



# higher education & training

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **MARKING GUIDELINE**

### **NATIONAL CERTIFICATE MECHANOTECHNOLOGY N3**

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**This marking guideline consists of 6 pages.**

**QUESTION 1: POWER TRANSMISSION, CLUTCHES AND COUPLING OF SHAFTS**

- 1.1 1.1.1  $P_D = P_M \times SF$   
 $P_D = 55 \times 1,3 \checkmark$   
 $P_D = 71,5 \checkmark^{1/2} \text{ kW} \checkmark^{1/2}$  (2)
- 1.1.2  $N_R = \frac{N_M}{N_M}$   
 $N_M = 1,2 \times 720 \checkmark$   
 $N_M = 864 \checkmark^{1/2} \text{ r/min} \checkmark^{1/2}$  (2)
- 1.1.3  $P_{CORRECTED} = (P_{BASIC} + P_{INCREMENT}) \times CORRECTION \text{ FACTOR} \checkmark$   
 $P_{CORRECTED} = (16,8 + 1,15) \times 0,95 \checkmark$   
 $P_{CORRECTED} = 17,053 \checkmark^{1/2} \text{ kW} \checkmark^{1/2}$  (3)
- 1.2 1.2.1 Planet gear assembly (1)
- 1.2.2
- Direct drive
  - Speed reduction
  - Reverse gear
  - Neutral
- (4)
- 1.3
- Marine couplings
  - Muff couplings
  - Flange couplings
- (3)
- 1.4
- Condition/s of operation
  - The duration of slip needed
  - The power to be transmitted
  - The torque to be transmitted
  - The frequency of engagement and disengagement
  - The speed of operation expected/required
- (Any 5 × 1) (5)  
**[20]**

**QUESTION 2: BRAKES**

- They require regular attention
  - Slow response to braking
  - Adjusters require regular attention
  - There's a great chance of cables and rods stretching
  - The system is greatly affected by dust and water
- (5)  
**[5]**

**QUESTION 3: BEARINGS**

- 3.1
- The bearing number
  - Nominal bore diameter
  - Nominal outside/external diameter
  - The width of the bearing
  - The basic static load
  - The basic dynamic load
- (Any 5 × 1) (5)
- 3.2
- 3.2.1 Bore diameter = 4 mm
- 3.2.2 Bearing number = 629 mm
- 3.2.3 B (width) = 6 mm

(3 × 1) (3)  
**[8]**

**QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION**

- 4.1
- 4.1.1 Pimp slip – the difference between the theoretical flow rate and the real flow rate.
- 4.1.2 Water hammer – the sudden change in the speed of fluid flow in an enclosed system, together with a change in pressure within the system.
- 4.1.3 Required head – the pressure required to overcome all resistance that prevents the pump from delivering the desired head.

**OR**

Required head – the expected delivery head, if there is no resistance within the operation of the pump.

(3 × 2) (6)

- 4.2
- 4.2.1 Siphon wick lubrication – the system uses capillary and syphon action of wick strands to carry oil from the cup along the wick to drip onto the bearing. The oil feed rate is controlled by varying the number of wick strands and the length of wick immersed in the oil.
- 4.2.2 Splash lubrication – consisting of a sump/reservoir where the crankshaft (with a scoop) dips into, the scoop/oil ring will scoop the oil during the rotation of the shaft.
- 4.2.3 Force feed lubrication – a pump is used to maintain a continuous delivery of oil. The flow of oil is dictated by the operation of the machine as it starts and stops, thus creating automation in the lubrication system.

(3 × 2) (6)

- 4.3
- Incorrect tuning of engine
  - Faulty fan unit
  - Dysfunctional thermostatic unit
  - When the cooling air is just too hot
  - When there is a blockage/limitation in the flow of cooling elements
  - Idling but stationary engine
- (Any 4 × 1) (4)  
**[16]**

**QUESTION 5: HYDRAULIC AND PNEUMATIC**

5.1.1

$$p = \frac{f}{a}$$

$$p = \frac{1,5 \times 10^3}{200 \times 10^{-6}} \checkmark$$

$$p = 7\,500 \checkmark \frac{1}{2} \text{ kPa} \checkmark \frac{1}{2} \text{ OR } 7,5 \checkmark \frac{1}{2} \text{ MPa} \checkmark \frac{1}{2}$$

5.1.2

$$p = P = 7\,500 \text{ kPa}$$

$$F = P \times A$$

$$F = 7500 \times 10^3 \times 2 \checkmark$$

$$F = 15\,000 \checkmark \frac{1}{2} \text{ kN} \checkmark \frac{1}{2}$$

5.1.3

$$A_{\text{small piston}} = \frac{\pi d^2}{4}$$

$$200 = \frac{\pi d^2}{4} \checkmark$$

$$d = 15,958 \text{ mm} \checkmark$$

(2 × 3) (6)

- 5.2 Hydraulic system uses fluid as an operational substance, while the pneumatic system uses air as an operational substance. (2)  
**[8]**

**QUESTION 6: INTERNAL COMBUSTION ENGINE**

- 6.1
- Cleans exhaust air from the cylinder
  - Fills the cylinder with clean air
  - Helps cool the components of combustion
- (3)

- 6.2 The point at which the piston changes direction during its strokes in the cylinder, as a result a top dead centre (TDC) and a bottom dead centre (BDC) exist. (2)  
**[5]**

**QUESTION 7: CRANES AND LIFTING MACHINES**

- 7.1
- Better resistance to fatigue
  - Wear on the rope takes place evenly
  - More flexible
  - Resistant to wear
- (4)
- 7.2
- A – Telescopic jib
  - B – Supporting jacks
  - C – Operating cab
- (3)  
**[7]**

**QUESTION 8: MATERIAL AND MATERIAL PROCESSES**

- 8.1
- 8.1.1 Malleability – The metal's ability to extend permanently, without breaking in all directions when hammered, bent, twisted, or rolled.
- 8.1.2 Elasticity – The metal's ability to deform under load and yet able to return to its original shape.
- 8.1.3 Tensile strength – The metal's ability to resist pulling and stretching forces without breaking.
- 8.1.4 Ductility – The metal's ability to withstand considerable elongation when under tension before breaking apart.
- (2 × 4) (4)
- 8.2
- To refine the grain structure of the material
  - To soften the metal
  - To reduce brittleness
  - To release internal stresses
- (4)  
**[12]**

**QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING**

- 9.1
- It serves as the basis to obtain credit.
  - It indicates when excess funds need to be invested.
  - It shows how the business uses its funds.
  - It shows the amount of cash available at a particular point in the business.
  - It gives an indication of potential cash surplus and shortage/s.
  - It helps determine how much cash will be available on an ongoing basis.
  - It helps determine how much cash will be available to fund a specific company project.
- (Any 4 × 1) (4)

- 9.2
- To help transform company goals into reality
  - To plan company operations
  - To determine whether the company business goals are being met/achieved
  - To serve as a control mechanism when it comes to limiting company expenses
- (4)
- 9.3 Productivity is the measure of a company's labour output/production when compared to its labour efforts/inputs. The efficiency of an organisation/company/business production.
- (3)

**[11]****QUESTION 10: ENTREPRENEURSHIP**

- 10.1
- What is the crime rate in the area?
  - How far from the competitors is the business?
  - Is the business close enough to the target market?
  - Is there something to keep customers occupied while they wait?
  - Is the business near a busy road/railway?
  - Is there a similar business in the area?
  - Are buildings in a reasonably good condition?
  - Will the business be available from the public road/railway?
  - Is there enough parking space for the customers?
  - Will the business be accessible via public transport? (Any 5 × 1) (5)
- 10.2 Entrepreneurs in South Africa are very significant because they assist the country with the following:
- Job creation
  - Revenue generation
  - They improve the standard of living
  - They add to national income (Any 3 × 1) (3)

**[8]****TOTAL: 100**