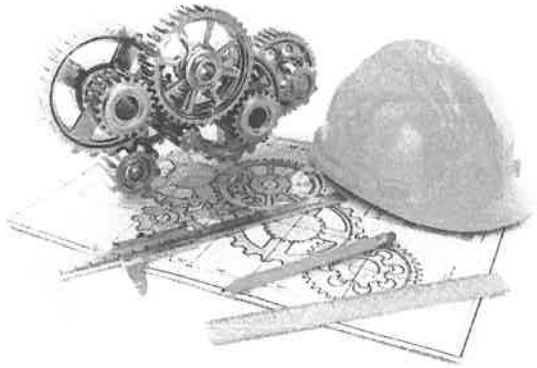
NATIONAL SENIOR CERTIFICATE EXAMINATION

2019

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**.

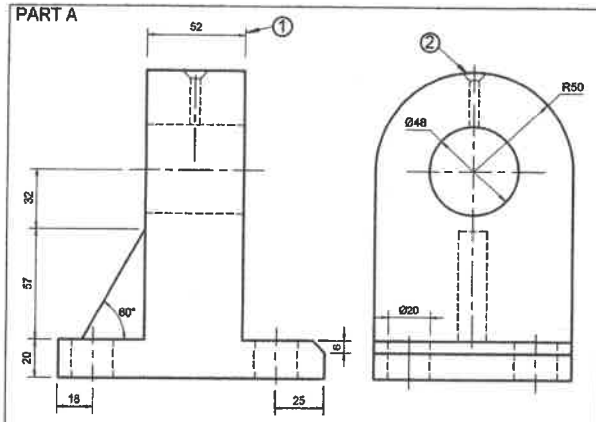
FOR OFFICIAL USE ONLY					
QUESTION	SECTION	MARK	MODERATED	MAXIMUM	CODE
1	MECHANICAL ANALYTICAL			20	
2	LOCI CAM			40	
3	ISOMETRIC DRAWING			40	
4	MECHANICAL ASSEMBLY			100	
	TOTAL			200	

EXAMINATION NUMBER

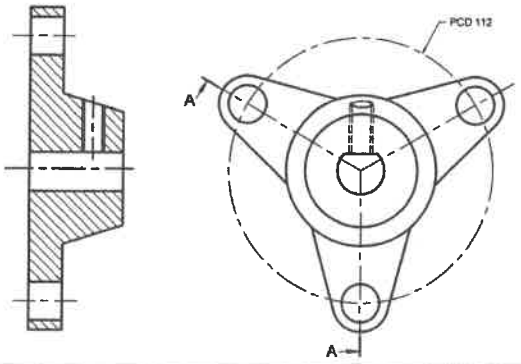
QUESTION 1

MECHANICAL ANALYTICAL

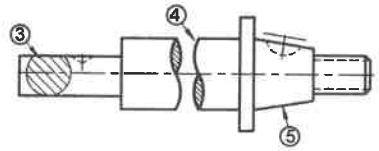
PART A



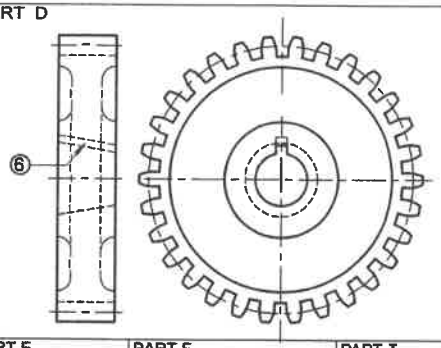
PART B



PART C

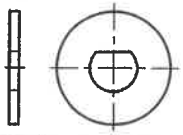


PART D



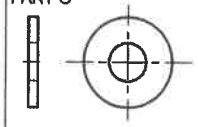
PART E

PART F



PART I

PART G



PART H

PART J

STUDY THE ADJACENT DRAWING AND ANSWER THE QUESTIONS THAT FOLLOW:

1.1 What does the abbreviation "NTS" stand for?	(1)	
1.2 What does the abbreviation "PCD" stand for?	(1)	
1.3 Name the part that is manufactured from key steel?	(1)	
1.4 What is the tolerance on all dimensions?	(1)	
1.5 What are the maximum and minimum dimensions tolerated at 1 in Part A?	(2)	
1.6 What type of hole is shown at 2 in Part A?	(1)	
1.7 Name the type of sectioning at 3 in Part C.	(1)	
1.8 What is feature 4 in Part C called?	(1)	
1.9 What is feature 5 in Part C called?	(1)	
1.10 What is feature 6 in Part D called?	(1)	
1.11 Calculate the exact dimension at 7 in Part I.	(1)	
1.12 Name the type of sectioning in Part B.	(1)	
1.13 What is the total height of Part A?	(1)	
1.14 Which part prevents the coupling from sliding on the shaft?	(1)	

1.15 In the space below, complete in freehand, the welding symbol indicating a square weld on site. (2)

WELDING SYMBOL

1.16 In the space below, complete the machining symbol indicating a perpendicular direction of lay using a grinding method to a surface roughness value of 0.2. (3)

MACHINING SYMBOL

MSIZA ENGINEERING

DESIGN / MANUFACTURE / ENGINEERING.

244 INDUSTRIAL PARK
NORTH END
PORT ELIZABETH
3655

TEL: 042 5551234
FAX: 042 5551235
CELL: 093 5551235
www.msmzl.co.za
info@msmzl.co.za

DRAWN BY:	P SWART
CHECKED BY:	FREDDIE TSHABALALA
APPROVED BY:	LEONARD MEYER
DATE:	14 JULY 2019
SIGNED:	DEAN SING

TITLE: INTERMEDIATE SHAFT AND GEAR

SCALE: NTS

ALL UNSPECIFIED RADII ARE R3.
TOLERANCES ON ALL DIMENSIONS ARE: ±0,25

PARTS LIST

NO	PART	QUANTITY	MATERIAL
A	HOUSING	1	CAST IRON
B	COUPLING	1	CAST IRON
C	SHAFT	1	MILD STEEL
D	GEAR	1	STEEL
E	BUSH	2	PHOSPHOR BRONZE
F	SPACER	1	PHOSPHOR BRONZE
G	WASHER	1	MILD STEEL
H	M12 GRUB SCREW	1	MILD STEEL
I	M20 HEXAGONAL NUT	1	MILD STEEL
J	WOODRUFF KEY	1	KEY STEEL

20 MARKS

EXAMINATION NUMBER

ANSWER SHEET 1

QUESTION 2

LOCI CAM

The drawings show the following:

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

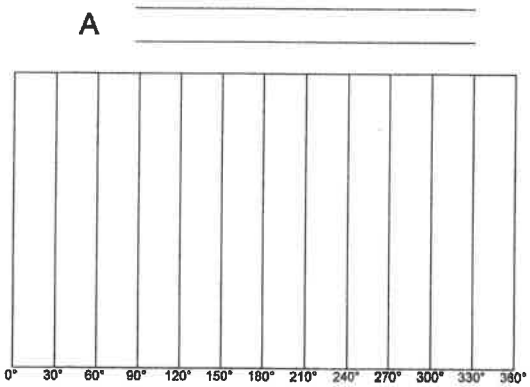
The cam imparts the following motion to the follower:

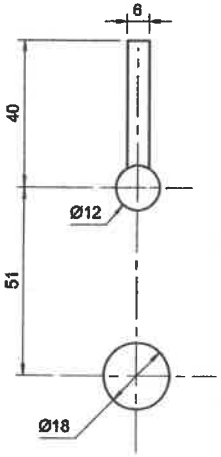
- 0° – 60° the follower is at ***rest.***
- 60° – 120° the follower ***rises*** 28 mm with ***uniform motion.***
- 120° – 165° the follower is at ***rest.***
- 165° – 255° the follower ***falls*** 56 mm with ***simple harmonic motion.***
- 255° – 300° the follower is at ***rest.***
- 300° – 360° the follower ***returns*** to its original position with ***uniform motion.***

The cam profile has the following specifications:

- The direction of turn is ***clockwise.***
- The ***camshaft*** has a diameter of 18 mm.

2.1 Draw and hatch the camshaft.
2.2 Draw the roller-ended follower to specification.
2.3 Draw the complete graph of displacement.
2.4 Draw the direction of rotation.
2.5 Draw and label all the divisions on the cam profile.
2.6 Draw the cam profile from the displacement graph.
2.7 Label the graph of displacement at **A.**
2.8 Show all constructions.





ASSESSMENT CRITERIA

• Graph & Label	15
• Plot Points	16
• Locus & Construction	4
• Shaft and Hatching	2
• Direction & Divisions	2
• Follower	1

GRPH 15	
PTS 16	
LOC 4	
SHFT 2	
DIR 2	
FOL 1	

40 MARKS

EXAMINATION NUMBER

ANSWER SHEET 2

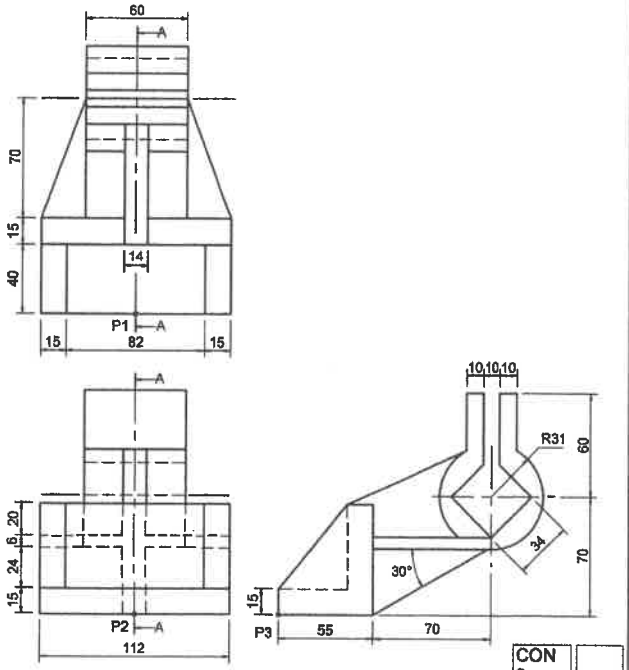
CONSTRUCTION AREA

QUESTION 3

ISOMETRIC DRAWING

The drawings below show 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 ***full-sectioned isometric*** drawing on ***cutting-plane A-A***.
3.2 Show the construction for the square 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	2
• Isometric Points 40/2	20
• Isometric Circles	8
• Centre Lines	2
• Hatching / Non-Hatching	6
• Position	2

CON 2	
ISOM 40/2	
CIRC 8	
CLS 2	
HAT 6	
POS 2	

40 MARKS

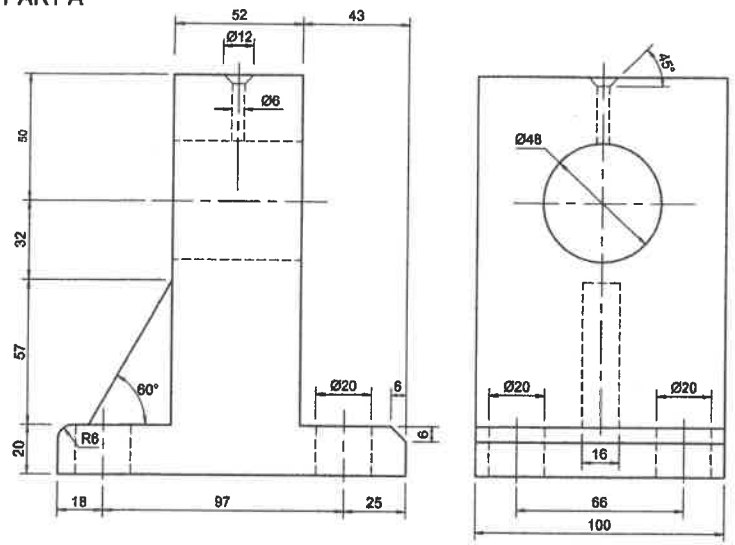
P

ANSWER SHEET 3

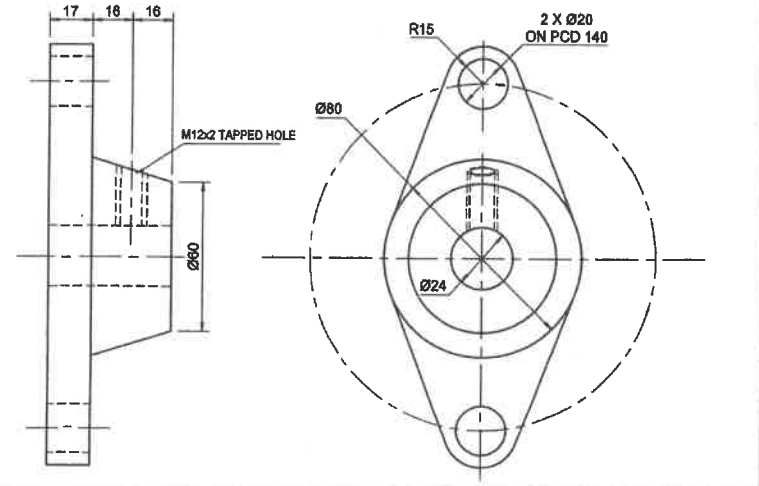
EXAMINATION NUMBER

FIGURE 1

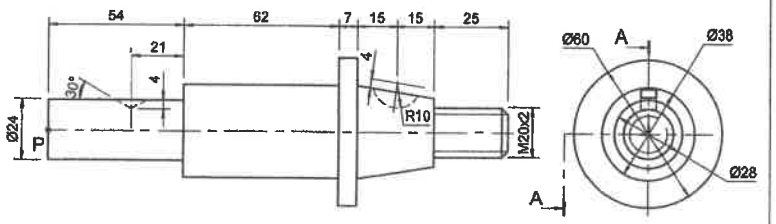
PART A



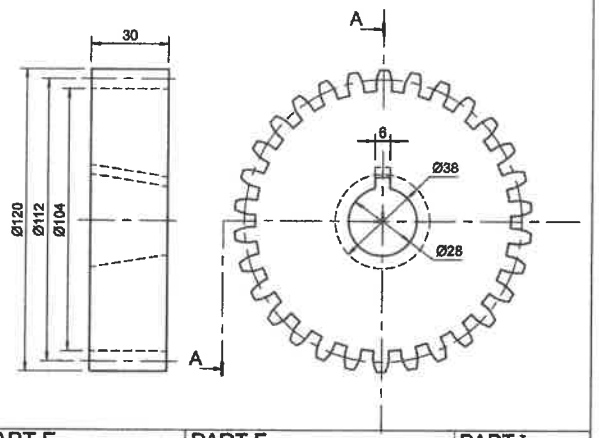
PART B



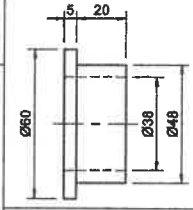
PART C



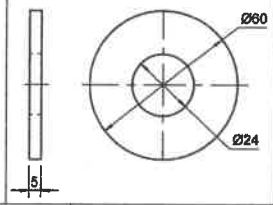
PART D



PART E



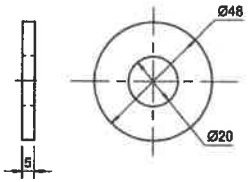
PART F



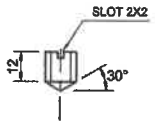
PART I

M20 NUT

PART G



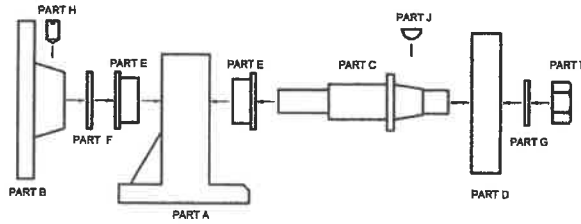
PART H



M12x2 GRUB SCREW

PART J

EXPLODED FRONT VIEW



100 MARKS

QUESTION 4

MECHANICAL ASSEMBLY

Figure 1 shows the different parts (not to scale) for an ***INTERMEDIATE SHAFT AND GEAR*** that need 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 ***half-sectional front view*** of the assembled parts on cutting plane ***A-A.*** The top half (above the centre line of the shaft) must be in section.

4.2 Draw a ***right view*** of the assembled parts, without the coupling (Part B), on the given centre lines.

4.3 Please note the following:

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

4.3.2 Show the ***hidden detail*** of only the housing (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 ***right 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 gear (Part D) must be drawn in convention.

PARTS LIST

NO	PART	QUANTITY	MATERIAL
A	HOUSING	1	CAST IRON
B	COUPLING	1	CAST IRON
C	SHAFT	1	MILD STEEL
D	GEAR	1	STEEL
E	BUSH	2	PHOSPHOR BRONZE
F	SPACER	1	PHOSPHOR BRONZE
G	WASHER	1	MILD STEEL
H	M12 GRUB SCREW	1	MILD STEEL
I	M20 HEXAGONAL NUT	1	MILD STEEL
J	WOODRUFF KEY	1	KEY STEEL

EXAMINATION NUMBER

QUESTION 4

MECHANICAL ASSEMBLY

P

ASSESSMENT CRITERIA			
FRONT VIEW			
A	HOUSING	11	
B	COUPLING	8	
C	SHAFT	8	
D	GEAR	6	
E	BUSHES	6	
F	SPACER	2	
G	WASHER	2	
H	M12 SCREW	2	
I	M16 NUT	6	
J	KEY	1	
TOTAL	52		

RIGHT VIEW			
A	HOUSING	7	
C	SHAFT	2	
D	GEAR	2	
G	WASHER	1	
I	M16 NUT	2	
HIDDEN DETAIL 12/2		6	
TOTAL	20		

ADDITIONAL			
CORRECT ASS.		3	
HATCHING	14/2	7	
NON-HATCHING	4/2	2	
CENTRE LINES	8/2	4	
DIMENSIONS		3	
CUTTING PLANE	8/2	4	
SYMBOL		2	
TITLE/SCALE/LABEL		3	
TOTAL	28		
TOTAL	100		

TITLE:	
SCALE:	

SYMBOL:	

ANSWER SHEET 4

EXAMINATION NUMBER