higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T720**(E)**(A3)T

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

3 April 2017 (X-Paper)

09:00–12:00

Candidates will require drawing instruments.

Calculators may be used.

This question paper consists of 10 pages and 1 formula sheet.

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. All work you do not want to be marked must be clearly crossed out.

INSTRUCTIONS AND INFORMATION

1.   Answer either QUESTION 1.1 OR QUESTION 1.2 in SECTION A.

2.   Answer QUESTIONS 2 to 9 in SECTION A.

3.   Answer any TWO of the three questions in SECTION B.

4.   Read ALL the questions carefully.

5.   Number the answers according to the numbering system used in this question paper.

6.   Start each question on a NEW page.

7.   Write neatly and legibly.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Answer ONLY QUESTION 1.1 OR QUESTION 1.2.

1.1   Explain FIVE basic safety measures, which apply to the use of pneumatic and hydraulic tools and equipment.   **[5]**

OR

1.2   Explain one regulation applicable to each of the following with reference to the Minerals Act of 1991:

   1.2.1   First-aid certification

   1.2.2   Using self-propelled vehicles

   1.2.3   Lights or lamps allowed in a coal mine

   1.2.4   Contraband
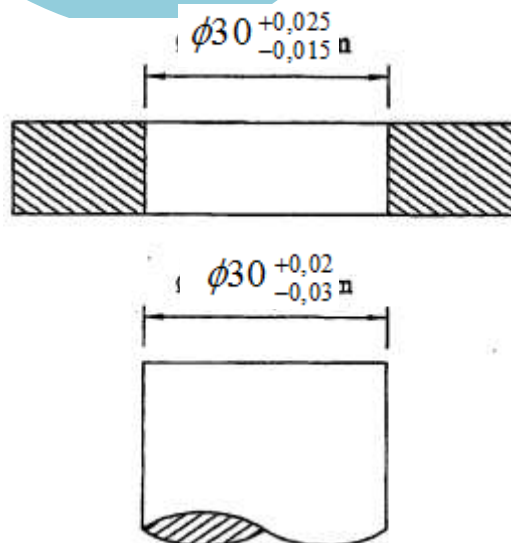
   1.2.5   Loose clothing

   (5 × 1)   **[5]**

QUESTION 2: COUPLINGS

Name FIVE different types of flexible couplings.   **[5]**

QUESTION 3: LIMITS AND FITS

FIGURE 1 shows the tolerance limits on a shaft and a hole

$\phi 30 {}^{+0,025}_{-0,015}$ ∎

$\phi 30 {}^{+0,02}_{-0,03}$ ∎

FIGURE 1

3.1 State whether the tolerance shown in FIGURE 1 is Unilateral or Bilateral for:

    3.1.1 The shaft (1)

    3.1.2 The hole (1)

3.2 Write down the lower limit of the shaft. (1)

3.3 Write down the high limit of the hole. (1)

3.4 Calculate the maximum allowance between the two mating parts. (1)

3.5 Determine the tolerance of the hole. (2)

[7]

QUESTION 4: BEARINGS

4.1 Briefly describe the following terms with regards to bearings:

    4.1.1 Radial load

    4.1.2 Axial load

    4.1.3 Angular load

    (3 × 1) (3)

4.2 Identify the types of roller bearings shown in FIGURE 2. Write only the answer next to the number (4.2.1 and 4.2.2) in the ANSWER BOOK.

    4.2.1   **4.2.2**

FIGURE 2

    (2 × 1) (2)

4.3 Explain why the method of fitting a bearing onto a shaft as shown in FIGURE 3 is incorrect.
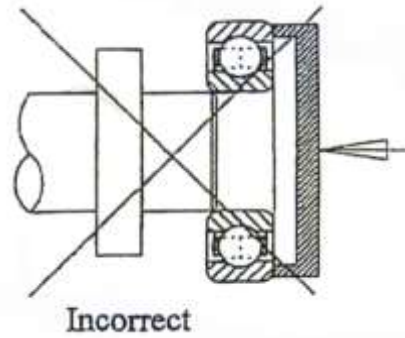

Incorrect

FIGURE 3 (2)

[7]

QUESTION 5: LUBRICATION AND VALVES

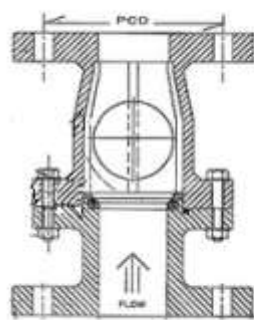5.1 List THREE types of gravity feed lubricating systems. (3)

5.2 Define the following terms related to lubrication.
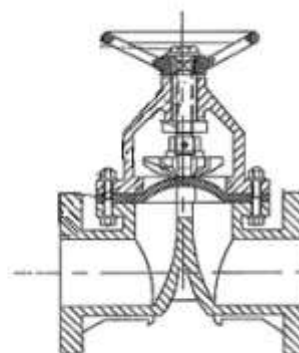
5.2.1 Burning point

5.2.2 Cohesion

(2 × 1) (2)

5.3 Name the TWO types of valves shown in FIGURE 4 below. Write only the answer next to the number (5.3.1 and 5.3.2) in the ANSWER BOOK.

5.3.1   5.3.2

FIGURE 4

(2 × 1) (2)

[7]

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

6.1   Explain the purpose of the following items:

      6.1.1   Lantern ring

      6.1.2   Expansion joints

                                                    (2 × 1)   (2)

6.2   State the TWO main purposes of packing and seals.   (2)

6.3   Give THREE reasons for insulating of water and steam pipes.   (3)

6.4   Name TWO types of materials that are used for packing and seals, in industry.   (2)

                                                            [9]

QUESTION 7: PUMPS

7.1   State TWO reasons why you would use a multistage centrifugal pump.   (2)

7.2   Explain the statement: "A centrifugal pump is not a positive displacement pump".   (2)

7.3   How would you neutralise the end thrust which develops in a multistage centrifugal pump?   (1)

7.4   Differentiate between piston pumps and plunger pumps.   (2)

                                                            [7]

QUESTION 8: COMPRESSORS

Explain the operation of a single stroke reciprocating air compressor.   **[5]**

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

9.1   Explain the function of the following V-belt components:

      9.1.1   Idler pulley

      9.1.2   Drive pulley

                                                    (2 × 1)   (2)

9.2 FIGURE 5 represents a simple gear drive. Indicate whether the statements following the figure are TRUE or FALSE. Choose the answer and write 'true' or 'false' next to the question number (9.2.1-9.2.3) in the ANSWER BOOK.
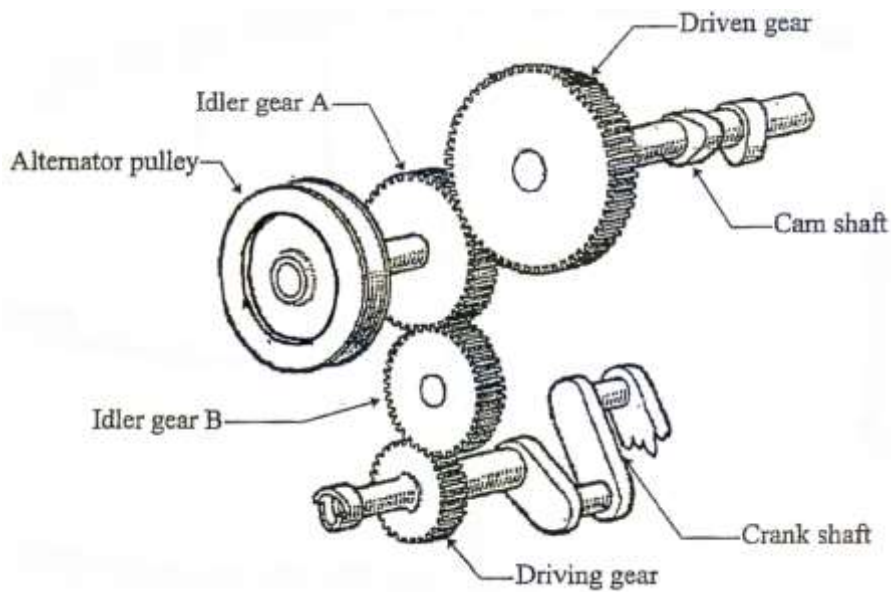

FIGURE 5

9.2.1 The direction of rotation of the cam shaft is the same as the crank shaft.

9.2.2 The direction of the alternator pulley rotates in the same direction as that of the crank shaft.

9.2.3 The presence of the intermediate gear A makes a difference on the rotational speed of the cam shaft

(3 × 1) (3)

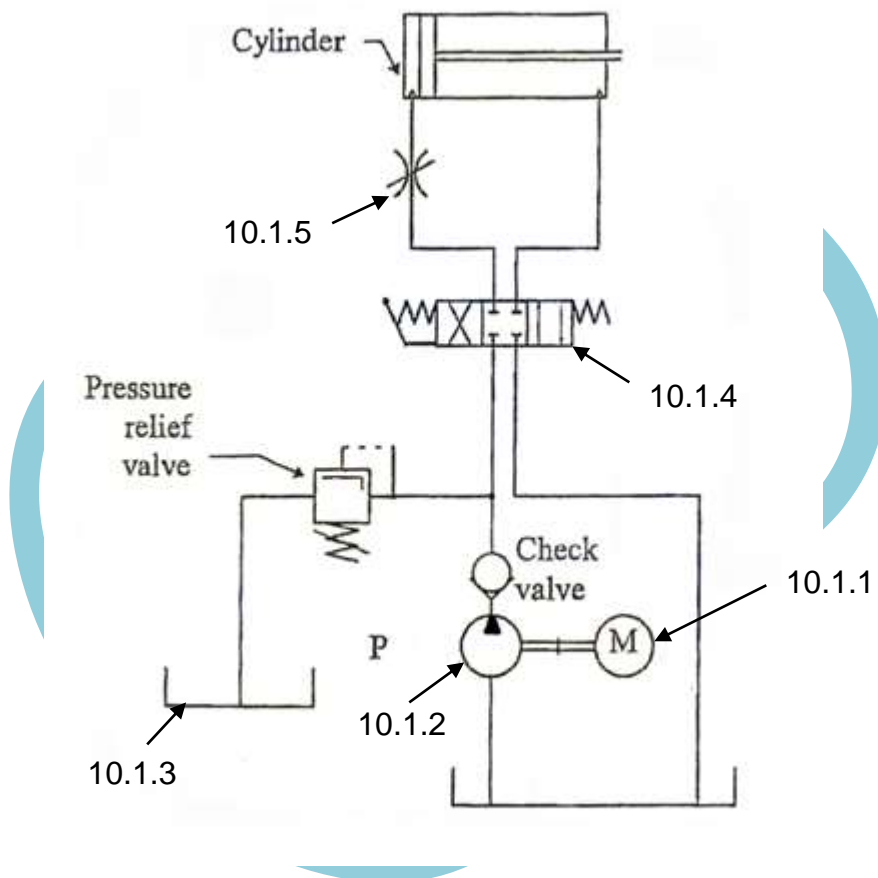9.3 Make a neat drawing of a compound gear drive. (3)
[8]

TOTAL SECTION A: 60

SECTION B

Answer any TWO of the three questions in SECTION B.

QUESTION 10: HYDRAULICS AND PNEUMATICS

10.1   Name the components associated with the ISO symbols shown in FIGURE 6 below. Write only the answer next to the question number (10.1.1-10.1.5) in the ANSWER BOOK.

FIGURE 6

(5 × 1)   (5)

10.2   State whether each of the following industrial applications is a hydraulic system or a pneumatic system. Write only the answer next to the question number (10.2.1–10.2.4) in the ANSWER BOOK.

10.2.1   Trench digging (earth moving and construction)

10.2.2   Pies, biscuits and pastries (food processing)

10.2.3   Production of medicines and drugs

10.2.4   Quick clamping of aluminium products

(4 × 1)   (4)

10.3   List THREE main functions of the reservoir in the hydraulic system.   (3)

10.4   State the function of the following pneumatic components:

         10.4.1   Actuator

         10.4.2   Air receiver

         10.4.3   Pipes
                                                                          (3 × 1)   (3)

10.5   State FIVE important daily tasks during the maintenance of a pneumatic
         system, with specific reference to compressors.   (5)
   **[20]**

QUESTION 11: CENTRE LATHES

11.1   Briefly explain the function of the following lathe attachments:

         11.1.1   Travelling steady

         11.1.2   Fixed steady
                                                                          (2 × 2)   (4)

11.2   State FIVE advantages of the use of the taper attachment when machining
         tapers, on a centre lathe.   (5)

11.3   State FOUR factors to be considered during CNC-programming.   (4)

11.4   A taper of 1 in 25 has to be turned on a shaft of 280 mm long.

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

11.5   A round shaft with an outside diameter of 40 mm must be provided with a
         double-start square thread with a 6 mm pitch. Take clearance angle as 3°.
         Calculate the following:

         11.5.1   The lead of the thread   (1)

         11.5.2   The mean diameter   (1)

         11.5.3   The helix angle   (2)

         11.5.4   The leading tool angle   (1)
                                                                                   [20]

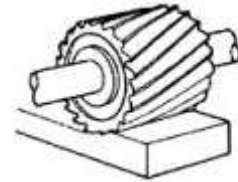## QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 Name the milling cutter types shown in FIGURE 7 below. Write only the answer next to the question number (12.1.1– 12.1.3) in the ANSWER BOOK.
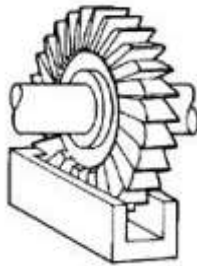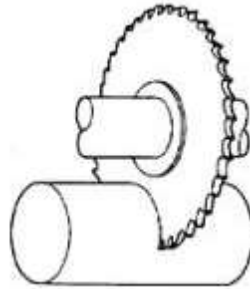
| 12.1.1 | 12.1.2 | 12.1.3 |

FIGURE 7 (3 × 1) (3)

12.2 Calculate the simple indexing of a hexagon, using the Brown and Sharp dividing head.

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

(3)

12.3 State FOUR constant factors to be considered when selecting a grinding wheel. (4)

12.4 Calculate the cutting speed of a milling cutter in metres per minute, when using a cutter of 35 mm in diameter at a speed of 360 revolutions per minute. (3)

12.5 Name TWO types of grinding wheels used on surface grinders. (2)

12.6 Name TWO advantages of up-cut milling (2)

12.7 Give THREE reasons why it is more desirable to use milling cutters with a small diameter. (3)

[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

FITTING AND MACHINING THEORY N2

FORMULA SHEET

$$f = f_t \times T \times N$$

$$S = \frac{\pi\,D\,N}{60}$$

$$S = \pi\,D\,n$$

$$\frac{40}{N}$$

$$\frac{N}{9°}$$

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

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

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

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

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

Lead = No. of starts × pitch

$$\text{Mean diameter} = OD\text{ - }\frac{\text{Pitch}}{2}$$

$$\tan\theta = \frac{\text{Lead}}{\text{Mean circumference}}$$