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**NATIONAL CERTIFICATE**

**FITTING AND MACHINING THEORY N2**

**APRIL 2018**

**4**

**This marking guideline consists of 8 pages.**



**MARKING GUIDELINE**

-3- T700**(E)**(A4)T FITTING AND MACHINING THEORY N2

**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]

-3- PRODUCTION AND QUALITY CONTROL N5

# QUESTION 3: LIMITS AND FITS

3.1 A – Clearance fit

1. – Transition fit
2. – 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]

-4- T700**(E)**(A)T

FITTING AND MACHINING THEORY N2

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

6.1 A – Gland

1. – Shaft
2. – Adjusting nuts
3. – Packing/Packing rings
4. – Pump casing (5)

* 1. 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)

* 1. 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

1. – Shaft
2. – Rotor (3)

**[6]**

# QUESTION 8: COMPRESSORS

8.1 True

8.2 False 8.3 False

8.4 True

(4 × 1) **[4]**

-7- FITTING AND MACHINING THEORY N2

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

# GEARBOXES

|  |
| --- |
| injury injury |

9.1 • To prevent accidents and to the operator

* To prevent accidents and to workers in the vicinity of the machine (2)

* 1. Drive pulley (1)

* 1. • 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.

* + 1. The regulator controls the amount of air flow.

* + 1. Non-return valves prevent the reversal of flow of air in a pneumatic system.

* + 1. 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 Lead = Number of starts × pitch of thread

= 3 × 6

= 18 mm (1)

* + 1. Pitch

Depth =

2



=

= 3 mm 

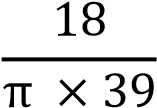
Mean diameter (Dm) = Outside diameter − depth

= 42 − 3

= 39 mm (2)

* + 1. Lead tan θ =

πDm



=

= 0,147 

θ = 8° 22′  (2)

11.4 S = πDN

S

N = 

π × D

0,2 × 60

= 

π × 0,175

N = 21,827 r/ min  (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]**

-8- FITTING AND MACHINING THEORY N2

# 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 40

Indexing =

N



=



= 4 

4 2

= 4 × 

9 2

 = 4 

Indexing = 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**