MCHT

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IIMVIWO ZEBANGA LOKUGQIBELA
NATIONAL SENIOR CERTIFICATE EXAMINATION
NASIONALE SENIOR SERTIFIKAAT-EKSAMEN

JUNE COMMON TESTS 2008

MECHANICAL TECHNOLOGY

IXESHA: 3 iiyure **TIME: 3 hours** **TYD: 3 uur**
AMANQAKU: 200 **MARKS: 200** **PUNTE: 200**

Write on the cover of your answer book, after the word "Subject" –
MECHANICAL TECHNOLOGY

This examination paper consists of 12 pages.

INSTRUCTIONS

1. Write your centre number and examination number in the spaces provided on the ANSWER BOOK.

2. Answer ALL the questions.

3. Read ALL the questions carefully.

4. Number the answers correctly according to the numbering system used in this question paper.

5. Write neatly and legibly.

6. Show ALL the calculations and units. Round off answers to TWO decimal places.

7. Candidates may use non-programmable scientific calculators, as well as drawing/mathematical instruments.

8. The value of the gravitational force should be taken as 10 m/s^2.

9. Use the criteria below to assist you in managing your time.

QUESTION	ASSESSMENT STANDARDS	CONTENTS COVERED	MARKS	TIME
1	1 – 9	Multiple-choice questions	20	18 minutes
2	6 and 8	Forces, Systems and Control	50	45 minutes
3	2	Tools and Equipment	20	18 minutes
4	3	Materials	20	18 minutes
5	1 and 4	Production, Construction methods and Safety	50	45 minutes
6	5	Joining methods	40	36 minutes
		TOTAL	**200**	**180 minutes**

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

(LO3: AS 1 — 9)

1.1 HIV AIDS is a transmitted disease from one person too another by …

A using the same cooking utensils.
B wearing the same clothing.
C using the same toilet facilities.
D tattoos or circumcision with infected needles.

1.2 Arc rays can burn eyes and skin. Identify the description that prevents others to be affected during arc welding in a workshop?

A To provide a non-flammable shielding
B By welding in ventilated areas
C By using double insulated protection during welding
D Wearing clear safety goggles

1.3 Which of the following advance engineering equipment are used to test pressure in a pressure vessel or cylinder?

A Gas analyser
B Compression tester
C Charpy impact tester
D Cylinder leakage tester

1.4 The 'hardness' of metal, alloy and plastic are being tested with a …

A Rockwell tester
B Torsion tester
C Hydraulic bending machine
D Compression tester

1.5 Which tester allows you to investigate the relationship between the torque applied to material and the influence of the material, as well as member length on deflection.

A Torsion tester
B Tensile tester
C Beam bending tester
D Moments and force tester

1.6 Which of the following thermosetting plastics are used in the manufacturing of vehicle body parts?

A Polyamide (nylon)
B Polyurethane
C Polyesters resins
D Tufnol (re-inforced plastic)

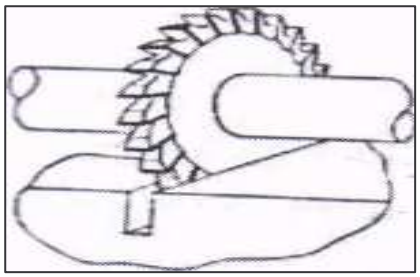
1.7 After copper becomes hardened, it can be restored to its original softness and ductility through a process called …

A hardening.
B annealing.
C tempering.
D normalising.

1.8 What happens to zinc when it is exposed to the atmosphere?

A Zinc will be corroded due to air molecules.
B Zinc becomes coated with an oxide film to prevent rust.
C Zinc becomes coated with a carbonated film that prevents corrosion.
D Zinc will become brittle when exposed to air.

1.9 Milling is an important process during manufacturing of gears. Identify the type of milling cutter shown in the picture below.



A Cylindrical cutter
B Concave cutter
C T-slot cutter
D Side and face cutter

1.10 Chamfering is carried out to remove sharp edges on a work piece. Which process would you use for internal chamfering of a drilled hole.

A Reaming process
B Countersink process
C Slotting process
D Spotfacing process

1.11 During Plain or Slab milling, which of the following is part of the set-up process?

A Bolt down the vice on the machine table.
B Check on the dial-test indicator whether the vice is square on the machine table.
C Calculate the cutting speed for the type of cutter and the material.
D All the above-mentioned.

1.12 The importance of cutting fluid during a drilling process is …

1 to prolong the tools life.
2 to prevent corrosion.
3 to ensure a better finish to the work piece.
4 all the above mentioned.

A 1 and 2
B 1 and 3
C 2 and 3
D 4

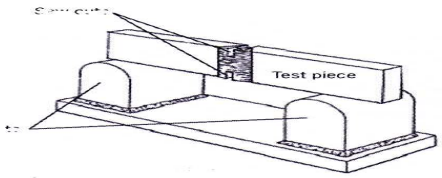
1.13 Why are slitting saws tapered towards the bore?

A To prevent binding
B To allow tilting of the saw
C To have a free cutting action
D To prevent blade from breaking

1.14 Porosity is a welding defect. Which of the following is NOT a cause of porosity?

A Atmospheric contamination
B Surface contamination
C Rusted MIG wire
D Poor penetration due to power shading

1.15 What is understood by the term, “nick-break test”?



A Breaking the weld to examine the internal defects.
B Breaking the weld to examine the external defects.
C Checking the shear fracture of the welded metal.
D To determine the depth fusion and amount of penetration.

1.16 Which non-destructive testing procedures is used to determine surface flaws?

A Ultrasonic testing
B Visual testing
C X-ray testing
D Liquid dye penetration

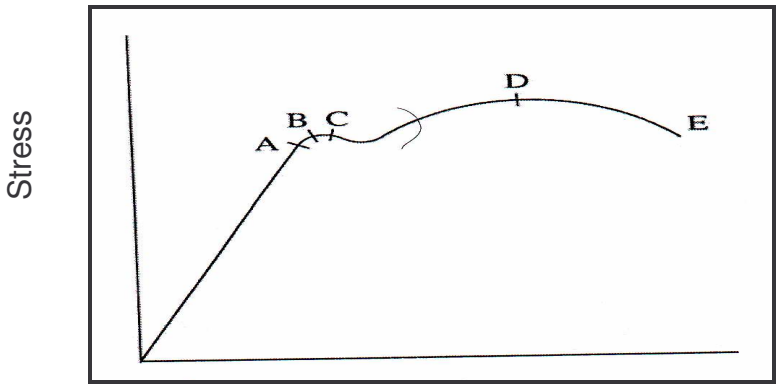
1.17 What is understood by Young's modulus of elasticity?

A Strain is directly proportional to the stress it causes.
B Stress value required to produce unit strain in a tensile specimen of a particular material.
C Maximum allowable stress in a material to prevent it from yielding.
D The number of times with the maximum stress is decreased to obtain a safe stress.

1.18 What will the tensile stress be when a 5 x 15 mm rectangular bar is subjected to a tensile load of 15 kN?

A 200 MPa
B 250 MPa
C 175 MPa
D 2000 MPa

1.19 Which of the following identifies the maximum stress in a material which is exceeded to a bar yield and break as shown on the stress/strain diagram?



A Maximum stress
B Breaking stress
C Yield point
D Elastic limit

1.20 Which of the following defines compressive stress?

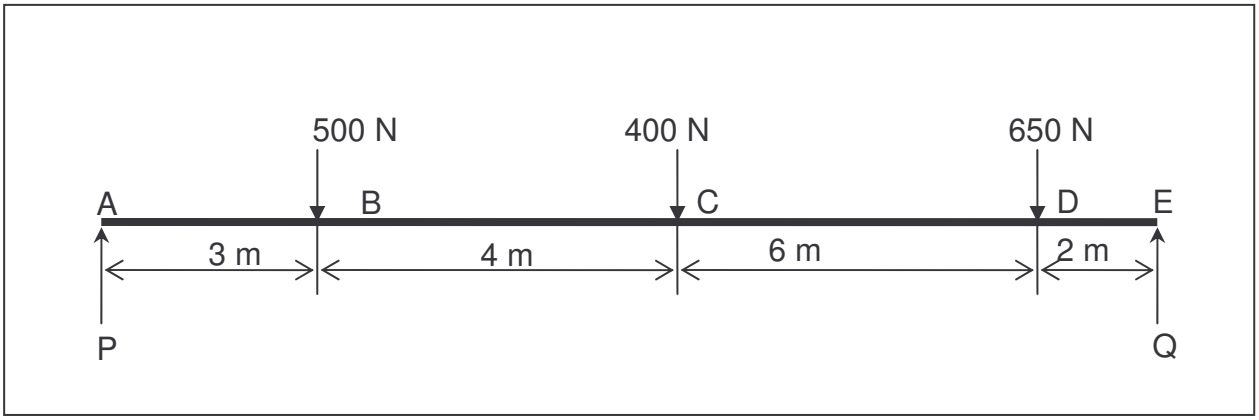
A An internal force in the material which resists a shearing load between two plates.
B Is an internal force present in a material when an external load is applied.
C Is an internal force present in a material resisting an external load.
D Is an external force acting upon a matter.

(20 x 1) **[20]**

QUESTION 2: APPLIED MECHANICS (FORCES) (LO3: AS 6 and 8)

2.1 The diagram below shows a beam AE with a span of 15 m, subjected to THREE point loads. Calculate the reaction forces P and Q and construct the shear force diagram for the beam.

Scale: Space diagram 5 mm = 1 m (beam)
Shear force 5 mm = 100 N



2.1.1 Calculate the reaction force P. (5)
2.1.2 Calculate the reaction force Q. (5)
2.1.3 Draw the beam according to scale. (4)
2.1.4 Draw the shear force diagram to scale. (7)

2.2 Explain the definitions of the following concepts:

2.2.1 Stress (2)
2.2.2 Strain (2)
2.2.3 Tensile stress (2)
2.2.4 Shearing stress (2)
2.2.5 Safety factor (2)

2.3 Calculate the compression stress in a 15 mm diameter round bar if it is subjected to a compressive load of 30 kN. (4)

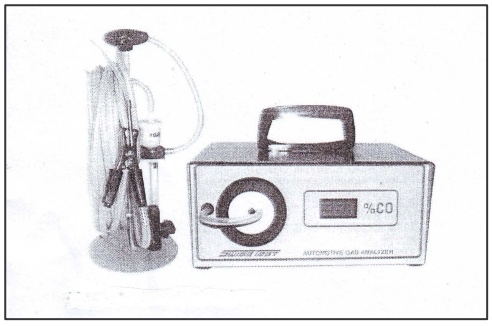
2.4 Calculate the strain in a steel rod which has elongated by 0,5 mm under a tensile load if the original length was 6 m. (5)

2.5 A 32 mm diameter round bar lengthens by 0,5 mm in a tensile test under a load of 100 kN. Calculate Young's modulus (E) for the bar if it's original length was 120 mm. (10)

[50]

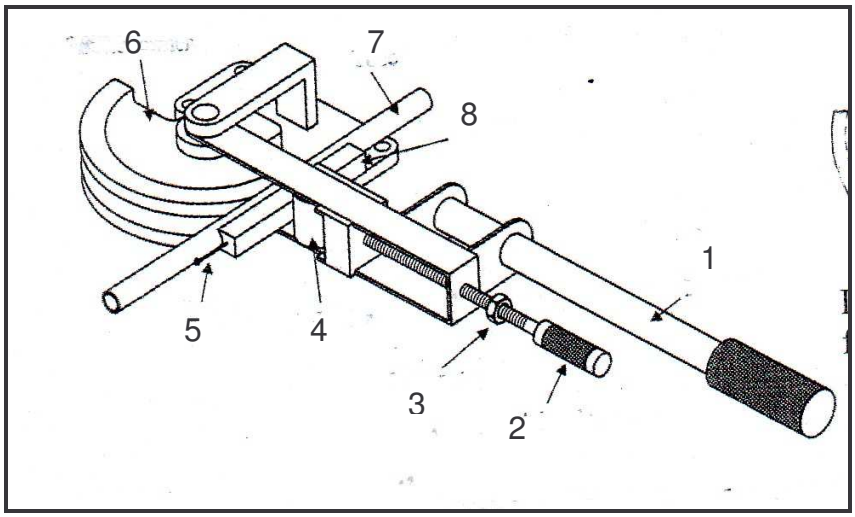
QUESTION 3: TOOLS AND EQUIPMENT (LO3: AS 2)

3.1 Because of the increase in fuel prices, the workshop instructor, Mr Dlamini asked the learners to perform an air/fuel ratio test using the gas analyzer. Explain the procedures of the gas analyzing machine step-by-step. (6)



3.2 How would you determine where the leakage is when performing a leakage test on a four stroke, four cylinder engine. (6)

3.3 The drawing below shows a mechanical tube bender which is used to bend mediumtubes and pipes used in the Mechanical workshop. Label the parts from 1 – 8. (8)



[20]

QUESTION 4: MATERIAL (LO3: AS 3)

The materials used in engineering industry are mostly metals.

4.1 Define the following mechanical properties of steel:

4.1.1 Toughness (2)
4.1.2 Elasticity (2)
4.1.3 Malleability (2)
4.1.4 Ductility (2)
4.1.5 Brittleness (2)
4.1.6 Hardness (2)
4.1.7 Tensile strength (2)

(14)

4.2 Heat treatment is carried out with the aim of giving the steel specific mechanical and physical properties.
Explain the purpose of the following heat treatment:

4.2.1 Annealing (2)
4.2.2 Normalising (2)
4.2.3 Hardening (2)
(6)

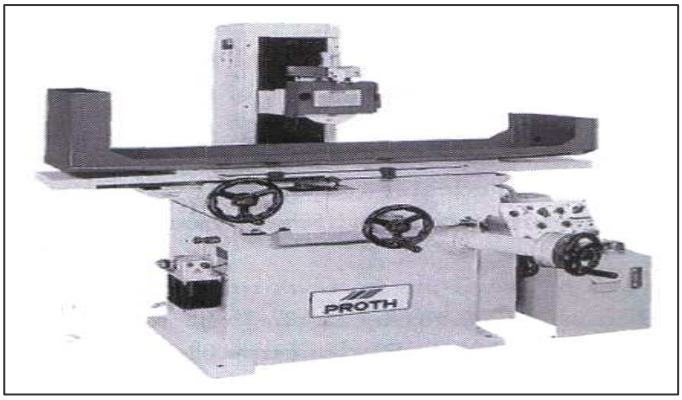
(20)

QUESTION 5: SAFETY and TERMINOLOGY (LO3: AS 1 and 4)

5.1 Xolani has been selected to demonstrate the joining technique using an arc welding machine.
In order to carry out the process, Xolani needs to observe the safety precautions before starting to weld.
Name FOUR safety precautions. (4)

5.2 A hexagon needs to be milled on a 20 mm diameter shaft as required by the practical project specifications. Due to a broken milling machine Andile was forced to use the SURFACE GRINDER to complete his project.
Identify FOUR safety precautions. (4)

SURFACE GRINDER



5.3 Guillotines are mostly used in the sheet metal industry. This can be a very dangerous activity. Name two safety devices which are used in conjunction with guillotines. (2)

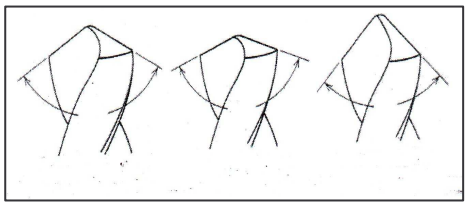
5.4 In the mechanical workshop, André was instructed to press out a rubber bush of the n a lower control arm of a Ford Bantam bakkie. Although he is familiar with the **hydraulic press**, Andre needs to follow the safety precautions. Name FIVE precautions that need to be observed before working on the machine. (5)

5.5 The acetylene gas of a welding plant is highly flammable. Name FIVE safety precautions that will prevent the cylinders from exploding when working with it. (5)

5.6 In the mechanical workshop, learners need to understand how to operate the horizontal POWER SAW. Identify FIVE procedures when metal is cut to size. (5)

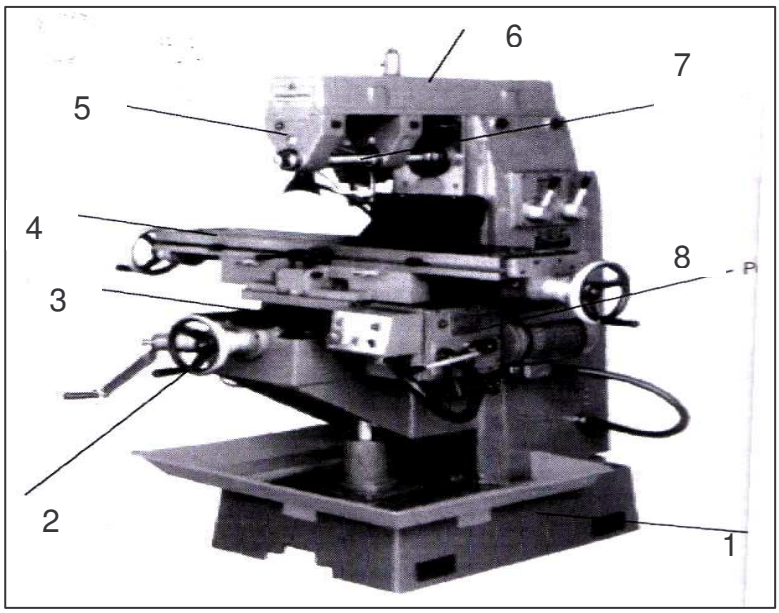
5.7 A set of standard drill bits are shown below. Write down the angle and give the practical use of each of the drill bits labeled A, B and C (6)

A **B** **C**

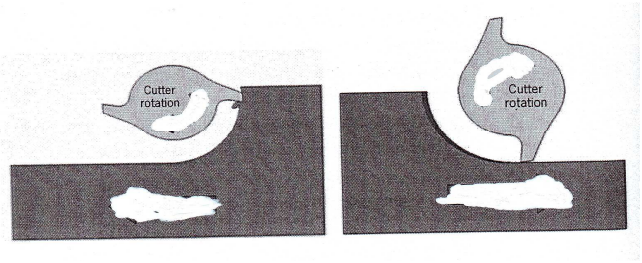


5.8 Name FOUR methods of indexing when using the milling machine. (4)

5.9 The following cross sectional view of a milling machine is shown below. Label the drawing from 1 to 8 (8)



5.10 Copy the sketches to demonstrate the difference between milling–up and milling-down, showing the cutter rotation the feed direction of the milling processes by means of arrows. (5)



5.11 When using simple indexing a Milling machine is used to mill 17 teeth on a gear blank. Calculate the indexing required on a Cincinnate index head. (2)
[50]

QUESTION 6: JOINING METHODS (LO3: AS 1 and 5)

6.1 When arc welding mild steel, there are certain possible welding defects that may occur during the process. State TWO possible causes and one remedy for each of the following defects. Create a table form.

Example:

NO.	*WELD DEFECTS*	*CAUSES*	*CURE*
1	*Slag inclusion*	*Gases entrapped in metal*	*Grind off and re-weld*

6.1.1 Poor/lack of penetration (3)
6.1.2 Poor/lack of fusion (3)
6.1.3 Spatter (3)
6.1.4 Cracks (3)

6.2 **Scenario**:

Mr. Khumalo is a non-destructive testing inspector for Nelly NDT inspectorate. He was requested to perform a non-destructive test on a finished weld.

6.2.1 Identify THREE non-destructive tests that you think Mr. Khumalo may prefer using. (3)

6.2.2 Formulate the test procedure of one of the three non-destructive test mentioned. (7)

6.3 In fusion welding, process heat is used to melt the base metal (parent metal) or the base and the filler metals for a weld pool, which is protected by flux cover. In the molten state, the metal mixes, and as it solidifies, the weld metal forms the bond between the two components to be joined.

Name the FIVE main fusion welding processes. (5 x 2) (10)

6.4 Joining materials by means of arc or gas welding is a dangerous activity. Name TWO safety precautions each under the following headings:

6.4.1 electric shock (2)
6.4.2 fumes (2)
6.4.3 arc-rays (2)
6.4.4 welding sparks (2)
[40]

GRAND TOTAL: 200