higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MECHANOTECHNICS N4

21 November 2024

This marking guideline consists of 10 pages.

Copyright reserved

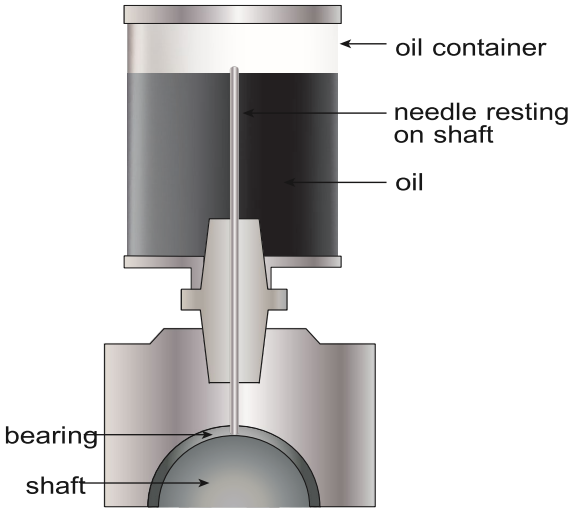
QUESTION 1

1.1
- The level of demand✓
- The nature of the target market✓
- Cost of labour✓
- Nature of the product✓
- The volume, size and mass of production✓
- The available space✓
- The length of processing time✓
- Complexity of the product✓
- Movability of the product✓ (Any FIVE from the given responses is correct) (5)

1.2
- There is less overspray.✓
- Less solvent is needed.✓
- Overhead spraying is easier.✓
- Bigger saving in thinners.✓
- Higher spraying pressure allows the use of thick paints.✓
- Air pockets in the paint supply are eliminated.✓

(Any FIVE from the given responses is correct) (5)

1.3

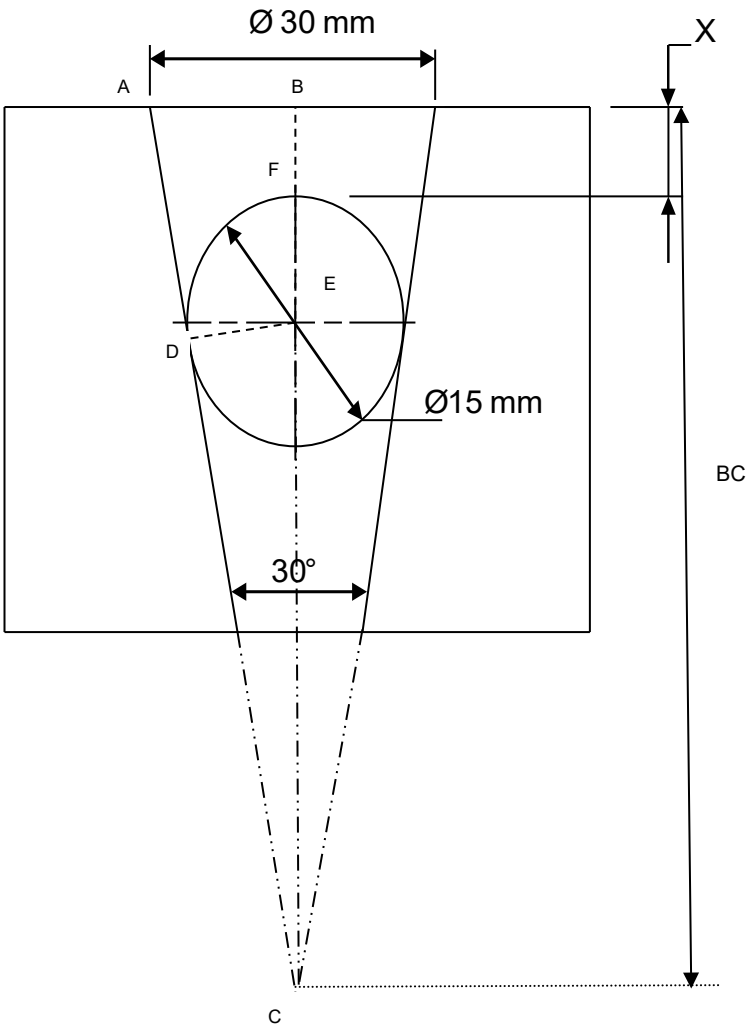


(TWO marks for the correct sketch and THREE marks for any correct labelling) (5)

[15]

QUESTION 2

2.1



$X = BC - CE - EF$ ✓

In triangle ABC

$$\tan 15^0 = \frac{AB}{BC}$$

$$BC = \frac{15}{\tan 15}$$ ✓

$BC = 56mm$ ✓

In triangle CDE

$$\sin 15^0 = \frac{DE}{CE}$$

$$CE = \frac{7,5}{\sin 15}$$ ✓

$CE = 29mm$ ✓

$X = 56 - 29 - 7,5$ ✓

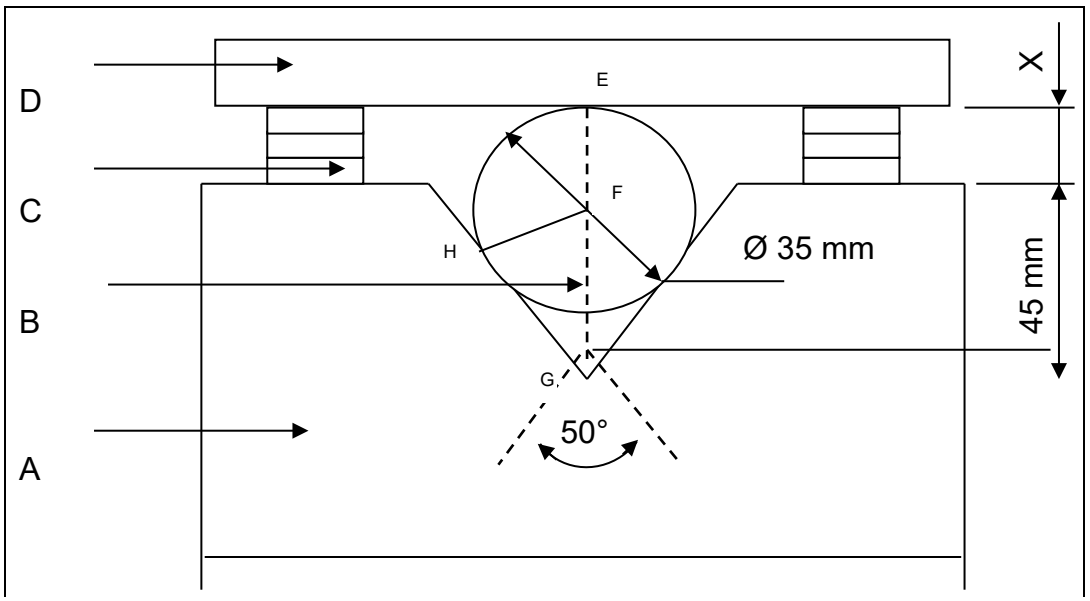
$X = 19,5\,\text{mm}$ ✓

(7)

2.2 2.2.1

- A V-groove block✓
- B Roller✓
- C Gauge blocks✓
- D Straight edge✓ (4)

2.2.2



$EG = 45 + x$

And

$EG = EF + FG$

In triangle FGH

$$\sin 25 = \frac{17,5}{FG}$$

$$FG = \frac{17,5}{\sin 25} \checkmark$$

$FG = 41,41mm \checkmark$

And

$EG = 17,5 + 41,41$
$EG = 58,91mm \checkmark$
$58,91 = 45 + x$
$x = 58,91 - 45$
$x = 13,91mm \checkmark$

(4)
[15]

QUESTION 3

$$\frac{T_1}{T_2} = e^{\mu\theta}$$
$$\frac{T_1}{T_2} = e^{0,37(\frac{175}{57,3})}$$
$$T_1 = 3,096T_2 \checkmark$$

Also

$$v = \pi d\left(\frac{N}{60}\right)$$
$$v = \pi(0,18)\left(\frac{190}{60}\right) \checkmark$$
$$v = 1,791m/s \checkmark$$

but

$$P = (T_1 - T_2)v$$
$$20000 = (3,096\,T_2 - T_2)1,791 \checkmark$$
$$T_2 = 5327,74N \checkmark$$

[5]

QUESTION 4

4.1 4.1.1

$$C = \frac{m}{2} \times (T_A + T_B)$$
$$T_A = 5,3T_B \checkmark$$

$$612 = \frac{m}{2} \times (5,3\,T_B + T_B)$$

Also

$$\text{mod}\,ule = \frac{circular..pitch}{\pi} \checkmark$$
$$\text{mod}\,ule = \frac{38,5}{\pi} \checkmark$$
$$\text{mod}\,ule = 12,25mm \checkmark$$

Therefore

$$612 = \frac{12,25}{2} \times (5,3\,T_B + T_B) \checkmark$$
$$T_B = 15,86 \checkmark$$
$$T_A = 5,3(15,86)$$
$$T_A = 84 \checkmark$$

(7)

4.1.2

$$C = \frac{m}{2} \times (T_A + T_B)$$

$$C = \frac{12,25}{2} \times (84 + 15.86) \checkmark$$

$$C = 611.6mm \checkmark$$ (2)

4.2.1

$$N_A \times T_A = T_B \times N_B$$

$$N_B = \frac{T_A \times N_A}{T_B}$$

$$N_B = \frac{68 \times 850}{136}$$

$$N_B = 425r/\min \checkmark$$

$$Nc = 425r/\min$$ (connected on same shaft)✓

And

$$N_D = \frac{T_A \times N_A \times T_C}{T_B \times T_D}$$

$$N_D = \frac{68 \times 850 \times 70}{136 \times 100} \checkmark$$

$$N_D = 297,5 \checkmark$$ (4)

4.2.2

$$C_x = \frac{m}{2} \times (T_A + T_B)$$

$$C_x = \frac{6}{2} \times (68 + 136)$$

$$C_x = 612mm \checkmark$$ (1)

4.2.3

$$C_y = \frac{m}{2} \times (T_C + T_D)$$

$$C_y = \frac{6}{2} \times (70 + 100)$$

$$C_y = 510mm \checkmark$$ (1)

[15]

QUESTION 5

5.1 5.1.1

$$A_t = \frac{\pi d^2}{4}$$

$$= \frac{\pi(0,04)^2}{4}$$

$$A_t = 1,257 \times 10^{-3} m^2 \checkmark$$

$$A_a = \frac{\pi d^2}{4}$$

$$= \frac{\pi(0,03)^2}{4}$$

$$A_a = 7,069 \times 10^{-4} m^2 \checkmark \quad (2)$$

5.1.2

$$v_t = \sqrt{2gh}$$

$$= \sqrt{2(9.81)(3)} \checkmark$$

$$v_t = 7,672 m/s \checkmark$$

$$v_A = \sqrt{\frac{gx^2}{2y}}$$

$$v_A = \sqrt{\frac{(9.81)0,5^2}{2(0.7)}} \checkmark$$

$$v_A = 1,324 m/s \checkmark \quad (4)$$

5.1.3

$$Q_A = v_a \times A_a$$

$$= 1,324 \times 7,069 \times 10^{-4} \checkmark$$

$$Q_A = 9,359 \times 10^{-4} m^3/s \checkmark$$

$$Q_t = v_t \times A_t$$

$$= 7,672 \times 1,257 \times 10^{-3} \checkmark$$

$$Q_t = 9,644 \times 10^{-3} m^3/s \checkmark \quad (4)$$

5.1.4

$$C_d = \frac{Q_a}{Q_t}$$

$$C_d = \frac{9,359 \times 10^{-4}}{9,644 \times 10^{-3}}$$

$$C_d = 0,097 \quad (2)$$

5.1.5 $$C_c = \frac{A_a}{A_t}$$

$$C_c = \frac{7,069 \times 10^{-4}}{1,257 \times 10^{-3}} \checkmark$$

$$C_c = 0,56 \checkmark$$ (2)

5.1.6 $$C_v = \frac{C_d}{C_c}$$

$$C_v = \frac{0,097}{0,56} \checkmark$$

$$C_v = 0,17 \checkmark$$ (2)

5.2 $$Q = \frac{10}{60}$$

$$Q = 0,167 m^3/s \checkmark$$

$$h_f = \frac{fLQ^2}{3.026d^5} \checkmark$$

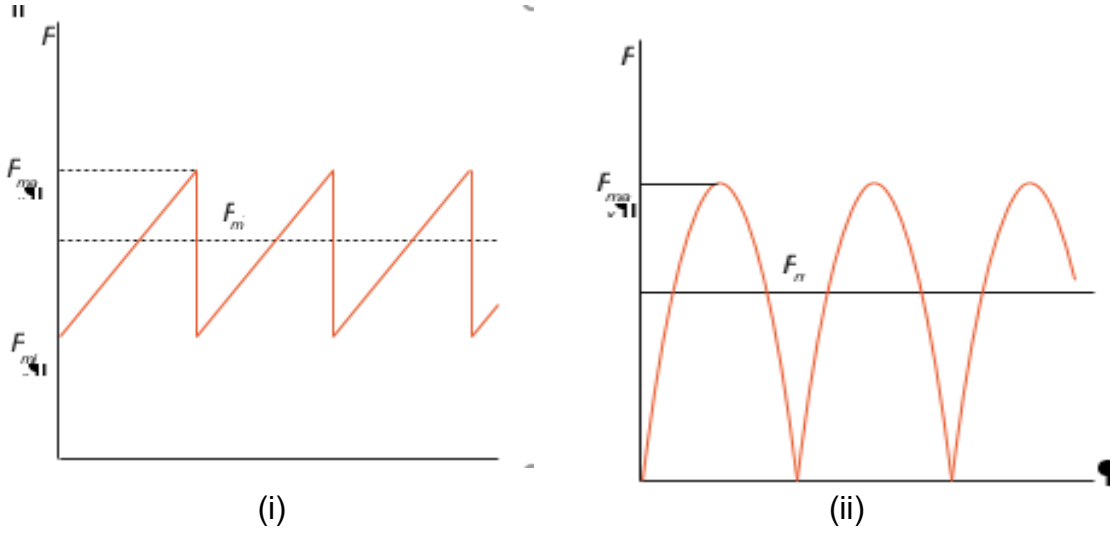
$$h_f = \frac{0,006 \times 3000 \times 0,167^2}{3.026(0,3)^5} \checkmark$$

$$h_f = 68,27m \checkmark$$ (4)

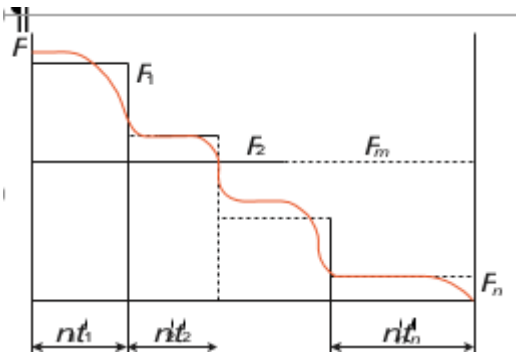
[20]

QUESTION 6

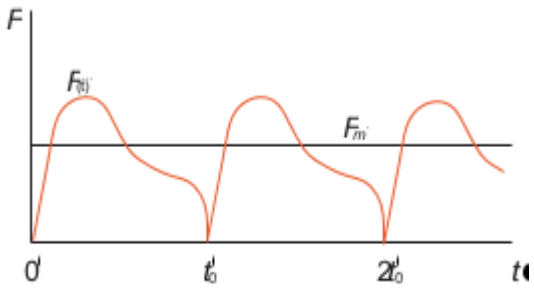
6.1



(i) (ii)



(iii)



(iv) (8)

NOTE: TWO marks for every correct graph

6.2 6.2.1

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

$$T = \frac{120000 \times 60}{2\pi 150} \checkmark$$

$$T = 7639,44N.\text{m} \checkmark$$ (2)

6.2.2

$$T_Q = F_T \times \frac{PCD}{2}$$

$$F_T = \frac{T \times 2}{PCD}$$

$$F_T = \frac{7639,44 \times 2}{0,2} \checkmark$$

$$F_T = 76394,4N \checkmark$$ (2)

6.2.3

$$F_R = F_T \tan\theta$$
$$F_R = 76394,4 \tan 20 \checkmark$$
$$F_R = 27805,29N \checkmark$$ (2)

6.2.4

$$F_{NR} = \frac{F_T}{Cos\theta}$$

$$= \frac{76394,4}{Cos20}$$

$$F_{NR} = 81297,2N \checkmark$$ (1)

[15]

QUESTION 7

7.1

$$\mu = \frac{f_u}{NR}$$

$$f_u = \mu \times NR$$

$$f_u = 0,2 \times 110 \times 9,81 \checkmark$$

$$f_u = 215,82N \checkmark$$

Therefore

$$WD = f_u \times s$$
$$= 215,82 \times 0,23 \checkmark$$
$$= 49,64J \checkmark$$ (4)

7.2

$$\mu = \frac{f_u}{NR}$$

$$WD_{tip} = 130 - 49,64 \checkmark$$

$$WD_{tip} = 80,36J \checkmark$$

$$WD = F_1 \times s$$

$$F_1 = \frac{WD}{S}$$

$$F_1 = \frac{80,36}{0,23} \checkmark$$

$$= 349,40N \checkmark$$ (4)

7.3

$$(A \times 80) = (1000 \times 40) + (349,4 \times 130) \checkmark$$
$$(A \times 80) = 40000 + 45422 \checkmark$$
$$A = 1067,8N \checkmark$$

$$(1000 \times 40) = (\mathrm{B} \times 80) + (349,4 \times 50) \checkmark$$
$$40000 = (\mathrm{B} \times 80) + 17470 \checkmark$$
$$B = 281,6N \checkmark$$

Test

$$F_{UP} = F_{DOWN}$$
$$1067,8 + 281,6 = 1000 + 349,4$$
$$1349,4N = 1349,4N \checkmark$$ (7)

[15]

TOTAL: 100

Copyright reserved