higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

25 November 2024 (X-paper)
09:00–12:00

Drawing instruments and non-programmable calculators may be used.

This question paper consists of 9 pages and 1 formula sheet.

098Q1E2425

Copyright reserved

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 the 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 any TWO of the three 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. Use only a black or blue pen.
6. Write neatly and legibly.

Copyright reserved

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

Answer only QUESTION 1.1 OR QUESTION 1.2.

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 No person shall fit a grinding wheel unless the manufacturer's rated minimum speed in revolutions per minute is clearly marked on the wheel.

1.1.2 A strong person may climb a ladder using one hand.

1.1.3 Grinding wheels are to be mounted concentrically onto the spindle.

1.1.4 Compressed gas cylinders must be stored in a well-ventilated area away from heat and direct sunlight.

1.1.5 It is not necessary to install a guard around a V-belt.

(5 × 1) **[5]**

OR

1.2 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.2.1 – 1.2.5) in the ANSWER BOOK.

1.2.1 Calcium carbide must not, under any circumstances, be taken into the underground workings of a mine

1.2.2 An underground mine worker may work or travel in an un-illuminated part of the mine without carrying any light as long as they can see the other workers.

1.2.3 A valid drivers' license is the only requirement for a worker to drive a vehicle on a mine.

1.2.4 Any unprotected cable must be suspended or placed in such a way that the cable cannot be damaged.

1.2.5 Cigarettes may be carried into the underground workings of a mine although smoking is not allowed in this area.

(5 × 1) **[5]**

Copyright reserved

QUESTION 2: COUPLINGS

2.1 Name THREE classifications of couplings. (3)

2.2 Name THREE types of flexible couplings. (3)
[6]

QUESTION 3: LIMITS AND FITS

3.1 Explain the following terms relating to limits and fits:

3.1.1 Bilateral tolerance

3.1.2 Unilateral tolerance

3.1.3 Tolerance

3.1.4 Basic size

3.1.5 Maximum limits of a size

(5 × 1) (5)

3.2 Describe the following types of limit systems:

3.2.1 The hole-basis system

3.2.2 The shaft-basis system

(2 × 1) (2)
[7]

QUESTION 4: BEARINGS

4.1 Name TWO methods of mounting an antifriction bearing by using the application of heat. (2)

4.2 Name THREE advantages of plain bearings. (3)
[5]

QUESTION 5: LUBRICATION AND VALVES

5.1 Explain what is meant by the following lubrication terms:

5.1.1 Cold point

5.1.2 Rubbing pressure

5.1.3 Adhesion

(3 × 1) (3)

Copyright reserved

5.2 FIGURE 1 below shows a diagram of a valve.

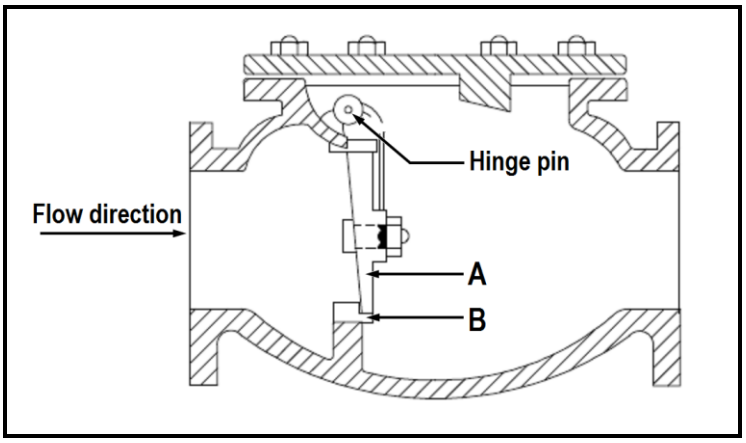


FIGURE 1

5.2.1 Name the type of valve shown in FIGURE 1. (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, JOINTS AND WATER-PIPE SYSTEMS

6.1 List THREE reasons for the failure of flanged joints. (3)

6.2 As a fitter in the plant, state if you will adjust a stuffing box while the pump is running and give a reason for the answer. (2 × 1) (2)

6.3 State FOUR disadvantages of the plastic piping. (4)

[9]

QUESTION 7: PUMPS

7.1 Name TWO types of reciprocating pumps. (2)

7.2 Complete the following sentences on pumps by filling the missing word or words. Write only the word or words next to the question number (7.2.1–7.2.4) in the ANSWER BOOK.

In centrifugal pumps the rotating component, called the (7.2.1…) provides rotary motion to the water contained in the casing. Water is forced out of the pump casing at the (7.2.2 …) because of the centrifugal force. As the water is expelled, a vacuum is created at the (7.2.3 …) of the pump. This allows atmospheric pressure to force more water in at the (7.2.4 …). (4)

[6]

Copyright reserved

QUESTION 8: COMPRESSORS

8.1 The inter-cooler and after-cooler form part of a two-stage compressor.

Briefly explain the difference between the *inter-cooler* and *after-cooler*. (2)

8.2 Name the TWO categories of air 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 State THREE safety measures to be taken when working with gear drives. (3)

9.3 Name the THREE types of reduction gearboxes used in industry. (3)

9.4 Explain the following chain drive terms:

9.4.1 Chain pitch

9.4.2 Centre distance between the sprockets

9.4.3 Driver sprocket

(3 × 1) (3)

[12]

TOTAL SECTION A: 60

SECTION B

Answer any TWO of the three questions in SECTION B.

QUESTION 10: PNUEMATICS AND HYDRAULICS

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

10.2 Explain the functions of the following valves used in pneumatic systems:

10.2.1 Pressure-relief valve

10.2.2 Non-return valve

10.2.3 Directional control valve

(3 × 1) (3)

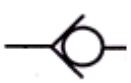
10.3 Name FIVE basic components of a hydraulic circuit. (5)

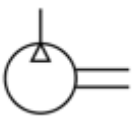
10.4 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–F) next to the question number (10.4.1–10.4.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
10.4.1	The force per unit area	A	check valve
10.4.2	Allows hydraulic oil to flow in one direction only	B	pressure relief valve
10.4.3	Changes the hydraulic liquid pressure into mechanical movement	C	pressure
10.4.4	Protects the hydraulic system from excessive pressure	D	control valve
10.4.5	Alerts, generates and cancels signals in a hydraulic system	E	flow
		F	actuator

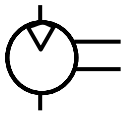
(5 × 1) (5)

10.5 Identify each of the following ISO pneumatic symbols:

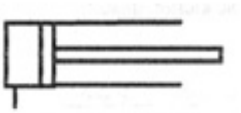
10.5.1 

10.5.2 

Copyright reserved

10.5.3 

10.5.4 

10.5.5 

(5 × 1) (5)
[20]

QUESTION 11: CENTRE LATHES

11.1 State THREE uses of lathe steadies. (3)

11.2 State TWO advantages of using the graduated sleeve method when perfoming taper turning on a centre lathe. (2)

11.3 A taper 1 in 15 has to be turned on a workpiece that is 300 mm long.

Calculate the amount of tailstock set-over required. (3)

11.4 A two-start square thread of 12 mm pitch has to be machine on a round shaft with an average diameter of 66 mm. Take the clearance angle as 3°.

Calculate:

11.4.1 The helix angle of the thread (θ) (4)

11.4.2 The leading angle of the thread (2)

11.4.3 The following angle of the cutting tool (2)

11.5 Explain the following terms applicable to CNC machining:

11.5.1 Incremental programming

11.5.2 Absolute programming

(2 × 1) (2)

11.6 Give TWO reasons why clearance angles are necessary on different lathe-cutting tools. (2)
[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 State TWO functions of the dividing head. (2)

12.2 Explain the functions of the following milling cutters:

12.2.1 Dovetail cutter

12.2.2 Slotting cutter

12.2.3 End mill cutter

12.2.4 Slot drill

(4 × 1) (4)

12.3 List THREE reasons for using a nicked helical cutter. (3)

12.4 Use Brown and Sharpe index plates, as shown below, to calculate the indexing required for the following:

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

12.4.1 58 equally spaced gear teeth (3)

12.4.2 An angular-shaped groove of 54 degrees (3)

12.5 Name TWO types of bonding materials that are used for grinding wheels. (2)

12.6 State THREE causes of glazing of grinding wheels. (3)

[20]

TOTAL SECTION B: 40

GRAND TOTAL: 100

Copyright reserved

FITTING AND MACHING THEORY N2

FORMULA SHEET

1. $f = ft \times \mathrm{T} \times \mathrm{N}$
2. $\mathrm{S} = \frac{\pi \mathrm{DN}}{60}$
3. $\mathrm{S} = \pi \mathrm{DN}$
4. $\frac{40}{\mathrm{N}}$
5. $\frac{\mathrm{N}}{9°}$
6. $\text{Setover} = \frac{\mathrm{D}-\mathrm{d}}{2} \times \frac{\text{length of workpiece}}{\text{length of taper}}$
7. $\text{Setover} = \frac{\text{length of workpiece}}{2} \times \text{Ratio}$
8. $\tan \frac{\theta}{2} = \frac{\mathrm{X}}{L}$
9. $\text{Lead} = \text{number of starts} \times \text{pitch}$
10. $\text{Mean Diameter (Dm)} = \text{Outer diameter} - \frac{1}{2} \times \text{pitch}$
11. $\tan \theta = \frac{\text{Lead}}{\pi \times \mathrm{Dm}}$
12. $\text{Leading angle} = 90° - (\text{helix angle} + \text{clearance angle})$
13. $\text{Following angle} = 90° + (\text{helix angle} - \text{clearance angle})$

Copyright reserved