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**NATIONAL CERTIFICATE**

**FITTING AND MACHINING THEORY N2**

**AUGUST 2019**

**1**

**This marking guideline consists of 9 pages.**



**MARKING GUIDELINE**

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FITTING AND MACHINING THEORY N2

# QUESTION 1: OCCUPATIONAL SAFETY

1.1 1.1.1 D

1.1.2 E 1.1.3 A

1.1.4 B

1.1.5 C

(5 × 1)

# OR

1.2 1.2.1 F

1.2.2 D 1.2.3 B

1.2.4 A

1.2.5 C

(5 × 1) **[5]**

# QUESTION 2: COUPLINGS

2.1 2.1.1 Permanent/Fixed/Rigid coupling

2.1.2 Flexible or self-aligning couplings

1. × 1) (2)

* 1. 2.2.1 Fluid drive coupling (1)

* + 1. Permanent/Fixed/Rigid coupling (1)

* + 1. A – driving member (pump/impeller)

B – driven member (turbine) (2)

**[6]**

# QUESTION 3: LIMITS AND FITS

3.1 40,030 mm (1)

3.2 40,035 mm (1)

3.3 39,980 mm (1)

3.4 Maximum allowance = (40 + 0,035 mm) – (40 – 0,020 mm) = 40,035 – 39,98

= 0,055 mm (2)

3.5 Minimum allowance = (40 + 0,030 mm) - (40 - 0,010 mm) = 40,030 – 39,99

= 0,04 mm (2)

**[7]**

# QUESTION 4: BEARINGS

4.1 A bearing is a device designed to reduce friction between two parts of a

machine, one stationary and the other rotating. (1)

4.2 • White metal

* Cast iron
* Bronze
* Nylon
* Teflon (Any 4 × 1) (4)

**[5]**

# QUESTION 5 : LUBRICATION AND VALVES

5.1 • Siphon-wick lubricator

* Sight-feed lubricator
* Needle lubricator (3 × 1) (3)

5.2 When a fluid flows through a foot valve, the flap of the foot valve opens  and

allows the fluid to flow. If the flow of the fluid is reversed, the flap closes and

does not allow the fluid to flow back. (3)

**[6]**

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

6.1 • Pressure within the pipe

* Nature of fluid medium
* Temperature of fluid
* Environmental conditions (4 × 1) (4)

* 1. The wedge design prevents steam from escaping by applying a light pressure

on the piston rod. (1)

* 1. • Plastic piping is relatively cheap
* Easy to handle due to its light weight
* No machining required
* Good insulator when used with electricity
* Combining pipes is very easy
* Corrosion resistant (Any 4 × 1) (4)

**[9]**

# QUESTION 7: PUMPS

7.1 7.1.1 Single acting pump

7.1.2 Double acting pump

7.1.3 Piston pump

(3 × 1) (3)

7.2 • Gear pump

* Helical screw gear pump
* Vane type pump
* Flexible impeller pump (Any 3 × 1) (3)

**[6]**

# QUESTION 8: COMPRESSORS

1. – Air intake
2. – Diffuser ring
3. – Volute casing
4. – Impeller eye

(4 × 1) **[4]**

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

9.1 • Chain drives

* Gear drives
* Belt drives (Any 2 × 1) (2)

* 1. The deflection should be 16 mm for every meter of span. (1)

* 1. • To transmit high power
* To increase speed and reduce torque or vice versa
* To change the direction of drive
* When space is limited (Any 3 × 1) (3)

9.4 9.4.1 Ensure that bearings are well lubricated. (1)

9.4.2 Measure the sag and adjust if it is too large (1)

9.5 • The speed of the motor would be too fast.

* The heavy load put onto the motor would cause the motor to stop rotating. (2)

9.6 • Single-reduction gearbox

* Double-reduction gearbox
* Worm and worm-wheel gearbox

(Any 2 × 1) (2)

# [12]

**TOTAL SECTION A:**   **60**

**SECTION B** (Any TWO answers)

# QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1 • Power transmission

* Lubrication
* Cooling
* Prevents corrosion
* Removes dirt (Any 3 × 1) (3)

10.2 10.2.1



10.2.2

10.2.3

(3 × 1) (3)

10.3 10.3.1 Provides mechanical energy to the hydraulic fluid.

* + 1. It protects the system from experiencing excessive pressure.

* + 1. Stores hydraulic fluid until it is required.

(3 × 1) (3)

* 1. Control valve (1)

* 1. 10.5.1 Non-return valve
     1. Compressor
     2. Pneumatic motor
     3. Pressurised receiver
     4. Single acting cylinder or cylinder

(5 × 1) (5)

10.6 10.6.1 False

* + 1. True
    2. True

(3 × 1) (3)

10.7 • Not affected by dust or corrosive atmospheres

* Can be used in damp and inflammable conditions (2)

# [20] QUESTION 11: CENTRE LATHES

11.1 • Used to support long work pieces on a centre lathe

* Used for turning long, small diameter shafts on a centre lathe
* Used to support a square bar on the centre lathe (Any 2 x 1) (2)

11.2 11.2.1 Travelling steady

11.2.2 Fixed steady

(2 × 1) (2)

* 1. Angle that the thread makes with a line perpendicular to the axis of the thread (1)

* 1. 11.4.1 𝐿𝐿𝐿𝐿𝐿𝐿𝐿𝐿 = 𝑁𝑁𝑁𝑁. 𝑁𝑁𝑜𝑜 𝑠𝑠𝑠𝑠𝐿𝐿𝑠𝑠𝑠𝑠𝑠𝑠 × 𝑃𝑃𝑃𝑃𝑠𝑠𝑃𝑃ℎ 𝑁𝑁𝑜𝑜 𝑠𝑠ℎ𝑠𝑠𝐿𝐿𝐿𝐿𝐿𝐿

= 3 × 10

= 30 𝑚𝑚𝑚𝑚

𝐿𝐿𝐿𝐿𝐿𝐿𝐿𝐿 tan 𝜃𝜃 =

𝜋𝜋𝜋𝜋𝑚𝑚

30

# = 

𝜋𝜋 ×155

= 0,0616

𝜃𝜃 = 3° 31′  (3)

11.4.2 𝐿𝐿𝐿𝐿𝐿𝐿𝐿𝐿𝑃𝑃𝐿𝐿𝐿𝐿 𝑠𝑠𝑁𝑁𝑁𝑁𝑡𝑡 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿 = 90° − (𝐻𝐻𝐿𝐿𝑡𝑡𝑃𝑃𝐻𝐻 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿 + 𝐶𝐶𝑡𝑡𝐿𝐿𝐿𝐿𝑠𝑠𝐿𝐿𝐿𝐿𝑃𝑃𝐿𝐿 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿)

= 90° − (3°31′ + 3°)

= 90° − ( 6°31′)

= 83°29′ (2)

11.4.3 𝐹𝐹𝑁𝑁𝑡𝑡𝑡𝑡𝑁𝑁𝐹𝐹𝑃𝑃𝐿𝐿𝐿𝐿 𝑠𝑠𝑁𝑁𝑁𝑁𝑡𝑡 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿

= 90° + (𝐻𝐻𝐿𝐿𝑡𝑡𝑃𝑃𝐻𝐻 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿 − 𝐶𝐶𝑡𝑡𝐿𝐿𝐿𝐿𝑠𝑠𝐿𝐿𝐿𝐿𝑃𝑃𝐿𝐿 𝐿𝐿𝐿𝐿𝐿𝐿𝑡𝑡𝐿𝐿)

= 90° + (3°31′ − 3°)  = 90° + ( 0°31′)

= 90°31′ (2)

11.5 𝑁𝑁 = 24 𝑠𝑠/𝑠𝑠𝐿𝐿𝑃𝑃

𝑁𝑁 = 24 × 60

## 𝑁𝑁 = 1 440 𝑠𝑠/𝑚𝑚𝑃𝑃𝐿𝐿

𝑉𝑉 = 𝜋𝜋𝜋𝜋𝑁𝑁

= 𝜋𝜋 × 0,02 × 1440

## 𝑁𝑁 = 90,478 𝑚𝑚/𝑚𝑚𝑃𝑃𝐿𝐿 (3)

11.6 𝐿𝐿 = 𝑜𝑜 × 𝑁𝑁 × 𝑠𝑠

𝐿𝐿

# 𝑜𝑜 =  = 

𝑁𝑁×𝑡𝑡

## 𝑜𝑜 = 0,36 𝑚𝑚𝑚𝑚/𝑠𝑠𝐿𝐿𝑟𝑟  (3)

11.7 11.7.1 G-commands

11.7.2 M-commands

(2 × 1) (2)

**[20]**

## **QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS**

12.1 Used to indicate the fraction of a turn in the holes on a specific hole-circle. (1)

12.2 The Cincinnati index plate has holes on both sides so it is reversible 

whereas the Brown and Sharp system has three loose plates with different

hole-circles on each plate. (2)

12.3 Slab milling cutter or rose cutter (1)

12.4 42° 45′

 = 42



= 42

𝑁𝑁

𝐼𝐼𝐿𝐿𝐿𝐿𝐿𝐿𝐻𝐻𝑃𝑃𝐿𝐿𝐿𝐿 = 9°



= 

= 

19

= 4

= 4  

1. 4 3 5

= 4 ×  OR 4 ×

1. 4 4 5

= 4   = 4 

 

Indexing = 4 full turns of the crank handle and 12 holes in a 16-hole circle OR

4 full turns of the crank handle and 15 holes in a 20-hole circle (7)

12.5 • Prevents the continuous forming of shavings

* Helps in the removal of shavings
* Reduces chattering
* Easier flow of coolant
* Improves the finish on the workpiece
* Provides a better cutting action • More economical on power consumptions (Any 4 × 1) (4)

12.6 12.6.1 Grit size refers to the actual size of the abrasive particles

* + 1. Grade of the grinding wheel refers to the strength of the bond which holds the abrasive grains in place

* + 1. The structure of the wheel refers to the spacing of the grit in the wheel

* + 1. The structure number indicates the structure of the grinding wheel

)4 × 1) (4)

12.7 Produces a flat surface which is smooth and accurate (1)

## **[20]**

**TOTAL SECTION B:**   **40**

**GRAND TOTAL:** **100**