



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

**FITTING AND TURNING
NQF LEVEL 4**

NOVEMBER EXAMINATION

(6011044)

**11 November 2016 (X-Paper)
09:00–12:00**

This question paper consists of 10 pages.

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.
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QUESTION 1: PUMPS

- 1.1 Name THREE precautions to be taken into account before and after replacing pump components. (3)
- 1.2 Draw a neat sketch of a flexible impeller pump. Show at least THREE labels. (3)
- 1.3 Briefly describe in your own words the working principle of reciprocating pumps. (2)
- 1.4 Quality checks to maintain pumps and associated equipment are done to ensure the safety of people and to minimise damage to machines and equipment.
- Name any TWO such checks that should be done on the pump motor. (2)

[10]**QUESTION 2: COMPRESSORS**

- 2.1 The vane compressor employs the positive-displacement working principle by design. Make a neat drawing of this compressor and show SIX labels. (3)
- 2.2 Explain the function of the following air-compressor components:
- 2.2.1 Regulator
- 2.2.2 Water drain (2 × 1) (2)
- 2.3 Name any TWO components that could be checked if there is an air leakage in the system. (2)
- 2.4 Once all work is completed you need to do a quality check on the assembly making sure everything is back in its correct place and that the system is ready for use.
- Describe THREE specific quality checks that you must carry out. (3)

[10]

QUESTION 3: HYDRAULIC AND PNEUMATICS

3.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (3.1.1–3.1.2) in the ANSWER BOOK.

3.1.1 Why is de-pressurising of the accumulator necessary before maintenance on a hydraulic system can proceed?

- A The accumulator may be damaged when the system is shut down
- B The oil is stored under high pressure and it can become dangerous to workers
- C The gas in the accumulator will contaminate the oil
- D Oil can leak out of the accumulator when it is opened

3.1.2 Bleeding of the hydraulic brake system of a car means:

- A Cleaning the system of dirt and foreign materials
- B The correct brake fluid is used
- C Getting rid of all the air in the system
- D Flushing out all the old oil from the system

(2 × 1) (2)

3.2 Explain the reason for installing the following safety devices in a hydraulic system:

3.2.1 Mechanical safety device

3.2.2 Electrical safety device.

(2 × 1) (2)

3.3 Give the name of the mechanical safety device that is installed near the receiver. (1)

3.4 The production manager tells the maintenance foreman that he wants the metal-cutting machine repaired in three hours which is under the standard five hours needed for this type of job.

The maintenance foreman assembles his maintenance team to discuss the removal and replacement of a hydraulic pump that lifts and drops the blades of the metal-cutting machine. He promises to give them a party on Friday if they can do the repairs in three hours.

They decide to perform some time-saving activities.

Study each of the proposed activities from 3.4.1–3.4.3 and answer the following questions on each:

- Was this a time saving activity? Answer YES or NO.
- Were the decisions appropriate to the task at hand? Motivate your answer.

- 3.4.1 The electrician's assistant is sent to switch off the power supply and says that he will put the lockout tag on later.
- 3.4.2 The fitter's assistant uses two shifting spanners to loosen the connecting pipes to the hydraulic pump. He/She must make sure that he/she does not spill too much oil from the large pressurised reservoir feeding the pump.
- 3.4.3 The maintenance fitters will have to perform all work on site. The foreman will ensure that they receive all the spares and consumables they require.

(3 × 2) (6)

3.5 State the FOUR main functions of the hydraulic oil/fluid in a hydraulic system. (4)

3.6 Choose a consequence from COLUMN B that matches an activity in COLUMN A. Write only the letter (A–E) next to the question number (3.5.1–3.5.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.6.1	Improper installation of a hydraulic seal	A	may cause serious damage to the machine
3.6.2	Improper fitting of hydraulic hoses by over bending and twisting	B	may result in serious injury to the operator
3.6.3	Failure to de-pressurise the hydraulic system before working on the system	C	may cause hydraulic system failure
3.6.4	Failure to isolate the pneumatic system	D	will suit the operational needs of the hydraulic system
3.6.5	Choosing the correct fluid for the hydraulic system	E	may result in early hose failure

(5)
[20]

QUESTION 4: SURFACE GRINDING

- 4.1 Why is it regarded as standard practice to check the grinding wheel for any defects such as cracks before it is used? (2)
- 4.2 While doing the pre-checks on the condition of the surface grinding machine, you find that the grinding-wheel spindle vibrates when it is started.
- 4.2.1 What can be the cause of this problem?
- 4.2.2 What could happen if this problem is not rectified? (2 × 1) (2)
- 4.3 The job instructions require the machining of the top and bottom face of a case-hardened block. The instructions provided recommends that the faces must be ground parallel and to a fine finish. A straight grinding wheel is to be used.
- 4.3.1 Which holding-down or clamping device would you use? (1)
- 4.3.2 While monitoring the grinding process, you observe that the grinding wheel has become glazed and you also find that the block is heating up.
- (a) What could be the cause of the problem?
- (b) What should be done to rectify it? (2 × 1) (2)
- 4.4 You have completed the grinding of the top face of the block and you are preparing to grind the other side.
- Why do you think it is very important to clean the block and the machine before you proceed with the grinding? (1)
- 4.5 Explain the function of the exhaust system and how it should be maintained on a surface grinder. (2)

[10]

QUESTION 5: CENTRE LATHE

- 5.1 A 50-mm diameter cast iron shaft is to be turned on a lathe. What would the required lathe spindle speed be in revolutions per minute when the cutting speed for turning cast iron is given as 22 m/min?

Formula: $S = \pi \times D \times N$ (3)

- 5.2 An artisan is given a job card to cut a screw thread on a centre lathe. Before he/she can operate the machine he/she needs to do some maintenance checks before starting the lathe.

List THREE of these maintenance checks. (3)

- 5.3 You are required to inspect the hand wheels and feed dials on the lathe.

5.3.1 Identify the main area of concern when you are inspecting these devices.

5.3.2 Explain what the result will be if these devices are not functioning properly.

(2 × 1) (2)

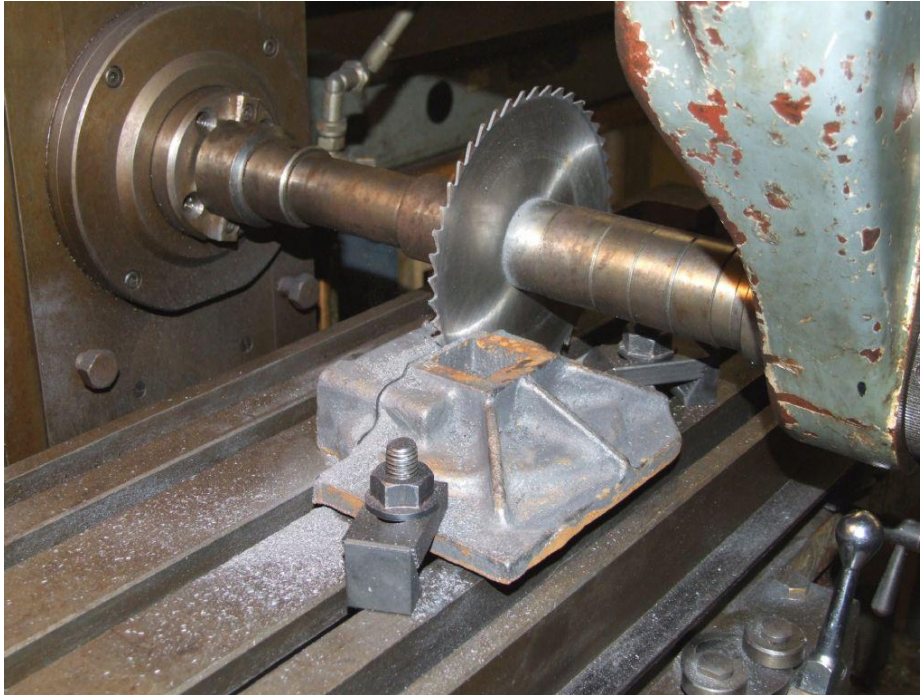
- 5.4 You are required to machine the outside diameter of a brass bush. The machining must be done between centres while the bush is fitted onto a mandrel.

Show with the aid of a neat drawing how the bush is fitted on the mandrel and set up between centres. Label the parts on your drawing.

(3)
[11]

QUESTION 6: MILLING MACHINES

- 6.1 Name TWO types of indexing that can be done by using a dividing head. (2)
- 6.2 FIGURE 1 (below) shows how a slitting cutter is used on a milling machine to cut a machine part. The same cutter must be used to cut a long square bar on the machine.

**FIGURE 1**

- 6.2.1 The holding and clamping devices must be carefully selected to prevent TWO possible problems in the machining operation set out above.

- The workpiece may fall and be damaged on the machine table.
- The workpiece may pinch the cutter, which may cause it to break.

Make a neat, labelled drawing showing how you will clamp the workpiece to prevent these two problems. (3)

- 6.2.2 During the machining process you observe that there are some vibrations on the machine arbour.

Identify ONE probable cause and recommend a solution for the problem. (2)

- 6.2.3 Safety is the most important factor when working on machines. What do you regard as the most important personal protective equipment requirement for the machine operator? (1)

- 6.3 Calculate the indexing required to machine two grooves at an angle of 120° onto a shaft face by using the Cincinnati index plates.

Formula: Indexing = $\frac{\Theta}{9}$

DIVIDING HEAD											
CINCINNATI INDEX PLATES											
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]

QUESTION 7: CNC TURNING AND MILLING

- 7.1 The pneumatic chuck on the numerical controlled lathe can be dangerous to the operators.
What safety precautions must the operator adhere to when he/she changes the workpieces? (1)
- 7.2 Give ONE advantage of using computer numerical-controlled machining processes when compared to normal machining processes. (1)
- 7.3 When setting up the CNC machine to machine a new component, it is important to first have a trial run.
Name TWO reasons why this is recommended. (2)
- 7.4 A CNC machine has various safety devices that protect the operator from injury during the machining process.
Name FOUR such devices and explain how they operate. (4)
- 7.5 A cutting-tool holder is used to hold or clamp a cutting tool.
Name the factors that you need to consider to select the right cutting-tool holder. (3)
- 7.6 When preparing for the workpiece to be machined on the machine, the tools and equipment must be checked.
List any FOUR critical factors that need to be checked during this process. (4)

7.7 An artisan operating the machine must identify and report changes and/or malfunctioning of the machine. Why is it necessary for the artisan to:

7.7.1 Recognise problems

7.7.2 Report problems

7.7.3 Recognise changes

7.7.4 Report changes

(4 × 1) (4)

7.8 Explain what you understand by the quality control of the process used to measure components. (3)

7.9 FIGURE 2 (below) shows the direction and pathways a drill has to follow to machine the holes at 'b' and 'c'.

Calculate the X-axis and Y-axis dimensions by using the absolute dimension method.

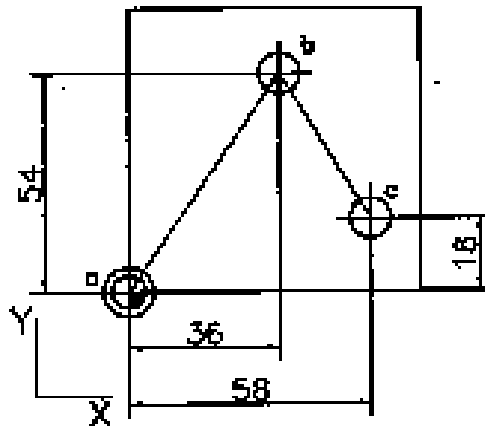


FIGURE 2

7.9.1 Do not write the program, but only write down the X and Y dimensions needed for the program. (2)

7.9.2 Write a simple program line by using the standard program writing format and appropriate codes to instruct the machine to rapidly move the drill from 'b' to 'c'. (3)

[27]

TOTAL: 100