



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

**NATIONAL CERTIFICATE
MECHANOTECHNOLOGY N3**

4 APRIL 2019

This marking guideline consists of 6 pages.

QUESTION 1: POWER TRANSMISSION, CLUTCHES AND COUPLING OF SHAFT

- 1.1 1.1.1
$$N_R = \frac{N_{Motor}}{N_{Machine}}$$

$$= \frac{1200}{800} \checkmark^{1/2}$$

$$= 1,5 : 1 \checkmark^{1/2} \quad (1)$$
- 1.1.2 SF = 1,2 [medium duty and soft start] – from tables (1)
- 1.1.3
$$P_{DESIGN} = P_{MOTOR} \times SF$$

$$= 38 \times 1,2 \checkmark$$

$$= 45,6 \checkmark^{1/2} \text{ kW } \checkmark^{1/2} \quad (2)$$
- 1.1.4 D = 180 mm [N_{MOTOR} and P_{DESIGN}] – from tables ✓ (1)
- 1.1.5
$$N_R = \frac{P_D}{P_{C/B}}$$

$$= \frac{45,6}{22} \checkmark$$

$$= 2,073 \checkmark^{1/2}$$

$$= 2 \text{ belts } \checkmark^{1/2} \quad (2)$$
- 1.2
- Power to be transmitted
 - Type of lubrication to be used
 - Load capacity
 - Different applicable ratios
 - Stresses generated on gear teeth
 - Space available
 - Shaft arrangement (Any 3 × 1) (3)
- 1.3 1.3.1 Split muff coupling (1)
- 1.3.2 A – Shaft
 B – Nut
 C – Key
 D – Split sleeve half (4 × 1) (4)
- 1.4 The clutch is used to transmit power through movement ✓ from one rotating shaft/part of the machine to another shaft/part of the machine. ✓ (2)
- 1.5
- Ideal for application where smooth pickups is required.
 - Engages and disengages automatically
 - Cannot be started under load (3 × 1) (3)

[20]

QUESTION 2: BRAKES

Air is transmitted through a compressor. By operating the brake lever pressure is applied to the brake chamber, ✓ causing the brake shoe to push outwards against the drum. ✓ When the brake is applied, the control valve opens and allows air to move into the cylinder ✓ and pushes the piston down. On release of the brakes the control valve closes ✓ cutting off air supply to the air cylinder. Air then travels through the pipes as the air piston moves upward, releasing the brakes. ✓ Excess air is allowed to escape through the exhaust ✓ pipe through the release valve.

[6]**QUESTION 3: BEARINGS**

- 3.1 Friction bearings operate on a principle of sliding friction between the shaft and bearing. ✓
Antifriction bearings operate on the principle of a rolling motion to allow shaft rotation. ✓ (2)
- 3.2
- Listening to the bearing sound during operation
 - Measuring the bearing temperature
 - Examining the lubricant used (3 × 1) (3)
- 3.3 True (1)
[6]

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

- 4.1 Position the fluid supply to the pump at a level higher than the pump. (2)
- 4.2 To serve as outlet for the air that is sometimes caught in the pump during operation. (2)
- 4.3 To prevent fluid from leaking from the pump. (1)
- 4.4
- It operates with a smaller sized radiator.
 - Water flow rate is improved.
 - A smaller volume of cooling water is required.
 - Water circulation is improved by the impeller. (4 × 1) (4)
- 4.5 Water circulates inside the pipes connected to the casing/shell ✓. Warm fluid flows through the shell while interior baffles regularly change the flow of the hydraulic fluid ✓. The fluid flows and gives up heat to the water in the tubes. ✓ The fluid being cooled moves in one direction while the water in the pipes moves in the opposite direction through the heat exchanger. ✓ (Any 3 × 1) (3)
- 4.6
- Crankshaft
 - Piston
 - Scoop
 - Oil/ also allow Oil Sump (4 × 1) (4)

[16]

QUESTION 5: HYDRAULICS AND PNEUMATICS

- 5.1
- It stores energy for the system (oil under pressure).
 - It absorbs shocks in the system.
 - It enhances a smooth operation.
- (3 × 1) (3)

5.2.



(1)

5.3 5.3.1 $A = \frac{V}{l}$

$$= \frac{620 \times 10^{-6}}{0,12} \checkmark$$

$$= 5,1667 \times 10^{-3} \checkmark^{1/2} \text{m}^2 \checkmark^{1/2}$$

(2)

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

$$d = \sqrt{\frac{4 \times 5,1667 \times 10^{-3}}{\pi}} \checkmark$$

$$= 81,108 \times 10^{-3} \checkmark^{1/2} \text{m} \checkmark^{1/2}$$

$$= 81,107 \text{ mm}$$

(2)

5.3.3 $P = \frac{F}{A}$

$$= \frac{40 \times 10^3}{5,1667 \times 10^{-3}} \checkmark$$

$$= 7,742 \checkmark^{1/2} \text{MPa} \checkmark^{1/2}$$

(2)
[10]

QUESTION 6: INTERNAL COMBUSTION ENGINES

- 6.1 False
6.2 False
6.3 True
6.4 True
6.5 True

(5 × 1) **[5]**

QUESTION 7: CRANES AND LIFTING MACHINES

- 7.1
- Crane cabin is too high.
 - Heavy loads cause excessive stresses.
 - During cold weather structural members can fail.
 - Erecting and dismantling the crane are expensive.
 - Planning is required before operating the crane.
 - The crane is very tall.
 - The operator is far from the point of operation.
 - Erecting the crane is time-consuming. (Any 5 × 1) (5)
- 7.2
- Supports the strands
 - Lubricates cable from the inside
 - Prevents corrosion
 - Provides a cushion effect (Any 3 × 1) (3)
- [8]**

QUESTION 8: MATERIALS AND MATERIAL PROCESSES

- 8.1 Heat treatment is a process whereby physical properties of a metal are changed by heating up the metal to a certain temperature✓ and then cooling it down.✓ (2)
- 8.2 8.2.1 Black (1)
- 8.2.2 Blue (1)
- 8.3
- Welding point becomes brittle
 - Melts quickly
 - Tensile strength decreases quickly
 - Expands and contracts more than steel does (4 × 1) (4)
- [8]**

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

- 9.1 A grievance means a worker is unhappy about a work situation✓ or in respect of which they feel they are offended.✓ (2)
- 9.2
- Providing health and safety at a workplace
 - Establishing an advisory council for occupational health and safety
 - Promoting safety when using machinery/articles in the workplace/plant
 - Protect other persons not at work against hazards to health and safety arising in connection with activities of persons at work.
 - Protecting persons from work related hazards
 - Providing for all occupational health and safety matters (Any 4 × 1) (4)

- 9.3
- An oral warning
 - A written warning
 - A temporary suspension
 - Dismissal
- (4 × 1) (4)
[10]

QUESTION 10: ENTREPRENEURSHIP

10.1 The term refers to a sole ownership ✓ where one person (an entrepreneur) has complete control of the business. ✓ He/She is the manager of the business, bearing all the risks as well as getting the benefits, ✓ including all profit generated. However the business is not a separate entity for he/she is personally liable for the losses/legal claims against the business. ✓ (4)

10.2 To make a profit (1)

- 10.3
- Good organiser
 - Action oriented
 - Self-confident
 - Self-driven
 - Persistent
 - Problem solver
 - Achiever
 - Independent thinker
 - Initiator
 - Innovative
 - Desire for feedback
 - Good planner (sets goals)
 - Takes calculated risks
- (Any 6 × 1) (6)
[11]

TOTAL: 100