frac{Q}{Hoev.\ straalstukke} = Va$

$\frac{2{,}2934}{Hoev.\ straalstukke} = 70{,}359 \times \frac{\pi}{4} \times (0{,}073)^2$✓

$Hoeveelheid\ straalstukke = 7{,}788, s\hat{e}\ 8\ straalstukke$✓ (8)

4.3.2 $h_f = \frac{fLQ^2}{3d^5}$

$$38{,}5 = \frac{0{,}006 \times L \times 2{,}2934^2}{3 \times (0,\ 4)^5}$$ ✓

$L = 37{,}479\ m$✓ (2)

[18]

TOTAAL: 100

Kopiereg voorbehou