higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T630**(E)**(J22)T

AUGUST EXAMINATION

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

22 July 2014 (Y-Paper)
13:00–16:00

Calculators may be used.

This question paper consists of 9 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 ALL the questions in SECTION A
2. Answer ONLY TWO questions in SECTION B
3. Answer either QUESTION 1.1 OR 1.2 of QUESTION 1
4. Read ALL the questions carefully.
5. Number the answers according to the numbering system used in this question paper.
6. Write neatly and legibly.

SECTION A
ANSWER ALL THE QUESTIONS IN SECTION A.

QUESTION 1: OCCUPATIONAL SAFETY

Answer 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. Choose the answer and write only 'true' or 'false' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 Overhead transmission belts must be provided with guards

1.1.2 When using a ladder, never secure the top part by means of a rope.

1.1.3 Fixed guards only move with each operation of the machine.

1.1.4 The manufacturer's information on a pressure vessel includes the date of export.

1.1.5 A machine must be stopped immediately, if it becomes a danger to those working in the area.

(5 x 1) (5)

OR

1.2 Indicate whether the following statements are TRUE or FALSE with regard to safety in the workplace. 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 After a heating task is performed in a mine, a competent person must inspect the area to ensure there is no possibility of a fire breaking out.

1.2.2 Naked lights are allowed BUT may not be left close to flammable material that may cause a fire or an explosion.

1.2.3 Smoking is ONLY allowed in the lifting cage.

1.2.4 No welding, flame-cutting or flame heating is to take place in a mine, unless fire extinguishers have been provided.

1.2.5 Calcium carbide is not to be taken underground unless it is in a water tight container approved by the manager.

(5 x 1) (5)
[5]

QUESTION 2: COUPLINGS

2.1 Name FIVE different types of RIGID couplings. (5)

2.2 Give TWO reasons why it is necessary to ensure the correct alignment of a fixed coupling. (2)
[7]

QUESTION 3: LIMITS AND FITS

A shaft is to be fitted into a bush. The sizes given for the bush and shaft are:

BUSH	SHAFT
$45^{+0,08}_{+0,03}$ mm	$45^{+0,02}_{-0,00}$ mm

3.1 Determine the following:

3.1.1 The minimum allowance of the fitted parts

3.1.2 The maximum allowance of the fitted parts

3.1.3 The tolerance on the shaft

3.1.4 The tolerance of the hole (4 x 1) (4)

3.2 What is the classification of this type of fit? (1)
[5]

QUESTION 4: BEARINGS

4.1 State one property of each of the following bearing materials:

4.1.1 White metal

4.1.2 Cast iron

4.1.3 Bronze

4.1.4 Nylon

4.1.5 Teflon

(5 x 1) (5)

4.2 Name the THREE types of rolling elements used in the manufacture of anti-friction design. (3)
[8]

QUESTION 5: LUBRICATION AND VALVES

FIGURE 1 represents a method of lubrication.

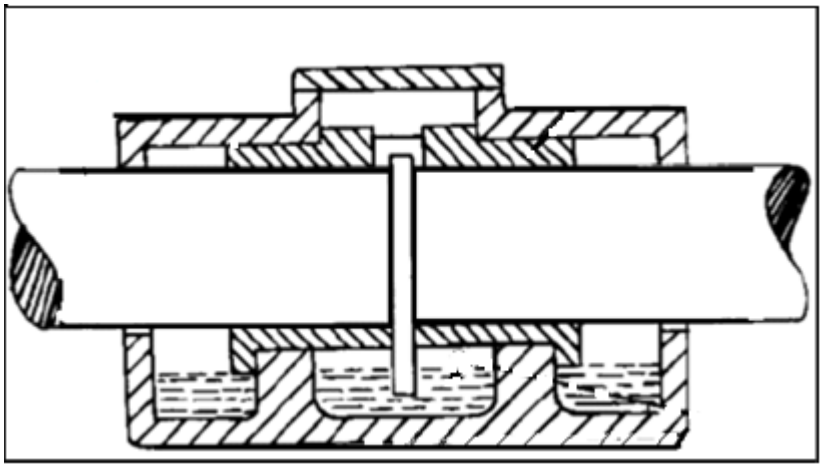


FIGURE 1

5.1 Name this type of lubrication. (1)

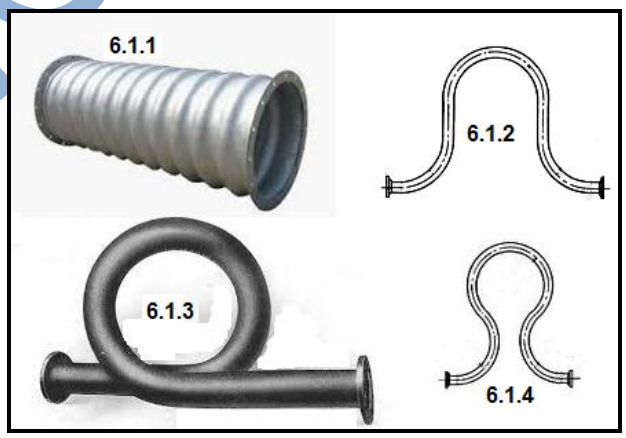
5.2 Briefly describe this lubrication method. (4)

5.3 State TWO functions of valves in fluid power systems. (2)

5.4 Differentiate between a normally open and a normally closed valve. (2)
[9]

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

6.1 FIGURE 2 shows FOUR types of joints that allow for expansion and contraction in pipelines. Name these FOUR types of joints. Write only the answer next to the question number (6.1.1 – 6.1.4) in the ANSWER BOOK.



(4)

FIGURE 2

6.2 List FOUR important guidelines to ensure the proper fitting of o-rings and seals in hydraulic systems. (4)
[8]

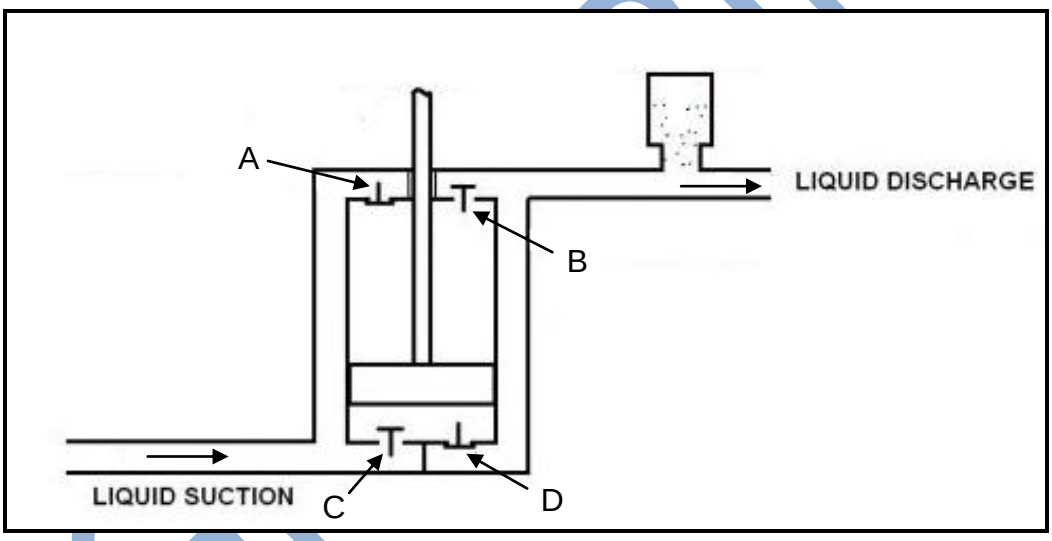
QUESTION 7: PUMPS

7.1 State TWO methods of neutralising water hammer in plunger pumps. (2)

7.2 Refer to FIGURE 3 and describe the operation of a double-acting plunger pump by inserting the correct letters for the various valves. Write only the answer next to the question number (7.2.1 – 7.2.4) in the ANSWER BOOK.

Stroke 1:
As the plunger moves upwards, water enters the chamber through the inlet valve (7.2.1), and delivers water past the outlet valve (7.2.2).

Stroke 2
As the plunger moves downwards, the water enters the chamber through the inlet valve (7.2.3), and delivers it past the outlet valve (7.2.4).



(4 x 1) (4)
[6]

FIGURE 3

QUESTION 8: COMPRESSORS

Explain the function of each of the following compressor components:

8.1 Filter

8.2 Drain Valve

8.3 Intercooler

8.4 After cooler

8.5 Pressure regulator switch

(5 x 1) **[5]**

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

9.1 State TWO advantages of chain drives when compared to gear drives. (2)

9.2 State TWO reasons for the need to eliminate excessive sag on chain drives. (2)

9.3 Name THREE different types of sprockets associated with chain drives. (3)
[7]

TOTAL SECTION A: 60

SECTION B

ANSWER ONLY TWO OF THE QUESTIONS IN SECTION B

QUESTION 10: PNEUMATICS AND HYDRAULICS

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

10.2 State FIVE factors which influence the choice of pneumatics over hydraulics for transmitting power to machines. (5)

10.3 Identify the FIVE hydraulic components shown in FIGURE 4. Write only the answer next to the question number (10.3.1 – 10.3.5) in the ANSWER BOOK. (5)

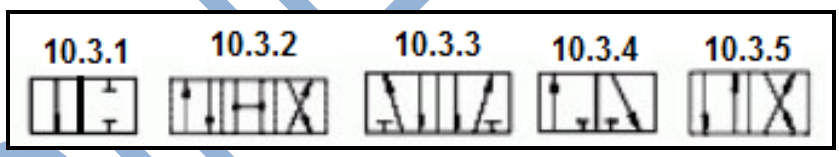


FIGURE 4

10.4 State FIVE basic aspects of inspection in the routine maintenance of a hydraulic circuit. (5)

10.5 Name the FOUR components which make up a pneumatic service unit. (4)
[20]

QUESTION 11: CENTRE LATHE

11.1 State FOUR advantages of the use of mandrels for the machinist. (4)

11.2 Name the TWO methods for setting over the tailstock in preparation for taper-turning on the centre lathe. (2)

11.3 A taper of included angle 6° (SIX DEGREES) has to be turned on a work-piece 280 mm long. Calculate the amount of tailstock set-over required. (3)

11.4 A round shaft with a pitch diameter of 100mm must be provided with a two-start square thread with a 5 mm pitch. The clearance angle is 3º.

Calculate:

11.4.1 the helix angle of the thread (3)

11.4.2 the leading angle of the cutting tool (1)

11.4.3 the following angle of the cutting tool (1)

11.5 Explain the following terms applicable to CNC machining

11.5.1 Incremental programming (1)

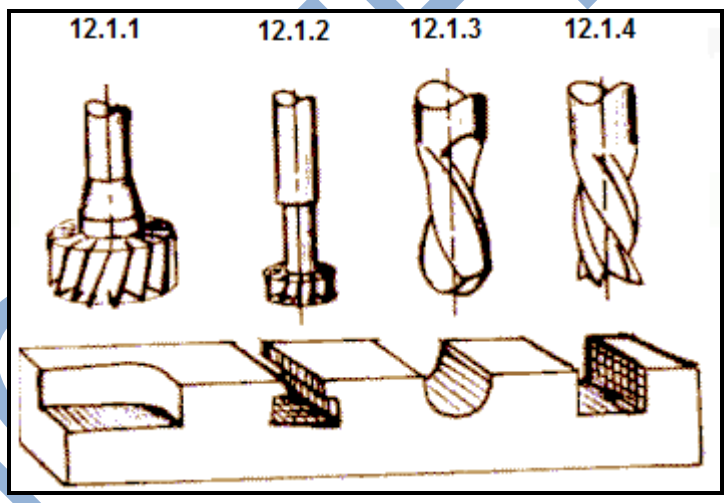
11.5.2 Absolute programming (1)

11.6 List FOUR items of information required by the parts programmer when writing a CNC machining programme. (4)

[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 Name the FOUR types of milling cutters shown in FIGURE 5. Write only the answer next to the question number (12.1.1 – 12.1.4) in the ANSWER BOOK.



(4)

FIGURE 5

12.2 A work-piece must have 13 gear-teeth machined on its circumference

12.2.1 What type of indexing would you perform on this gear blank? (1)

12.2.2 Calculate the required indexing, using a Cincinnati dividing head as shown below

The Cincinnati Dividing Head											
Side 1	24	25	28	30	34	37	38	39	41	42	43
Side 2	46	47	49	51	53	54	57	58	59	62	66

(4)

12.3 State TWO advantages of the down cut milling process (2)

12.4 State TWO disadvantages of the down cut milling process (2)

12.5 State FOUR factors related to the workpiece, which will help you to select the correct grinding wheel. (4)

12.6 Name THREE types of bonding materials which holds the abrasive particles in grinding wheels together. (3)
[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

FITTING AND MACHINING THEORY N2

FORMULA SHEET

$f = ft \times T \times N$

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

$S = \pi DN$

$\frac{40}{N}$

$\frac{N}{9°}$

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

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

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

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

Lead = No of starts × pitch