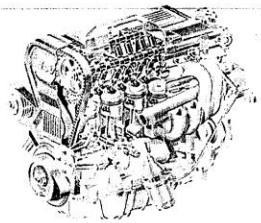
HILLCREST HIGH SCHOOL

ENGINEERING GRAPHICS AND DESIGN EXAM

NOVEMBER EXAM



GRADE 12
2020
PAPER 2

TIME: 3 hours
Examiner: Mrs Tonkin

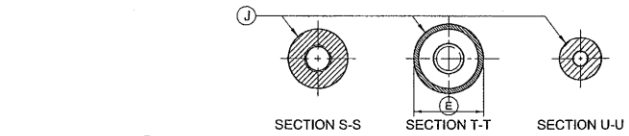
MARKS: 200
Moderator: Mr Victor

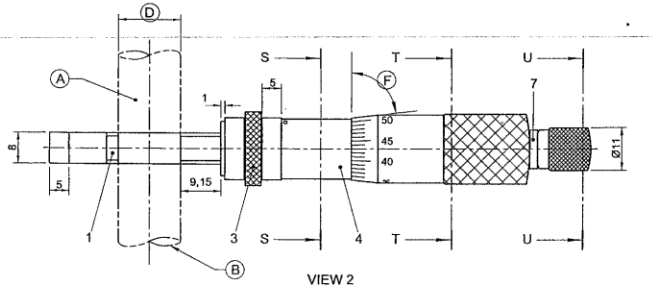
NB: READ THE INTRUCTIONS

1. This paper consists of **6 pages** including the cover page and **4 questions**.
2. Answer **ALL** questions.
3. Take note of the mark allocation in each question.
4. The questions must be answered on the answer sheets provided.
5. All the answer sheets must be **re-stapled** in **NUMERICAL** sequence and handed in irrespective of whether the question was attempted or not.
6. Time management is essential in order to complete all the questions.
7. Print your Name in the block provided on EVERY answer sheet.
8. All answers must be drawn accurately and neatly.
9. Any details or dimensions not given must be assumed in good proportion.

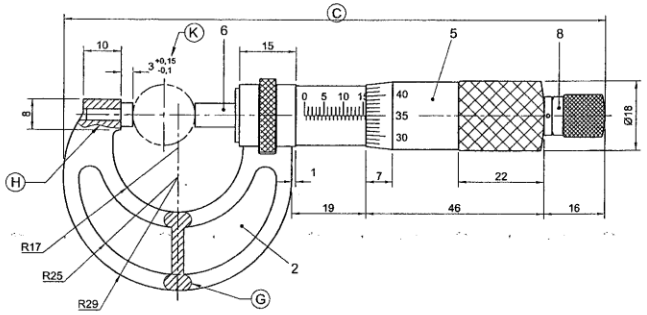
QUESTION	SECTION	MARK	MODERATE	MAXIMUM
1	MECHANICAL ANALYTICAL			28
2	LOCI – CAM			39
3	ISOMETRIC			40
4	MECHANICAL ASSEMBLY			93
	TOTAL			**200**
	SYMBOL			**100**

NAME:
TEACHER:





VIEW 2



VIEW 1

PARTS LIST

	PART	QUANTITY	MATERIAL
1	ANVIL	1	TUNGSTEN
2	FRAME	1	CAST IRON
3	SPINDLE LOCKNUT	1	TOOL STEEL
4	INNER SLEEVE	1	TOOL STEEL
5	OUTER SLEEVE	1	TOOL STEEL
6	SPINDLE	1	SILVER STEEL
7	SCREW	1	TOOL STEEL
8	RATCHET	1	TOOL STEEL

DRAWING PROGRAM: AUTOCAD 2018	SCALE 1 : 1
DIMENSIONS ARE ACCURATE AT 20 °C	DRAWING NUMBER MC 25-V2018
ACCURACY: 1 TURN OF THE OUTER SLEEVE = 0,5 mm	
MEASUREMENT RANGE: MINIMUM = 0,01 & MAXIMUM = 25,00	
APPROVED: SIYABONGI	DATE: 2018-02-28
CHECKED: JACQUES	DATE: 2018-02-10
DRAWN: WENDY	DATE: 2018-01-08
TITLE MICROMETER	

QUESTION 1: ANALYTICAL (MECHANICAL)

Given:
The front view and top view of a micrometer, sections, a parts list, a title block and a table of questions. The drawing has not been prepared to the indicated scale.

Instructions:
Complete the table below by neatly answering the questions which refer to the accompanying drawing, title block and mechanical content. [28]

	QUESTIONS	ANSWERS			
1	Who prepared the drawing?		½		
2	On what date was the drawing checked?		½		
3	What was Siyabongi's responsibility?		½		
4	What is the drawing number?		½		
5	What material is used to manufacture the anvil?		1		
6	How many parts make up this micrometer?		1		
7	At what temperature will the micrometer be accurate?		1		
8	What is the maximum size that this micrometer can measure?		1		
9	Why is the shaft at A drawn as a phantom line (double chain line)?		1		
10	What does the S-break at B indicate?		1		
11	Give TWO uses of chain lines on mechanical drawings.		2		
12	How many surfaces on this micrometer are knurled?		1		
13	What is VIEW 1 called?		1		
14	Determine the complete dimensions at: C: D: E:		5		
15	Measure the angle at F.		1		
16	Name the type of section at G.		1		
17	Name the type of section at H.		1		
18	Name the type of section at J.		2		
19	With reference to the tolerance at K, determine the minimum dimension.		2		
20	In the space below (ANSWER 20), draw, in neat freehand, the symbol for the projection system used.		4		
		TOTAL	28		

ANSWER 20: Projection symbol

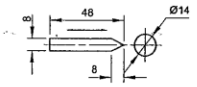
QUESTION 2: LOCI (CAM)

Given:
The detail of a wedge-shaped follower and the camshaft

Specifications:
- The follower reciprocates on the horizontal centre line of the camshaft
- The minimum distance from the follower to the centre of the camshaft = 14 mm
- Rotation = clockwise

Motion:
The cam imparts the following motion to the follower:
- It moves left with uniform acceleration and retardation for 40 mm over the first 180°
- It moves further left with uniform motion for 15 mm over the next 90°
- It moves right with simple harmonic motion back to the original position for the rest of the rotation.

Instructions:
- Draw, to scale 1 : 1, the given camshaft and the wedge-shaped follower at the minimum distance.
- Draw, to a rotational scale of 30° = 8 mm and a displacement scale of 1 : 1, the complete displacement graph for the required motion.
- Label the displacement graph and include the scale.
- Project and draw the cam profile from the displacement graph.
- Show the direction of rotation on the cam profile.
- Show ALL construction. **[39]**



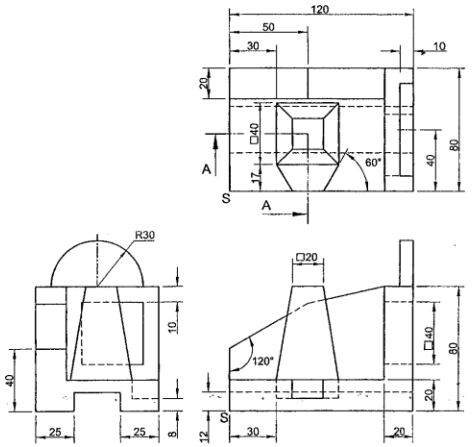
ASSESSMENT CRITERIA						
1	GIVEN + MINIMUM DISTANCE + CL	5				
2	GRAPH CONSTRUCTION	7				
3	PLOTTING POINTS + GRAPH CURVES	11				
4	CAM CONSTRUCTION	5				
5	PLOTTING OF CAM	7				
6	CAM PROFILE	4				
PENALTIES (-)						
	TOTAL	39				

QUESTION 3: ISOMETRIC DRAWING

Given:
- The front view, top view and left view of a jig
- The position of point S on the drawing sheet

Instructions:
Using scale 1 : 1, convert the orthographic views of the jig into a sectional isometric drawing on cutting plane A-A.

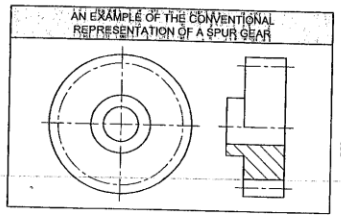
- Make S the lowest point of the drawing.
- Show ALL necessary construction.
- NO hidden detail is required. **[40]**

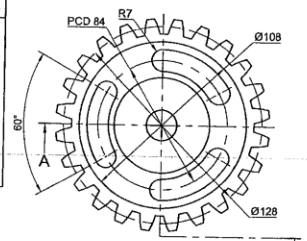


S

ASSESSMENT CRITERIA					
1	AUX. VIEW + PLACING	$2\frac{1}{2}$			
2	ISOMETRIC + NON-ISOMETRIC LINES	23			
3	SECTIONED SURFACES	9			
4	ISOMETRIC CIRCLES + CIRCLE CONSTR'	$5\frac{1}{2}$			
	TOTAL	40			

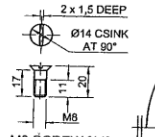
Please turn over



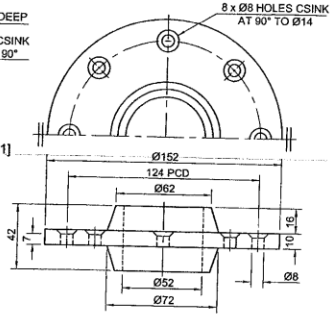


SPUR GEAR [3]

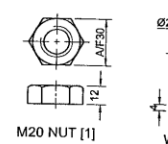
NOTE:
GEARS HAVE BEEN OMITTED FOR PURPOSE OF CLARITY



M8 SCREW [11]

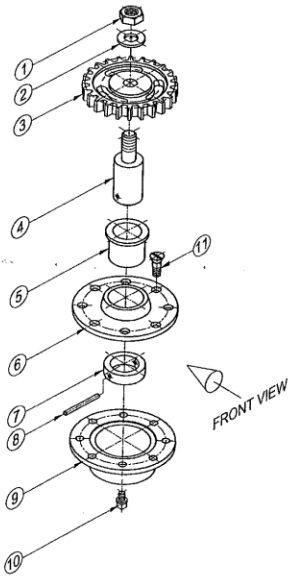


COLLAR PLATE [6]

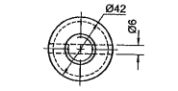


M20 NUT [1]

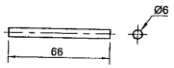
WASHER [2]



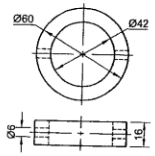
EXPLODED ISOMETRIC DRAWING



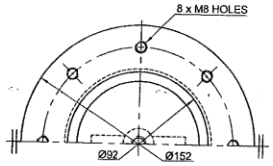
SHAFT [4]

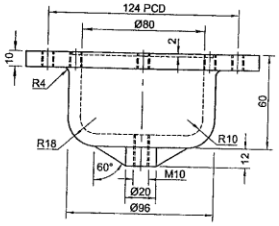


PIN [8]

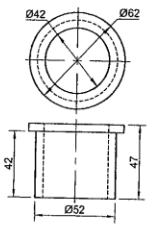


COLLAR [7]

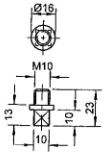




SUMP [9]



BUSH [5]



PLUG [10]

QUESTION 4: ASSEMBLY DRAWING

Given:

- The exploded isometric drawing of the parts of a gear and sump assembly, showing the position of each part relative to all the others.
- Orthographic views of each of the parts of the gear and sump assembly
- An example of the conventional representation of a spur gear

Instructions:

- Answer this question on page 6.
- Draw, to scale 1 : 1 and in third-angle orthographic projection, the following views of the assembled parts of the gear and sump assembly:
  - **4.1 The half-sectional front view** on cutting plane A-A. Show the left half in section, as seen from the direction of the arrow on the exploded isometric drawing. The cutting plane is shown on the top view of the spur gear (part 3).
  - **4.2 The top view.** Show only the top half of the view by applying the convention for the presentation of a symmetrical object.

NOTE:

- Planning is essential.
- ALL drawings must comply with the guidelines as contained in the *SANS 10111*.
- Show THREE faces of the M20 nut (part 1).
- Draw the conventional representation of the spur gear (part 3) in both views.
- NO hidden detail is required. **[93]**

PARTS LIST

	PART	QUANTITY	MATERIAL
1	M20 NUT	1	MILD STEEL
2	WASHER	1	MILD STEEL
3	SPUR GEAR	1	CAST IRON
4	SHAFT	1	CAST IRON
5	BUSH	1	MILD STEEL
6	COLLAR PLATE	1	MILD STEEL
7	COLLAR	1	MILD STEEL
8	PIN	1	MILD STEEL
9	SUMP	1	CAST IRON
10	PLUG	1	CAST IRON
11	M8 SCREW	8	MILD STEEL

CASTFORM
ENGINEERING (PTY) LTD

98 BROAD STREET
MIDDELFONTEIN
4070
www.foundry.co.za

GEAR AND SUMP ASSEMBLY

ALL DIMENSIONS ARE IN MILLIMETRES

ALL UNSPECIFIED RADII ARE 3 mm

Please turn over

FOR OFFICIAL USE ONLY	
INCORRECT OVERALL SCALE	
INCORRECT HATCHING	
PARTS NOT ASSEMBLED	
TOTAL PENALTIES (-)	

ASSESSMENT CRITERIA						
TOP VIEW						
		POSSIBLE	OBTAINED	SIGN	MODERATED	
1	GEAR	6				
2	COLLAR PLATE	$\frac{1}{2}$				
3	M20 NUT + WASHER	$4\frac{1}{2}$				
4	SYMMETRY	1				
SUBTOTAL		**12**				
SECTIONAL FRONT VIEW						
1	SUMP	$16\frac{1}{2}$				
2	PLUG	7				
3	COLLAR PLATE	$4\frac{1}{4}$				
4	BUSH	3				
5	COLLAR + PIN	5				
6	SHAFT	$9\frac{1}{2}$				
7	GEAR	10				
8	M20 NUT + WASHER	$6\frac{1}{2}$				
9	M8 SCREW	6				
SUBTOTAL		**68**				
GENERAL						
1	CENTRE LINES	3				
2	ASSEMBLY	10				
SUBTOTAL		**13**				
TOTAL		**93**				
PENALTIES (-)						
GRAND TOTAL						