higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

24 November 2020 (X-paper)
09:00–12:00

Calculators and drawing instruments may be used.

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

249Q1E2024

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 of questions will be marked. Clearly cross out all work that 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 in SECTION B.
3. Read all the questions carefully.
4. Number the answers according to the numbering system used in this question paper.
5. Write neatly and legibly.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Answer ONLY QUESTION 1.1 OR QUESTION 1.2.

1.1 State FIVE rules for the safe handling and storage of compressed gas cylinders. **[5]**

OR

1.2 State FIVE regulations associated with first aid certification for underground and surface mine workers. **[5]**

QUESTION 2: COUPLINGS

2.1 List FOUR types of permanent (fixed) couplings. (4)

2.2 State TWO reasons why it is necessary to ensure the accurate alignment of fixed couplings. (2)
[6]

QUESTION 3: LIMITS AND FITS

3.1 Define the following terms:

3.1.1 Interchangeability of parts

3.1.2 Basic size

3.1.3 Tolerance

3.1.4 Allowance

(4 × 1) (4)

3.2 The diameter of a shaft is given as: $48^{+0,10\ mm}_{-0,12\ mm}$

Determine the tolerance of the shaft. (3)
[7]

QUESTION 4: BEARINGS

FIGURE 1 shows a diagram of a bearing.

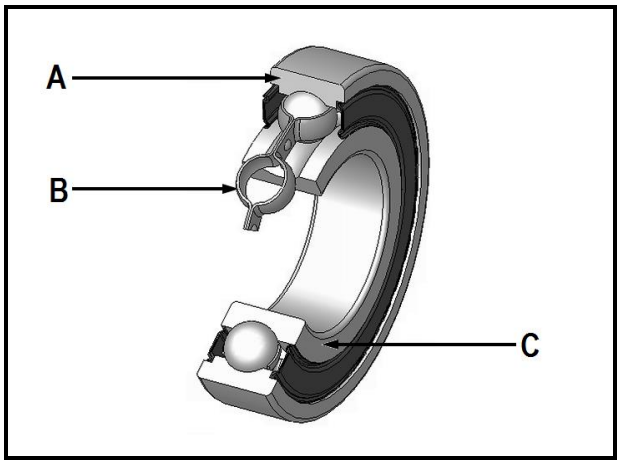


FIGURE 1

4.1 Name the bearing shown in FIGURE 1. (1)

4.2 Name the parts labelled A, B and C. Write only the answers next to the letters (A–C) in the ANSWER BOOK. (3)

4.3 State the function of this type of bearing. (1)
[5]

QUESTION 5: LUBRICATION AND VALVES

5.1 List THREE factors that should be considered when choosing a lubricant. (3)

5.2 FIGURE 2 shows a diagram of a valve.

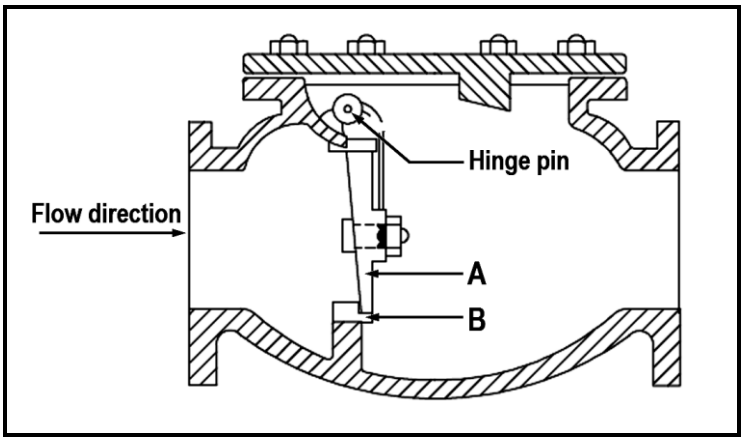


FIGURE 2

5.2.1 Name the valve shown in FIGURE 2. (1)

5.2.2 Name the parts labelled A and B. Write only the answers next to the letters (A–B) in the ANSWER BOOK. (2)
[6]

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

6.1 State FIVE reasons for the failure of flanged joints. (5)

6.2 List FOUR advantages of plastic piping. (4)
[9]

QUESTION 7: PUMPS

7.1 Name the type of pump used for the following applications:

7.1.1 To pump water to greater heights.

7.1.2 To pump oil and acids at differing pressures.

7.1.3 To pump clean liquids and fuel.

(3 × 1) (3)

7.2 State the function of the volute casing of a centrifugal pump. (1)

7.3 Name TWO classes of pumps that are categorised as positive displacement pumps. (2)
[6]

QUESTION 8: COMPRESSORS

8.1 State TWO functions of after-coolers in compressors. (2)

8.2 Name any TWO types of rotary compressors. (2)
[4]

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

9.1 Explain the following V-belt drive terms:

9.1.1 Arc of contact

9.1.2 Idler pulley

9.1.3 Centre distance between pulleys

(3 × 1) (3)

9.2 Explain the following gear drive terms:

9.2.1 Velocity ratio

9.2.2 Mechanical advantage

(2 × 1) (2)

9.3 State the main difference between compound gear train and a simple gear train. (2)

9.4 List THREE advantages of chain drives over belt drives. (3)

9.5 Name TWO components of a single-reduction gearbox. (2)
[12]

TOTAL SECTION A: 60

SECTION B

Answer only TWO questions from SECTION B.

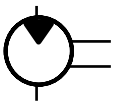
QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1 List SIX advantages of pneumatic systems. (6)

10.2 Identify the ISO hydraulic symbols below. Write only the answer next to the question number (10.2.1–10.2.4) in the ANSWER BOOK.

10.2.1

10.2.2 

10.2.3 

10.2.4 

(4 × 1) (4)

10.3 State the function of each of the four components identified in 10.2 above. (4)

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

10.5 Explain the function of the following pneumatic components:

10.5.1 Air receiver

10.5.2 Pressure relief valve

10.5.3 Non-return valve

10.5.4 Compressor

(4 × 1) (4)
[20]

QUESTION 11: CENTRE LATHES

11.1 State the function of a lathe mandrel. (1)

11.2 State FOUR advantages of using mandrels on a lathe. (4)

11.3 One method used to set over the tailstock when taper turning on the centre lathe is the *graduated sleeve method.*

11.3.1 State TWO advantages of using this method.

11.3.2 State TWO disadvantages of using this method.

(2 × 2) (4)

11.4 A taper of 1 in 12 is to be turned on a workpiece of a certain length.

Determine the angle at which the compound slide should be set to produce this taper. (3)

11.5 A workpiece with a length of 300 mm is to be machined on a centre lathe at a spindle speed of 240 r/min. The feed of the cutting tool is 0,5 mm/rev.

Calculate the time taken to complete one longitudinal cut along the workpiece. (3)

11.6 A taper of 9 in 100 must be turned on a workpiece which is 450 mm long.

Calculate the amount of tailstock set-over required. (2)

11.7 State the THREE basic instructional forms applicable to the CNC lathe. (3)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 FIGURE 4 shows the milling processes carried out on a milling machine. Name the milling processes labelled A to E. Write only the answers next to the letters (A–E) in the ANSWER BOOK.

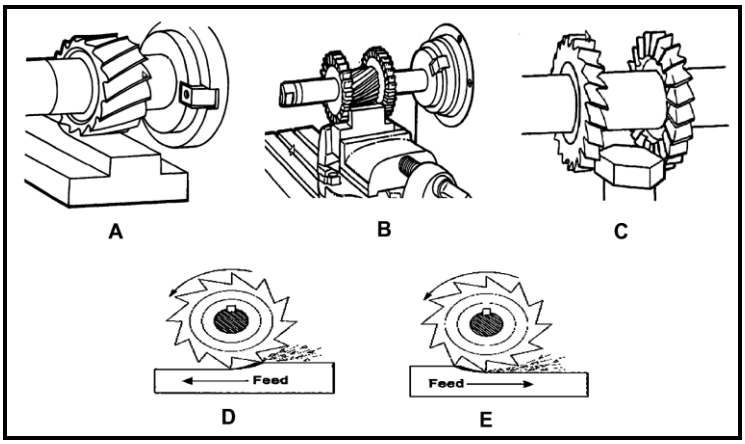


FIGURE 4 (5)

12.2 FIGURE 5 shows a dividing head used on a milling machine. Name the parts labelled A–C. Write only the answers next to the letters (A–C) in the ANSWER BOOK.

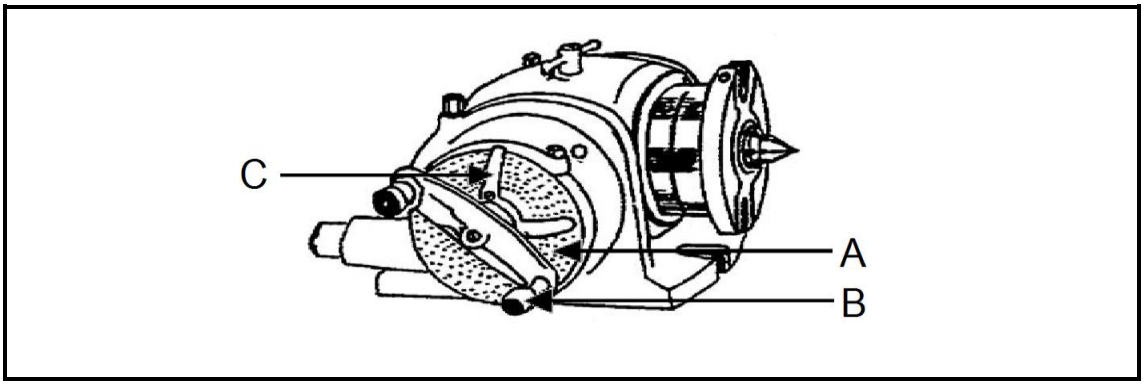


FIGURE 5 (3)

12.3 A gear with 88 teeth must be machined on a milling machine.

Calculate the required indexing for the gear using the Brown and Sharp dividing head.

NOTE: Only plate 2 is available

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

(5)

12.4 State THREE reasons why a surface grinder may cause chatter marks on a workpiece. (3)

12.5 State TWO causes of glazing of grinding wheels. (2)

12.6 Differentiate between *off-hand* grinding and *surface grinding*. (2)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

FITTING AND MACHINING THEORY N2

FORMULA SHEET

$L = f \times T \times N$

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

$S = \pi DN$

$\frac{40}{N}$

$\frac{N}{9°}$

$Set\text{-}over = \frac{D-d}{2} \times \frac{length\ of\ workpiece}{length\ of\ taper}$

$Set\text{-}over = \frac{\text{length of workpiece}}{2} \times Ratio$

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

Leading angle = 90° – (Helix angle + clearance angle)

Following angle = 90° + (Helix angle – clearance angle)

Lead = No of starts × pitch

$N = \frac{1\,000\ S}{\pi D}$