

# NATIONAL SENIOR CERTIFICATE EXAMINATION

## 2018

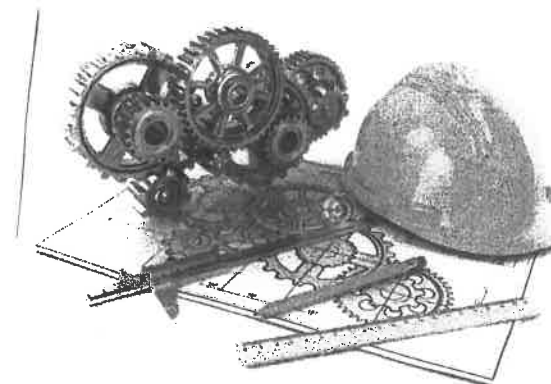
### ENGINEERING GRAPHICS AND DESIGN

### PAPER 2

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

#### PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of **6 pages**, including the cover page and **4 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, even 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 may be **assumed** in **good proportion**.
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**.



#### FOR OFFICIAL USE ONLY

QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
1	MECHANICAL ANALYTICAL			20	
2	LOC CAM			40	
3	ISOMETRIC DRAWING			40	
4	MECHANICAL ASSEMBLY			100	
SYMBOL	TOTAL			200	
	TOTAL			100	

FINAL CONVERTED MARK

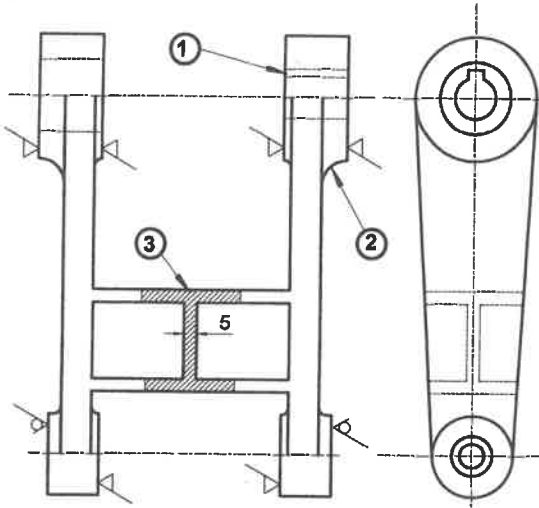
100

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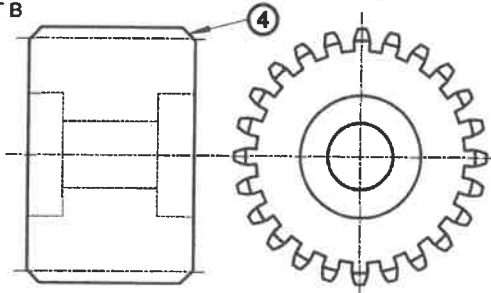
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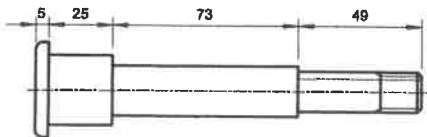
PART A



PART B

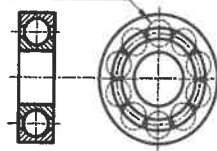


PART C



PART D

10 x Ø10 BALLS  
ON PCD 34



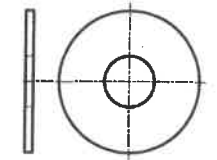
PART G



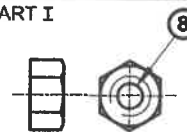
PART H



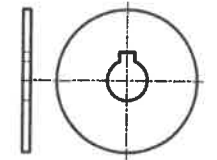
PART E



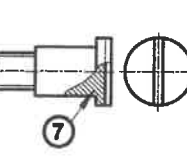
PART I



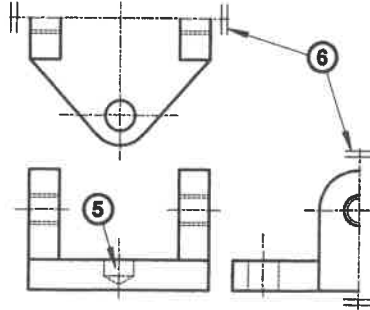
PART F



PART J



PART K



PARTS LIST

NO	PART	QUANTITY	MATERIAL
A	FRAME	1	CAST IRON
B	GEAR	1	CAST IRON
C	SHAFT	1	HIGH-TENSILE STEEL
D	BALL BEARING	2	STEEL
E	SPACER 1	1	PHOSPHOR BRONZE
F	SPACER 2	1	PHOSPHOR BRONZE
G	KEY	1	MILD STEEL
H	WASHER	1	MILD STEEL
I	M16 HEXAGONAL NUT	1	MILD STEEL
J	M12 THREADED PIN	2	MILD STEEL
K	BASE	1	CAST IRON

**DRAWN BY:** BERNARD JAMESON  
**CHECKED BY:** AMINA NADAR  
**APPROVED BY:** FRANCO  
**DATE:** 18 NOVEMBER 2017  
**SIGNED:** CARLOS MOLELE

**TITLE:**  
**BELT TENSIONER**  
**SCALE 1:2**

ALL UNSPECIFIED RADII ARE R3.  
 TOLERANCES ON ALL DIMENSIONS ARE: ±0.25

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**QUESTION 1**

**MECHANICAL  
 ANALYTICAL**

STUDY THE ADJACENT DRAWING AND ANSWER THE QUESTIONS THAT FOLLOW:

1.1 What scale is indicated for the drawing?	1
1.2 How many parts make up the belt tensioner?	1
1.3 What material is used for the bearing?	1
1.4 What should all unspecified radii be?	1
1.5 What is the diameter of the balls for the bearing?	1
1.6 What is feature 1 in Part A called?	1
1.7 What is feature 2 in Part A called?	1
1.8 Name the type of sectioning at 3 in Part A.	1
1.9 What is feature 4 in Part B called?	1
1.10 What type of hole is shown by feature 5 in Part K?	1
1.11 Explain the meaning of feature 6 in Part K.	1
1.12 What does the abbreviation "PCD" in Part D stand for?	1
1.13 How many surfaces in Part A need to be machined?	1
1.14 Name the type of sectioning at 7 in Part J.	1
1.15 Calculate the exact dimension at 8 in Part I.	1
1.16 What is the length of the shaft?	1
1.17 Which part prevents the shaft from turning in the frame?	1
1.18 In the space below, draw in NEAT freehand, a welding symbol indicating a fillet weld all round.	3

WELDING SYMBOL

ANSWER SHEET 1

EXAMINATION NUMBER

20 MARKS

QUESTION 2

LOC  
CAM

The incomplete **graph of displacement** of a **wedge-ended** follower as well as the centre of the camshaft, as shown by the given centre lines, is given.

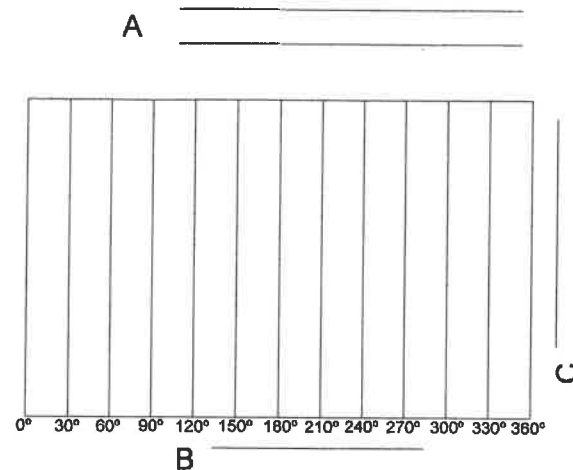
The cam imparts the following motion to the follower:

- 0°–90° the follower **rises** 30 mm with **uniform motion**.
- 90°–180° the follower **rises** 30 mm with **simple harmonic motion**.
- 180°–360° the follower returns to its original position with **uniform acceleration and retardation**.

The cam profile has the following specifications:

- The direction of turn is **anti-clockwise**.
- The **camshaft** has a diameter of 22 mm.

- 2.1 Draw the complete graph of displacement.
- 2.2 Draw the cam profile from the displacement graph.
- 2.3 Draw and hatch the camshaft.
- 2.4 Draw the wedge-ended follower (to your own appropriate size and measurements)
- 2.5 Draw the direction of rotation.
- 2.6 Print, in capitals, the required **label** for the graph of displacement at **A**, the horizontal scale at **B** and the vertical scale at **C**.
- 2.7 Show all constructions.
- 2.8 Draw and label all the divisions on the cam profile.



**ASSESSMENT CRITERIA**

- Graph 20/2 = 10
- Plot Points 15
- Locus 3
- Shaft and Hatching 2
- Direction 1
- Follower 2
- Label, constructions & scale 7

GRPH	
20/2	
PTS	
15	
LOC	
3	
SHFT	
2	
DIR	
1	
FOL	
2	
LB	
7	

40 MARKS

EXAMINATION NUMBER

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ANSWER SHEET 2

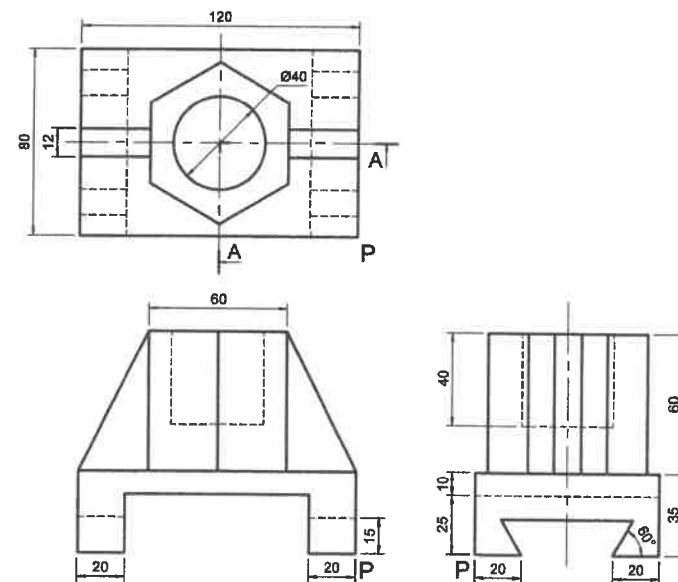
CONSTRUCTION AREA

QUESTION 3

ISOMETRIC  
DRAWING

The figure below shows the front view, top view and right view of a **CASTING**. The **CASTING** is cut by **cutting-plane A-A**.

- 3.1 Draw a neat **half-sectioned isometric** drawing on **cutting-plane A-A**.
- 3.2 Show the construction for the hexagon and any other auxiliary views.
- 3.3 Draw the centre lines for the circle.
- 3.4 Make point **P** the lowest part of your drawing.
- 3.5 Start your drawing on the given crosshairs.



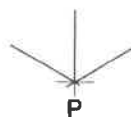
ASSESSMENT CRITERIA

• Constructions	3
• Isometric Points 40/2	20
• Isometric Circles	6
• Centre Lines	2
• Hatching / Non-Hatching	7
• Positioning	2

CON 3	
ISOM 40/2	
CIRC 6	
CLS 2	
HAT 7	
POS 2	

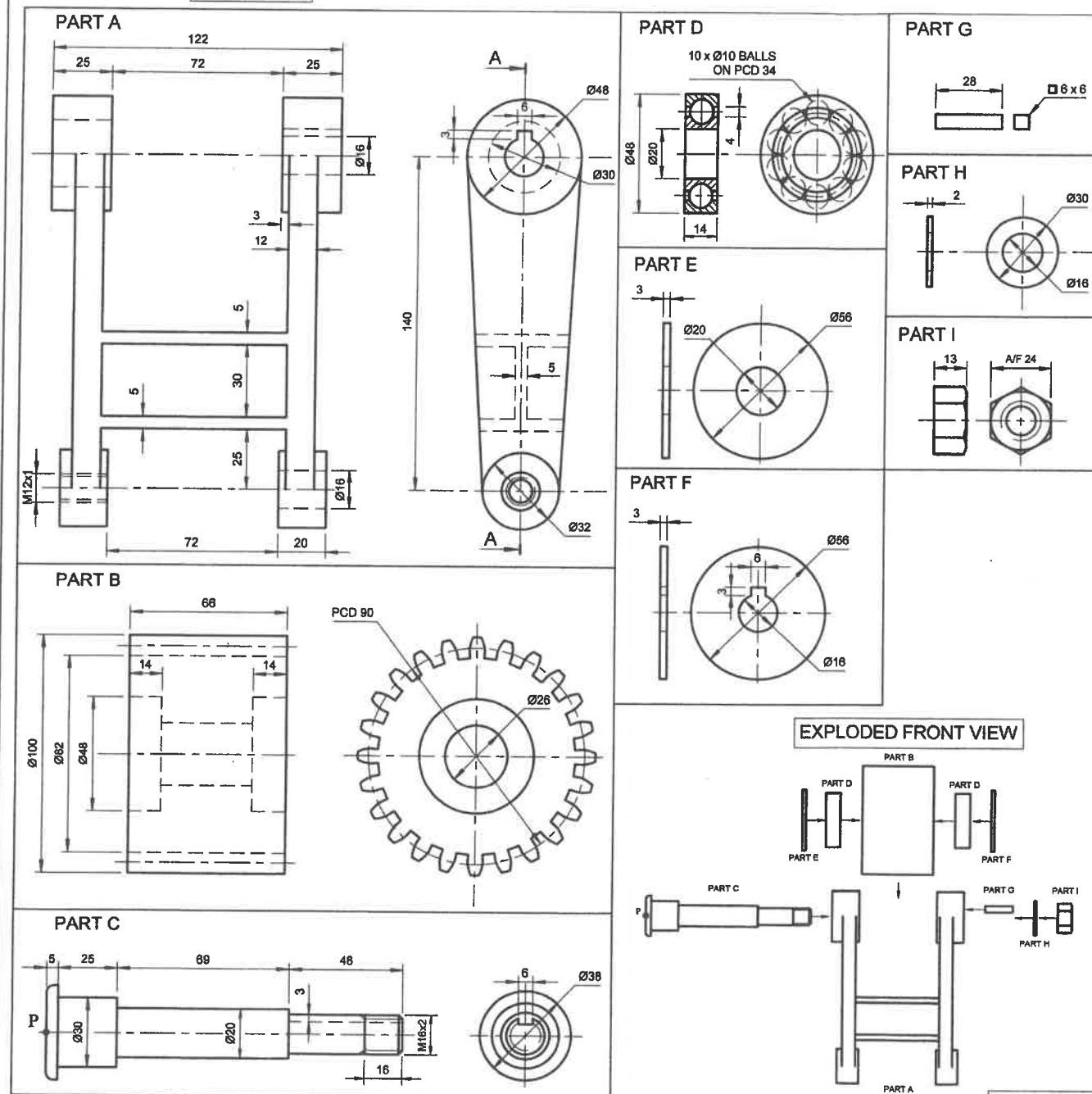
40 MARKS

EXAMINATION NUMBER



ANSWER SHEET 3

FIGURE 1



## QUESTION 4

MECHANICAL  
ASSEMBLY

Figure 1 shows the different parts (not to scale) for a **BELT TENSIONER** 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 lines and point P on the shaft (Part C) as a reference to plan the drawing layout.

- 4.1 Draw a **full sectional front view** of the assembled parts on cutting plane A-A.
- 4.2 Draw an **outside right view** of the assembled parts on the given centre lines.
- 4.3 Please note the following:
  - 4.3.1 Show **3 faces** of the **hexagonal nut** in the **front view**.
  - 4.3.2 Show the **hidden detail** of only the frame (Part A) in the **right view**.
  - 4.3.3 Draw the **cutting plane** and the missing centre lines.
  - 4.3.4 Insert 3 functional **dimensions** in the **front view**.
  - 4.3.5 Draw the projection **symbol** in the space provided.
  - 4.3.6 Print the **title** and **scale** in the space provided.
  - 4.3.7 Correctly label the completed **front view**.
  - 4.3.8 The bearings (Part D) must be drawn in convention.

PARTS LIST			
NO	PART	QUANTITY	MATERIAL
A	FRAME	1	CAST IRON
B	GEAR	1	CAST IRON
C	SHAFT	1	HIGH-TENSILE STEEL
D	BALL BEARING	2	STEEL
E	SPACER 1	1	PHOSPHOR BRONZE
F	SPACER 2	1	PHOSPHOR BRONZE
G	KEY	1	MILD STEEL
H	WASHER	1	MILD STEEL
I	M16 HEXAGONAL NUT	1	MILD STEEL

EXAMINATION NUMBER

100 MARKS

## QUESTION 4

MECHANICAL  
ASSEMBLY

## ASSESSMENT CRITERIA

## FRONT VIEW

A	FRAME	26/2	13	
B	GEAR		8	
C	SHAFT		9	
D	BEARINGS		8	
E/F	SPACERS		4	
G	KEY		2	
H	WASHER		1	
I	M16 NUT		5	
	INT THREAD		2	
TOTAL			52	

## RIGHT VIEW

A	FRAME		7	
B	GEAR		2	
E/F	SPACER		1	
C	SHAFT		3	
H	WASHER		1	
I	M16 NUT		2	
HIDDEN DETAIL		6/2	3	
TOTAL			19	

## ADDITIONAL

CORRECT ASS.		3	
HATCHING	16/2	8	
NON-HATCHING	8/2	4	
CENTRELINES	4/2	2	
DIMENSIONS		3	
CUTTING PLANE		4	
SYMBOL	4/2	2	
TITLE/SCALE/LABEL		3	
TOTAL		29	
TOTAL		100	



TITLE:

SCALE:

SYMBOL:

ANSWER SHEET 4

EXAMINATION NUMBER