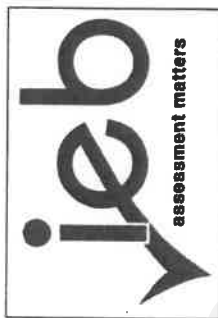




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NATIONAL SENIOR CERTIFICATE EXAMINATION

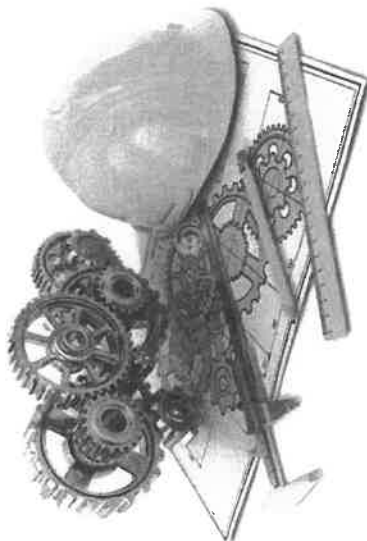
2021

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	
	TOTAL			200	

CHECKED BY

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.
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.

EXAMINATION NUMBER

QUESTION 2.1

Loc1

MECHANISM

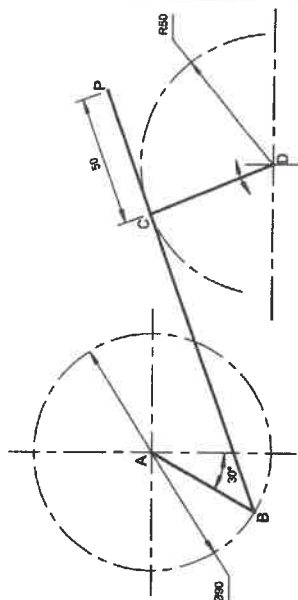
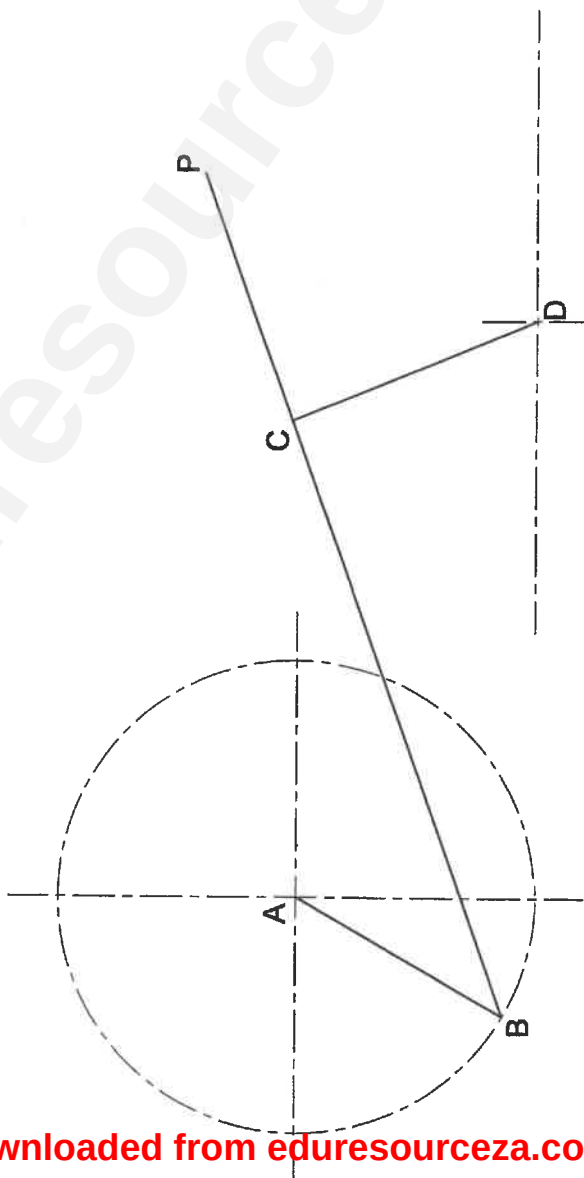
The given figure shows a mechanism consisting of a crank **AB**, with connecting rods **BC** and **CD** joined at point **C**.

P is a point extended on rod BC.

The crank **AB** rotates clockwise around centre **A** and rod **BC** pivots at **C** and **D** during rotation.

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

- The length of rod **BC** is 120
- 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
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15 MARKS

EXAMINATION NUMBER

ANSWER SHEET 2.1

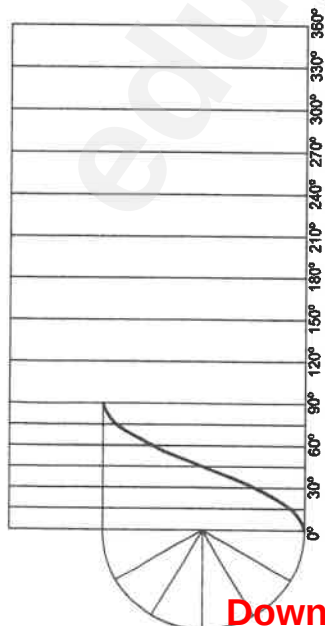
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PLEASE TURN OVER

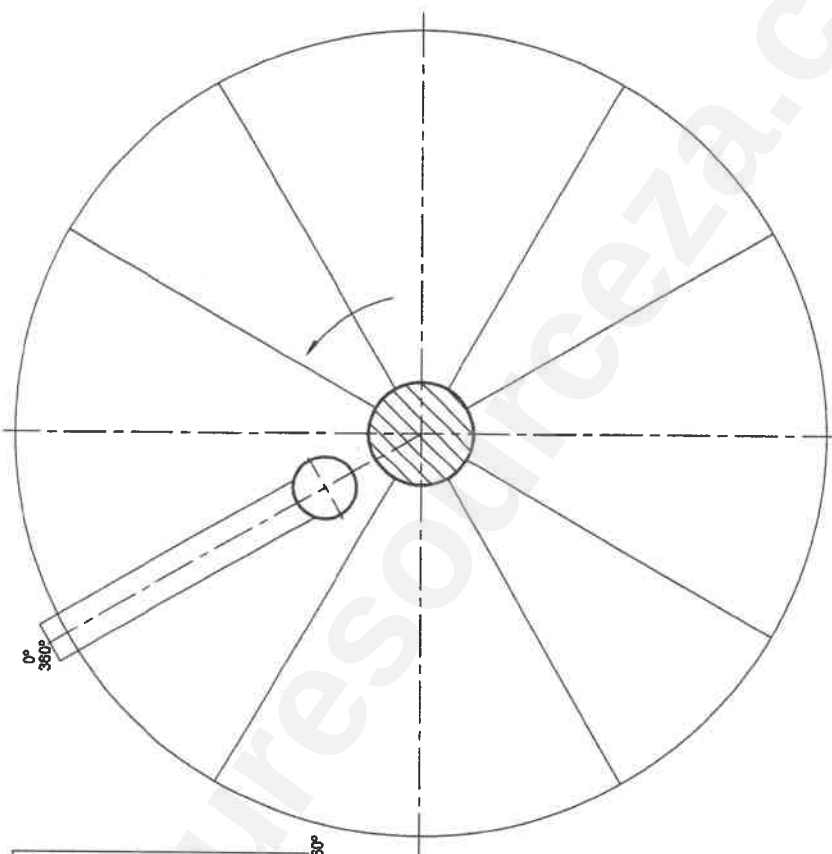
QUESTION 2.2

LOC
CAM

DISPLACEMENT GRAPH



SCALE: 8 mm = 30°



The following are given in the adjacent drawing:

- the incomplete *graph of displacement* in position of a *roller-ended follower*.
- the vertical and horizontal centre lines of the camshaft.
- the shaft and follower detail at the starting position.

The cam imparts the following motion to the follower:

- 0° – 90° the follower rises 38 mm with *simple harmonic motion*. (Given)
- 90° – 135° the follower is at *rest*.
- 135° – 180° the follower rises 18 mm with *uniform motion*.
- 180° – 360° the follower returns to its original position with *uniform acceleration and retardation*.

The roller diameter is 12 mm

Draw the following:

2.2.1 the complete graph of displacement for the required motion.

2.2.2 all missing divisions on the cam profile.

2.2.3 the cam profile from the displacement graph.

2.2.4 show all constructions.

ASSESSMENT CRITERIA

- Graph 6
- Plot Points 14
- Locus & Construction 4
- Direction & Divisions 1

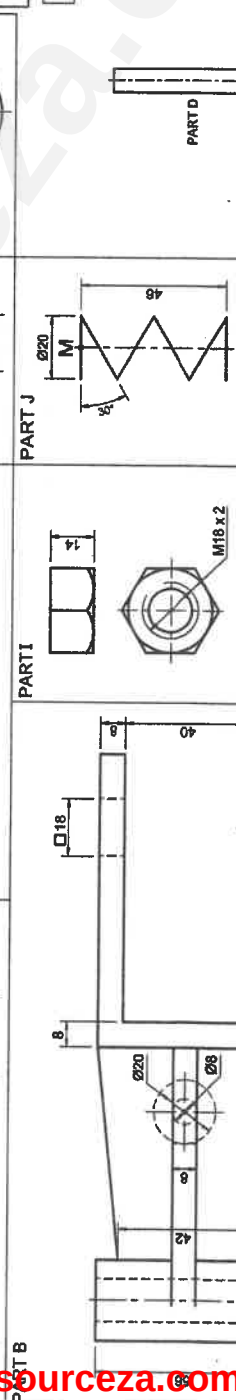
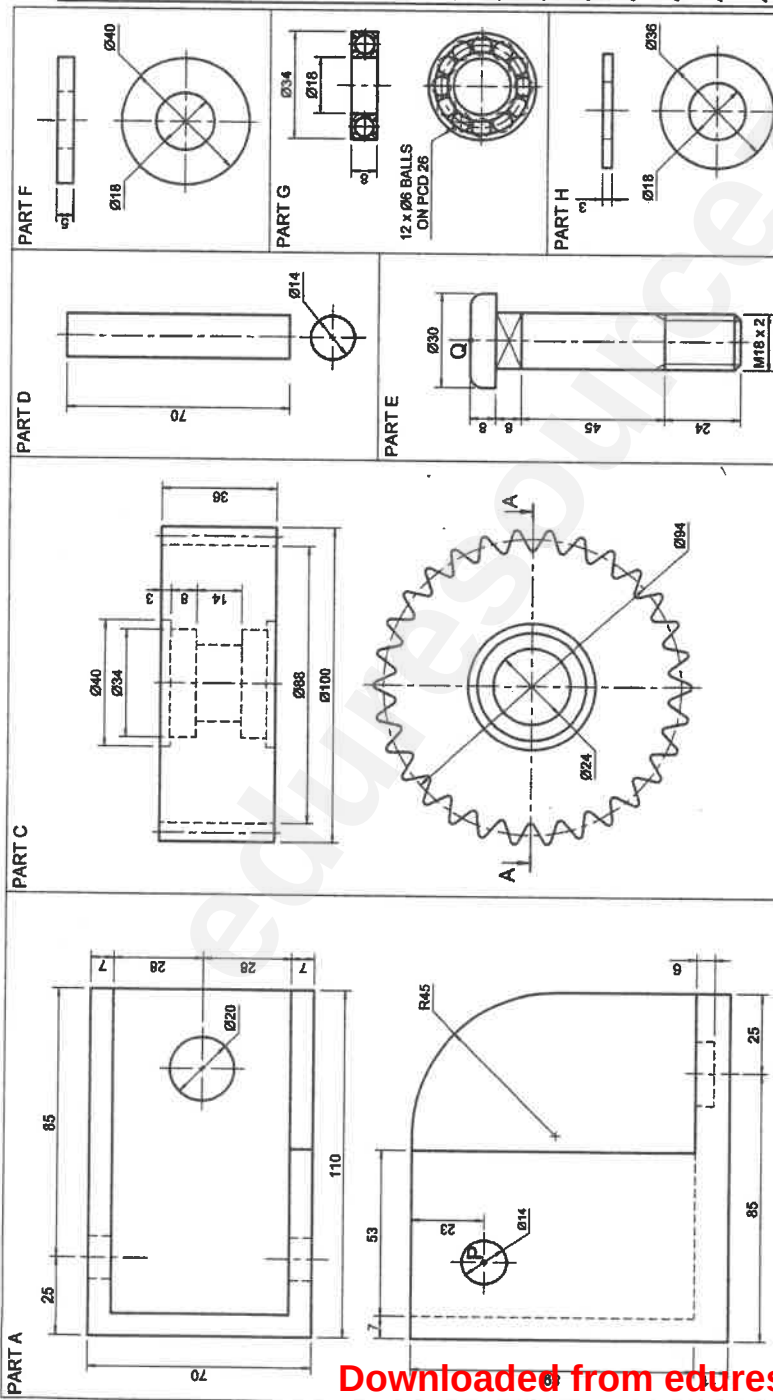
GRPH					
PTS					
LOC					
DIR					

25 MARKS

EXAMINATION NUMBER

ANSWER SHEET 2.2

FIGURE 1



NO	PART	QUANTITY	MATERIAL
A	HOUSING	1	MILD STEEL
B	FORK	1	MILD STEEL
C	GEAR	1	HIGH-TENSILE STEEL
D	PIN	1	MILD STEEL
E	M18 BOLT	1	HIGH-TENSILE STEEL
F	BEARING COVER	2	MILD STEEL
G	BEARING	2	STEEL
H	WASHER	1	MILD STEEL
I	M18 NUT	1	HIGH-TENSILE STEEL
J	SPRING	1	SPRING STEEL

EXPLODED TOP VIEW

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

The **exploded top 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 housing (Part A) and point Q on the M18 bolt (Part E) as a reference to plan the drawing layout.

4.1 Draw an **outside front view** of the assembled parts on the given centre lines.

4.2 Draw a **full sectional top view** of the assembled parts on cutting plane A-A.

4.3 Please note the following:

4.3.1 Show 2 faces for the **M18 hexagonal nut** in the **top view**.

4.3.2 Show the **hidden detail** of only the housing (Part A) in the **front view**.

4.3.3 Draw all the centre lines.

4.3.4 Draw the **cutting plane** in the **front view**.

4.3.5 Insert 3 functional **dimensions** in the **front view**.

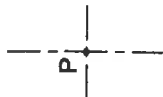
4.3.6 Print the **title** and **scale** in the space provided.

4.3.7 Correctly label the completed **top view**.

4.3.8 Point M on the spring (Part J) fits on point N on the fork (Part B) and is only seen in the outside front view.

100 MARKS

EXAMINATION NUMBER



QUESTION 4
MECHANICAL
ASSEMBLY

ASSESSMENT CRITERIA		
SECTIONED TOP VIEW		
A HOUSING	8	
B FORK	14/2	7
C GEAR	8/2	4
D PIN		2
E M18 BOLT		7
F BEARING COVER	4	
G BEARING		8
H WASHER		1
I M18 NUT		4
TOTAL		45

OUTSIDE FRONT VIEW		
A HOUSING		7
B FORK	10/2	5
C GEAR		2
E M18 BOLT		2
H WASHER		1
I M18 NUT		2
J SPRING		4
HIDDEN DETAIL		5
TOTAL		28

ADDITIONAL		
CORRECT ASS.		3
HATCHING	16/2	8
NON-HATCHING	8/2	3
CENTRE LINES	6/2	3
DIMENSIONS		3
CUTTING PLANE	8/2	3
TITLE/SCALE/LABEL		4
TOTAL		27

TOTAL	100
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EXAMINATION NUMBER

ANSWER SHEET 4

SCALE:

TITLE: