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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# NASIENRIGLYN

## NASIONALE SERTIFIKAAT

## STERKTE- EN STRUKTUURLEER N5

**28 Julie 2021**

**Hierdie nasienriglyn bestaan uit 6 bladsye.**

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## VRAAG 1

1.1 $$\sigma_{e.grens} = \frac{F_{e.grens}}{A_I} = \frac{113\,000}{\frac{\pi}{4}.(0{,}0215^2)} = 311{,}252\,MPa$$ (3)

1.2 $$E = \frac{F_{e.grens}.L}{A_I.X_{e.grens}} = \frac{113\,000.(0{,}09)}{\frac{\pi}{4}.(0{,}0215^2).(0{,}00121 \times 10^{-3})} = 23\,152{,}948\,GPa$$ (3)

1.3 $$\sigma_y = \frac{F_y}{A_I} = \frac{258\,000}{\frac{\pi}{4}.(0{,}0215^2)} = 710{,}645\,MPa$$ (3)

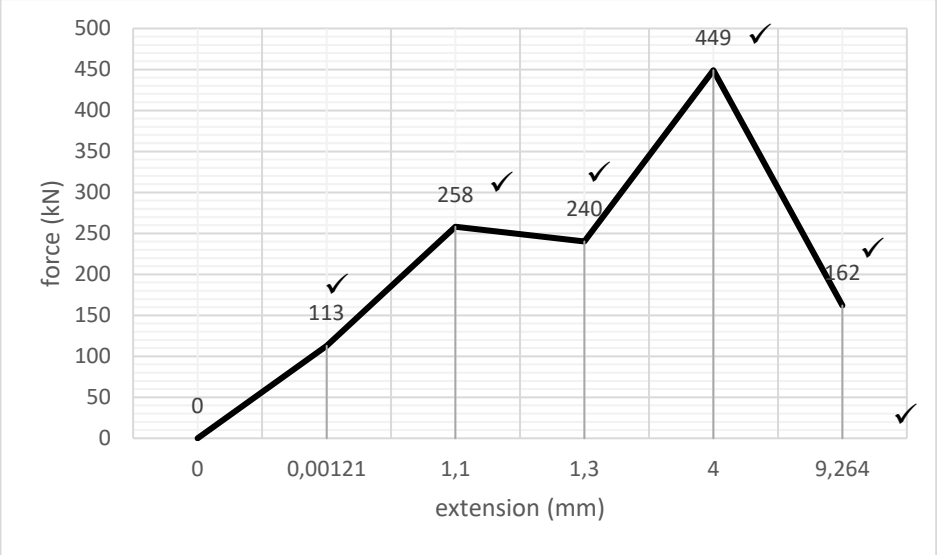
1.4 $$\sigma_{maks} = \frac{F_{maks}}{A_I} = \frac{449\,000}{\frac{\pi}{4}.(0{,}0215^2)} = 1236{,}743\,MPa$$ (3)

1.5 $$\sigma_F = \frac{F_F}{A_F} = \frac{162\,000}{\frac{\pi}{4}.(0{,}01488^2)} = 931{,}578\,MPa$$ (3)

1.6 $$\%\Delta X = \frac{X_F}{L} = \left(\frac{9{,}264}{90}\right).100 = 10{,}293\%$$ (3)

1.7 $$\%A_{vermindering} = \frac{A_o - A_F}{A_o} = \left(\frac{21{,}5^2 - 14{,}88^2}{21{,}5^2}\right).100 = 52{,}1\%$$ (3)

1.8




(6)

1.9 $$U = \frac{1}{2}.F_{e.grens}.X_{e.grens} = \frac{1}{2}.(113\,000).(0{,}00121 \times 10^{-3})$$
$$= 0{,}0683\,J$$ (3)

**[30]**

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## VRAAG 2

2.1
- Swak ondergrond✓
- Krimpbare ondergrond (sagte klei)✓
- Uitermatige vibrasies weens verkeer✓ en masjinerie✓
- Gly van lae op 'n helling✓
- Beweging van grondwater✓ (6)

2.2.1 $$\sigma = \frac{PD}{4\,t\eta}$$

$$= \frac{P\ D}{4 \times t}$$

$$= \frac{4{,}8 \times 10^6 \times 0{,}2}{4 \times 0{,}004}$$

$$= 60\ MPa$$ (5)

2.2.2 $$\sigma = \frac{F}{A}$$

$$F = 60 \times 10^6 \times 3{,}142 \times 0{,}2 \times 0{,}004$$

$$= 150{,}8\ kN$$ (3)

**[14]**

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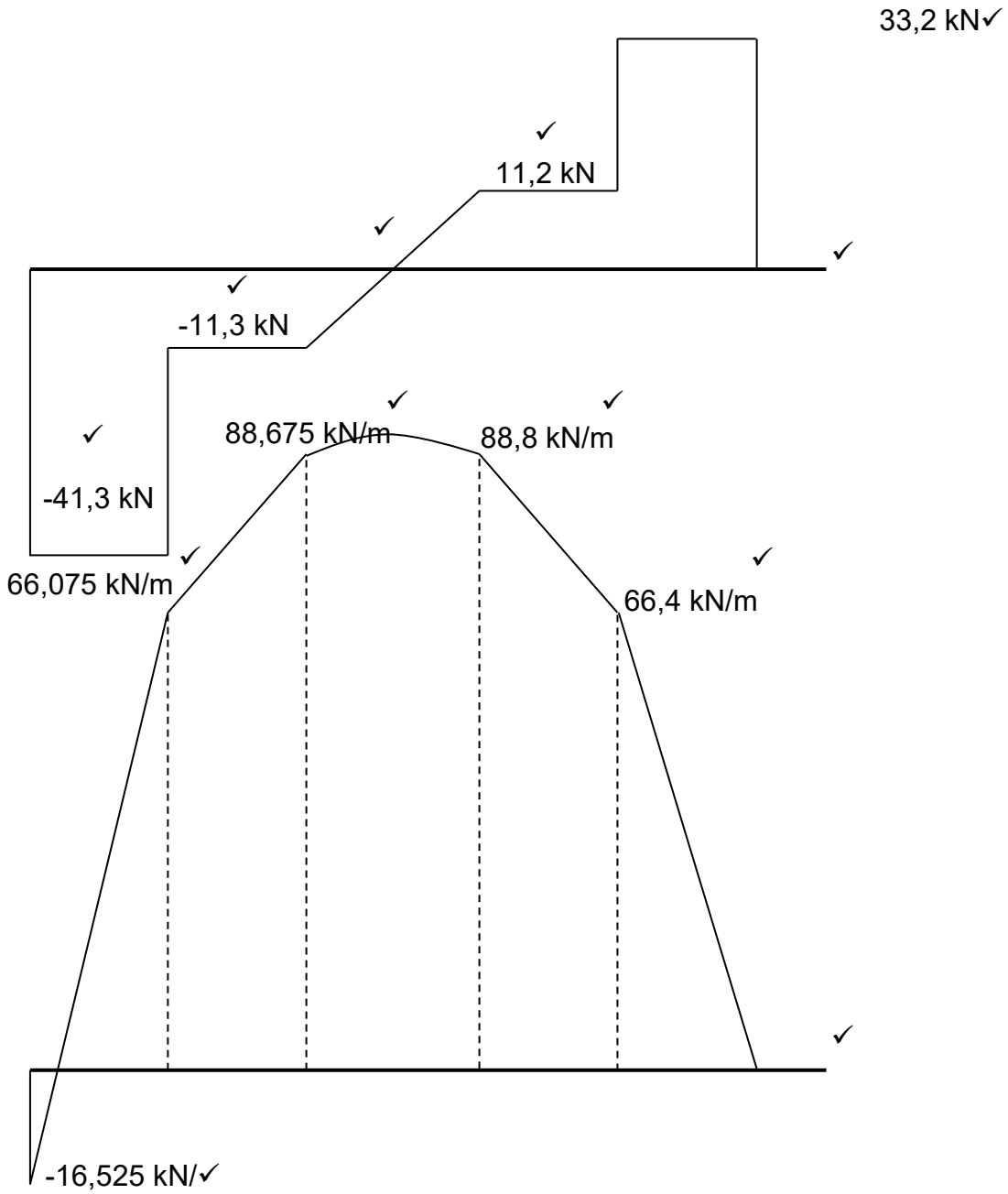
**VRAAG 3**




$\frac{\tan\beta}{\frac{16,525}{x}} = \frac{\tan\beta}{\frac{66,075}{2-x}}$ ✓ ✓ ✓ ✓

✓ $16,525.(2-x) = 66,075.x$

$\therefore x = 0,4\ m\ van\ LK$ **[17]**

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## VRAAG 4

Die kritieke (minste) weerstand teen buiging:

$$I_{yy} = \frac{D.B^3}{12} = \frac{0{,}008.(0{,}0045^3)}{12} = 0{,}0135 \times 10^{-6}\ m^4$$

Met twee skarnierente:

$$P_e = \frac{\pi^2.E.I_{yy}}{L_e^2} = \frac{\pi^2.(88 \times 10^9).(0{,}0135 \times 10^{-6})}{0{,}0435^2} = 6{,}2\ MN$$

Met twee vaste ente:

$$P_e = \frac{\pi^2.E.I_{yy}}{L_e^2} = \frac{\pi^2.(88 \times 10^9).(0{,}0135 \times 10^{-6})}{(0{,}5 \times 0{,}0435)^2} = 24{,}786\ MN$$

Die kritieke veilige las is 24,786 MN. **[13]**

## VRAAG 5

5.1

$$T = \frac{J.\tau}{R} = \frac{\pi.(0{,}215^4).(27 \times 10^6)}{32.(\frac{0{,}215}{2})} = 52\,687{,}675\ Nm$$

$$P = 2\pi.N.T = \frac{2\pi.(400).(52\,687{,}675)}{60} = 1\,103{,}488\ kW$$

(7)

5.2

$$T = 52\,687{,}675 = \frac{\pi}{16}.D^3.(32 \times 10^6)$$

$$\therefore\ D^3 = 0{,}008386 = \frac{D^4 - d^4}{D}$$

$$\therefore\ 0{,}008386 = \frac{220^4 - d^4}{220}$$

$$\therefore d = 5{,}3\ mm$$

(7)
**[14]**

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**VRAAG 6**

6.1
- Trektoets
- Kompressietoets
- Skuiftoets
- Hardheidstoets
- Impaktoets
- Vermoeidheidstoets (6)

6.2
- Lesings is onafhanklik van oppervlakte✓
- Direkte lesing op die nommerskyf✓
- Spoed✓ en akkuraatheid✓ van die toets
- Sal nie die oppervlak uitermatig beskadig nie✓
- Klein verlies aan akkuraatheid weens 'n klein intandingstuk✓ (6)

**[12]**

**TOTAAL: 100**

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