higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

4 APRIL 2018

This marking guideline consists of 8 pages.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Candidates need to answer either QUESTION 1.1 OR QUESTION 1.2.

1.1 1.1.1
- Provide maximum positive protection.
- Must be corrosion and fire resistant.
- Easily repairable.
- Guard must not create hazards such as splinters and pinch points.
- Should be a permanent feature of the machine without weakening the structure.
- Should not affect the efficiency of the machine. (Any 2 X 1) (2)

1.1 1.1.2
- Fixed guards
- Interlocking guards
- Automatic guards

(3 × 1) (3)
[5]

OR

1.2 1.2.1 When an accident causes the immediate death of a person, ✓ the place must not be disturbed or altered.✓ (2)

1.2.2
- When the disturbance is necessary to prevent further accidents
- To remove injured persons and corpses or to rescue persons from danger
- When work stoppage seriously affects the working of the mine

(3 x 1) (3)
[5]

QUESTION 2: COUPLINGS

2.1
- Rigid/Permanent/Fixed couplings
- Flexible couplings
- Self-aligning couplings (3)

2.2
- Drive flange
- Driven flange
- Key
- Driving shaft
- Driven shaft
- Nuts and bolts
- Resilient material between flanges (Any 3 × 1) (3)

[6]

QUESTION 3: LIMITS AND FITS

3.1 A – Clearance fit
B – Transition fit
C – Interference fit (3)

3.2
- The speed of rotation between two components
- The length of the bearing surface
- The finish of the surfaces (3)

3.3 Interference fit (1)
[7]

QUESTION 4: BEARINGS

- Excessive load on bearing
- Lack of or inadequate supply of lubrication
- Dirty oil causing friction
- Uneven bearing surfaces
- Bearing not seated properly
- Bearing and shaft out of line
- Eccentric shaft
- Incorrect grade of oil
- Bearing halves pulled up too tight (Any 5 × 1) **[5]**

QUESTION 5: LUBRICANTS AND VALVES

5.1 5.1.1 Liquid
5.1.2 Semi-solid
5.1.3 Liquid
(3 × 1) (3)

5.2
- Ball
- Gate
- Diaphragm
- Globe (Any 3 × 1) (3)

[6]

QUESTION 6: PACKING, STUFFING BOXES, JOINTS AND WATER PIPE SYSTEMS

6.1 A – Gland
B – Shaft
C – Adjusting nuts
D – Packing/Packing rings
E – Pump casing (5)

6.2 Thermoplastic piping becomes soft and pliable when heated and it can be softened over and over by reheating it✓ whereas thermosetting plastic piping undergoes a chemical change when exposed to heat and pressure and cannot be softened by reheating.✓ (2)

6.3 6.3.1 90° elbow is used where two pipes must be connected at an angle of 90° to each other for a specific use.

6.3.2 Cross piece is where pipes must be connected and joined from four directions.

(2 × 1) (2)
[9]

QUESTION 7: PUMPS

7.1
- Centrifugal pumps
- Reciprocating pumps
- Rotary pumps (3)

7.2 A – Sliding vanes
B – Shaft
C – Rotor (3)
[6]

QUESTION 8: COMPRESSORS

8.1 True
8.2 False
8.3 False
8.4 True

(4 × 1) **[4]**

QUESTION 9: V-BELTS, CHAIN DRIVES, GEAR DRIVES AND REDUCTION GEARBOXES

9.1
- To prevent accidents and injury to the operator
- To prevent accidents and injury to workers in the vicinity of the machine (2)

9.2 Drive pulley (1)

9.3
- Compact and can be used in confined spaces
- Provides a direct drive
- Positive drive/No slip takes place
- Lasts longer
- Can deal with high torque (Any 3 × 1) (3)

9.4
- Wear causes elongation of chains
- Cannot operate at high speeds
- Breaks without warning
- Noisy
- Flexible in one plane
- Sprockets need replacing due to wear (Any 4 × 1) (4)

9.5 Reduction gearing means the speed of power drives are reduced drastically,✓ but at the same time heavier work can be done without the load stopping the motor.✓ (2)

[12]

TOTAL SECTION A: 60

SECTION B

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1 Pressure
Area (2 × 1) (2)

10.2 10.2.1
- Pump
- Reservoir
- Actuator/Cylinder
- Valves
- Piping (Any 3 × 1) (3)

10.2.2
- Pump – produces the movement of the hydraulic fluid to develop pressure in the fluid.
- Reservoir – stores hydraulic fluid until it is needed.
- Actuator/Cylinder – changes the hydraulic pressure into mechanical movement
- Valves – used to control the flow of hydraulic fluid in the system.
- Piping – channels the pressurized hydraulic fluid in the system.

(Any 3 × 1) (3)

10.3
- Power transmission
- Lubrication
- Cooling (3 × 1) (3)

10.4
- Reliability - Pneumatic equipment are very reliable and durable.
- Adaptability – existing machinery can be easily automated with minimum of alterations.
- Safety – working with compressed air in safer than working with electrical or hydraulic power.
- Variable speed and power – Pneumatic circuits can be easily adjusted to produce different speeds of operation.
- Economy – pneumatic equipment has low set-up and maintenance costs.
- Operation in adverse conditions – pneumatic components are not affected by dust or corrosive atmospheres
- Availability – compressed air is readily available in most industries

(Any 5 × 1) (5)

10.5 10.5.1 The pressure relief valve releases air if the system exceeds safe limits.

10.5.2 The regulator controls the amount of air flow.

10.5.3 Non-return valves prevent the reversal of flow of air in a pneumatic system.

10.5.4 The directional control valve controls the direction of air flow.

(4 × 1) (4)
[20]

QUESTION 11: CENTRE LATHES

11.1 Computer numerical control (1)

11.2 11.2.1
- Short tapers can be cut to any angle.
- It is simple to operate and calculate.
- Internal and external tapers can be turned.

(3 x 1) (3)

11.2.2
- It is not accurate.
- The length of taper is limited to the travel of the compound slide.
- It can only be fed by hand causing fatigue to the operator and inaccurate surface finish of the workpiece.

(3 x 1) (3)

11.3 11.3.1

$$\text{Lead} = \text{Number of starts} \times \text{pitch of thread}$$
$$= 3 \times 6$$
$$= 18 \text{ mm} \checkmark$$ (1)

11.3.2

$$\text{Depth} = \frac{\text{Pitch}}{2}$$
$$= \frac{6}{2}$$
$$= 3 \text{ mm} \checkmark$$

$$\text{Mean diameter (Dm)} = \text{Outside diameter} - \text{depth}$$
$$= 42 - 3$$
$$= 39 \text{ mm} \checkmark$$ (2)

11.3.3

$$\tan\theta = \frac{\text{Lead}}{\pi \text{Dm}}$$
$$= \frac{18}{\pi \times 39}$$
$$= 0{,}147 \checkmark$$
$$\theta = 8° 22' \checkmark$$ (2)

11.4

$$S = \pi DN$$
$$N = \frac{S}{\pi \times D} \checkmark$$
$$= \frac{0{,}2 \times 60}{\pi \times 0{,}175} \checkmark$$
$$N = 21{,}827 \text{ r/min} \checkmark$$ (3)

11.5 11.5.1
- Supporting long, slender workpieces between centres
- Maintaining concentricity of long workpieces while machining
- Reducing vibration or chatter, ensuring a better finish of the workpiece
- Supporting workpieces against the pressure of heavy machining

(Any 3 × 1) (3)

11.5.2 Travelling steady (1)

11.5.3 Fixed steady (1)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 12.1.1 Dividing head (1)

12.1.2 It divides the circumference of a workpiece equally into the number of required parts. (1)

12.1.3 A – Index plate
B – Crank handle
C – Sector arms (3)

12.2 $\text{Indexing} = \frac{40}{\text{N}}$

$= \frac{40}{9}$

$= 4\frac{4}{9}$ ✓

$= 4\left[\frac{4}{9} \times \frac{2}{2}\right]$ ✓

$= 4\frac{8}{18}$ ✓

$\text{Indexing} = \text{Four full turns of the crank handle and eight holes in an 18 hole plate.}$ ✓✓ (5)

12.3
- Costs less
- Less vibration on arbour
- Higher arbour speed
- Less power needed to drive the cutter
- Less chance of shearing the key (5)

12.4 12.4.1 Aluminium oxide
12.4.2 Silicon carbide (2 × 1) (2)

12.5
- Scratching of the workpiece
- Chatter marks of the workpiece
- Burning of the workpiece
- Loading of the grinding wheel
- Glazing of the grinding wheel (Any 3 × 1) (3)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100