



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**NOVEMBER 2017**

**MECHANICAL TECHNOLOGY**

**MARKS: 200**

**TIME: 3 hours**

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This question paper consists of 28 pages, including a 1-page formula sheet.

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**INSTRUCTIONS AND INFORMATION**

1. Write your NAME on the ANSWER BOOK.
2. This question paper consists of FOUR sections:  
SECTION A: COMPULSORY  
SECTION B: FITTING AND MACHINING  
SECTION C: AUTOMOTIVE  
SECTION D: WELDING AND METALWORK
3. Answer SECTION A (COMPULSORY) and then answer SECTION B or C or D, according to your choice of specialisation.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Start EACH question on a NEW page.
6. Show ALL calculations and units. Round off final answers to TWO decimal places.
7. You may use a non-programmable scientific calculator and drawing instruments.
8. The value of gravitational force should be taken as  $10 \text{ m.s}^{-2}$ .
9. All dimensions are in millimetres, unless stated otherwise in the question.
10. Write neatly and legibly.
11. A formula sheet is attached to the question paper.
12. Use the criteria at the beginning of each section to assist you to manage your time.

<b>SECTION A: COMPULSORY (Page 4)</b>			
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT COVERED	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	25 minutes
<b>TOTAL FOR SECTION A</b>		<b>100</b>	<b>75 minutes</b>

<b>SECTION B: FITTING AND MACHINING (SPECIFIC) (Page 14)</b>			
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
6	Terminology (Specific)	25	30 minutes
7	Tools and Equipment (Specific)	8	8 minutes
8	Forces (Specific)	19	19 minutes
9	Maintenance (Specific)	8	8 minutes
10	Joining Methods (Specific)	12	12 minutes
11	Systems and Control (Specific)	16	16 minutes
12	Pumps (Specific)	12	12 minutes
<b>TOTAL FOR SECTION B</b>		<b>100</b>	<b>105 minutes</b>
<b>TOTAL FOR SECTION A + B</b>		<b>200</b>	<b>180 minutes</b>

<b>SECTION C: AUTOMOTIVE (SPECIFIC) (Page 19)</b>			
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
13	Tools and Equipment (Specific)	9	10 minutes
14	Engines (Specific)	15	15 minutes
15	Systems and Control (Specific)	29	30 minutes
16	Maintenance (Specific)	11	10 minutes
17	Forces (Specific)	30	35 minutes
18	Terminology (Specific)	6	5 minutes
<b>TOTAL FOR SECTION C</b>		<b>100</b>	<b>105 minutes</b>
<b>TOTAL FOR SECTION A + C</b>		<b>200</b>	<b>180 minutes</b>

<b>SECTION D: WELDING AND METALWORK (SPECIFIC) (Page 24)</b>			
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
19	Welding Terminology (templates, trusses, cost calculations, terms, welding symbols) (Specific)	18	18 minutes
20	Tools and Equipment (Specific)	7	5 minutes
21	Forces (Specific)	17	15 minutes
22	Maintenance (Specific)	6	5 minutes
23	Joining Methods (Specific)	15	15 minutes
24	Terminology (development) (Specific)	19	27 minutes
25	Terminology (steel sections) (Specific)	18	20 minutes
<b>TOTAL FOR SECTION D</b>		<b>100</b>	<b>105 minutes</b>
<b>TOTAL FOR SECTION A + D</b>		<b>200</b>	<b>180 minutes</b>

**SECTION A: COMPULSORY**

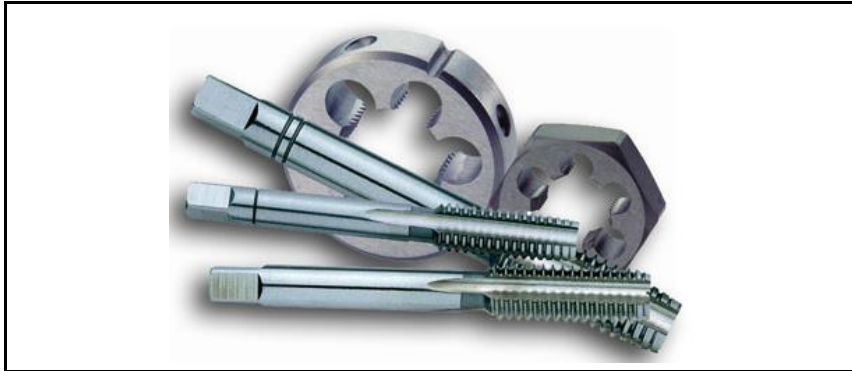
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT COVERED	MARKS	TIME
1	Multiple-choice	20	15 minutes
2	Safety	24	15 minutes
3	Tools and equipment	16	10 minutes
4	Maintenance	8	10 minutes
5	Materials	32	25 minutes
<b>TOTAL FOR SECTION A</b>		<b>100</b>	<b>75 minutes</b>

**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

Four possible answers, indicated by A, B, C and D are supplied as possible answers to each question. Choose the correct answer and write the letter of your choice next to the question number in the answer book, for example 1.21 C.

- 1.1 What is the purpose of the Occupational Health and Safety Act (OHSA), 1993 (Act 85 of 1993)?
- A It governs your health in the work place.
  - B It governs your safety in the work place.
  - C It governs your health and safety in the work place.
  - D None of the above. (1)
- 1.2 HIV is transmitted in one of the following ways:
- A Unprotected sexual contact
  - B Using shared syringes and needles
  - C Tattoos or circumcision with infected instruments
  - D All of the above (1)
- 1.3 The drill press can be classed as one of the following machines:
- A Cutting machine
  - B Grinding machine
  - C Shearing machine
  - D Pressing machine (1)

1.4 A set of internal taps for internal threads comprise of the following:



**FIGURE 1.4**

- A Taper tap  
B Intermediate tap  
C Plug or bottoming tap  
D All of the above (1)
- 1.5 The process of relieving stresses, set up by cold working is termed ...  
A casting.  
B hardening.  
C tempering.  
D normalising. (1)
- 1.6 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)
- 1.7 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)

- 1.8 Which ONE does NOT fit which needs to be taken into consideration when working with a hydraulic press?



FIGURE 1.8

- A The predetermined pressure may be exceeded for a short period of time.  
B The platform must be rigid and square with the cylinder of the press.  
C The platform must rest on the supports provided.  
D All the bolts and nuts are tightened on the apparatus. (1)

- 1.9 What are round dies used for?



FIGURE 1.9

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

1.10



FIGURE 1.10

An angle grinder, as illustrated in FIGURE 1.10, is a hand-held power tool used for ...

- A cutting.
- B grinding.
- C polishing.
- D All of the above.

(1)

1.11 Power driven guillotines usually work by activating ...



FIGURE 1.11

- A a manual switch.
- B an electric foot pedal.
- C an automatic guard.
- D a high powered blade.

(1)

1.12 A 100 N force is inclined at 30° to the horizontal.

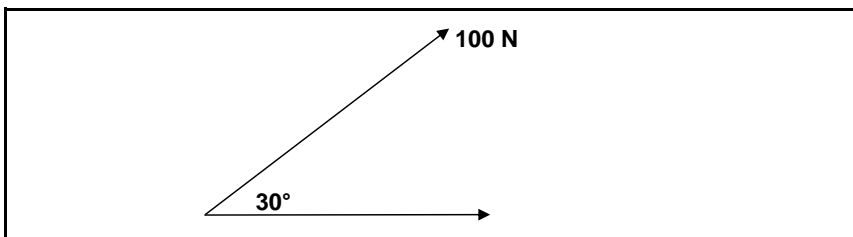


FIGURE 1.12

Determine the magnitude of the horizontal force.

- A 68,8 N
- B 86,6 N
- C 86,8 N
- D 68,6 N

(1)

1.13 What is the value of  $\Theta$  if  $\tan \Theta = 0,86$ ?

- A 34,22°
- B 43,69°
- C 40,69°
- D 46,96°

(1)

1.14 The life-blood of any machine is the lubricant. What makes lubricants efficient?

- A It must not offer resistance to movement.
- B It must maintain its firm thickness.
- C It must not 'gum up' or lose its fluidity.
- D All the above mentioned.

(1)

1.15 Which of the following statements result in the malfunctioning of a bearing?

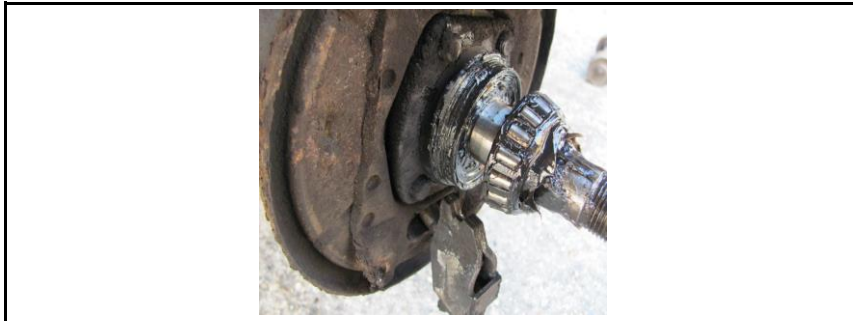


FIGURE 1.15

- A Damaged or worn oil seal
- B Excessive use of grease
- C A limited use of machinery
- D All the above mentioned

(1)

1.16 Which ONE of the following gear systems will be suitable for the operation of an electronic sliding gate?

- A Worm gear system
- B Rack and pinion system
- C Spur gear system
- D Helical system

(1)



1.17 What type of force is shown in FIGURE 1.17 below?



FIGURE 1.17

- A Tensile force
  - B Shearing force
  - C Compressive force
  - D Rolling force
- (1)

1.18 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)

1.19 The most important method of extracting iron from iron ore is called ...

- A smelting.
  - B charging.
  - C alloying.
  - D tempering.
- (1)

1.20 Inside the blast furnace, impurities from the iron ore become trapped in the ...

- A cupola.
  - B stoves.
  - C molten limestone.
  - D carbon monoxide.
- (1)

[20]

**QUESTION 2: SAFETY**

2.1 FIGURE 2.1 is an illustration of a bench grinder.



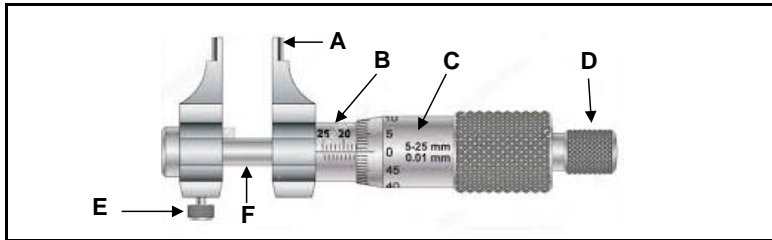
**FIGURE 2.1**

- List FOUR pre-checks that need to be done before switching on a bench grinder. (4)
- 2.2 What are the FOUR main causes of accidents in the workshop? (4)
- 2.3 State TWO purposes of a power saw. (2)
- 2.4 Give ONE safety precaution that must be observed when considering each of the following:
- 2.4.1 Ventilation (2)
- 2.4.2 Lighting (2)
- 2.5 Name FOUR safety precautions that must be observed when handling gas cylinders. (4)
- 2.6 Which safety devices or guards are used in conjunction with shearing machines (guillotines)? (2)
- 2.7 Name FOUR safety rules to be observed during the use of the drill press. (4)
- [24]**

**QUESTION 3: TOOLS**

3.1 FIGURE 3.1 below shows a precision measuring tool.

3.1.1 Identify the precision measuring tool represented in FIGURE 3.1. (1)



**FIGURE 3.1**

3.1.2 Label the parts numbered A, B, C, E and F. (5)

3.2 Mention THREE reasons for using a torque wrench on an engine. (3)

3.3 FIGURE 3.3 below shows a grinding machine which is commonly used in a mechanical workshop.



**FIGURE 3.3**

What is this grinding machine called? (1)

3.4 Name the THREE types of drilling machines used in the workshop. (3)

3.5 How would you go about caring for a drilling machine? (3)

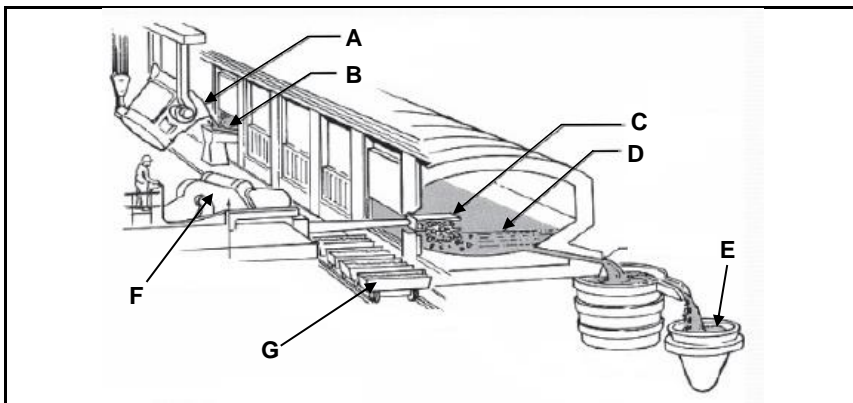
**[16]**

**QUESTION 4: MAINTENANCE**

- 4.1 Name THREE properties of a good lubricant. (3)
- 4.2 When choosing a lubricant for a specific function, some factors need to be taken into consideration? Mention THREE of these factors. (3)
- 4.3 What is the purpose of lubrication? (2)
- 4.4 What is the result of a lack of lubrication? (2)
- [10]**

**QUESTION 5: MATERIALS**

- 5.1 Why is annealing one of the most important processes in the heat treatment of steel? (2)
- 5.2 Why should parts to be case-hardened be surrounded by substances rich in carbon? (2)
- 5.3 FIGURE 5.3 below shows an open-hearth furnace. (6)

**FIGURE 5.3**

- Label the parts **A–G**. (6)
- 5.4 What are the main factors to be considered during the heat treatment of steel? (2)
- 5.5 Briefly explain how cold chisels are tempered. (4)
- 5.6 Which procedure will you follow to determine whether steel has been heated to a hardening temperature? (2)
- 5.7 Explain the difference between hardening and tempering. (4)

- 5.8 Choose a definition from COLUMN B that matches a process in COLUMN A. Write only the letter (A–D) next to the question number (5.8.1–5.8.4) in the ANSWER BOOK, for example 5.8.5 E.

Commented [u1]:

COLUMN A (PROCESS)		COLUMN B (DEFINITION)	
5.8.1	Tempering	A	The metal is heated to a specified temperature and then cooled in still air.
5.8.2	Annealing	B	In this process the outer case is turned into a high-carbon steel.
5.8.3	Normalising	C	The steel is reheated to a suitable temperature and quenched again.
5.8.4	Case-hardening	D	The metal is heated to a specified temperature and then slowly cooled in the furnace.

(4)

- 5.9 The hardening of steel can be achieved through a specific heat treatment which depends on three factors. Name these THREE factors.

(3)

[30]

**TOTAL SECTION A: 100**

**SECTION B: FITTING AND TURNING (SPECIFIC)**

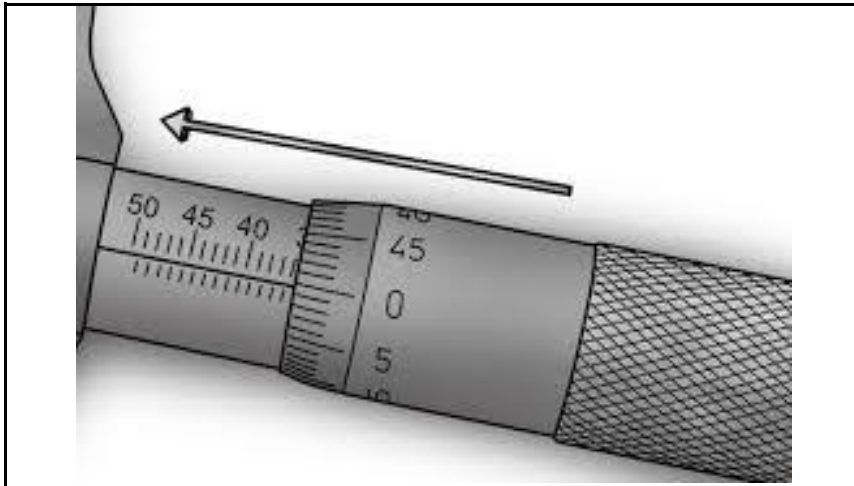
Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
6	Terminology (Specific)	25	30 minutes
7	Tools and Equipment (Specific)	8	8 minutes
8	Forces (Specific)	19	19 minutes
9	Maintenance (Specific)	8	8 minutes
10	Joining Methods (Specific)	12	12 minutes
11	Systems and Control (Specific)	16	16 minutes
12	Pumps (Specific)	12	12 minutes
<b>TOTAL FOR SECTION B</b>		<b>100</b>	<b>105 minutes</b>
<b>TOTAL FOR SECTION A + B</b>		<b>200</b>	<b>180 minutes</b>

**QUESTION 6: TERMINOLOGY**

- 6.1 The compound slide method is one method of taper turning.  
Mention TWO advantages and TWO disadvantages of this method. (4)
- 6.2 Mention FOUR categories where taper work can be carried out. (4)
- 6.3 You are given a task to make a work-piece using the milling machine. The workpiece is a shaft with a diameter of 90 mm. One end must be machined square and the other to a hexagon.  
Determine by using calculations how much the cutter must be fed into the work-piece (depth of cut) to cut the biggest ...
- 6.3.1 square. (6)
- 6.3.2 hexagon. (6)
- 6.4 Name the TWO systems of standardised measurements that are being used world-wide. (2)
- 6.5 In mechanical technology, we have our own symbols and meanings, which saves a lot of time and give the worker much needed information.  
Give the meaning to the following abbreviations:
- 6.5.1 ASSY (1)
- 6.5.2 CHAM (1)
- 6.5.3 DIA (1)
- [25]**

**QUESTION 7: TOOLS AND EQUIPMENT**

7.1 FIGURE 7.1 has an illustration of a micrometre.



**FIGURE 7.1**

Determine the reading displayed on the micrometre shown in FIGURE 7.1. (3)

7.2 Study the diagram illustrated in FIGURE 7.2.



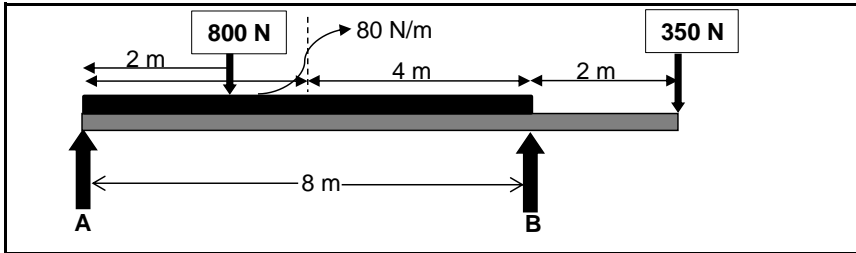
**FIGURE 7.2**

State ONE purpose of the instrument shown in FIGURE 7.2. (2)

7.3 Give THREE reasons for using a dial indicator. (3)  
**[8]**

**QUESTION 8: FORCES**

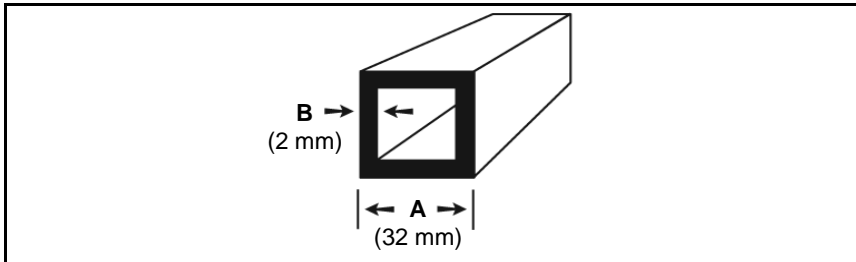
8.1 FIGURE 8.1 indicates a uniform beam supported by two vertical supports, **A** and **B**. Two vertical point loads of 800 and 350 newton, and a uniformly distributed load of 80 newton per meter over the distance between the two supports, are exerted onto the beam.



**FIGURE 8.1**

Make use of calculations and determine the reactions in supports **A** and **B** while the beam is in equilibrium. (6)

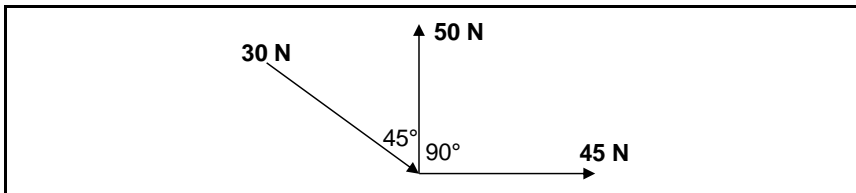
8.2 Study FIGURE 8.2 below.



**FIGURE 8.2**

Calculate the tensile stress in a  $32 \times 32 \times 2$  square tube as shown in FIGURE 8.2, if it is subjected to a force of 20 kN. (6)

8.3 FIGURE 8.3 below shows a system of forces with three coplanar forces acting on the same point.



**FIGURE 8.3**

Use calculations and determine the magnitude and direction of the resultant force of this system of forces. Draw and complete the diagram in FIGURE 8.3. Show all the horizontal and vertical components before you do the calculations. (10) [22]



**QUESTION 9: MAINTENANCE**

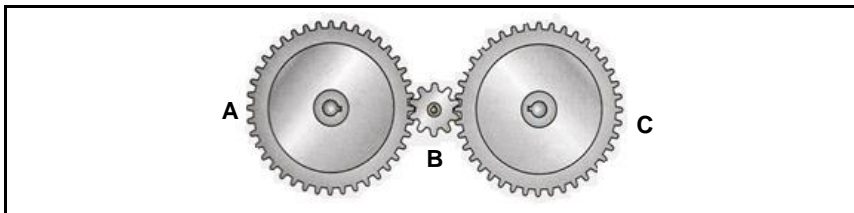
- 9.1 Explain overloading as it occurs in workshop machinery. (2)
- 9.2 What are the factors that influence the size of the centrifugal force? (3)
- 9.3 State TWO laws of sliding friction. (2)
- 9.4 What is the meaning of static balancing? (1)

**[8]****QUESTION 10: JOINING METHODS**

- 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 Root (2)
- 10.2.3 Axis (2)
- 10.2.4 Depth of screw thread (2)
- 10.2.5 Screw thread angle (2)

**[12]****QUESTION 11: SYSTEMS AND CONTROL**

- 11.1 FIGURE 11.1 below indicates gears meshing with one another.

**FIGURE 11.1**

- 11.1.1 If gear C is turning anti-clockwise, in which direction will gear A turn? (1)
- 11.1.2 Motivate your answer of QUESTION 11.1.1 above. (1)
- 11.1.3 What is an idler gear? (2)
- 11.1.4 Name TWO functions of the idler gear in FIGURE 11.1 above. (2)

11.1.5 A shaft revolving at 900 rpm has a 380 mm diameter pulley which drives a 150 mm diameter pulley on a second shaft by means of a driving belt.

Calculate the speed of the driven shaft in rpm (simple drive system). (3)

11.1.6 List FOUR disadvantages of spur gears. (4)

[13]

### QUESTION 12: PUMPS

12.1 Various pumps are used in daily activities.

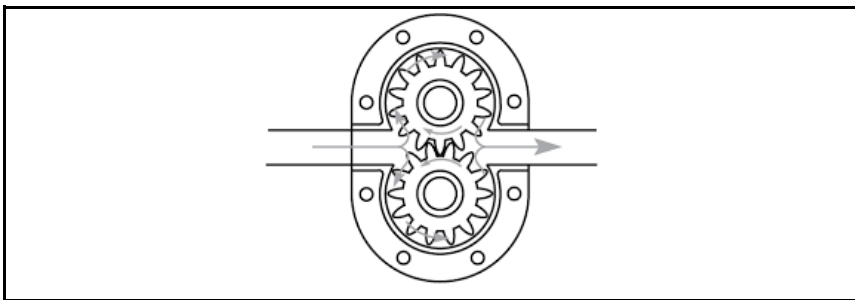


FIGURE 12.1

Which type of pump is shown in FIGURE 12.1? (1)

12.2 Mention THREE advantages of this specific pump in FIGURE 12.1. (3)

12.3 FIGURE 12.3 shows the vane pump.

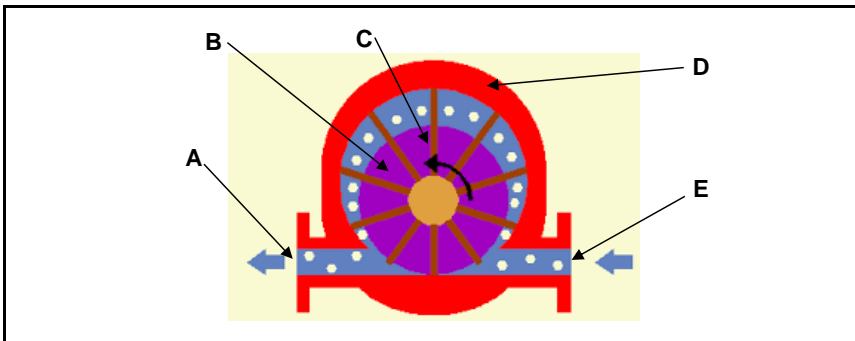


FIGURE 12.3

Label the parts marked A–E. (5)

12.4 Mention THREE disadvantages of the vane pump. (3)

[12]

**TOTAL SECTION B: 100**

**SECTION C: AUTOMOTIVE (SPECIFIC)**

Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
13	Tools and Equipment (Specific)	9	10 minutes
14	Engines (Specific)	15	15 minutes
15	Systems and Control (Specific)	29	30 minutes
16	Maintenance (Specific)	11	10 minutes
17	Forces (Specific)	30	35 minutes
18	Terminology (Specific)	6	5 minutes
<b>TOTAL FOR SECTION C</b>		<b>100</b>	<b>105 minutes</b>
<b>TOTAL FOR SECTION A + C</b>		<b>200</b>	<b>180 minutes</b>

**QUESTION 13: TOOLS AND EQUIPMENT**

13.1 Study FIGURE 13.1 below.



**FIGURE 13.1**

- Give THREE uses of a dial indicator. (3)
- 13.2 How would you care for a telescopic gauge? (3)
- 13.3 State the unit for torque. (1)
- 13.4 Give TWO reasons for using a torque wrench. (2)
- [9]**

**QUESTION 14: ENGINES**

14.1 Various components are driven by camshafts as illustrated in FIGURE 14.1.



**FIGURE 14.1**

Mention at least TWO components that are driven by the camshaft. (2)

14.2 What are timing gears used for? (2)

14.3 What device is used in conjunction with timing chains to counteract the effect of chain elongation or stretching? (1)

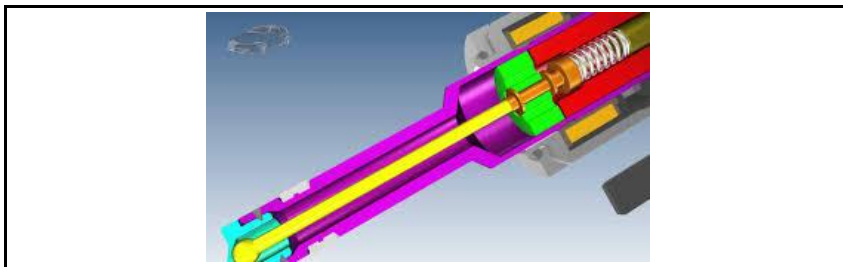
14.4 How many rockers are in a four-cylinder engine? (1)

14.5 State the function of the following:

14.5.1 Engine valves (1)

14.5.2 Valve springs (1)

14.6 Study the diagram in FIGURE 14.6 which illustrates an electromagnet.



**FIGURE 14.6**

14.6.1 Explain the operational principle of an electromagnet/solenoid injector. (5)

14.6.2 State the advantages of the electromagnetic solenoid injector. (2)

**[15]**

**QUESTION 15: SYSTEMS AND CONTROL**

15.1 Mention TWO types of final drives. (2)

15.2 What is the function of viscous couplings? (1)

15.3 Name the functions of each of the following steering control components:

15.3.1




Tie rod end

**FIGURE 15.3.1**

(3)

15.3.2




Ball joint

**FIGURE 15.3.2**

(3)

15.3.3



Drag link

**FIGURE 15.3.3**

(3)

15.4 Give THREE factors which result in a weak/worn shock absorber. (3)

15.5 Study the illustration below in FIGURE 15.5.



**FIGURE 15.5**

Describe the function of a stabiliser bar as illustrated in FIGURE 15.5. (2)

15.6 State the purpose of predetermined firing order. (4)

15.7 What is the firing order for a six cylinder V-engine? (1)

- 15.8 Mention TWO disadvantageous consequences of incorrect spark plug gaps in the following cases:
- 15.8.1 Gap that is too big. (4)
- 15.8.2 Gap that is too small. (4)
- [30]**

**QUESTION 16: MAINTENANCE**

- 16.1 List the factors for the reasons of malfunction with regard to maintenance. (3)
- 16.2 Name THREE factors to be considered during the drilling process. (3)
- 16.3 Give THREE advantages of a gear pump. (3)
- 16.4 Name TWO types of filter cores. (2)
- [11]**

**QUESTION 17: FORCES**

- 17.1 Calculate the power developed in a four-cylinder four stroke engine with a cylinder diameter of 70 mm and a stroke length of 95 mm at 3000 r/min. The mean effective pressure is 1 500 kPa. (5)
- 17.2 Calculate the torque applied to a bolt by a torque wrench, with a length of 400 mm, when a force of 250 N is applied. (3)
- 17.3 Explain the term: 'compression ratio' (3)
- 17.4 The bore of an engine is 110 mm and the stroke is 120 mm. If the clearance volume is 95 m<sup>3</sup>, determine the compression ratio of the engine. (6)
- 17.5 What is the unit for the following applications?
- 17.5.1 Work done (1)
- 17.5.2 Power (1)
- 17.6 Identify the TWO kinds of mean effective pressures (MEP). (2)
- 17.7 Describe what you understand to be the following and use an illustration to assist your description.
- 17.7.1 Tensile stress (3)
- 17.7.2 Compressive stress (3)
- 17.7.3 Shear stress (3)
- [30]**

**QUESTION 18: TERMINOLOGY**

18.1 Explain the following terminologies and give an example of each:

18.1.1 Workshop administration (2)

18.1.2 Capital (2)

18.1.3 Employees (2)

18.1.4 Business site (2)

**[8]**

**TOTAL SECTION C: 100**

**SECTION D: WELDING AND METALWORK (SPECIFIC)**

Use the criteria below to assist you to manage your time.			
QUESTION	CONTENT	MARKS	TIME
19	Welding Terminology (templates, trusses, cost calculations, terms, welding symbols) (Specific)	18	18 minutes
20	Tools and Equipment (Specific)	7	5 minutes
21	Forces (Specific)	17	15 minutes
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23	Joining Methods (Specific)	15	15 minutes
24	Terminology (development) (Specific)	19	27 minutes
25	Terminology (steel sections) (Specific)	18	20 minutes
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<b>TOTAL FOR SECTION A + D</b>		<b>200</b>	<b>180 minutes</b>

**QUESTION 19: JOINING METHODS**

19.1 Identify the following welding symbols below. Make a neat sketch to explain how EACH welding joint will be applicable in practice.

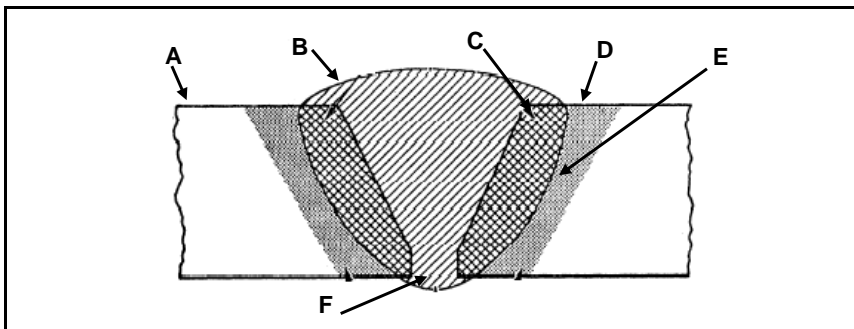
19.1.1  (2)

19.1.2  (2)

19.1.3  (2)

19.2 With the aid of simple sketches, name and show TWO different types of welding positions. (6)

19.3 FIGURE 19.3 below shows a sectional view of an arc-welded joint.



**FIGURE 19.3**

Label the parts numbered A–F. (6) [18]



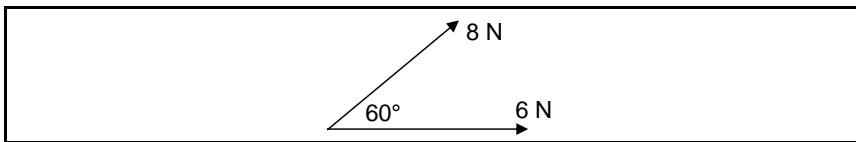
**QUESTION 20: Tools & EQUIPMENT**

- 20.1 Name the THREE taps used in the workshop to make internal threads. (3)
- 20.2 What is the drill size in mm when using the following taps?
  - 20.2.1 8 mm (1)
  - 20.2.2 10 mm (1)
  - 20.2.3 12 mm (1)
- 20.3 What is a guillotine? (1)

[7]

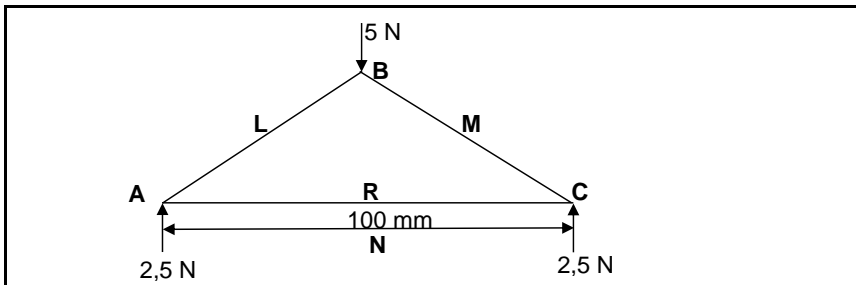
**QUESTION 21: FORCES**

- 21.1 Calculate the magnitude and direction (the vertical and horizontal components) of the resultant force in FIGURE 21.1 below. (10)



**FIGURE 21.1**

- 21.2 Study the forces in the system of forces in FIGURE 21.2 below.



**FIGURE 21.2**

Determine graphically the nature of the forces in the system of forces in FIGURE 21.2. Use Bow's notation to construct a triangle of forces and show that they are in equilibrium. For the construction use a scale of 1 N = 20 mm.

(7)  
[17]

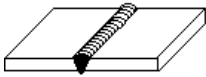
**QUESTION 22: MAINTENANCE**

- 22.1 Identify TWO maintenance inspections on rolling machines. (2)
- 22.2 What is the effect of the lack of maintenance? (2)
- 22.3 Describe overloading with regard to the punch and shearing machine. (2)

**[6]****QUESTION 23: JOINING METHODS**

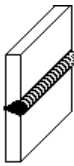
- 23.1 What is the purpose of tack welding? (2)
- 23.2 Name the FIVE basic welding joints. (5)
- 23.3 Identify the FOUR basic welding positions shown below.

23.3.1



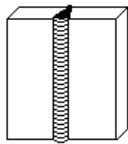
(1)

23.3.2



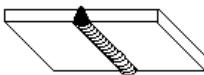
(1)

23.3.3



(1)

23.3.4



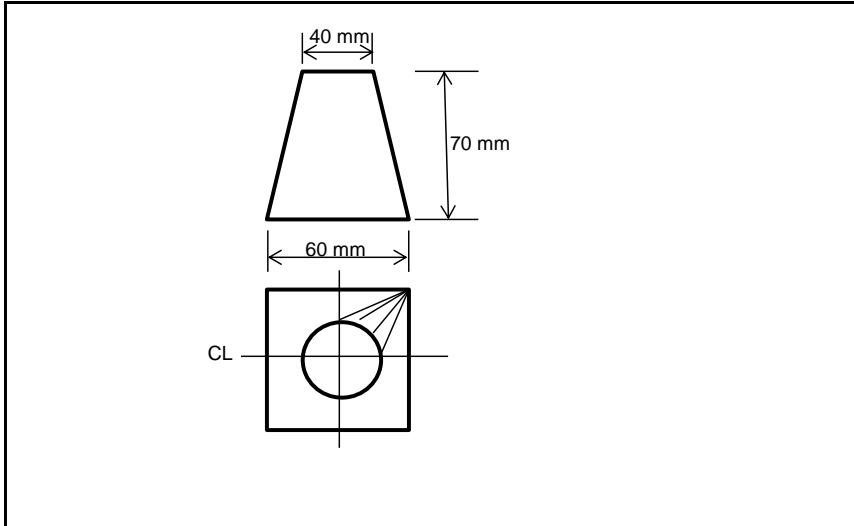
(1)

- 23.4 List the THREE basic procedures in which MIG welding can be undertaken. (3)
- 23.5 Name ONE welding defect. (1)

**[15]**

**QUESTION 24: TERMINOLOGY**

24.1



**FIGURE 24.1**

Develop the square to round transition piece as shown in the front and top view in FIGURE 24.1.

**[19]**

**QUESTION 25: STEEL SECTIONS**

25.1 Illustrate, with freehand isometric drawings the following steel sections:

- 25.1.1 Flat bar (2)
- 25.1.2 Square bar (2)
- 25.1.3 Round bar (2)
- 25.1.4 Equal flanged angle iron (2)
- 25.1.5 Channel iron (2)

25.2 Explain the term: notching (2)

25.3 Name THREE different types of joints in steel-framed construction. (3)

25.4 Where are steel and steel sections being manufactured? (1)

25.5 Make neat sketches of an angle iron facing toe-up and toe-down. (2)

**[18]**

**TOTAL SECTION D: 100  
GRAND TOTAL: 200**

**FORMULA SHEET****1. TERMINOLOGY**

$$\text{Depth of cutter} = \frac{\text{Diameter} - x}{2}$$

$$\sin \theta = \frac{x}{\text{Dia}}$$

Where  $x$  = depth of cut

**2. FORCES**

Clockwise moments = Anti-clockwise moments

Upward forces = Downward forces

$$\text{Stress} = \frac{\text{Force/Load}}{\text{Area}}$$

$$\text{Cross Sectional Area} = \frac{\pi D^2}{4} \quad \text{for round objects}$$

$$\text{Cross Sectional Area} = s \times s \quad \text{for square objects}$$

$$\text{Cross Sectional Area} = l \times b \quad \text{for rectangular objects}$$

**3. SYSTEMS AND CONTROL**

$$\pi D_A \times N_A = \pi D_B \times N_B$$

$$T_A \times N_A = T_B \times N_B = T_C \times N_C$$

$$\text{Pressure} = \frac{\text{FORCE}}{\text{AREA}}$$