



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MECHANICAL TECHNOLOGY: FITTING AND MACHINING

NOVEMBER 2022

MARKS: 200

TIME: 3 HOURS

This question paper consists of 12 pages and a 2-page formula sheet

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INSTRUCTIONS AND INFORMATION

1. Write your NAME in your answer book.
2. Read ALL the questions carefully.
3. Answer ALL the questions.
4. Number the answers correctly according to the numbering system used in the question paper.
5. The value of gravitational acceleration should be taken as $10 \text{ m}\cdot\text{s}^{-2}$.
6. Start EACH question on a NEW page.
7. Show all calculations and units. Round off final answers to TWO decimal places.
8. All dimensions are in millimetres, unless stated otherwise in the question.
9. A formula sheet is attached to the question paper.
10. Sketches must be neat.
11. Write neatly and legibly
12. Use the criteria below to assist you in managing your time.

| GENERIC | | | |
|-----------------|----------------------------------|--------------|--------------------|
| QUESTION | CONTENT | MARKS | TIME |
| 1 | Multiple-choice questions | 20 | 15 minutes |
| 2 | Safety | 24 | 15 minutes |
| 3 | Tools and Equipment | 16 | 10 minutes |
| 4 | Maintenance | 8 | 10 minutes |
| 5 | Materials | 32 | 20 minutes |
| SPECIFIC | | | |
| 6 | Terminology | 25 | 30 minutes |
| 7 | Tools and Equipment | 8 | 8 minutes |
| 8 | Forces | 22 | 19 minutes |
| 9 | Maintenance | 8 | 8 minutes |
| 10 | Joining Methods | 10 | 10 minutes |
| 11 | Systems and Control | 16 | 16 minutes |
| 12 | Pumps | 12 | 12 minutes |
| | GRAND TOTAL | 200 | 180 minutes |

QUESTION1: MULTIPLE-CHOICE QUESTIONS (GENERIC)

Various possible answers are given in the following questions. Answer the questions by writing A, B, C or D against the question answer. For example 1.21 D.

- 1.1 Which ONE of the following safety precautions is applicable when using hand tools?
- A. Work at a very slow speed
 - B. Work with well-lubricated tools
 - C. Use tools only for the purpose for which they were made
 - D. Replace all tools after use (1)
- 1.2 Which of the following is a cause of accidents?
- A. Work at safe speed
 - B. Use of correct tools for the job
 - C. Wear protective clothing
 - D. Wear loose fitting clothing at the lathe (1)
- 1.3 Which of the following statements is an unsafe act in the workplace?
- A. Poor lighting
 - B. Not using safety goggles while drilling
 - C. Slippery floor
 - D. Insufficient machinery (1)
- 1.4 Which of the following processes would you use to remove small amounts of material from an undersized hole so as to produce an accurate size?
- A. Counter sinking process
 - B. Reaming process
 - C. Boring process
 - D. Drilling process (1)
- 1.5 Before you start working on the bench grinder, make sure the tool rest is not further thanmm from the grinding machine
- A. 2,5
 - B. 3
 - C. 2
 - D. 5 (1)

- 1.6 The drill press can be classed as one of the following ways:
A. Cutting machine
B. Grinding machine
C. Shearing machine
D. Pressing machine (1)
- 1.7 A set of internal tapers for internal threads comprise of the following:
A. Taper tap
B. Intermediate tap
C. Bottoming tap
D. All of the above (1)
- 1.8 The process of relieving stresses, set up by cold working is known as
A. Casting
B. Hardening
C. Tempering
D. Normalising (1)
- 1.9 Which of the following statements is a description of annealing?
A. Restoring metal to its softest state
B. Shaping of metal by hammer when red hot
C. Removing some of the brittleness after hardening
D. Producing maximum harness (1)
- 1.10 What is the round dies used for?



FIGURE 1.10

- A. Cutting internal threads
B. Countersink a hole
C. Cut external threads on round bars
D. All of the above (1)

- 1.11 What is a guillotine used for in the mechanical workshop?
A. To roll sheet metal
B. To bend sheet metal
C. To cut sheet metal
D. To join sheet metal (1)
- 1.12 A hydraulic press employs the principle of the multiplication of a force within a closed system by using
A. Air under pressure
B. Fluid under pressure
C. Electric current
D. Lever advantage (1)
- 1.13 What is the value of Θ if $\tan \Theta = 0.86$?
A. $34,22^\circ$
B. $43,69^\circ$
C. $40,69^\circ$
D. $46,96^\circ$ (1)
- 1.14 Which of the following statements result in the malfunctioning of a bearing?



FIGURE 1.14

- A. Damaged or worn oil seal
B. Excessive use of grease
C. A limited use of machinery
D. All the above mentioned (1)
- 1.15 Lack of lubrication in any type of machinery is caused by
A. overloading
B. low operating speed
C. undercutting
D. high volatility (1)

- 1.16 Elasticity refers to a metal's ability to
A. change shape without breaking
B. return to its original shape after being deformed
C. resist corrosion by air, moisture and chemicals
D. combine with other metal easily to form alloys (1)
- 1.17 The most important method of extracting iron from iron ore is called
A. smelting
B. charging
C. alloying
D. tempering (1)
- 1.18 What is smelted in a blast furnace?
A. Rocks
B. Iron ore
C. Pig iron
D. Carbon (1)
- 1.19 Which element is used to make coke used in a blast furnace?
A. Limestone
B. Dolomite
C. Coal
D. Iron ore (1)
- 1.20 Inside the blast furnace, impurities from iron ore become trapped in the.....
A. cupola
B. stoves
C. molted limestone
D. carbon monoxide (1)

[20]

QUESTION 2: SAFETY (GENERIC)

- 2.1 List FOUR pre-checks that need to be done before switching on the bench grinder. (4)
- 2.2 Give THREE safety rules to follow when handling gas cylinders. (3)
- 2.3 Name FOUR safety precautions that must be observed when using a portable hand drill. (4)

- 2.4 Which safety devices or guards are used in conjunction with shearing machines (guillotines) (2)
- 2.5 Name THREE personal protective items to be worn while operating machinery in a workshop. (3)
- 2.6 Which important safety procedure should be carried out after finishing the cutting process on a lathe? (1)
- 2.7 Name THREE safety precautions when working on a hydraulic press. (3)
- 2.8 What are the FOUR main causes of accidents in the workshop? (4)

[24]

QUESTION 3: TOOLS AND EQUIPMENT (GENERIC)

- 3.1 Describe the function of the following equipment:
- 3.1.1 Angle grinder (2)
- 3.1.2 Rolling machine (2)
- 3.1.3 Press machine (2)
- 3.2 What is the function of the diagram shown in FIGURE 3.2 below?



FIGURE 3.2 (2)

- 3.3 Name THREE reasons for using a torque wrench on an engine (4)
- 3.4 Explain the purpose of the extension bars of a guillotine? (2)
- 3.5 Give TWO types of drilling machines used in the workshop. (2)

[16]

QUESTION 4: MAINTENANCE (GENERIC)

- 4.1 What is the purpose of lubrication? (2)
- 4.2 Name THREE properties of a good lubricant. (3)
- 4.3 What is the result of lack of lubrication? (1)
- 4.4 Mention TWO factors to be taken to consideration when choosing a lubricant for a specific factor. (2)

[8]

QUESTION 5: MATERIALS (GENERIC)

- 5.1 Why is annealing one of the most important processes in the heat treatment of steel? (2)
- 5.2 Name the product produced by a blast furnace. (1)
- 5.3 FIGURE 5.3 below shows the cross-sectional view of a furnace

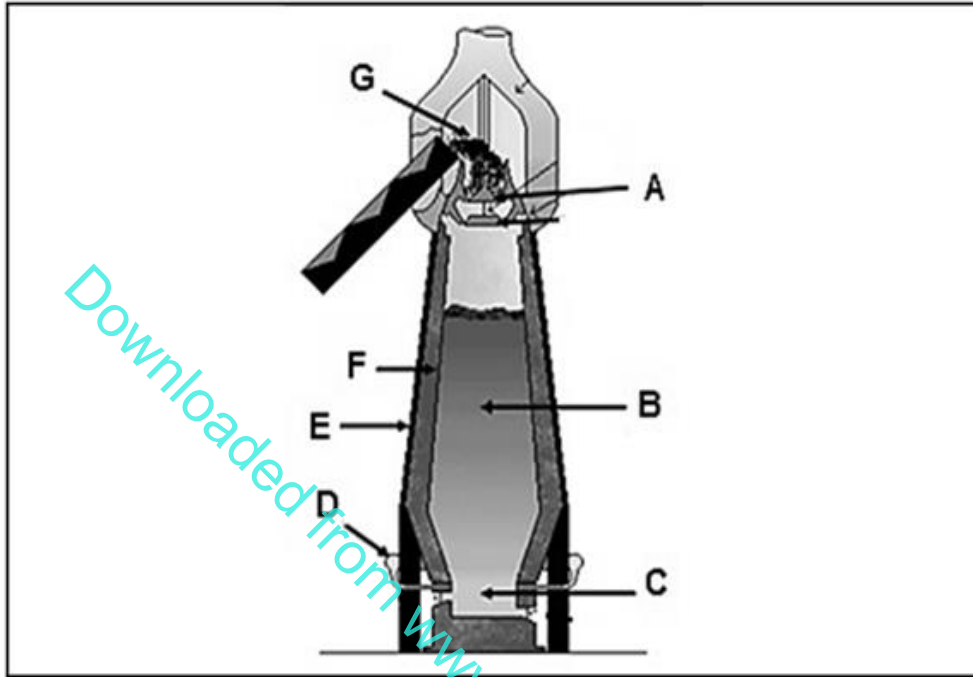


FIGURE 5.3 (7)

- 5.4 State ONE function of each of the following elements used in a blast furnace: (7)
- 5.4.1 Iron ore. (2)
 - 5.4.2 Coke. (2)
 - 5.4.3 Limestone or dolomite. (2)
- 5.5 Briefly explain how cold chisels are tempered. (4)
- 5.6 The hardening of steel process can be achieved through a specific heat treatment which depends on the three factors. Name these THREE factors (3)
- 5.7 Describe the operation of an electric-arc furnace. (3)
- 5.8 Which procedure will you follow to determine whether steel has been heated to a hardening temperature? (2)
- 5.9 Choose a definition from COLUMN B that matches a process in COLUMN A. Write only the letter (A-D) next to the question number (5.9.1-5.9.4) in the ANSWER BOOK, for example 5.9.5 E. (4)

| COLUMN A | COLUMN B |
|----------------------|--|
| 5.9.1 Tempering | A. The metal is heated to a specified temperature and then cooled in still air. |
| 5.9.2 Annealing | B. In this process the outer case is turned into a high-carbon steel. |
| 5.9.3 Normalising | C. The steel is heated to a suitable temperature and quenched again. |
| 5.9.4 Case-hardening | D. The metal is heated to a specified temperature and then slowly cooled in the furnace. |

[32]

QUESTION 6: TERMINOLOGY (SPECIFIC)

- 6.1 The compound slide method is one method of taper turning. Mention TWO advantages of this method. (2)
- 6.2 Describe the function of each of the following types of equipment on a centre lathe:
- 6.2.1 Tool post (2)
- 6.2.2 Tailstock (2)
- 6.3 A three-start thread with a pitch of 7 mm is to be cut on a centre lathe. If the mean diameter of the thread is 68mm, calculate the following:
- 6.3.1 The helix angle of the thread (4)
- 6.3.2 The leading tool angle (2)
- 6.3.3 The following tool angle (2)
- 6.4 Describe the difference between a horizontal and vertical milling machine (2)
- 6.5 A parallel key needs to be manufactured to secure a pulley onto a 48 mm diameter shaft. Calculate the following dimensions of the key:
- 6.5.1 The width of the key (3)
- 6.5.2 The thickness of the key (3)
- 6.5.3 The length of the key (3)

[25]

QUESTION 7: TOOLS AND EQUIPMENTS (SPECIFIC)

7.1 State ONE purpose of the following

7.1.1 Dial test indicator (1)

7.1.2 Tap wrench (1)

7.2 Give THREE reasons of using a dial indicator. (3)

7.3 FIGURE 7.3 has an illustration of a micrometer. Determine the reading displayed on the micrometer shown below. (3)

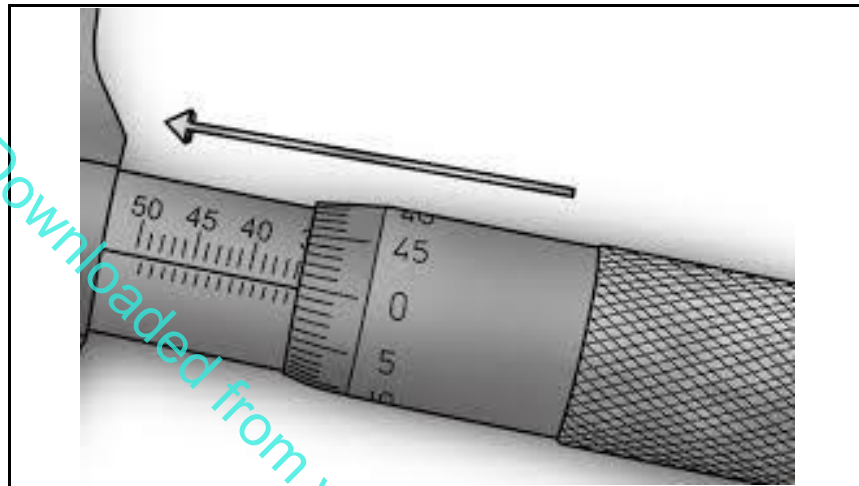


FIGURE 7.3

[8]

QUESTION 8: FORCES (SPECIFIC)

8.1 The FIGURE 8.1 indicates a beam supported by two vertical supports, A and B. the vertical point loads of 800 N and 350 N are exerted onto the beam. Calculate the magnitude of the reactions in supports A and B.

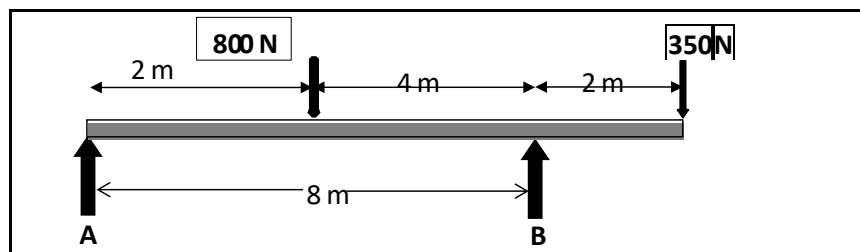


FIGURE 8.1

(6)

8.2 Calculate the compressive stress in a brass bush caused by a load of 25 kN.
The bush has an outside diameter of 65 mm and an inside diameter of 58mm. (6)

8.3 The FIGURE 8.3 below shows a system of forces with three coplanar forces acting on the same point. Use calculations and determine the magnitude and direction of the resultant force of this system of forces.

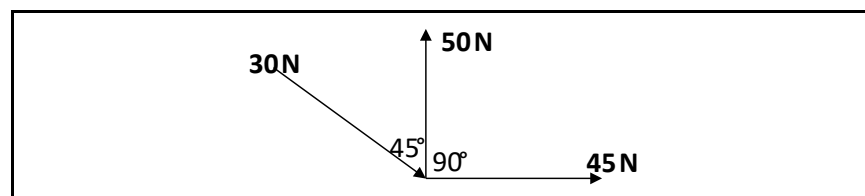


FIGURE 8.3 (10)

[22]

QUESTION 9: MAINTENANCE (SPECIFIC)

9.1 Explain the following terms used when studying

9.1.1 Viscosity (2)

9.1.2 Static balancing (2)

9.1.3 Coefficient of friction (2)

9.2 State ONE procedure that may be followed to reduce physical wear on the milling cutter of a milling machine. (2)

[8]

QUESTION 10: JOINING METHODS (SPECIFIC)

10.1 What are the basic applications of screw threads? (2)

10.2 Define the following terminologies:

10.2.1 Crest (2)

10.2.2 Depth of screw angle (2)

10.2.3 Axis (2)

10.3 The pitch of a M20 V-screw thread is 2.5 mm. Calculate the depth of the screw thread. (2)

[10]

QUESTION 11: SYSTEMS AND CONTROL (SPECIFIC)

- 11.1 List FOUR disadvantages of spur gears. (4)
- 11.2 Calculate the force on a piston rod, 30 mm in diameter, during the forward stroke. The diameter of the piston is 110 mm and the pressure in the cylinder is 1,5MPa. (4)
- 11.3 Gear system is used to control a mechanical gate. The driver gear has 46 teeth and rotates at 500 r/min. The idler gear that is used to change the direction of rotation rotates at 1000 r/min. the driven gear has 60 teeth.
- 11.3.1 Determine by means of calculations, the number of teeth on the idler gear. (4)
- 11.3.2 Determine by means of calculations, the rotation frequency of the driven gear in revolutions per minute. (4)

[16]

QUESTION 12: PUMPS

- 12.1 State the purpose of the volute casing used pumps. (2)
- 12.2 List TWO applications of pumps (2)
- 12.3 FIGURE 12.3 shows a type of pump which can be used.

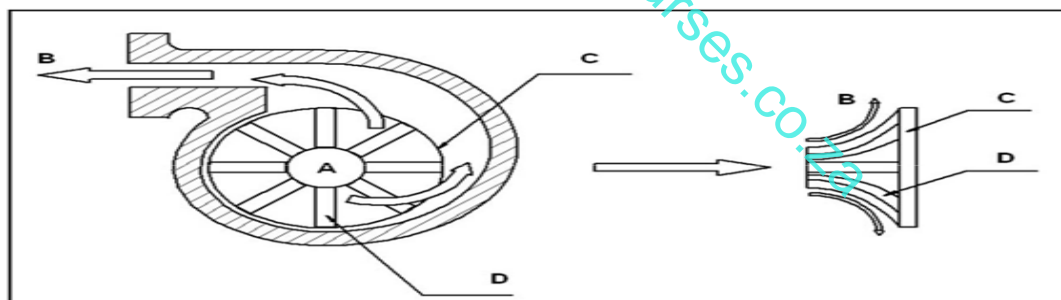


FIGURE 12.3

- 12.3.1 Identify the type of pump shown in FIGURE 12.3 (1)
- 12.3.2 Label parts **A-D** (4)
- 12.3.3 Explain the operation of the pump in FIGURE 12.3 (3)

[12]

TOTAL: 200