higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

FITTING AND TURNING
NQF LEVEL 4

(6011044)

22 November (Y-Paper)
13:00–16:00

This question paper consists of 7 pages.

Copyright reserved

TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

Copyright reserved

QUESTION 1: PUMPS

1.1 Maintenance work has been done on a pump.

State TWO precautions to be followed before using this pump. (2)

1.2 Explain the working principle of a gear pump. (4)

1.3 Name TWO types of reciprocating pumps which operate by using a reciprocating piston. (2)

1.4 Installation or maintenance of pumps requires that it must be electrically and mechanically isolated from energy sources.

State TWO reasons for machines to be locked and tagged. (2)
[10]

QUESTION 2: COMPRESSORS

2.1 Explain the working principle of the compressors below and give an example of each:

2.1.1 Positive displacement compressor

2.1.2 Negative displacement compressor

(2 × 3) (6)

2.2 State TWO items to be checked on a compressor during routine maintenance. (2)

2.3 Explain the function of each of the following units in a compressed air system:

2.3.1 Motor

2.3.2 Pressure gauge

(2 × 1) (2)
[10]

QUESTION 3: HYDRAULICS AND PNEUMATICS

3.1 Choose a phrase from COLUMN B that completes the sentence in COLUMN A. Write only the letter (A–G) next to the question number (3.1.1–3.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Safety glasses must be worn …	A	which can cause damage to your eyes
3.1.2	Leaks on a hydraulic system must never be checked …	B	when working around hydraulic or pneumatic systems
3.1.3	A non-volatile solvent …	C	all pressure in the systems must be relieved
3.1.4	Compressed air contains oil droplets …	D	must be used to wash the hydraulic components of a system
3.1.5	Before disconnecting any hydraulic or pneumatic lines …	E	by running your hand or finger along the line
		F	check that all pipe and hose connections are tight
		G	return machine to service

(5 × 1) (5)

3.2 Explain the function of each of the following hydraulic valves used in a hydraulic system:

3.2.1 Throttle valve

3.2.2 Variable flow valve

(2 × 1) (2)

3.3 Explain what is meant by *energy conversion* between the electrical, mechanical and pneumatic energy elements in a pneumatic system. (5)

3.4 3.4.1 List THREE hydraulic applications. (3)

3.4.2 State TWO safety precautions when working with pneumatic systems. (2)

3.5 State THREE differences between pneumatic and hydraulic systems. (3)

[20]

QUESTION 4: SURFACE GRINDING

4.1 Choose a phrase from COLUMN B that completes the description in COLUMN A. Write only the letter (A–F) next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Dressing a grinding wheel …	A	by regularly performing a ring test
4.1.2	Truing a grinding wheel is done …	B	could be caused by dirty coolant being used during the grinding operation
4.1.3	The wheel must be inspected for cracks…	C	to correct the out-of-round condition of a grinding wheel
4.1.4	Fishtail scratches on a workpiece …	D	is used for sharpening milling cutters
4.1.5	The flaring-cup wheel …	E	improves the cutting action of the grinding wheel
		F	increases coolant

(5 × 1) (5)

4.2 During a grinding operation on a surface grinding machine the operator notices that the workpiece is getting discoloured or burnt.

4.2.1 Identify TWO factors that cause the workpiece to burn. (2)

4.2.2 State TWO remedial actions that the operator could take to solve the problem in QUESTION 4.2.1. (2)

4.3 Why is it essential that the operator wears safety goggles when he/she is performing a grinding operation? (1)

[10]

QUESTION 5: CENTRE LATHE

5.1 State THREE aspects that should be taken into account during the setup of a lathe for a machining process. (3)

5.2 List THREE lathe parts that are mounted to the lathe carriage. (3)

5.3 The cutting speed for an iron cylindrical shaft is 25 m/min.

Calculate the rotational speed in r/s if this workpiece has a diameter of 600 mm. Hint: $S = \pi \times D \times N$ (3)

Copyright reserved

5.4 The turning job has been completed and you are required to clean the machine.

5.4.1 Explain why it is necessary to do this.

5.4.2 Name the cleaning medium or substance that will you use.

(2 × 1) (2)

5.5 Name any instrument or machine part that is used to set up the workpiece and cutting tool in order to achieve the correct centre height. (1)

[12]

QUESTION 6: MILLING MACHINE

6.1 Name THREE factors that will influence the cutting chip size during the operation of a milling machine. (3)

6.2 A 60 mm diameter cutter with 8 teeth and a cutting speed of 20 m/min has a feed of 0,06 per tooth.

Calculate the feed rate cut in mm/min.

Hint: $S = \pi \times D \times N$ $F = f \times T \times N$ (3)

6.3 Calculate the required indexing using Brown and Sharpe index plates and a set of appropriate change gears when a gear with 97 teeth must be machined on the milling machine.

Brown and Sharpe hole numbers:

Plate 1: 15, 16, 17, 18, 19, 20
Plate 2: 21, 23, 27, 29, 31, 33
Plate 3: 37, 39, 41, 43, 47, 49

Standard gears with number of teeth: 24, 28, 32, 40, 44, 48, 56, 64, 72, 86, 100

HINT: Indexing = $\frac{40}{N}$ Gear ratio = (N-n) $\frac{40}{N}$ (4)

6.4 Give TWO reasons why it is important to do quality checks on milling machine operations. (2)

[12]

Copyright reserved

QUESTION 7: CNC LATHE AND MILLING

7.1 You have received the drawing of a part to be machined on a CNC lathe.

Indicate the correct sequence in which the operation needs to take place. (7)

7.2 The operator notices mistakes in the program that has been set on the centre lathe.

List the steps he will apply manually to edit the program on the CNC controller. (5)

7.3 Calculate the depth of a cut per tooth required for a 32 mm diameter carbide milling cutter with 4 flutes when cutting alloy steel at 820 r/min.

HINT: MMP = $\frac{m/mm}{RPM \times FL}$ S = 60m/min (2)

7.4 A dry run with air cutting is used to detect motion errors and to ensure that the spindle direction correlates with the tool tip. Determining the difference between rapid and feed motions is impossible because the execution is at dry-run feed.

Name the steps you will follow to rectify this problem. (4)

7.5 7.5.1 An artisan has completed a dry-run cycle and notices that the machine has displayed an error.

What can be done to pinpoint exactly which line in the program contains the error? (1)

7.5.2 List the steps to run a normal cycle with single block execution. (5)

7.6 Briefly explain why it is important to keep a backup copy of the internal settings like speed and feed rate of a CNC machine. (2)

[26]

TOTAL: 100

Copyright reserved