



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE FITTING AND MACHINING THEORY N2

(11022032)

**4 April 2023 (X-paper)
09:00–12:00**

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 8 pages and 1 formula sheet.

110Q1A2304

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
FITTING AND MACHINING THEORY N2
TIME: 3 HOURS
MARKS: 100

NOTE: If you answer more than the required number of questions, only the required number will be marked. Clearly cross out ALL work you do NOT want to be marked.

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions in SECTION A, except for QUESTION 1 where you must answer either QUESTION 1.1 **OR** QUESTION 1.2.
 2. Answer only TWO questions from SECTION B.
 3. Read all the questions carefully.
 4. Number the answers according to the numbering system used in this question paper.
 5. Start each section on a new page.
 6. Use only a black or a blue pen.
 7. Write neatly and legibly.
-

SECTION A**QUESTION 1: OCCUPATIONAL SAFETY**

Answer only QUESTION 1.1 **OR** QUESTION 1.2.

- 1.1 State FIVE precautionary measures to be taken into account when working on electrical equipment. (5)

OR

- 1.2 State FIVE precautions that must be adhered to in preventing underground fires. (5)

[5]

QUESTION 2: COUPLINGS

- 2.1 List THREE main groups into which couplings are classified. (3)

- 2.2 Name THREE types of coupling misalignment. (3)

[6]

QUESTION 3: LIMITS AND FITS

- 3.1 FIGURE 1 below shows the dimensions of the slide fit of a shaft into a bush.

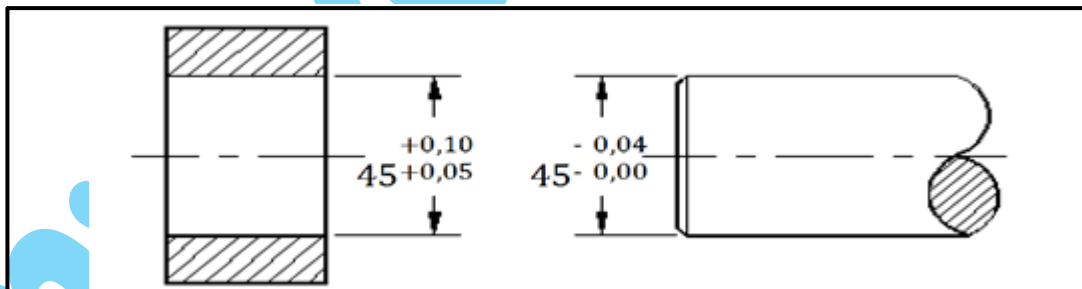


FIGURE 1

- 3.1.1 Calculate the tolerance on the shaft.

- 3.1.2 Name the type of tolerance applicable to the bush.

- 3.1.3 Name the type of tolerance applicable to the shaft.

(3 × 1)

(3)

3.2 A shrink fit between a shaft and a coupling is given as 120 H7 - g6.

State what is meant by the following symbols regarding this fit:

3.2.1 The capital letter H

3.2.2 The number 7

3.2.3 The small letter g

3.2.4 The number 6

(4 × 1)

(4)

[7]

QUESTION 4: BEARINGS

List FIVE causes of overheating in plain bearings.

[5]

QUESTION 5: LUBRICATION AND VALVES

5.1 Name THREE lubricating devices associated with the gravity-feed principle.

(3)

5.2 Explain the lubrication term *burning point*.

(1)

5.3 State TWO functions of valves used in fluid power systems.

(2)

[6]

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

6.1 List TWO factors to consider when choosing jointing materials.

(2)

6.2 List THREE important guidelines to ensure the proper fittings of O-rings and seals in hydraulic systems.

(3)

6.3 State FOUR advantages of using plastic piping.

(4)

[9]

QUESTION 7: PUMPS

- 7.1 Explain the function of a pump. (1)
- 7.2 FIGURE 2 shows a sketch of a gear pump.

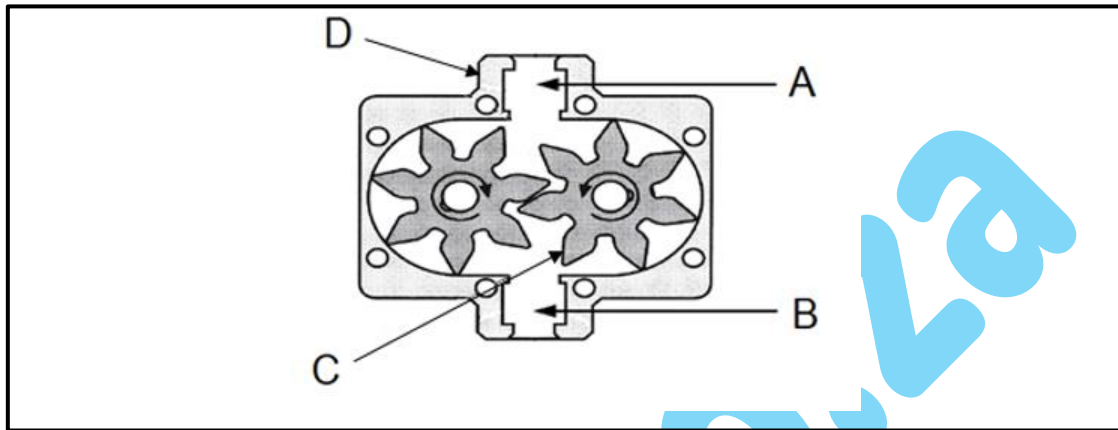


FIGURE 2

- 7.2.1 Name the FOUR parts of the pump labelled (A–D). Write only the answers next to the letter (A–D) in the ANSWER BOOK. (4)
- 7.2.2 State whether the gear pump is a positive displacement pump or a negative displacement pump. (1)

[6]

QUESTION 8: COMPRESSORS

- Explain the operating principle of a single-stroke reciprocating air compressor. [4]

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

- 9.1 State TWO safety precautions to be observed when working on belt drives. (2)
- 9.2 What is the name given to the pulley fitted to the motor of a V-belt installation? (1)
- 9.3 State THREE advantages of *gear drives* compared to *V-belt drives*. (3)
- 9.4 List FOUR disadvantages of *chain drives*. (4)
- 9.5 Explain the term *reduction gearing*. (2)

[12]

TOTAL SECTION A: 60

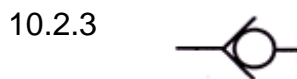
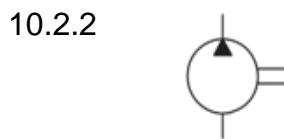
SECTION B

Answer only TWO questions from this section.

QUESTION 10: PNEUMATICS AND HYDRAULICS

10.1 Name the TWO most important factors in the functioning of a pneumatic system. (2)

10.2 Identify the ISO hydraulic symbols below. Write only the answer next to the question number (10.2.1–10.2.5) in the ANSWER BOOK. (5)



(5 × 1) (5)

10.3 Explain the functions of each of the following hydraulic components: (5)

10.3.1 Pressure relief valve

10.3.2 Control valve

(2 × 1) (2)

10.4 Explain how the hydraulic fluid is used to perform the following functions in a hydraulic system: (3)

10.4.1 Power transmission

10.4.2 Lubrication

10.4.3 Cooling

(3 × 1) (3)

10.5 State the main difference between a *hydraulic system* and a *pneumatic system*. (2)

- 10.6 Make neat, freehand sketches of the ISO symbols representing the following pneumatic components:
- 10.6.1 Compressor
 - 10.6.2 Air receiver
 - 10.6.3 Pneumatic motor
- (3 × 1) (3)
- 10.7 List the THREE checks to be done on hoses when maintaining a pneumatic system. (3)
- [20]**

QUESTION 11: CENTRE LATHE

- 11.1 Name TWO types of steadies that are used on the centre lathe. (2)
- 11.2 One method used to cut tapers on the lathe is the compound slide method.
- 11.2.1 State THREE advantages of using this method. (3)
 - 11.2.2 State THREE disadvantages of using this method. (3)
- 11.3 Explain the following terms applicable to CNC machining:
- 11.3.1 Incremental programming
 - 11.3.2 Absolute programming
 - 11.3.3 G-commands
 - 11.3.4 M-commands
- (4 × 1) (4)
- 11.4 A two-start screw thread with a 6 mm pitch must be cut on a lathe. Assume the clearance angle to be 4°.
- Calculate the following if the average diameter is 90 mm:
- 11.4.1 The helix angle (θ) of the thread. (4)
 - 11.4.2 The lead angle of the cutting tool. (2)
 - 11.4.3 The following angle of the cutting tool. (2)
- [20]**

QUESTION 12: MILLING MACHINES AND SURFACE GRINDING

12.1 Name the FIVE types of milling processes indicated in FIGURE 3 below. Write only the answers next to the question number (12.1.1–12.1.5) in the ANSWER BOOK.

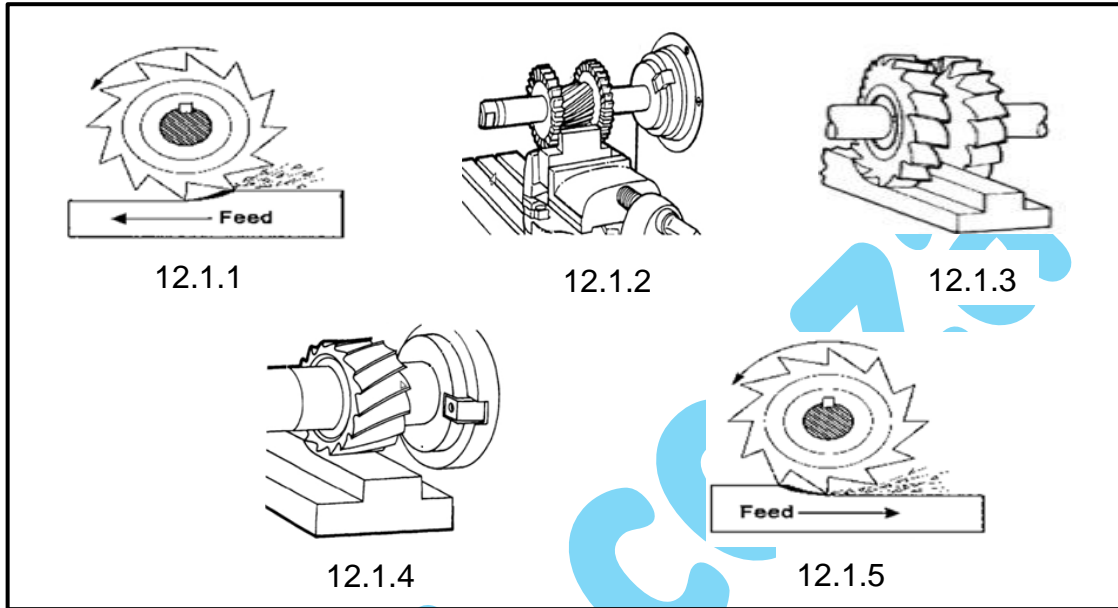


FIGURE 3

12.2 Calculate the cutting speed of the cutter, in metres per minute, when using a cutter with a 40 mm diameter at a speed of 320 revolutions per minute.

12.3 Calculate the indexing to cut SIX sides on the end of a shaft by using the following indexing methods:

12.3.1 Rapid indexing, using a 24-hole index plate (use 24/N).

12.3.2 Simple indexing, using the Brown and Sharp Index Plate 3.

THE BROWN AND SHARP DIVIDING HEAD						
Number of holes						
Plate 1	15	16	17	18	19	20
Plate 2	21	23	27	29	31	33
Plate 3	37	39	41	43	47	49

12.4 Give FOUR reasons for chatter marks on a workpiece.

12.5 Explain the grinding-wheel term *grit size*.

TOTAL SECTION B: 40
GRAND TOTAL: 100

FORMULA SHEET

1. $f = ft \times T \times N$

2. $S = \frac{\pi DN}{60}$

3. $S = \pi DN$

4. $\frac{40}{N}$

5. $\frac{N}{9^\circ}$

6. $\text{Setover} = \frac{D-d}{2} \times \frac{\text{length of workpiece}}{\text{length of taper}}$

7. $\tan \frac{\theta}{2} = \frac{X}{L}$

8. $\text{Leading angle} = 90^\circ - (\text{helix angle} + \text{clearance angle})$

9. $\text{Following angle} = 90^\circ + (\text{helix angle} - \text{clearance angle})$

10. $\text{Lead} = \text{number of starts} \times \text{pitch}$