higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MECHANOTECHNICS N4

12 August 2021

This marking guideline consists of 8 pages.

NOTE: √ half mark
✓ full mark

QUESTION 1

1.1
- Multi-purpose machines ensure flexibility of production
- Production is not limited to certain work processes
- Machines can be fully utilised
- There is no interruption if one machine breaks down
- Faulty parts found during inspection are not rejected
- Effective control over manufacturing cost (Any 5 × 1) (5)

Please check – the above seems to be incorrect

1.2 1.2.1 Air spray painting (1)

1.2.2 A – Air pressure
B – Spray nozzle
C – Suction pipe
D – Paint (4)

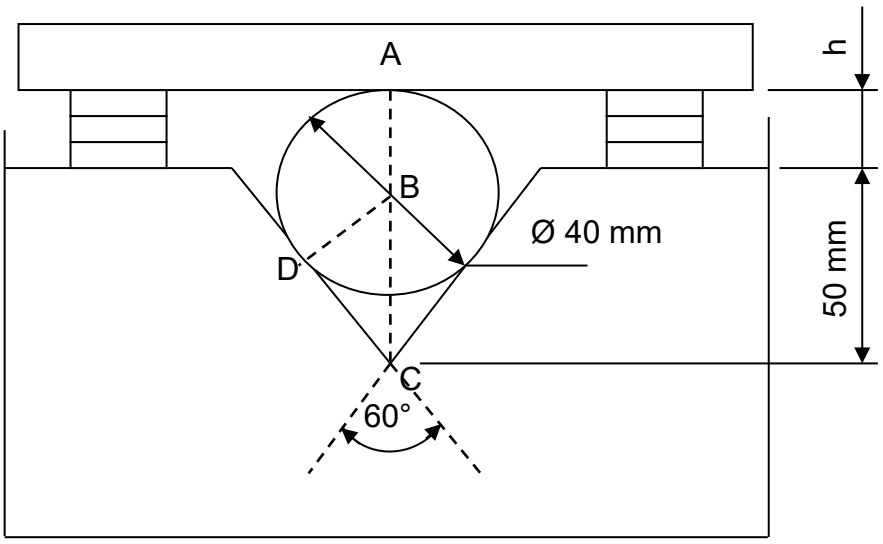
1.3
- Gravity-feed lubrication
- Grease lubrication
- Splash lubrication
- Forced lubrication
- Pressure-feed lubrication (5)

[15]

QUESTION 2

2.1 1 – Straight edge
2 – Gauge block
3 – Roller
4 – V-block (4)

2.2



$h = AC - 50$ $\quad OR \quad h + 50 = AB + BC$

$AC = AB + BC$ $\quad h + 50 = 20 + BC$

$BC \ in \ BCD$ $\quad BC = \dfrac{20}{\sin 30°}$

$Sin\theta = \dfrac{BD}{BC}$ $\quad = 40mm$

$BC = \dfrac{20}{\sin 30°}$ ✓ $\quad h + 50 = 20 + 40$

$= 40mm$ ✓ $\quad h = 60 - 50$

$AC = AB + BC$ $\quad h = 10$

$AC = 40 + 20$ ✓

$N_D = 1000r / \min$ ✓

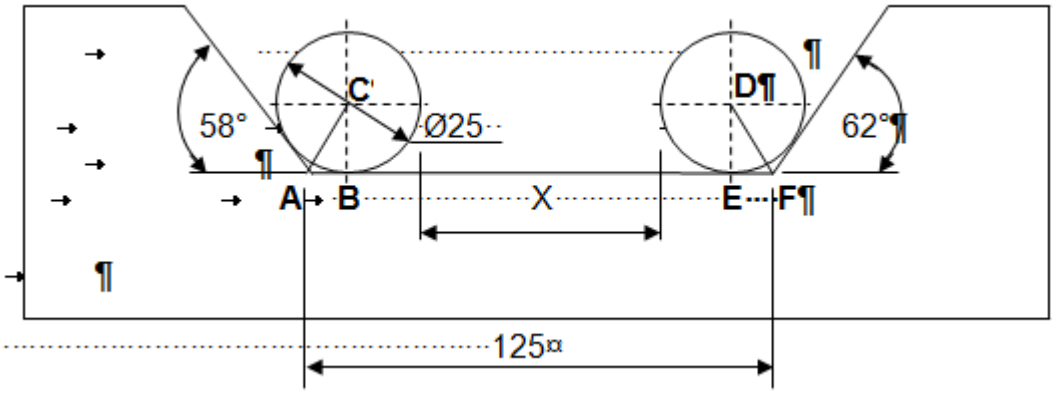
$h = AC - 50$

$= 60 - 50$ ✓

$= 10, mm$ ✓

(6)

2.3



$X = 125 - 2r - AB - EF$ √

$r = 12,5$ √

$In \ \Delta ABC \ \tan 61° = \dfrac{12,5}{AB}$ ✓

$AB = \dfrac{12,5}{\tan 61°}$

$AB = 6,929mm$ ✓

$In \ \Delta DEF \ \tan 59° = \dfrac{12,5}{EF}$

$EF = \dfrac{12,5}{\tan 59°}$

$EF = 7,511mm$ ✓

$X = 125 - 2r - AB - EF$

$X = 125 - 2(12,5) - 6,929 - 7,511$

$X = 85,56mm$ ✓

(5)

[15]

QUESTION 3

3.1 $PCD_{pinion} = mxT_{pinion}$
$= 6x30$
$= 180mm$ ✓

$VR = \frac{5}{3}$
$T_A = \frac{5}{3} T_B$ ✓
$T_A = \frac{5}{3} x30$ ✓
$= 50 \ teeth$ ✓

$PCD_B = mxT_{Gear}$
$= 6x50$
$= 300mm$ ✓ (5)

3.2 $C = \frac{m}{2}(T_A + T_B)$
$C = \frac{6}{2}(50+30)$ ✓
$= 240mm$ ✓ (2)

3.3 $D_{OA} = mx(T_A + 2)$
$D_{OA} = 6x(50+2)$ ✓
$= 312mm$ ✓

$D_{OB} = mx(T_A + 2)$
$D_{OB} = 6x(30+2)$ ✓
$= 192mm$ ✓ (4)

3.4 $Depth_{Total} = addendum + dedendum$
$Addendum = 6mm$ ✓
$Dedendum = 1{,}157xm$
$= 1{,}157x6$ ✓
$= 6{,}942mm$ ✓

$Depth_{Total} = 6 + 6{,}942$
$= 12{,}942mm$ ✓ (4)

[15]

QUESTION 4

4.1

$$v = \frac{\pi(D+t)N}{60}$$
$$= \frac{\pi(0,6+0,02)x600}{60} \checkmark$$
$$= 19,478 m/s \checkmark$$
$$T_C = mv^2$$
$$= 0,5(19,478)^2$$
$$= 189,696N \checkmark$$

(3)

4.2

$$T_1 = \sigma.w.t$$
$$= 4x10^6 x0,155x0,02 \checkmark$$
$$= 12400N \checkmark$$

(2)
[5]

QUESTION 5

5.1

$$v_1 xA_1 = v_2 xA_2$$
$$v_1 = \frac{v_2 xA_2}{A_1}$$
$$v_1 = \frac{v_2 x0,1}{0,063} \checkmark$$
$$v_1 = 1,587v_2 \checkmark$$

$$\frac{P_1}{\rho g} + \frac{v_1^2}{2g} + h_1 = \frac{P_2}{\rho g} + \frac{v_2^2}{2g} + h_2$$

$$\frac{35000}{10^3 x9,81} + \frac{v_1^2}{2x9,81} + 0 = \frac{55000}{10^3 x9,81} + \frac{v_2^2}{2x9,81} + 3 \checkmark$$

$$3,568 + 0,051(v_1)^2 = 5,607 + 0,051(v_2)^2 + 3 \checkmark$$
$$0,051{v_1}^2 - 0,051v_2^2 = 5,039$$
$$0,051({v_1}^2 - v_2^2) = 5,039 \checkmark$$
$$({v_1}^2 - v_2^2) = \frac{5,039}{0,051} \checkmark$$
$$({v_1}^2 - v_2^2) = 98,804$$
$$(1,587v_2)^2 - v_2^2) = 98,804$$
$$(2,519{v_2}^2 - v_2^2) = 98,804 \checkmark$$
$$1,519{v_2}^2 = 98,804$$
$${v_2}^2 = \frac{98,804}{1,519} \checkmark$$

$$v_2^{\ 2} = 65{,}045$$
$$v_2 = \sqrt{65{,}045}$$
$$= 8{,}065 m/s \checkmark$$

$$v_1 = 1{,}587 v_2$$
$$= 1{,}587 x 8{,}065 \checkmark$$
$$= 12{,}799 m/s \checkmark$$

$$Q = v_1 x A_1$$
$$Q = 12{,}799 x \frac{\pi (0{,}063)^2}{4} \checkmark$$
$$= 0{,}0399 m^3/s \checkmark$$
$$= 39{,}9 \ell/s \checkmark$$ (14)

5.2

$$A_t = \frac{\pi d_t^{\ 2}}{4}$$
$$A_t = \frac{\pi 0{,}045^2}{4}$$
$$A_t = 0{,}0016 m^2 \checkmark$$

$$v_t = \sqrt{2gh}$$
$$v_t = \sqrt{2(9.81)4}$$
$$v_t = 8{,}859 m/s \checkmark$$

$$Q_t = V_t \times A_t$$
$$Q_t = 8{,}859 \times 0{,}0016$$
$$Q_t = 0{,}0142 m^3/s \checkmark$$

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

AND

$$Q_a = C_d \times Q_t$$
$$Q_a = 0{,}64 \times 0{,}0142 \checkmark$$
$$Q_a = 0{,}00909 m^3/s \checkmark$$
$$Q_a = 32724 l/h \checkmark$$ (6)

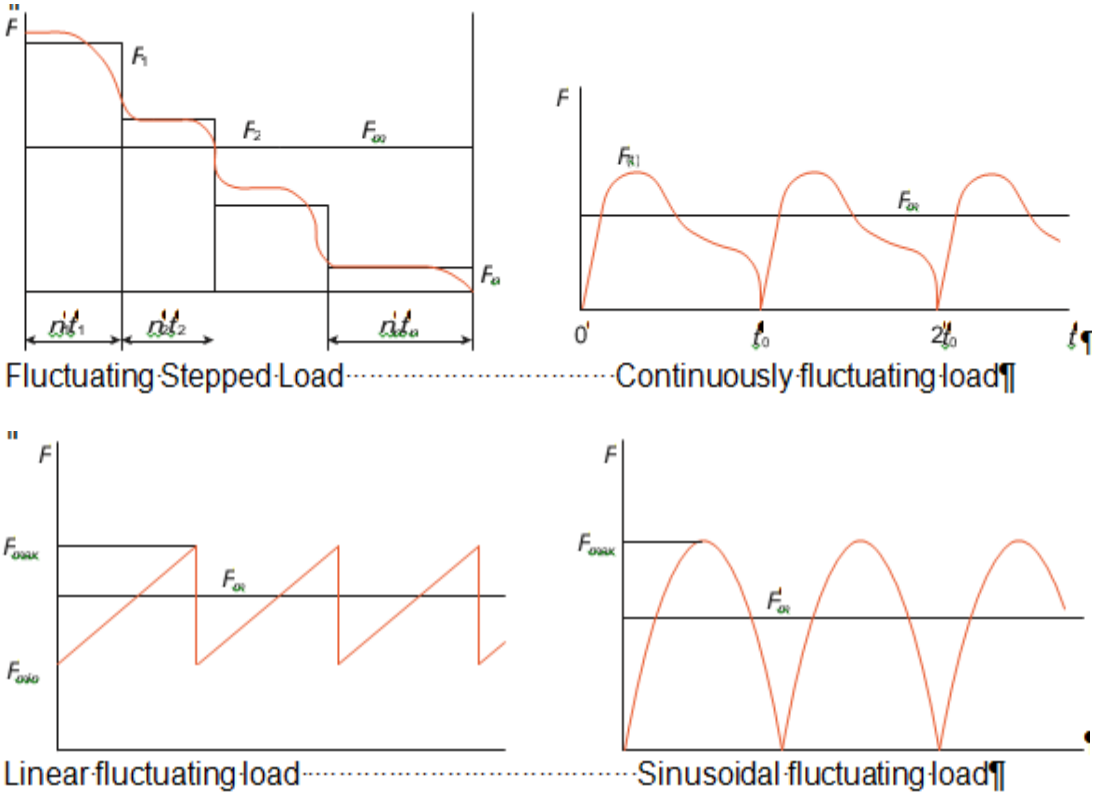
[20]

QUESTION 6

6.1
- Fluctuating stepped load
- Linear fluctuating load
- Sinusoidal fluctuating load
- Continuously fluctuating load

(Any 3 × 1) (3)

6.2



Fluctuating Stepped Load ..... Continuously fluctuating load

Linear fluctuating load ..... Sinusoidal fluctuating load

(TWO marks for the correct sketch and TWO marks for the labelling in each graph) (12)

[15]

I was unable to edit the labelling above – E.g. Fluctuation stepped load NOT Stepped Load

QUESTION 7

7.1 7.1.1

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

$$T = \frac{Px60}{2\pi N}$$
$$= \frac{3000x60}{2\pi x1500} \checkmark$$
$$= 19{,}099 N.m \checkmark$$

(2)

7.1.2

$$\eta = \frac{P_o}{P_i}$$
$$P_o = 3000x0{,}8 \checkmark$$
$$= 2400W \checkmark$$

$$P = \frac{2\pi NT}{60}$$
$$T = \frac{Px60}{2\pi N}$$
$$= \frac{2400x60}{2\pi x3600} \checkmark$$
$$= 6,366N.m \checkmark$$ (4)

7.1.3
$$P = \frac{2\pi NT}{60}$$
$$T = \frac{Px60}{2\pi N}$$
$$= \frac{2400x60}{2\pi x40} \checkmark$$
$$= 572,957N.m \checkmark$$ (2)

7.2 7.2.1
$$P = \frac{W}{t}$$
$$= \frac{Fxs}{t}$$
$$= \frac{1200x0,275}{13} \checkmark$$
$$= 25,385W \checkmark$$
$$= 0,025kW \checkmark$$ (3)

7.2.2
$$T = Fxr$$
$$= 1000x0,175 \checkmark$$
$$= 175N.m \checkmark$$
$$P = \frac{2\pi NT}{60}$$
$$= \frac{2\pi x350x175}{60} \checkmark$$
$$= 6414,085W$$
$$= 6,414kW \checkmark$$

OR

$$v = \frac{\pi DN}{60}$$
$$v = \frac{\pi(0,35)x(350}{60} \checkmark$$
$$= 6,414m/s \checkmark$$
$$P = F\ xv$$
$$= 1000x6,414 \checkmark$$
$$= 6414W$$
$$= 6,414kW \checkmark$$ (4)

[15]

TOTAL: 100