higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

4 July 2022 (X-paper)
09:00–12:00

Drawing instruments and a nonprogrammable calculator may be used.

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

104Q1A2204

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

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 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. Start each section on a new page.

6. Use only a black or blue pen.

7. Write neatly and legibly.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Answer either QUESTION 1.1 **OR** QUESTION 1.2

1.1   State FIVE characteristics of effective machine guards.   (5)

OR

1.2   State FIVE regulations associated with first aid certification for underground and surface mine workers, according to the Minerals Act No. 50 of 1991.   (5)
[5]

QUESTION 2: COUPLINGS

2.1   Name FOUR different types of rigid couplings.   (4)

2.2   Explain why couplings cannot be used as clutches.   (2)
[6]

QUESTION 3: LIMITS AND FITS

3.1   Name the classification under which the following types of fits are categorised:

    3.1.1   Drive fit

    3.1.2   Push fit

    3.1.3   Slide fit

    3.1.4   Shrink fit

    3.1.5   Running fit

                                            (5 × 1)   (5)

3.2   Explain the following terms with respect to limits and fits:

    3.2.1   Unilateral tolerance

    3.2.2   Bilateral tolerance

                                            (2 × 1)   (2)
[7]

QUESTION 4: BEARINGS

FIGURE 1 shows the rolling elements of different types of bearings.

Name each rolling element labelled (A – E). Write only the answer next to the letter (A–E) in the ANSWER BOOK.
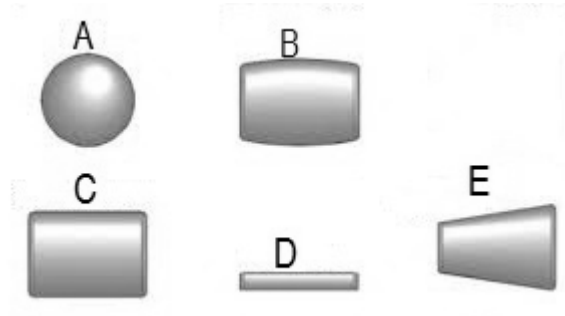

FIGURE 1 [5]

QUESTION 5: LUBRICATION AND VALVES

5.1   Define the term *flash point.* (1)

5.2   Determine FOUR factors that make a lubricant efficient. (4)

5.3   Name ONE lubricating device associated with the force-feed principle. (1)

[6]

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

6.1   FIGURE 2 below shows a diagram of a stuffing box.

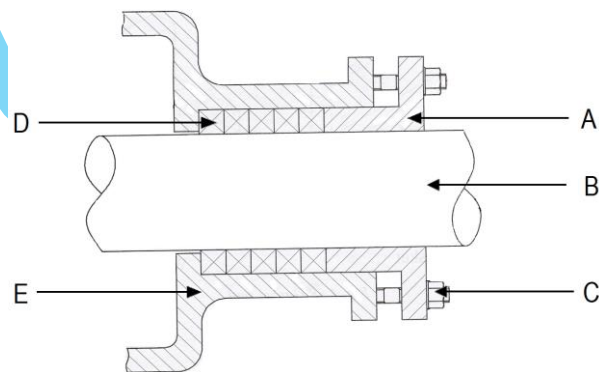Name the parts labelled (A–E) in FIGURE 2. Write only the answer next to the letter (A–E) in the ANSWER BOOK

FIGURE 2 (5)

6.2   As a fitter in the plant, will you make adjustments to a stuffing box while the pump is running? Give a reason for your answer. (2)

6.3   Briefly state TWO functions of valves. (2)

[9]

QUESTION 7: PUMPS

7.1   State the difference between a *piston pump* and a *plunger pump*. (2)

7.2   Complete the following sentences 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 order to prevent leakage of water out of the pump, a (7.2.1) … with soft packing is fitted onto a reciprocating pump. Reciprocating pumps are (7.2.2) … displacement pumps. The squeezing and opening of the impeller blades of a flexible impeller pump creates a (7.2.3) … at the suction side and (7.2.4) … at the delivery side of the pump. (4)

[6]

QUESTION 8: COMPRESSORS

Indicate whether the following statements are TRUE or FALSE. Write only 'True' or 'False' next to the question number (8.1–8.4) in the ANSWER BOOK

8.1   Moisture traps are used on intercoolers and after-coolers.

8.2   Pneumatic tools are tools driven by liquid pressure.

8.3   Start and stop control on compressors is facilitated by a thermostat.

8.4   Pressure gauges indicate the pressure of the air inside the air receiver.

(4 × 1)   **[4]**

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

9.1   State THREE reasons for the need to eliminate excessive sag on chain drives. (3)

9.2   State TWO main factors that will determine the correct meshing of gears in operation. (2)

9.3   State TWO reasons for the use of intermediate gears. (2)

9.4   Explain the following with regard to belt drives:

9.4.1   Centre distance
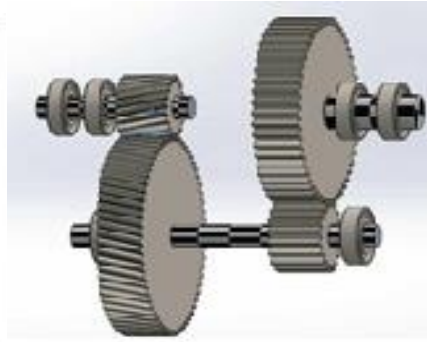
9.4.2   Driven pulley

9.4.3   Idler pulley

(3 × 1)   (3)

9.5 Name the TWO types of reduction gearboxes shown in FIGURE 3. Write only the answer next to the letter (A and B) in the ANSWER BOOK.

A B

FIGURE 3 (2)

[12]

TOTAL SECTION A: 60

SECTION B

NOTE: Answer only TWO questions in SECTION B

QUESTION 10: PNUEMATICS AND HYDRAULICS

10.1 State THREE functions of hydraulic fluid. (3)

10.2 Explain the functions of the following components used in hydraulic systems:

    10.2.1 Pressure relief valve

    10.2.2 Hydraulic pump

    10.2.3 Non-return valve

    10.2.4 Directional control valve

    10.2.5 Reservoir

    (5 × 1) (5)

10.3 State FIVE tasks that must be carried out during the daily maintenance on pneumatic systems. (5)

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

10.5 List FIVE advantages of pneumatic systems. (5)

[20]

QUESTION 11 CENTRE LATHES

11.1 State FIVE items of information required by the parts programmer when writing a CNC programme. (5)

11.2 Explain the difference between the *travelling lathe steady* and the *fixed lathe steady.* (2)

11.3 A taper 1 in 14 has to be turned on a workpiece of 280 mm long.

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

11.4 A three-start screw thread with a 7 mm pitch must be cut on a lathe. The mean diameter is 90 mm. Assume that the clearance angle is 3°.

Calculate:

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

11.4.2 The leading angle of the cutting tool (2)

11.4.3 The following 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)
[20]

QUESTION 12 MILLING MACHINES AND SURFACE GRINDERS

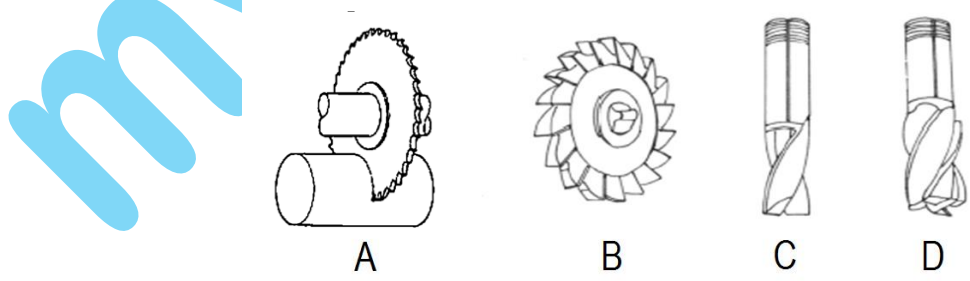12.1 FIGURE 4 shows different types of milling cutters.

FIGURE 4

12.1.1 Name the FOUR milling cutters shown in FIGURE 4. Write only the answer next to the letter (A–D) in the ANSWER BOOK. (4)

12.1.2 State ONE use for each of the milling cutters shown in FIGURE 4. (4)

12.2 Use the Brown and Sharpe index plate 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

12.2.1 58 equally spaced gear teeth (3)

12.2.2 An angular-shaped groove of 45º (3)

12.3 Name TWO types of bonding materials that hold the abrasive particles in grinding wheels together. (2)

12.4 State FOUR factors related to the work-piece which will help one select the correct grinding wheel. (4)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

FITTING AND MACHINING THEORY N2

FORMULA SHEET

$L = f \times t \times N$

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

$S = \pi DN$

$Indexing\ formula = \dfrac{40}{N}$

$Indexing\ formula = \dfrac{N}{9°}$

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

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

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

$Lead = No\ of\ starts \times pitch$

$\tan \theta = \dfrac{lead}{\pi \times D_m}$

$D_m = Outside\,diameter - \dfrac{pitch}{2}$

$Leading\ angle = 90° - (Helix\ angle + clearance\ angle)$

$Following\ angle = 90° + (Helix\ angle - clearance\ angle)$