higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

MECHANOTECHNOLOGY N3

12 APRIL 2021

This marking guideline consists of 6 pages.

QUESTION 1: POWER TRANSMISSION, CLUTCHES AND COUPLING OF SHAFTS

1.1 1.1.1

$$N(RATIO) = \frac{N(MOTOR)}{N(BELT)}$$

$$N(RATIO) = \frac{1\,250}{650} \quad \checkmark$$

$$N(RATIO) = 1{,}923$$

$$\mathrm{N(RATIO)} = 1{,}923 : 1 \ \checkmark \qquad (2)$$

1.1.2 Type of start vs Duty class vs Operational hours

$$SF = 1.3 \ \checkmark\checkmark \qquad (2)$$

1.1.3

$$P(DESIGN) = P(MOTOR) \times SF$$

$$P(DESIGN) = 40 \times 1{,}3 \ \checkmark$$

$$P = 52\ kW \ \checkmark \qquad (2)$$

1.1.4 D(APPROXIMATE) vs N(MOTOR)

52 kW vs 1 250 r/min

$$D(APPROXIMATE) = 180\ mm \ \checkmark\checkmark \qquad (2)$$

1.1.5

$$P(MOTOR) = \frac{2\pi \mathrm{NT}}{60}$$

$$T = \frac{40\,000 \times 60 \checkmark}{2\pi \times 1\,250 \checkmark}$$

$$T = 305{,}577 \ \checkmark ½\ Nm \ \checkmark ½ \qquad (3)$$

1.2 1.2.1 Centre distance: the distance from the centre of the driving pulley/sprocket to the centre of the driven pulley/sprocket

1.2.2 Belt deflection: the amount of movement on the belt resulting from its slackness

1.2.3 A machine part that connects a drive shaft with a driven shaft in such a way that the connection can easily be disengaged.

1.2.4 A part of the machine that is used to join one or more shafts to provide single shaft of required length.

(4 × 2) (8)

[19]

QUESTION 2: BRAKES

2.1 2.1.1 C
2.1.2 D

(2 × 1) (2)

2.2
- It is easily repairable because of its simplicity.
- The wheels are coupled separately/independently, hence breaking of a single cable or rod will not affect the entire system.
- Power failure has no effect on the functionality of this braking system.

(Any 2 × 1) (2)

2.3
- The system depends on the flow of the electric current.
- The system depends on electric power.
- The system will be ineffective due to power failure. (Any 2 × 1) (2)

[6]

QUESTION 3: BEARINGS

3.1 Part bearings – support radial loads in housings

3.2 Solid bearings – support radial loads in generators, motor starters and idler pulleys

3.3 Split bearings – support radial loads in reciprocating engines and gear shafts

3.4 Thrust bearings – support axial/thrust loads in one direction as they are placed on thrust collars

3.5 Guide bearings – support sliding, and reciprocating movement as found in centre lathes and pump assemblies

(5 × 2) **[10]**

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

4.1
- To minimise chances of explosion
- To maintain the correct viscosity of the lubricant
- For the pressure tank to store more air
- To maintain lubrication of parts (4)

4.2
- Liquid – oil
- Semi-solid – grease
- Solid – graphite, boron nitrate (3 × 2) (6)

4.3
- Open-vane impeller
- Semi-open or ribbed impeller
- Enclosed or shrouded impeller (3)

[13]

QUESTION 5: HYDRAULIC AND PNEUMATIC

5.1 5.1.1

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

$$d = \sqrt{\frac{0{,}00163 \times 4}{3{,}1416}} \quad \checkmark$$

$$d = 0{,}045556\ m$$

$$d = 45.556 \checkmark ½\ mm \checkmark ½$$

5.1.2

$$p = \frac{\mathrm{F}}{\mathrm{A}}$$

$$F = 420 \times 10^3 \times 0{,}00163 \ \checkmark$$

$$F = 684{,}6 \checkmark ½\ N \ \checkmark ½$$

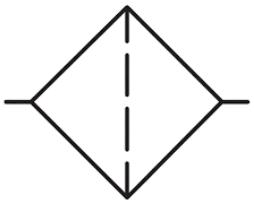
(2 × 2) (4)

5.2 When pressure is exerted on the surfaces of a liquid in an enclosed system, the pressure is transmitted with equal force in all directions. (2)

5.3 5.3.1

✓✓

5.3.2



✓✓

(2 × 2) (4)
[10]

QUESTION 6: INTERNAL COMBUSTION ENGINES

6.1 A – spark plug
B – combustion chamber
C – piston
D – connecting rod (conrod)
E – displacement volume (5)

6.2
- Compression stroke
- Power stroke
- Exhaust stroke (3)

[8]

QUESTION 7: CRANES AND LIFTING MACHINES

7.1
- The cost of building, dismantling, and transporting components is very high.
- The crane has limitations of functionality as it is static on site.
- The crane's ability to operate is limited to its radius.
- The covering area of the crane is limited because it is fixed in one position. (4)

7.2 A – trolley/hoisting drum
B – rail
C – hook (3)
[7]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

8.1 8.1.1
- Overheating causes sagging and collapsing.
- There is no colour change when heated.
- Heat tends to soften the metal. (3)

8.1.2
- Serious reduction of corrosion-resisting properties due to heat
- Distortion and grain growth (2)

8.2 8.2.1 Nylon becomes stiff.

8.2.2 Perspex becomes rigid.

(2 × 1) (2)
[7]

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

9.1
- To promote good working relations in the workplace.
- To prevent worker grievances/dissatisfaction from accumulating unattended by supervisors
- A means for management to know about the working conditions and relations between employees
- A means of internal dispute resolution (4)

9.2
- Accurate
- Objective
- Clear
- Brief
- Insightful
- Open-minded (Any 5 x 1) (5)

9.3
- The quantity of the items needed
- When the items are needed
- By whom the request is being made (3)

[12]

QUESTION 10: ENTREPRENEURSHIP

10.1
- Good organisers
- Good managers
- Directors and controllers of activities designed to achieve pre-established goal.
- Combine the qualities of entrepreneurship with a sound business idea (4)

10.2
- Competition
- Expansion potential
- Business service
- Nature of the business product
- Symbiosis
- Convenience and accessibility
- The size of the business (Any 4 x 1) (4)

[8]

TOTAL: 100