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

1.1 1.1.1 NR = $\frac{N_M}{N_C}$✓

= $\frac{1\,300}{500}$✓

= 2,6 : 1✓ (3)

1.1.2 PD = $P_M \times SF$ But, SF = 1,2 [medium duty vs heavy start, 9 hrs]✓

= $12 \times 1{,}2$

= $14{,}4\ kW$✓ (2)

1.1.3 $Motor\ Speed = 1300\ r/min$ ✓½

$Design\ Power = 14{,}4\ kW$ ✓½

$Minimum\ pulley\ diametre \pm$ D = 100 mm✓ (2)

1.2
- Cylindrical drum/pulley
- Star wheel
- Friction blocks/slippers (3)

1.3
- Direct drive
- Speed reduction
- Reverse gear
- Neutral
- Positive drive
- Compactness
- Radial loads on gear system bearings
- Amounts of power transmitted
- Direct power transmission and efficiency (Any 4 × 1) (4)

1.4 Belt-drive
- Slip reduces power and efficiency, but acts as a safety measure.
- The belt has a fixed length.
- Little maintenance is needed.

Chain drive
- No slippage possible (positive drive).
- The chain can be extended/reduced.
- Regular maintenance is required (6)

[20]

QUESTION 2: BRAKES

- The system can be extended to the trailer.
- Air is inexpensive.
- The brake functions as long as there is air in the reservoir.
- Compressed air delivers unlimited force. **[4]**

QUESTION 3: BEARINGS

3.1 3.1.1 Type of bearing.

3.1.2 Width series of bearing

3.1.3 Diameter series of bearing

(3 × 1) (3)

3.2
- Listening to sound of bearing
- Measuring temperature of bearing
- Examining lubricant used (3)

3.3
- Insufficient lubrication
- Pollution/Contamination
- Variation in the sizes of the rollers/balls
- Excessive clearance between shaft and bearing
- Races turning in the housing or the shaft
- Shaft not perfectly round
- Flattened roller
- Indent on raceways
- Bearing slip on shaft (Any 4 × 1) (4)

[10]

QUESTION 4: WATER PUMPS, COOLING AND LUBRICATION

4.1
- Thermostat not working / inefficient
- Engine not correctly tuned
- In a direct cooling system the engine may overheat when the vehicle is not moving
- Cooling air too hot
- Faulty fan unit
- Passage of cooling air blocked (Any 4 × 1) (4)

4.2
- Minimise chances of explosion
- Storing more air in reservoir
- Ensuring lubricant retains correct viscosity
- Ensuring easily achieved lubrication in system (4)

4.3 To reduce friction between moving parts of machine by promoting smoother action and less wear damage, maximising life-span and endurance of machine (3)

4.4
- Plunger is longer than stroke
- Piston length shorter than stroke (2)

[13]

QUESTION 5: HYDRAULICS AND PNEUMATICS

5.1 5.1.1 $A_B = \frac{\pi d^2}{4}$

$= \sqrt{\frac{0,02 \times 4}{\pi}}$ ✓

$= 159,577\ mm$ ✓ (2)

5.1.2 $\left(\frac{F}{a}\right)_A = \left(\frac{W}{A}\right)_B$

$\left(\frac{F_A}{2000\ x\ 10^{-6}}\right)$ ✓ $= \left(\frac{800}{0,02}\right)$ ✓

$= 80\ N$ ✓

Alternatively

$P_B = \frac{F_B}{A_B}$

$= \frac{800}{0,02}$

= 40 kPa ✓

$P_B = P_A = \frac{F_A}{A_A}$

$40\ x\ 10^3 = \frac{F_A}{2000\ x\ 10^{-6}}$ ✓

F_A = 80 N ✓ (3)

5.1.3 $V_B = A \times l$

$= 0,02\ x\ 9\ x\ 10^{-3}$

$= 0,18\ x\ 10^{-3}\ m^3$ ✓

But, $V_A = V_B$ ✓

$V_A = A\ x\ l$

$l_A = \frac{0,18\ x\ 10^{-3}}{0,002}$

$= 90\ mm$ ✓ (3)

5.2 Velocity of air-flow increases when pipe converges, and decreases when pipe diverges (3)

[11]

QUESTION 6: INTERNAL COMBUSTION ENGINE

PETROL ENGINE	DIESEL ENGINE
6.1.1 Uses carburettor	Uses injector pump
6.1.2 Large combustion chamber	Smaller combustion chamber
6.1.3 Engine parts weigh less	Heavy engine parts
6.1.4 Uses spark plugs	Uses fuel injectors
6.1.5 Accelerator butterfly connected directly to the pedal (Any THREE)	Equipped with engine governor (Any THREE)

[6]

QUESTION 7: CRANES AND LIFTING MACHINES

7.1
- Rope speed ratio can be controlled
- Heavier loads lifted without using more power (2)

7.2
- Langs lay method
- Cross-lay/ordinary method (2)

7.3
- To move heavy loads that are difficult to handle due to size (2)

7.4
- Improves safe working conditions
- Protects crane from unnecessary fatigue and abuse
- Reduces maintenance costs and downtime
- Improves productivity (Any 2 × 1) (2)

7.5 Hoist/Lift hook (1)

[9]

QUESTION 8: MATERIAL AND MATERIAL PROCESSES

8.1
- Thermostats cannot be softened and remoulded when heated.
- Thermoplastics soften when heated and can be remoulded and recycled.

(2 × 2) (4)

8.2 8.2.1 Process whereby low carbon steel parts are inserted between carbon rich materials and product is put into furnace for heating.

8.2.2 Process of steel being heated slowly to specific temperature, and then allowed to cool down in air.

(2 × 2) (4)

[8]

QUESTION 9: INDUSTRIAL ORGANISATION AND PLANNING

9.1
- To provide health and safety to all employees
- To provide safety about the use of machinery
- To protect employees from all forms of hazards
- To establish an advisory board/council for health and safety
- To provide for matters connected to health and safety (Any 4 × 1) (4)

9.2 Budget control is the organisation's means of planning for the acquisition and use of its budget/capital.✓ This involves setting up a cash budget, a capital budget and a balance sheet.✓ (2)

9.3 9.3.1
- To keep records of hours worked
- To indicate job specification per employee
- To assist the management to apply budget control
- To record hours worked by each worker
- To control employees' punctuality (Any 2 × 1) (2)

9.3.2 To record flow of manufactured products and flow routes for historical reference (2)

9.3.3 Specifies work to be done by an employee/operator and may also serve as authorisation to the employee to carry out a specific job (2)
[12]

QUESTION 10: ENTREPRENEURSHIP

10.1 Identified an opportunity and assembling the necessary resources to start a business in the face of risks and uncertainty with the objective of making a profit (3)

10.2 10.2.1 Comparing two different things to suggest a solution to a problem

10.2.2 Group discussion to generate alternative ideas without discrediting any ideas presented during the process

(2 × 2) (4)
[7]

TOTAL: 100