higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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AUGUST 2012

NATIONAL CERTIFICATE

FITTING AND MACHINING THEORY N2

(11022032)

24 July (X-Paper)
09:00 – 12:00

Calculators may be used.

Candidates need drawing instruments.

This question paper consists of 9 pages and a 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. SECTION A is COMPULSORY and must be answered by ALL the candidates.
2. Answer either QUESTION 1.1 or QUESTION 1.2.
3. Answer only TWO questions in SECTION B.
4. Read ALL the questions carefully.
5. Number the answers correctly according to the numbering system used in this question paper.
6. Write neatly and legibly.

SECTION A (COMPULSORY)

QUESTION 1: OCCUPATIONAL SAFETY

Answer only 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) or (1.2.1 – 1.2.5) in the ANSWER BOOK.

1.1.1 A machine must be stopped immediately, if it becomes a danger to those working in the area. (1)

1.1.2 Fixed guards only move with the movement of the machine. (1)

1.1.3 When using a ladder, never secure the top part by means of a rope. (1)

1.1.4 The manufacturer's information on a pressure vessel includes the date of export. (1)

1.1.5 Overhead transmission belts must be provided with guards. (1) **[5]**

OR

1.2 1.2.1 No welding, flame-cutting or flame heating is to take place in a mine, unless fire extinguishers have been provided. (1)

1.2.2 Bicarbonate of soda is not to be taken underground. (1)

1.2.3 Smoking is only allowed in the lifting cage. (1)

1.2.4 Naked lights are allowed but may not be left close to flammable material that may cause fire or explosion. (1)

1.2.5 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) **[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 must have a slide fit into a bush and the sizes given for the hole and shaft are:

BUSH		SHAFT	
	+0,08 mm		-0,02 mm
45	+0,03 mm	45	-0,00 mm

3.1 Name the types of tolerance described by the allowable dimensions of the bush (for example, uni-lateral, bi-lateral, et cetera). (1)

3.2 Name the types of tolerance described by the allowable dimension of the shaft (for example uni-lateral, bi-lateral, et cetera). (1)

3.3 3.3.1 Calculate, from the dimension above, the tolerance on the shaft. (1)

3.3.2 Calculate, from the dimension above, the tolerance on the bush. (1)

3.4 Into which classification of fit does this assembly fall? (For example clearance, transition or interference fit). (1)

[5]

QUESTION 4: BEARINGS

4.1 Bearing materials have certain properties. Write the appropriate bearing material type (white metal; cast iron; bronze; nylon; teflon; steel; copper; et cetera) next to the bearing material property (4.1.1 – 4.1.4) in the ANSWER BOOK.

4.1.1 Embedability (1)

4.1.2 Load-carrying ability (1)

4.1.3 Thermal conductivity (1)

4.1.4 Corrosion resistance (1)

4.2 Name the THREE types of rolling elements used in the manufacture of anti-friction bearings. (3)

[7]

QUESTION 5: LUBRICATION AND VALVES

5.1 Identify the lubricator shown in FIGURE 1 below. (1)

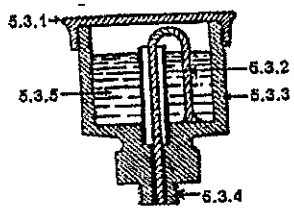


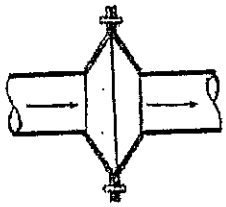
FIGURE 1

5.2 Give a brief description of how this lubricator works. (2)

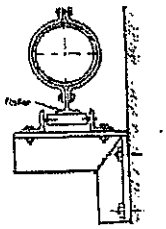
5.3 Name the parts as indicated in FIGURE 1 above. Write the answer next to the question number (5.3.1 – 5.3.5) in the ANSWER BOOK. (5)
[8]

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

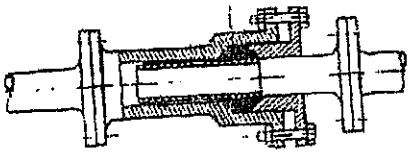
6.1 FIGURE 2 below shows FOUR expansion and contraction joints used in pipelines. Identify each one and write the answer next to the question number (6.1.1 – 6.1.4) in the ANSWER BOOK.



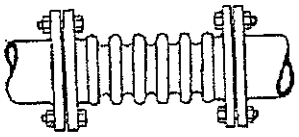
6.1.1



6.1.2



6.1.3



6.1.4

FIGURE 2

(4)

6.2 Name any FOUR material types used for packaging and seals. (4)
[8]

QUESTION 7: PUMPS

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

7.2 FIGURE 3 shows the operation of a double-acting plunger pump. Complete the sentences below by filling in the missing word(s). Write only the word(s) next to the question number (7.2.1 – 7.2.4) in the ANSWER BOOK.

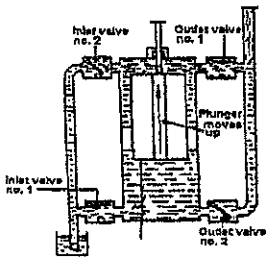


FIGURE 3

Stroke 1

The plunger moves upwards.
Water enters the chamber through inlet valve number 7.2.1 ... and delivers water past outlet valve number 7.2.2 ... . (2)

Stroke 2

The plunger moves downwards.
The water enters the chamber through inlet valve number 7.2.3 ... and is delivered past outlet valve number 7.2.4 ... . (2)
[6]

QUESTION 8: COMPRESSORS

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (8.1 – 8.7) in the ANSWER BOOK.

8.1 The air receiver is used for storing compressed air under high pressure until it is ready for use. (1)

8.2 The low-pressure cylinder is the second stage at which air is drawn in from the high-pressure cylinder before being compressed, cooled and stored. (1)

8.3 Moisture traps are used on intercoolers and after-coolers. (1)

8.4 The device used to separate water from the air to prevent the presence of water in tools and machinery during pneumatic operation, is called the after-cooler. (1)

8.5 Pistons and piston rods are used in horisontal reciprocating compressors. (1)

8.6 Start and stop control on a compressor is facilitated by a thermostat. (1)

8.7 Pneumatic tools are tools driven by fluid pressure. (1)
[7]

QUESTION 9: V-BELT, GEAR AND CHAIN DRIVES

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

9.2 Give 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 questions in this section.

QUESTION 10: HYDRAULICS AND PNEUMATICS

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

10.2 State FIVE factors which influence the choice between using hydraulics or pneumatics when transmitting power to machines. (5)

10.3 Identify the EIGHT basic components of a hydraulic system, as indicated in FIGURE 4. Write the answer next to the question number (10.3.1 – 10.3.8) in the ANSWER BOOK.

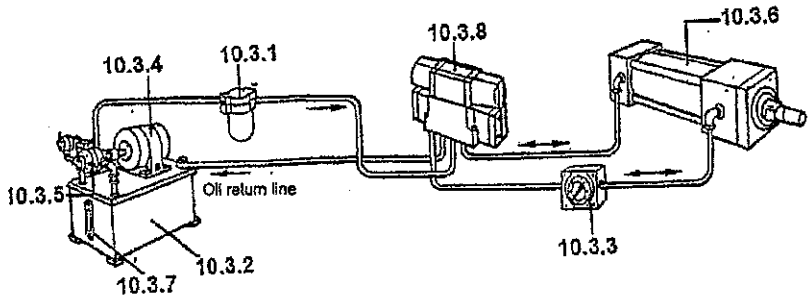


FIGURE 4 (8)

10.4 Explain in your own words TWO basic aspects of inspection in the routine maintenance of hydraulic circuits. (2)

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

QUESTION 11: CENTRE LATHES

11.1 State FOUR advantages of the use of mandrels to 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 1 in 14 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 mean diameter of 100 mm must be provided with a two-start thread with a 10 mm pitch.

Calculate the following:

11.4.1 The helix angle of the thread (θ) (3)

11.4.2 The leading angle of the thread (1)

11.4.3 The following angle of the cutting tool (clearance angle = 3°) (1)

11.5 Explain in your OWN words the following terms applicable to CNC machining:

11.5.1 Incremental programming (1)

11.5.2 Absolute programming (1)

11.6 State FOUR items of information required by the parts programmer when writing a CNC programme. (4)
[20]

QUESTION 12: MILLING MACHINES AND SURFACE GRINDERS

12.1 Name FOUR types of milling processes. (4)

12.2 A workpiece 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 Give a reason for the answer in QUESTION 12.2.1. (1)

12.3 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

(3)

12.4 Name FOUR types of bonding medium which holds the abrasive particles in grinding wheels together. (4)

12.5 Grinding wheels have symbols for identification purpose. Give the FOUR factors by which you would identify a grinding wheel. (4)

12.6 Give THREE factors related to the workpiece which will help you to select the correct grinding wheel. (3)
[20]

TOTAL SECTION B: 40
GRAND TOTAL: 100

FITTING AND MACHINING THEORY N2

FORMULA SHEET

$$f = ft \times T \times N$$

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

$$S = \pi DN$$

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

$$\frac{N}{9°}$$

$$\frac{D-d}{2} \times \frac{length\ of\ workpiece}{length\ of\ taper}$$

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

$90°$ - *(Helix angle + clearance angle)*
$90°$ + *(Helix angle - clearance angle)*