



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

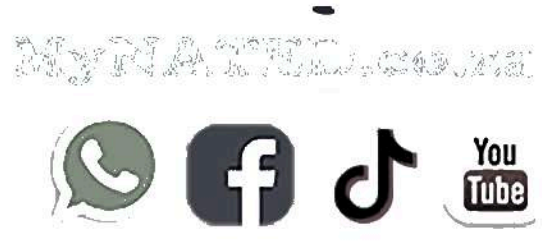
MARKING GUIDELINE

NATIONAL CERTIFICATE

MECHANOTECHNICS N6

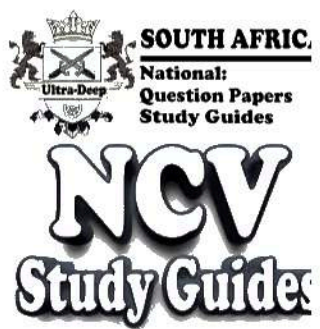
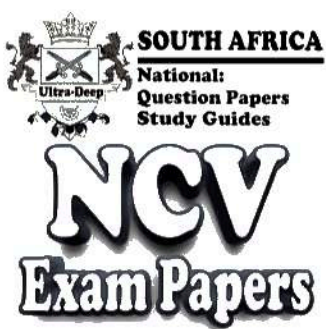
25 November 2024

This marking guideline consists of 9 pages.



THANK YOU FOR DOWNLOADING THIS PAST EXAM PAPER/MEMO, WE HOPE IT WILL BE OF HELP TO YOU
These are the only apps affiliated with
Download Papers from

These are some of our apps (via Google Play)



Start your TVET journey with the best apps to help you achieve the best result in your exams. Our apps and websites cater for Nated and NCV students



TVET Papers
Study after Matric
Start your TVET journey
with the best site for
TVET students



Ultra-Deep™
Multimedia
does web and mobile
app development. We
aim to help students



Click on the banner above to visit

DISCLAIMER

© nated.co.za a

e

QUESTION 1

- 1.1
- Plate clutches
 - Conical clutches
 - Centrifugal clutches
- (3)

1.2 1.2.1

$$P = \frac{2\pi NT}{60}$$

$$T = \frac{60 \times 30 \times 1000}{2\pi \times 1100} \checkmark$$

$$= 260,4 \text{ Nm} \checkmark$$

(2)

1.2.2

$$Rf = \frac{1}{2} (R + r)$$

$$= \frac{1}{2} (100 + 75)$$

$$= 87,5 \text{ mm} \checkmark$$

$$T = \frac{\mu \times F_A \times R_f}{\sin \theta}$$

$$F_A = \frac{260,4 \sin 15^\circ}{0,28 \times 0,0875} \checkmark$$

$$= 2751 \text{ N} \checkmark$$

(3)

1.2.3

$$F_{engage} = F_A \left(1 + \frac{\mu}{\tan \theta}\right)$$

$$= 2751 \left(1 + \frac{0,28}{\tan 15^\circ}\right) \checkmark$$

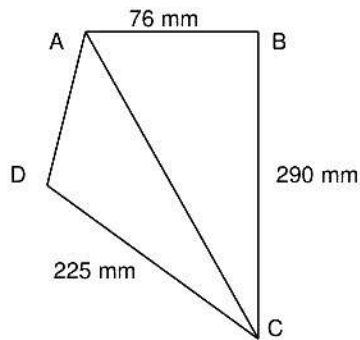
$$= 5626 \text{ N} \checkmark$$

(2)

[10]

QUESTION 2

2.1



$$\begin{aligned} AC &= \sqrt{(AB)^2 + (BC)^2} \\ &= \sqrt{(76)^2 + (290)^2} \checkmark \\ &= 299,793 \text{ mm} \checkmark \end{aligned}$$

$$\tan \alpha = \frac{AB}{BC} = \frac{76}{290}$$

$$\begin{aligned} \alpha &= \tan^{-1} \left(\frac{76}{290} \right) \checkmark \\ &= 14,685^\circ \checkmark \end{aligned}$$

ACD

$$AC = 299,793$$

$$\cos \beta = \frac{CD}{AC} = \frac{225}{299,793}$$

$$\begin{aligned} \beta &= \cos^{-1} \left(\frac{225}{299,793} \right) \\ &= 41,265^\circ \checkmark \end{aligned}$$

$$\begin{aligned} \theta &= 360^\circ - 90^\circ - \beta - \alpha \checkmark \\ &= 360^\circ - 90^\circ - 41,365 - 14,685 \\ &= 213,95^\circ \checkmark \end{aligned}$$

(8)

$$2.2 \quad \frac{T_1}{T_2} = 2,718^{\mu\theta} T_2$$

$$\begin{aligned} T_1 &= 2,718^{\mu\theta} T_2 \\ &= 2,718 \left(0,25 \times \frac{213,95^\circ}{57,3} \right) \times T_2 \checkmark \\ &= 2,545 T_2 \checkmark \end{aligned}$$

NOTE: Perpendicular distance of T_2 is not 76 mm

$$\text{ACD } \hat{A} = 180^\circ - 90^\circ - 41,355 = 48,635$$

$$\text{ABC } \hat{A} = 180 - 90^\circ - 14,685 = 75,315^\circ$$

$$\text{So } \hat{A} = 180^\circ - 48,635^\circ - 75,315^\circ = 56,05^\circ$$

Moments about B

Sum of clockwise moments = Sum of anti-clockwise moments

$$T_2 \times 0,225 = (T_1 \sin 56,05 \times 0,076) + (F \times 0,6) \checkmark$$

$$(T_2 \times 0,225) = (2,543 \times T_2 \sin 56,05^\circ \times 0,076) + (250 \times 0,6) \checkmark$$

$$0,225T_2 - 0,16T_2 = 150 \checkmark$$

$$T_2 = 2307,692 \text{ N } \checkmark$$

$$T_1 = 5868,461 \text{ N } \checkmark \quad (5)$$

$$\begin{aligned} 2.3 \quad T_{\text{brake}} &= (T_1 - T_2) r \\ &= (5858,461 - 2307,692) \times 0,225 \checkmark \\ &= 801,173 \text{ Nm} \checkmark \end{aligned}$$

(2)
[15]

QUESTION 3

$$\begin{aligned} 3.1 \quad \frac{T_1}{T_2} &= e^{\mu\theta} \\ \frac{T_1}{T_2} &= e^{(0,3 \times \frac{180}{57,3})} \checkmark \\ T_1 &= 2566 T_2 \\ T_2 &= 1169,13 \text{ N} \checkmark \\ T_1 &= 3000 \text{ N} \end{aligned}$$

(2)

$$\begin{aligned}
 3.2 \quad T &= F \times r \\
 &= (T_1 - T_2) r \\
 &= (3000 - 1169,13) 0,28 \checkmark \\
 &= 512,64 \text{ Nm} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 3.3 \quad T &= (T_1 - T_2) r \\
 512,64 &= (2,566T_2 - T_2) 0,16 \checkmark \\
 T_2 &= 2045,9 \text{ N} \checkmark \\
 T_1 &= 5250 \text{ N} \checkmark
 \end{aligned} \tag{3}$$

$$\begin{aligned}
 3.4 \quad \text{Clockwise moments} &= \text{Anti-clockwise moments} \\
 (L \times 1) &= (3000 + 1169,13) \times 0,6 \checkmark \checkmark \\
 L &= 2501,478 \text{ N} \checkmark \\
 R &= 1667,652 \text{ N} \checkmark \text{ (Upward forces = Downward forces)}
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 3.5 \quad \text{Clockwise moments} &= \text{Anti-clockwise moments} \\
 (L \times 1) &= (5\,250 + 2045,9) \times 0,32 \checkmark \checkmark \\
 L &= 2334,688 \text{ N} \checkmark \\
 R &= 4961,1 \text{ N} \checkmark \text{ (Upward forces = Downward forces)}
 \end{aligned} \tag{4}$$

[15]

QUESTION 4

$$\begin{aligned}
 4.1 \quad 4.1.1 \quad PCD &= m \times t \\
 &= 10 \times 35 \checkmark \\
 &= 350 \text{ mm} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.1.2 \quad CD &= \frac{PCD_A}{2} + \frac{PCD_B}{2} \\
 &= \frac{40}{2} + \frac{350}{2} \checkmark \\
 &= 195 \text{ mm} \checkmark
 \end{aligned} \tag{2}$$

$$\begin{aligned}
 4.1.3 \quad P &= m \times \pi \\
 &= 10\pi \\
 &= 31,42 \checkmark \\
 \tan \theta &= \frac{p \times n}{\pi \times D_m} \\
 &= \frac{31,42 \times 3}{\pi \times 40} \\
 &= 0,75 \checkmark \\
 \theta &= \tan^{-1}(0,75) \\
 &= 36,87^\circ \checkmark \\
 n &= \frac{\tan \theta}{\tan(\theta + \phi) \times 100} \\
 \tan(\theta + \phi) &= \tan \theta \times \frac{100}{n} \\
 \tan(36,9^\circ + \phi) &= \tan 36,9^\circ \times \frac{100}{80} \checkmark \\
 &= 0,9385 \checkmark \\
 36,9^\circ + \phi &= 43,18^\circ \checkmark \\
 \phi &= 6,28^\circ \checkmark \\
 \mu &= \tan 6,28^\circ \\
 &= 0,11 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 4.2 \quad 4.2.1 \quad \alpha &= \frac{W_2 - W_1}{t} \\
 &= \frac{720 - 300}{8} \\
 &= 5,49 \text{ rad/s}^2 \checkmark
 \end{aligned}$$

$$\begin{aligned}
 T &= I\alpha \\
 &= (mk^2)\alpha \\
 &= (50)(0,2)^2(5,49) \checkmark \\
 &= 10,99 + 0,6 \\
 &= 11,6 \text{ Nm} \checkmark
 \end{aligned} \quad (3)$$

$$\begin{aligned}
 4.2.2 \quad P &= \frac{2\pi n \times N \times T}{60} \\
 &= \frac{2\pi \times 720 \times 11,6}{60} \checkmark \\
 &= 0,874 \text{ kW} \checkmark
 \end{aligned} \quad (2)$$

[17]

QUESTION 5

$$\begin{aligned}
 5.1 \quad 5.1.1 \quad V &= \sqrt{\mu gr} \\
 &= \sqrt{0,45 \times 9,81 \times 22} \checkmark \\
 &= 9,85 \text{ m/s} \checkmark \\
 &= 35,5 \text{ km/h} \checkmark
 \end{aligned}$$

$$\begin{aligned}
 5.1.2 \quad V &= \sqrt{\frac{gbr}{2h}} \\
 &= \sqrt{\frac{9,81 \times 1,2 \times 22}{2 \times 0,75}} \checkmark \\
 &= 13,14 \text{ m/s} \checkmark \\
 &= 47,3 \text{ km/h} \checkmark
 \end{aligned}$$

(2 × 3) (6)

$$\begin{aligned}
 5.2 \quad W &= 1\,400 \times 9,81 \\
 &= 13\,734 \text{ N} \checkmark \\
 N_F &= \frac{w \times y}{d} \\
 &= \frac{13\,734 \times 1,8}{3} \checkmark \\
 &= 8\,240,40 \text{ N} \checkmark \\
 N_R &= 13\,734 - 8\,240,4 \\
 &= 5\,493,6 \text{ N} \checkmark \\
 w &= \mu W \times \frac{h}{d} \\
 &= 0,5 \times 13\,734 \times \frac{0,6}{3} \\
 &= 1\,373,4 \text{ N} \checkmark \\
 N_F &= 8\,240,4 + 1\,373,4 \\
 &= 9\,613,8 \text{ N} \checkmark \\
 N_R &= 5\,493,6 - 1\,373,4 \\
 &= 4\,120,4 \checkmark
 \end{aligned}$$

(7)

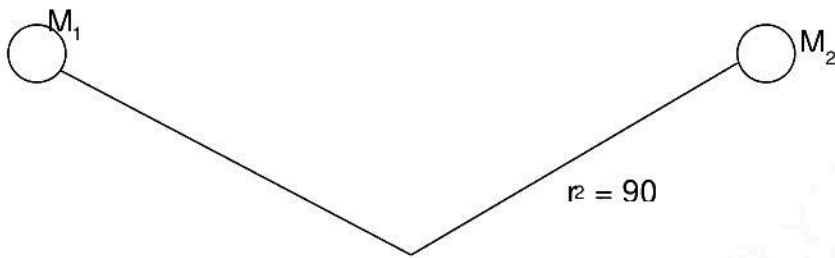
QUESTION 6

$$m_1 r_1 = 15 \times 80 = 1200 \text{ kg mm} \checkmark$$

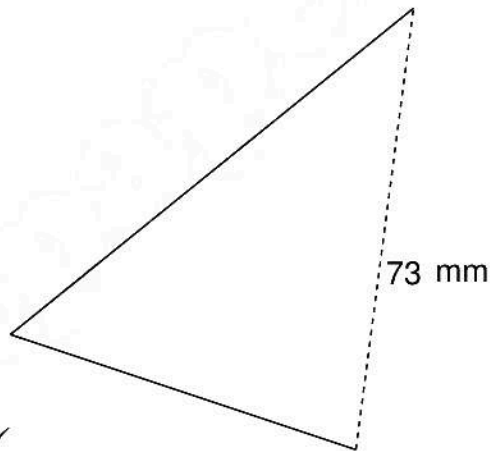
$$m_2 r_2 = 19 \times 90 = 1710 \text{ kg mm} \checkmark$$

$$m_3 r_3 = \frac{73 \times 200}{10} \\ = 1460 \text{ kg mm} \checkmark$$

$$\therefore r_3 = \frac{1460}{20} \\ = 73 \text{ mm at } 120^\circ \text{ from } M_1 \checkmark \checkmark$$



Space diagram $\checkmark \checkmark \checkmark$



Scale: 10 mm = 200 kg.mm $\checkmark$

Vector diagram $\checkmark \checkmark \checkmark$

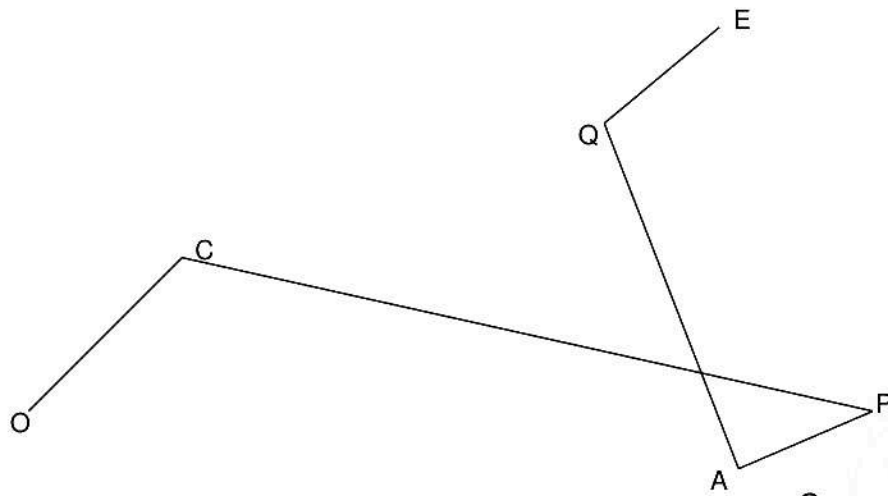
[12]

QUESTION 7

$$7.1 \quad V_{oe} = wr \\ = \left(\frac{2\pi N}{60} \right) (r) \\ = \frac{2\pi(120)}{60} \times 0,125 \checkmark \\ 1,57 \text{ m/s} \checkmark$$

(2)

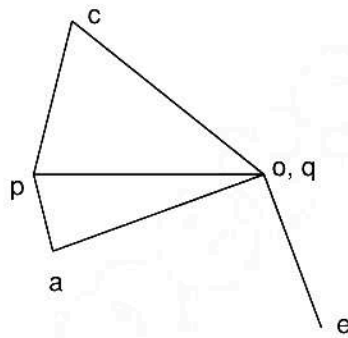
7.2



Space diagram ✓✓✓✓

(4)

7.3



Velocity diagram ✓✓✓✓

(4)

7.4

7.4.1

$$V_a = 0,5 \text{ m/s}$$

7.4.2

$$\begin{aligned} \alpha_{cp} &= \frac{(V_{oc})^2}{oc} \\ &= \frac{(1,57)^2}{0,125} \checkmark \\ &= 19,71 \text{ m/s}^2 \checkmark \end{aligned}$$

7.4.3

$$\begin{aligned} \alpha_{cp} &= \frac{(v_{cp})^2}{cp} \\ &= \frac{(1,2)^2}{0,5} \checkmark \\ &= 4,5 \text{ m/s}^2 \checkmark \end{aligned}$$

7.4.4

$$\begin{aligned} \alpha_{AQ} &= \frac{V_{aq}^2}{AQ} \\ &= \frac{(1,25)^2}{0,25} \checkmark \\ &= 6,25 \text{ m/s}^2 \checkmark \end{aligned}$$

(4 × 2)

(8)

[18]

TOTAL: