Candidates will require drawing instruments, pens and a ruler.

Calculators may be used.

This question paper consists of 8 pages, 1 diagram sheet, table 1 and a 1-page 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 ALL the questions in SECTION A.
2. Answer only TWO questions in SECTION B.
3. Answer either QUESTION 1.1 or QUESTION 1.2.
4. Read ALL the questions carefully.
5. Start each question on a NEW page.
6. Number the answers correctly according to the numbering system used in this question paper.
7. Write neatly and legibly.

SECTION A

QUESTION 1: OCCUPATIONAL SAFETY

NOTE: Answer either QUESTION 1.1 or QUESTION 1.2

1.1 Indicate whether the following statements are TRUE or FALSE with regard to safety in the workplace. Write only 'true' or 'false' next to the question number (1.1.1 – 1.1.5) in the ANSWER BOOK.
1.1.1 Pneumatic equipment – Ensure that the regulator pressure at the compressor reaches the correct gauge reading before cut-out. This can be checked by observing the red line on the pressure gauge. (1)

1.1.2 Hydraulic equipment – Before use, one should blow air and oil hoses clean with compressed air. (1)

1.1.3 Storage of gas cylinder – Gas cylinders should be dragged and not rolled. (1)

1.1.4 Safety appliances – A machine should be stopped within 48 hours after a safety appliance (warning bell, emergency brake, etcetera) fails and it poses a danger to those working in the area. (1)

1.1.5 Transmission belts – An inspector may decide when overhead transmission belts are light enough not to need overhead guards. (1)

OR

1.2 Indicate whether the following statements are TRUE or FALSE with regard to safety in the workplace. Write only 'true' or 'false' next to the question number (1.2.1 – 1.2.5) in the ANSWER BOOK.

1.2.1 Underground work – Every person in charge of more than 300 workmen must be in possession of a first-aid certificate. (1)

1.2.2 Underground work – All workers under the age of 50 years old must have a first-aid certificate. (1)

1.2.3 Workers on the surface – All workers who work near machinery on the surface of a mine, do not need to be in possession of a first-aid certificate. (1)

1.2.4 Underground and surface mining – Every person has a period of five years within which to obtain a first-aid certificate. (1)

1.2.5 First-aid certificates are renewable every three years. (1)

QUESTION 2: COUPLINGS

2.1 Explain the difference between a coupling and a clutch. (2)

2.2 Name TWO different types of flexible coupling. (2)

2.3 What are the TWO main types of coupling misalignment? (2)

PTO
6.3 Explain how a lantern ring works by filling in the missing word(s). Write only the word(s) next to the question number (6.3.1 – 6.3.3) in the ANSWER BOOK.

The lantern ring is a steel ring which has a series of (6.3.1) ... set into a recess along its circumference.

Water is piped via a/an (6.3.2) ... from a water chamber to form a/an attached (6.3.3) ... around the shaft to prevent water from entering the inlet side of the pump (Example, centrifugal pump.)

QUESTION 7: PUMPS

FIGURE 3 on the attached DIAGRAM SHEET shows an illustration of a pump.

7.1 Name the category under which this pump is classified.

7.2 Label from A – D the different parts of this pump as shown in FIGURE 3. Write the answer next to the question number (A – D) in the ANSWER BOOK.

QUESTION 8: COMPRESSORS

8.1 Explain in your own words, TWO functions of an aftercooler with regards to compressors.

8.2 Name the device used on intercoolers and aftercoolers which is used to trap condensatation forming inside them.

8.3 Name the different types of rotary compressors.
QUESTION 3: LIMITS AND FITS

3.1 Explain in your own words, the difference between the TWO systems of limits and fits:

3.1.1 Hole basis system
3.1.2 Shaft basis system

(1) (1)

3.2 A shaft has to be machined according to a transition fit within the limits – 36 H7 k6 in order for the hole to fit. Use the information in TABLE 1 (attached DIAGRAM SHEET) to answer the following:

3.2.1 Name the basis system that must be used.
3.2.2 What is the type of fit derived from this dimension?
3.2.3 Determine the tolerance of the shaft.
3.2.4 Is the tolerance bi-lateral or unilateral?

(1) (1) (1) [6]

QUESTION 4: BEARINGS

4.1 State FOUR disadvantages of plain bearing over anti-friction bearings.

(4)

4.2 Name THREE devices used for the removal of bearings.

(3) [7]

QUESTION 5: LUBRICATION AND VALVES

FIGURE 1 on the attached DIAGRAM SHEET gives a representation of a lubricator.

5.1 Name this lubricator.

(1)

5.2 Give a brief explanation, in your own words how it operates.

(2)

5.3 Name FIVE parts of the lubricator as indicated in FIGURE 1 (A – E). Write the answer next to the question number (A – E) in the ANSWERBOOK.

(5) [8]

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

6.1 Name FOUR important components of a stuffing box assembly as indicated in FIGURE 2 (A – D) on the attached DIAGRAM SHEET. Write the answer next to the question number (A – D) in the ANSWERBOOK.

(4)

6.2 Give the main reason for using a lantern ring in association with stuffing boxes.

(1)

6.2.1

6.2.2 What would happen if you do not use a latern ring?

(1)
QUESTION 9: V-BELTS, CHAIN AND GEAR DRIVES

9.1 Give THREE reasons why covers or guards are fitted on belt-drives. (3)

9.2 FIGURE 4 on the attached DIAGRAM SHEET is an illustration of a belt-drive. With reference to FIGURE 4 (A – E), list the different parts and terms associated with belt drives. Write the answer next to the question number (A – E) in the ANSWERBOOK. (5)

SECTION B

QUESTION 10: HYDRAULICS AND PNEUMATICS

NOTE: Answer only TWO questions in this section.

10.1 Explain, in your own words, the function of a pressure relief valve in a hydraulic system. (1)

10.2 Make neat, freehand sketches of ISO symbols representing the following pneumatic and hydraulic components:

10.2.1 4/2 Directional control valve (1)
10.2.2 Flow control valve (1)
10.2.3 Check valve (1)
10.2.4 Filter with water trap (1)
10.2.5 Service unit (1)

10.3 Name SIX valve types you would find in a typical hydraulic system. (6)

10.4 Explain, in your own words, the FIVE basic aspects of inspection in the routine maintenance of a compressor. (5)

10.5 Explain, in your own words, the main function of the pump in a hydraulic system in terms of the conservation of energy. (1)

10.6 Briefly describe the following with regard to the design of a reservoir:

10.6.1 Ensures that dirt and contaminants do not re-enter the hydraulic system (1)

10.6.2 Helps to cool the oil as much as possible [20]
QUESTION 11: CENTRE LATHES

11.1 Name THREE methods of taper-turning on a center lathe. (3)

11.2 State THREE advantages of using mandrels on a center lathe. (3)

11.3 Name TWO types of mandrels commonly used during machining on a centre lathe. (2)

11.4 State FIVE factors to consider when writing a CNC program. (5)

11.5 Name the programming system which uses zero as the point of reference, at all times during the machining cycle. (1)

11.6 Calculate the time taken to take one cut during a machining task on the centre lathe. The length of the cut is 250 mm and the machine feed is set at 0.5 mm/revolutions. The spindle speed of the machine is 199 r/min (revolutions per minute). Calculate the time in minutes and seconds. (3)

11.7 Give THREE possible reasons for 'chatter marks' on a completed machined work-piece. (3)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 State FOUR advantages for using milling cutters with coarse teeth. (4)

12.2 Calculate the indexing required for the following, using a Browne and Sharpe index plate as shown below:

12.2.1 58 equally spaced gear teeth
12.2.2 An angular-shaped groove of 45°

NOTE: Browne & Sharpe indexing information

<table>
<thead>
<tr>
<th>The Browne and Sharpe Dividing Head</th>
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<tbody>
<tr>
<td>Plate 1</td>
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<td>Plate 3</td>
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12.3 Describe in your own words, what is understood by the following types of grinding terms. Give ONE example of each:

12.3.1 Off-hand grinding
12.3.2 Precision grinding

(1) (1)

12.4 Name TWO types of surface grinder machines

(1)

12.5 Give THREE reasons for 'chatter marks' on a completed surface-ground work-piece.

(3)

12.6 Give THREE reasons for ('burning') on a completed flat-surface-ground work-piece.

(3)

TOTAL SECTION B: 40
GRAND TOTAL 100
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Fitting and Machining Theory N2

Formula Sheet

\[ f = ft \times T \times N \]

\[ S = \frac{\pi DN}{60} \]

\[ S = \pi DN \]

\[ \frac{40}{N} \]

\[ \frac{N}{90^\circ} \]

\[ \frac{D - d}{2} \times \frac{\text{length of workpiece}}{\text{length of taper}} \]

\[ \tan \frac{\theta}{2} = \frac{X}{L} \]

\[ 90^\circ - (\text{Helix angle} + \text{clearance angle}) \]

\[ 90^\circ + (\text{Helix angle} - \text{clearance angle}) \]