

**NATIONAL SENIOR CERTIFICATE EXAMINATION**  
**MAY 2023**

**ENGINEERING GRAPHICS AND DESIGN**  
**PAPER 2**

**MARKS: 200**  
**TIME: 3 HOURS**

| FOR OFFICIAL USE ONLY |                       |      |           |            |      |
|-----------------------|-----------------------|------|-----------|------------|------|
| QUESTION              | SECTION               | MARK | MODERATED | MAXIMUM    | CODE |
| 1                     | MECHANICAL ANALYTICAL |      |           | 20         |      |
| 2.1                   | LOCI MECHANISM        |      |           | 15         |      |
| 2.2                   | LOCI CAM              |      |           | 25         |      |
| 3                     | ISOMETRIC DRAWING     |      |           | 40         |      |
| 4                     | MECHANICAL ASSEMBLY   |      |           | 100        |      |
|                       | <b>TOTAL</b>          |      |           | <b>200</b> |      |

**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

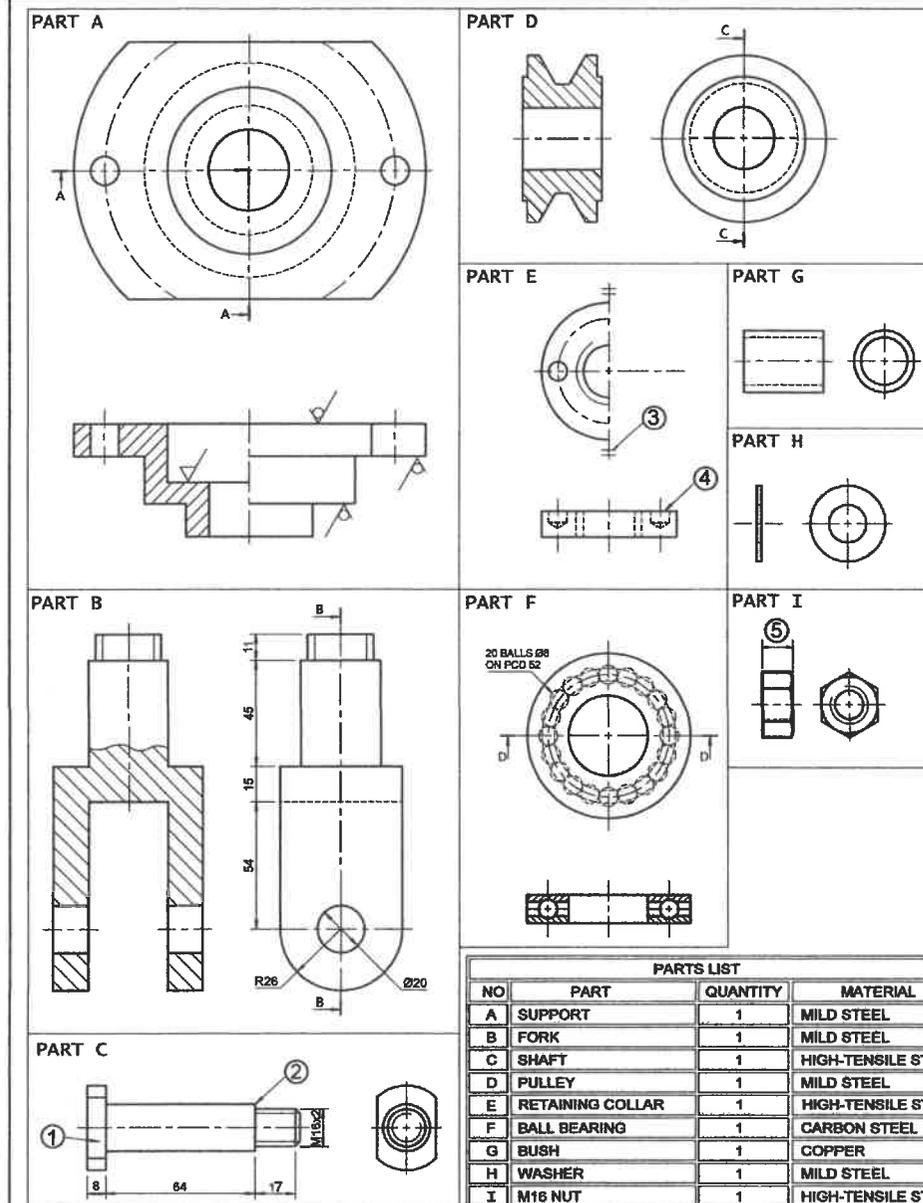
1. This question paper consists of 7 pages, including the cover page and 5 questions.
2. All questions must be answered.
3. Unless specified otherwise, all questions are in **third-angle orthographic projection**.
4. Unless specified otherwise, all questions are to be completed to a **scale of 1:1**.
5. All answer sheets must be re-stapled in numerical order and handed in, including unanswered questions.
6. All **construction work** must be shown, even if a **stencil** was used.
7. Print your **examination number** neatly on each page.
8. Use only the **answer sheets** provided.
9. Your drawings should be **well presented** and reflect **neatness and accuracy**. Marks will be **deducted** for untidy and inaccurate work.
10. All dimensions or detail not given must be **assumed** in **good proportion** with the rest of the drawing.
11. **Stencils and calculators** may be used.
12. All drawings must adhere to the SANS 10111-1.
13. In order to save time, **detailed assembly parts** must be **drawn to convention**.

CHECKED BY

Please paste the barcoded label here

**EXAMINATION NUMBER**

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**QUESTION 1**

**MECHANICAL ANALYTICAL**

**ANSWER**

The adjacent figures show the parts of a swivel pulley. The questions below are based on these figures. Choose the correct answer and write down its corresponding LETTER in the space provided.

- How many parts are manufactured with mild steel?  
A. One      B. Two      C. Three      D. Four
- From what material is the ball bearing (Part F) manufactured?  
A. Copper      B. Mild steel      C. Carbon steel      D. High-tensile steel
- What is Feature 1 on the shaft (Part C)?  
A. Square on a shaft      B. Flat face on a shaft      C. Across flats      D. Bearing
- What is Feature 2 on the shaft (Part C)?  
A. Round      B. Shoulder on a shaft      C. Sphere      D. Chamfer
- What type of sectioning (A-A) is shown on the support (Part A)?  
A. Half-section      B. Full section      C. Part section      D. Top section
- What symbol does Feature 3 represent on the retaining collar (Part E)?  
A. Parallel      B. Square      C. Equal to      D. Symmetrical
- What type of hole does Feature 4 represent on the retaining collar (Part E)?  
A. Threaded hole      B. Blind hole      C. Counterbore hole      D. Countersunk hole
- How many balls are in the bearing (Part F)?  
A. 16      B. 18      C. 20      D. 22
- What is the total length of the fork (Part B)?  
A. 80      B. 95      C. 140      D. 151
- What is the total length of the shaft (Part C)?  
A. 81      B. 89      C. 91      D. 93
- Calculate the exact thickness, Feature 5, of the nut (Part I).  
A. 11,2      B. 12      C. 12,8      D. 16
- Which part could decrease the friction between a shaft and a pulley?  
A. Nut      B. Collar      C. Washer      D. Bush
- What does the circle on the welding symbol indicate?  
A. Site weld      B. Weld all around      C. Gas weld      D. Fillet weld
- What type of welding is shown by the welding symbol?  
A. Single-U butt weld      B. Single-V butt weld      C. Single-J butt weld      D. Square butt weld
- What welding process is shown by the welding symbol?  
A. Arc welding      B. TIG welding      C. MIG welding      D. Gas flame welding
- How many surfaces needs machining by removal of material on the support (Part A)?  
A. 1      B. 2      C. 3      D. 4
- What is the roughness value on the machining symbol?  
A. 0,25      B. 0,05      C. N11      D. M
- What is the machining allowance on the machining symbol?  
A. 0,25      B. 0,05      C. N11      D. M
- What is the direction of the lay on the machining symbol?  
A. Equal      B. Crossed      C. Perpendicular      D. Parallel to plane
- What is the correct symbol for third angle orthographic projection?  
A.      B.      C.      D.

20 MARKS

EXAMINATION NUMBER

ANSWER SHEET 1

**QUESTION 2.1**

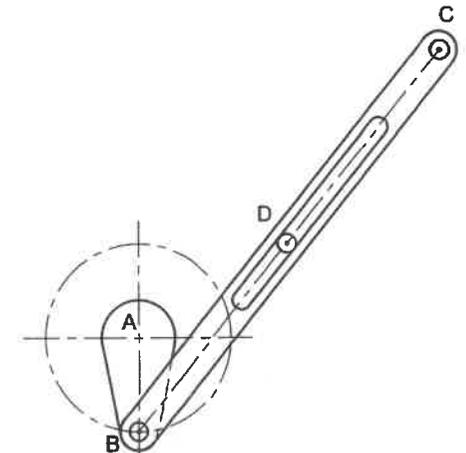
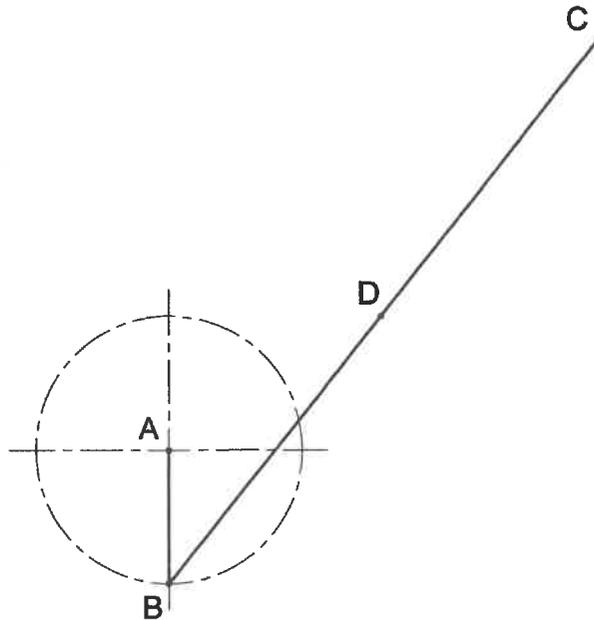
**LOCI  
MECHANISM**

The given figure below shows a mechanism consisting of a crank **AB** that is pin-jointed to a slotted link **BC**. The slotted link **BC** slides over a fixed pin **D**.

The crank **AB** rotates in an **anti-clockwise** direction. The slotted link **BC** slides over pin **D** during the rotation of crank **AB**.

Use the given centre lines to construct and draw the locus of point **C** for one full rotation of the mechanism.

- The length of rod **BC** is 130 mm.
- Draw the direction arrow.
- Show all **constructions**.



| <b>ASSESSMENT CRITERIA</b> |    |
|----------------------------|----|
| • Construction             | 2  |
| • Plot Points              | 11 |
| • Direction                | 1  |
| • Locus                    | 1  |

|           |  |  |
|-----------|--|--|
| CON<br>2  |  |  |
| PTS<br>11 |  |  |
| DIR<br>1  |  |  |
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**15 MARKS**

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**ANSWER SHEET 2.1**





FIGURE 1

QUESTION 4  
MECHANICAL ASSEMBLY

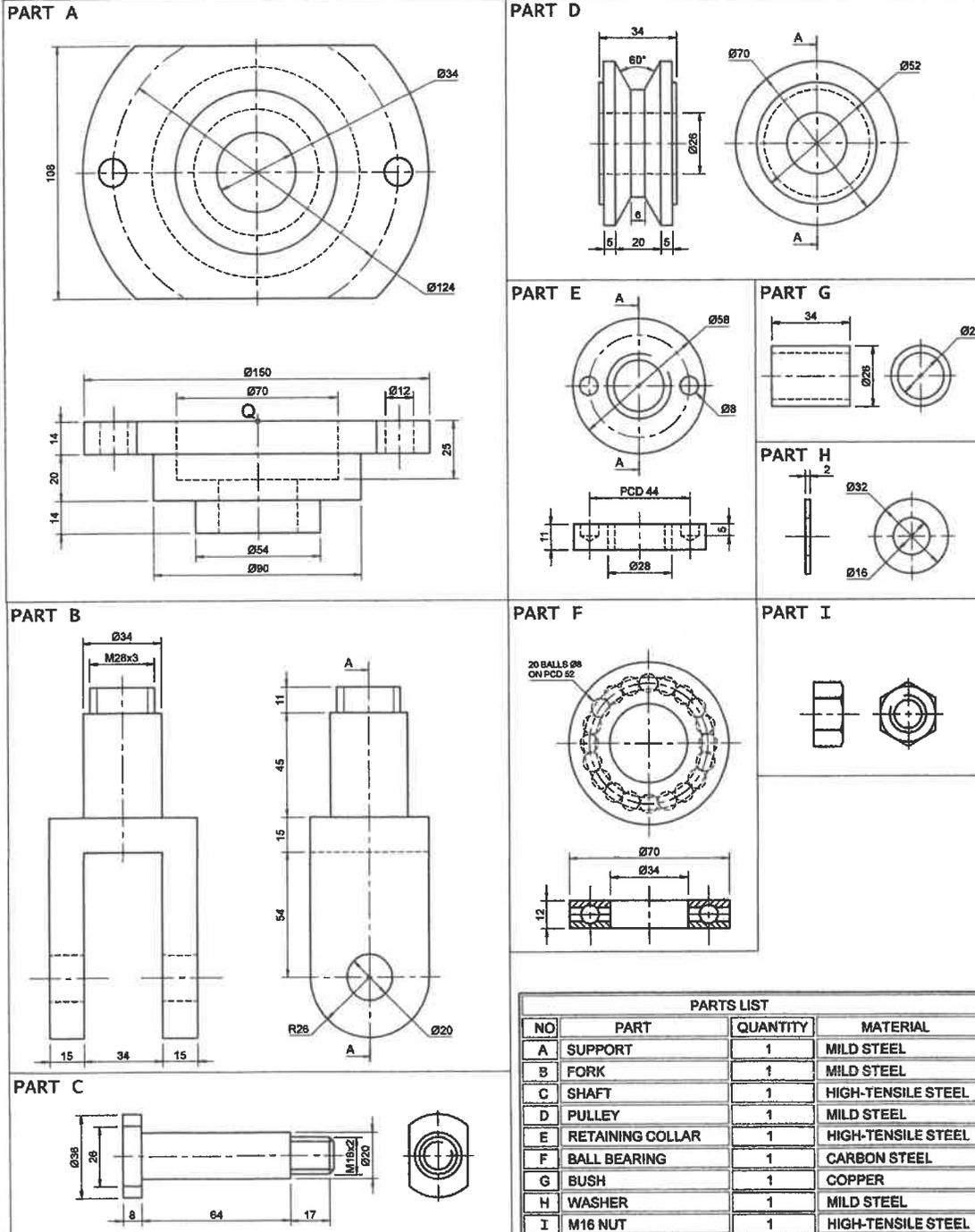


Figure 1 shows the different parts (not to scale) for a SWIVEL PULLEY that needs to be assembled.

The exploded front view of how the parts are assembled is also shown.

Complete the following on Answer Sheet 4 to a scale of 1:1.

Use the given centre line and point Q on the support (Part A) as a reference to plan the drawing layout.

4.1 Draw a full sectioned front view on cutting plane A-A of the swivel pulley.

4.2 Draw an outside right view of the swivel pulley.

4.3 Please note the following:

4.3.1 Show 3 faces for the M16 hexagonal nut in the front view.

4.3.2 Show the hidden detail of only the pulley (Part D) in the right view.

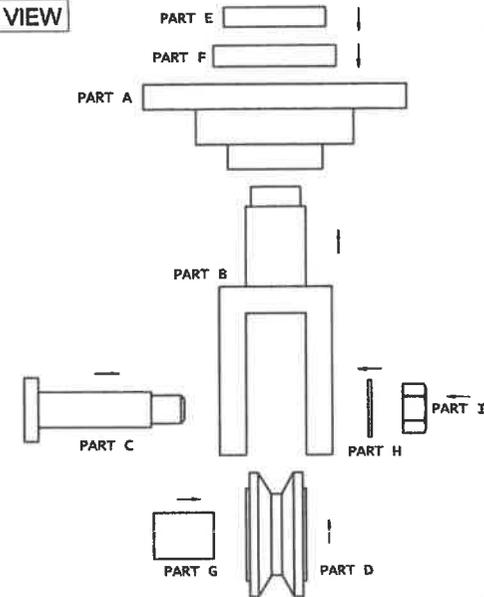
4.3.3 Draw all centre lines.

4.3.4 Draw the cutting plane in the right view.

4.3.5 Insert 2 functional dimensions in the front view.

4.3.6 Print the title and scale in the space provided.

EXPLODED FRONT VIEW



100 MARKS

EXAMINATION NUMBER

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