



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

**NATIONAL CERTIFICATE
MECHANOTECHNOLOGY N3**

2 AUGUST 2019

This marking guideline consists of 6 pages.

QUESTION 1: POWER TRANSMISSION; CLUTCHES AND COUPLING OF SHAFTS

- 1.1 1.1.1 $D = 355 \text{ mm}$ and $d = 200 \text{ mm}$ (1)
- 1.1.2 $L = [(D + d) \times 1,57] + \text{correction factor}$
 $= [(355 + 200) \times 1,57] + (2 \times 760)✓$
 $= 2\,391,35✓^{1/2} \text{ mm}✓^{1/2}$ (2)
- 1.1.3 $CF = 0,9$ (Table) (1)
- 1.1.4 $P_D = P_m \times SF$
 $= 15 \times 1,1✓$
 $= 16,5✓^{1/2} \text{ kW}✓^{1/2}$ (2)
- 1.2 1.2.1 To determine the increase in belt size so that is suitable for the duty demand
- 1.2.2 To take up slack in the belt
 To increase the angle of contact. (2 × 1) (2)
- 1.3 Refers to the slackness/movement of the belt (1)
- 1.4
- Positive clutch
 - Friction clutch
 - Centrifugal clutch
 - Hydraulic clutch
- (4)
- 1.5
- Low operating costs (economical)
 - Range of speed variations
 - Smooth and quiet in operation
 - Simple design
 - Protected against overloads
- (5)
- 1.6
- Muff
 - Flange
- (2)
- [20]**

QUESTION 2: BRAKES

- Dust is not easily thrown out.
 - It is difficult to cool the drum.
 - When too hot, the brake drum expands excessively.
 - Brake friction causes wear on the inside of the drum.
 - Brake drums are too large, therefore difficult to handle.
 - Due to heat, the braking efficiency diminishes at high temperatures
- (Any 5 × 1) **[5]**

QUESTION 3: BEARINGS

- 3.1 3.1.1 Double direction thrust ball bearing (1)
- 3.1.2 Axial loads (1)
- 3.1.3 A – Housing ring
 B – Ball and cage trust assembly
 C – Centre ring (3)
- 3.2 • Speed of operation
 • Space available around the bearing
 • Acting direction of load
 • Nature and size of misalignment between shaft and housing
 • Magnitude of load (5)
- [10]**

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

- 4.1 • Keeps the engine cooled
 • Reduces noise in engine parts
 • Prolongs the engine life-span
 • Absorbs shocks between the engine parts
 • Reduces the power loss
 • Prevents welding and seizure
 • Keeps the engine clean
 • Serves as a sealant
 • Reduces oxidation and rust (Any 5 × 1) (5)
- 4.2 In direct cooling the heat from the combustion process (engine) is transferred directly✓ from the cylinder/s to the fins✓ around the cylinder.
- In indirect cooling the heat from the engine is transferred to the water✓ circulating around it. The water goes through a radiator✓ where it is cooled by the air flow (or a fan).✓ (5)
- 4.3 • As a result of the water pump a smaller volume of cooling water is required.
 • Water flow rate is improved.
 • Water circulation is improved by the impeller.
 • The size of the radiator is reduced. (4)
- [14]**

QUESTION 5: HYDRAULICS

5.1 5.1.1 $p = \frac{F}{A} \checkmark$
 $F = p \times \frac{\pi \times d^2}{4}$
 $F = 680 \times 10^3 \times \frac{\pi \times (0,2)^2}{4} \checkmark$
 $= 23,363 \text{ kN} \checkmark$

5.1.2 $V = AL n \checkmark$
 $= \frac{\pi}{4} \times (0,02)^2 \times 0,05 \times 3 \checkmark$
 $= 0,00471 \checkmark^{1/2} \text{ m}^3 \checkmark^{1/2}$

(2 × 3) (6)

- 5.2 • Atmospheric pressure
 • Applied pressure (2)

- 5.3 • Pressure relief valve
 • Flow control valve
 • Directional control valve (3)

(2)
[13]**QUESTION 6: INTERNAL COMBUSTION ENGINES**

- 6.1 Carburettor (1)

- 6.2 A – Choke butterfly
 B – Discharge nozzle
 C – Venturi
 D – Throttle butterfly (4)

[5]

QUESTION 7: CRANES AND LIFTING MACHINES

- 7.1
- Number of drops a rope can make.
 - Maximum length per drop.
 - The braking force of the rope
 - The rope must withstand distortion and crushing.
 - The rope must resist corrosion
 - The maximum velocity.
 - The hoisting drum and pulley diameter.
 - The rope must resist abrasion.
 - Mass the rope can handle.
 - Size of the grooves and/or pulleys. (Any 4 × 1) (4)
- 7.2
- 7.2.1 The crane driver's cabin, crane jib and counter-weight rotate in a clockwise✓ and anticlockwise motion. ✓
- 7.2.2 Sideways movement of the crane✓ along rail✓ (2 × 2) (4)
- [8]**

QUESTION 8: MATERIALS AND MATERIAL PROCESSES

- 8.1
- Thermoplastics get soft when they are heated, and solidify again once cooled.
 - Thermosetting plastics go through a chemical change during moulding, and can never be softened by reheating again. (2)
- 8.2
- Toughness
 - Hardness
 - Wear resistance (3)
- [5]**

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

- 9.1 To provide the correct materials✓ in correct quantity✓ at the right place at the right time✓ (3)
- 9.2
- Equipment and facilities
 - Product and/or service
 - Mechanisation
 - Condition of raw materials
 - The extend of power used
 - Layout and flow of production in the workplace (6)

- 9.3
- Wrong timing
 - Order of presentation
 - Lack of clarity
 - Loss of information
 - Credibility of the source
- (Any 3 × 1) (3)
[12]

QUESTION 10: ENTREPRENEURSHIP

- 10.1 Entrepreneurship refers to a situation where an entrepreneur, ✓ after having identified an opportunity, ✓ assembles the necessary resources and creates a new business ✓ in the face of uncertainty and risks, with the ultimate goal of making profit and achieving growth. ✓
- (Any 3 × 1) (3)

- 10.2
- Define the problem.
 - Never criticise any ideas.
 - Don't build/evaluate on any of the ideas.
 - Accommodate wild and crazy ideas too.
 - Accommodate as many ideas as possible.
 - Compile a list of all ideas obtained.
 - Combine ideas received and build on them.
- (Any 5 × 1) (5)
[8]

TOTAL: 100