

NATIONAL SENIOR CERTIFICATE EXAMINATION  
MAY 2023

ENGINEERING GRAPHICS AND DESIGN  
MARKING GUIDELINES  
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	
	TOTAL			200	

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

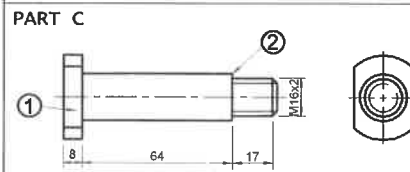
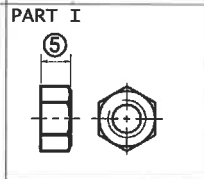
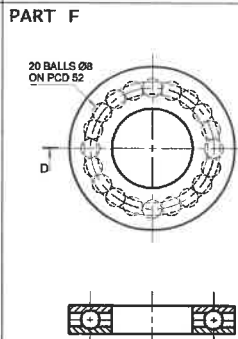
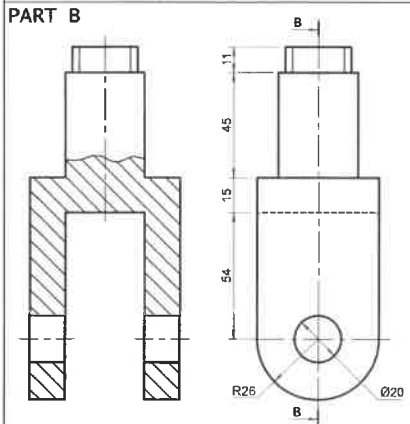
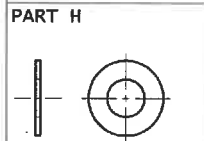
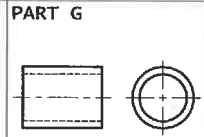
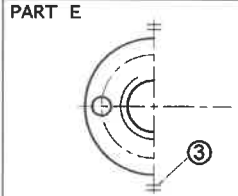
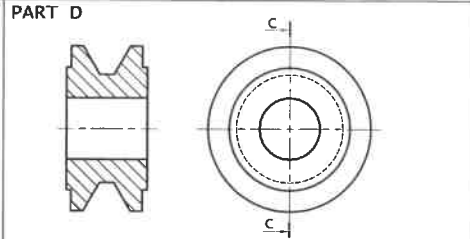
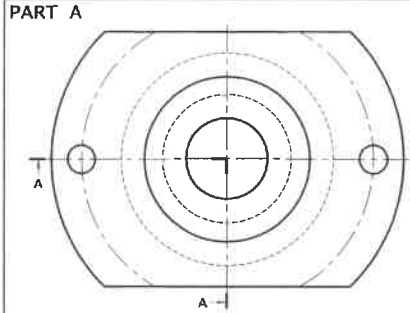
1. This question paper consists of 7 pages, including the cover page and 5 questions.
2. All questions must be answered.
3. Unless specified otherwise, all questions are in **third-angle orthographic projection**.
4. Unless specified otherwise, all questions are to be completed to a **scale of 1:1**.
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

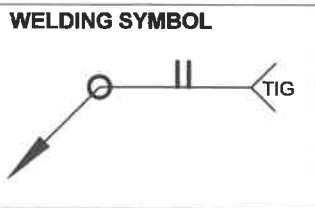
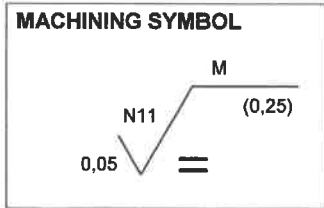
Please paste the barcoded label here

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--



PARTS LIST			
NO	PART	QUANTITY	MATERIAL
A	SUPPORT	1	MILD STEEL
B	FORK	1	MILD STEEL
C	SHAFT	1	HIGH-TENSILE STEEL
D	PULLEY	1	MILD STEEL
E	RETAINING COLLAR	1	HIGH-TENSILE STEEL
F	BALL BEARING	1	CARBON STEEL
G	BUSH	1	COPPER
H	WASHER	1	MILD STEEL
I	M18 NUT	1	HIGH-TENSILE STEEL



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. Countersunk 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.

QUESTION 1  
MECHANICAL  
ANALYTICAL

ANSWER	
D	1
C	1
B	1
B	1
A	1
D	1
B	1
C	1
D	1
C	1
D	1
B	1
D	1
B	1
D	1
A	1
C	1
B	1
B	1

20 MARKS

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--

ANSWER SHEET 1

QUESTION 2.1

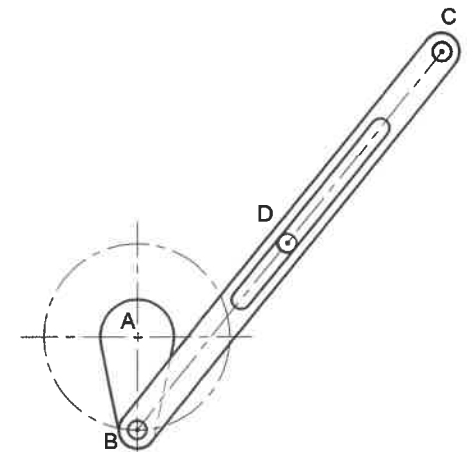
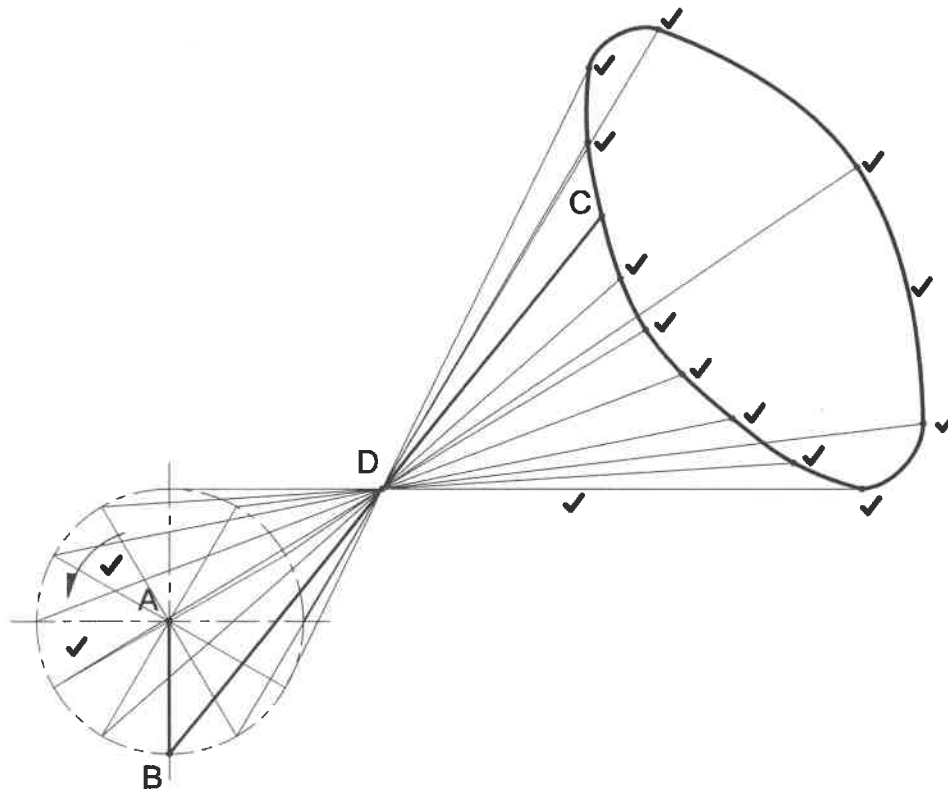
LOCI  
MECHANISM

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**.



ASSESSMENT CRITERIA		
• Construction	2	
• Plot Points	11	
• Direction	1	
• Locus	1	

CON 2	✓	
PTS 11	✓	
DIR 1	✓	
LOC 1	✓	

15 MARKS

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

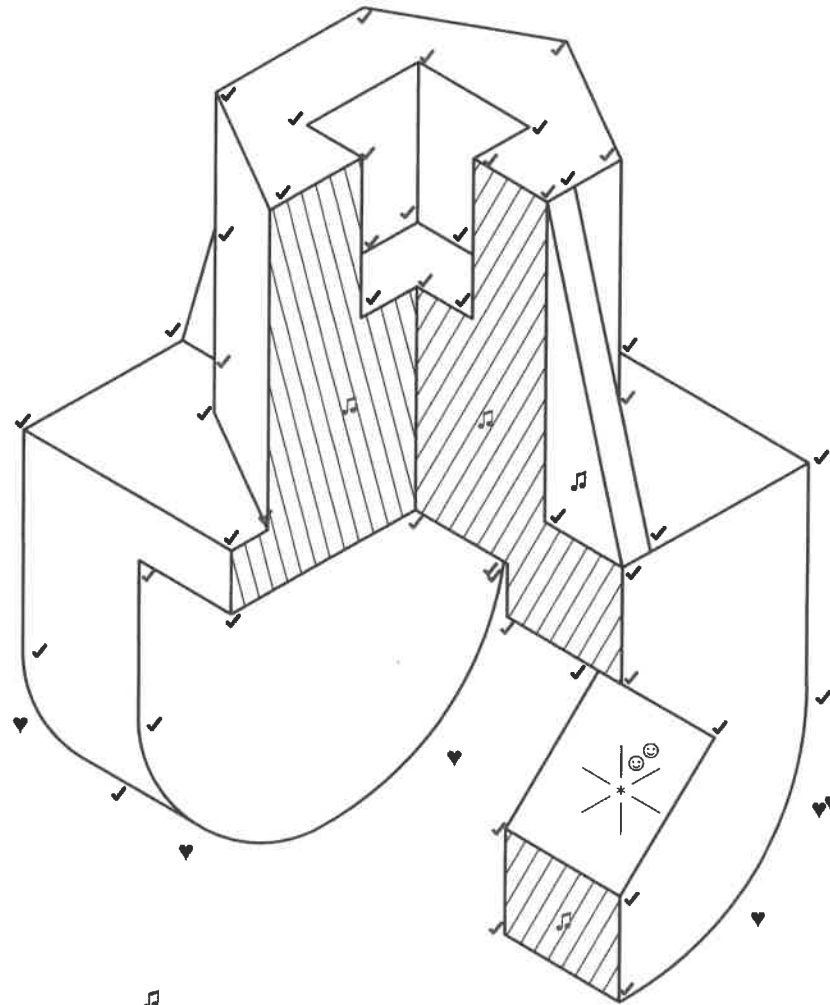
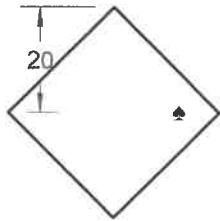
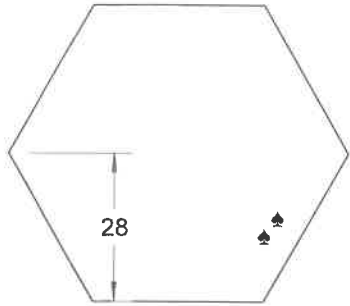
ANSWER SHEET 2.1



**QUESTION 3**

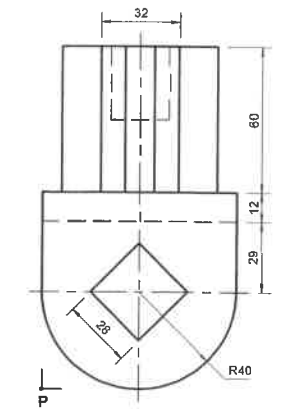
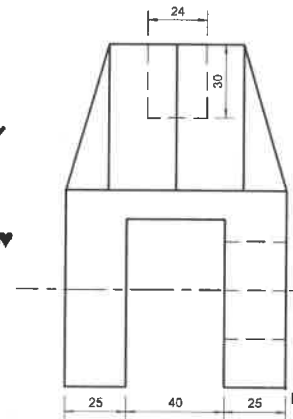
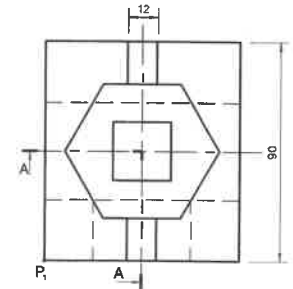
**ISOMETRIC  
DRAWING**

**CONSTRUCTION AREA**

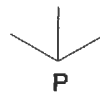


The figures below show the front view, top view and left view of a heavy-duty **CASTING**. The **CASTING** is cut by **cutting-plane A-A**.

- 3.1 Draw a neat **half-sectioned isometric** drawing of the **CASTING** on **cutting-plane A-A**.
- 3.2 Draw the auxiliary view of the hexagon and the square in the construction area.
- 3.3 Draw the centre lines and show all the constructions for the circle.
- 3.4 Make point **P** the starting point of your drawing.



Correct hatch angle



**ASSESSMENT CRITERIA**

- Construction 3
- Isometric Points 48/2 24
- Isometric Circles 6
- Hatching / Non-Hatching 5
- Centre lines 2

CON 3	♠	
ISOM 24	✓	
CIRC 6	♥	
HAT 5	♫	
CL 2	⊙	

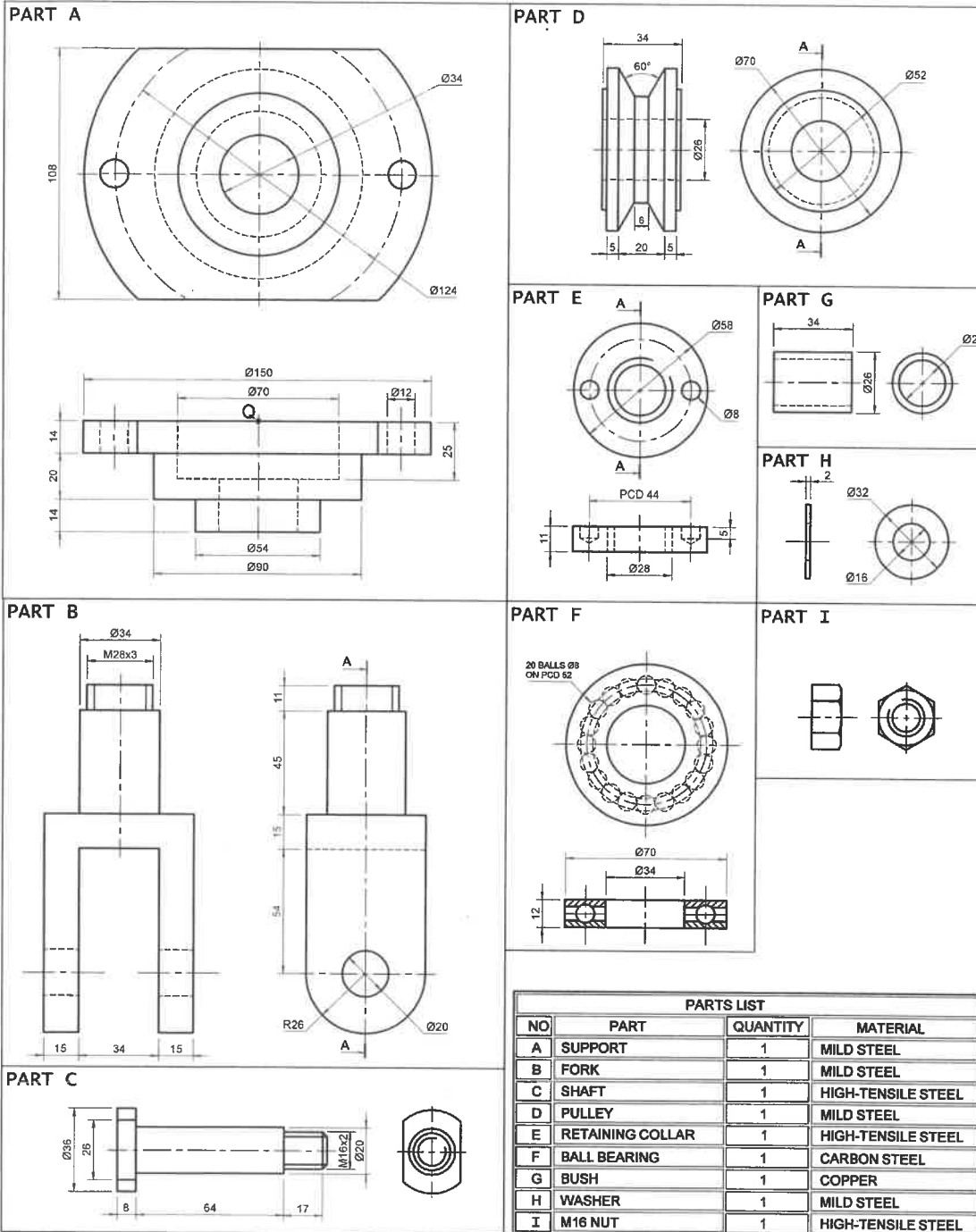
**40 MARKS**

**EXAMINATION NUMBER**

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**ANSWER SHEET 3**

FIGURE 1



QUESTION 4  
MECHANICAL ASSEMBLY

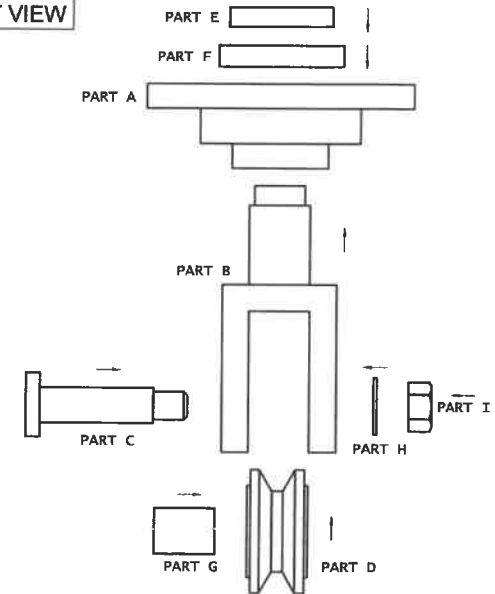
Figure 1 shows the different parts (not to scale) for a **SWIVEL PULLEY** that needs to be assembled.

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

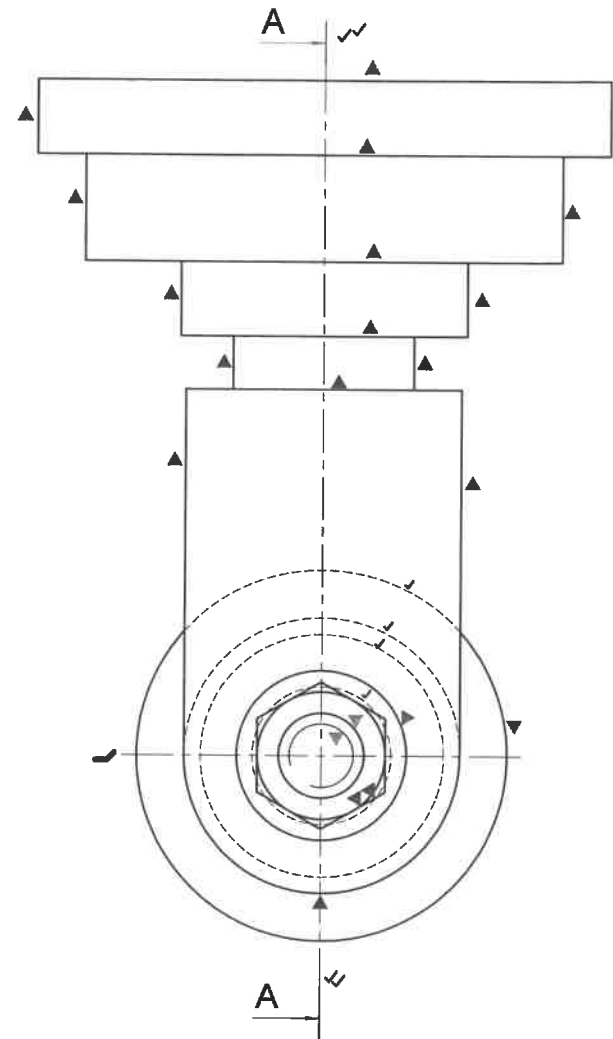
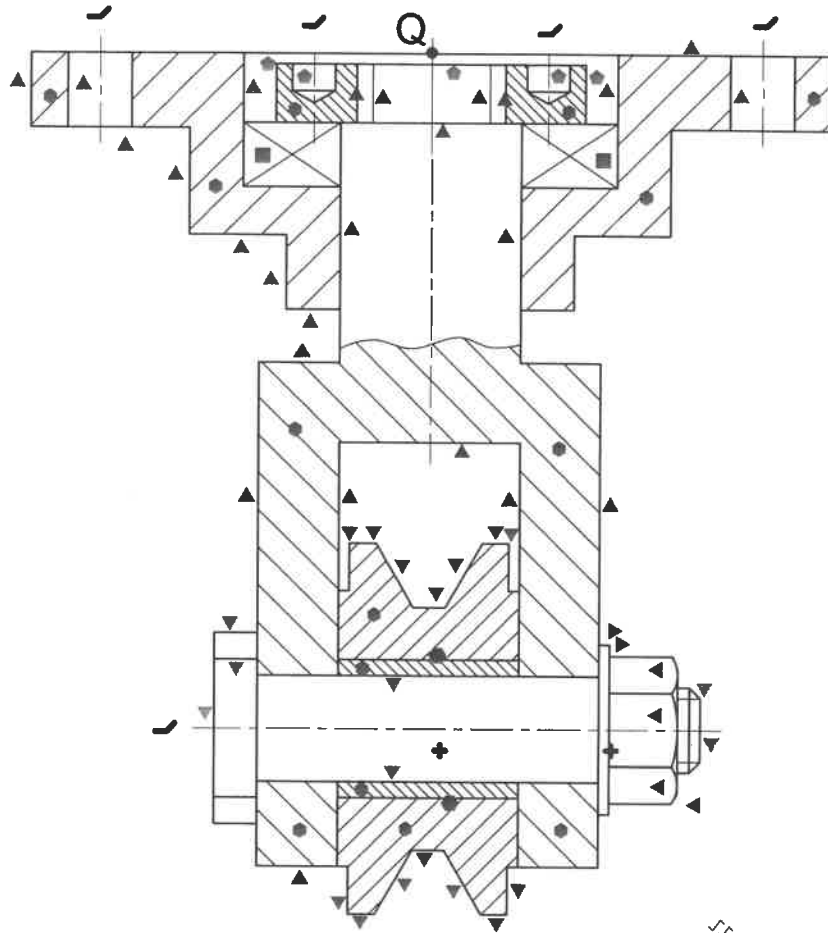


100 MARKS

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**QUESTION 4**  
MECHANICAL  
ASSEMBLY



ASSESSMENT CRITERIA			
SECTIONED FRONT VIEW			
A SUPPORT	11	▲	
B FORK	14	▲	
C SHAFT	7	▼	
D PULLEY	14	▼	
E COLLAR	5	◆	
F BEARING	2	■	
G BUSH	2	●	
H WASHER	2	▶	
I M16 NUT	4	◀	
<b>TOTAL</b>	<b>61</b>		

OUTSIDE RIGHT VIEW			
A SUPPORT	10/2	5	▲
B FORK	6/2	3	▲
C SHAFT		2	▼
D PULLEY		1	▼
H WASHER		1	▶
I M16 NUT		2	◀
HIDDEN DETAIL		4	✓
<b>TOTAL</b>	<b>18</b>		

ADDITIONAL			
CORRECT ASS.	3	✓	
HATCHING	14/2	7	◆
NON-HATCHING		2	+
CENTRE LINES	6/2	3	↵
DIMENSIONS		2	◀
CUTTING PLANE	4/2	2	✓
TITLE/SCALE		2	✓
<b>TOTAL</b>	<b>21</b>		
<b>TOTAL</b>	<b>100</b>		

TITLE: SWIVEL PULLEY ✓ SCALE: SCALE 1:1 ✓

ANSWER SHEET 4

EXAMINATION NUMBER

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--