Manufacturing of Mechanical components using CNC turning & milling (MECH)

Course Learning Objectives	- Exploring the concept of CNC programming, operations and making applications on CNC turning /milling machines. - Gaining Advanced knowledge of CNC machining process and hands-on experience to program and machine the component. - Applying the concepts of machining and equipment handling with Program in CNC Turning /Milling machines. - Comprehending the advantages and application of CNC turning /milling machines in the manufacturing industry with industrial component drawings. - Hands-on experience in component manufacturing as per industrial practice.
Course Outcomes	- Explore the modern manufacturing technologies. - Create the programs for industrial components produced by CNC machines. - Analyze the Cutting process parameter selection, tools and path planning. - Exhibit industrial skills in the field of automotive manufacturing. - Implement multiple skill sets under the domain of manufacturing. - Implement the industrial measuring practice and examine functionalityand comparison of final product as per specification.

Course Duration: 45 Hours

UNIT I   CNC   technology   and   CNC   programming
CNC programming Introduction and demonstration of line programs - CNC programming on lathe & milling machine - CNC programming for lathe and milling machines using different machining cycles - Procedures Associated with part programming, Cutting process parameter selection, Process planning issues and path planning - G & M Codes, Interpolations, Canned Cycles and Subprograms.

UNIT II   Programming   generation   and   application   in   CNC Simulator
Functions and Identification of different parts of CNC lathe including data input – Functions and Identification of different parts of CNC mill including data input -Tool compensations Exposure for programming and simulation in Fanuc control - CNC programming on lathe & milling machine for different operations in simulator - Practice on CNC controller using on-screen simulation for generating different profile.
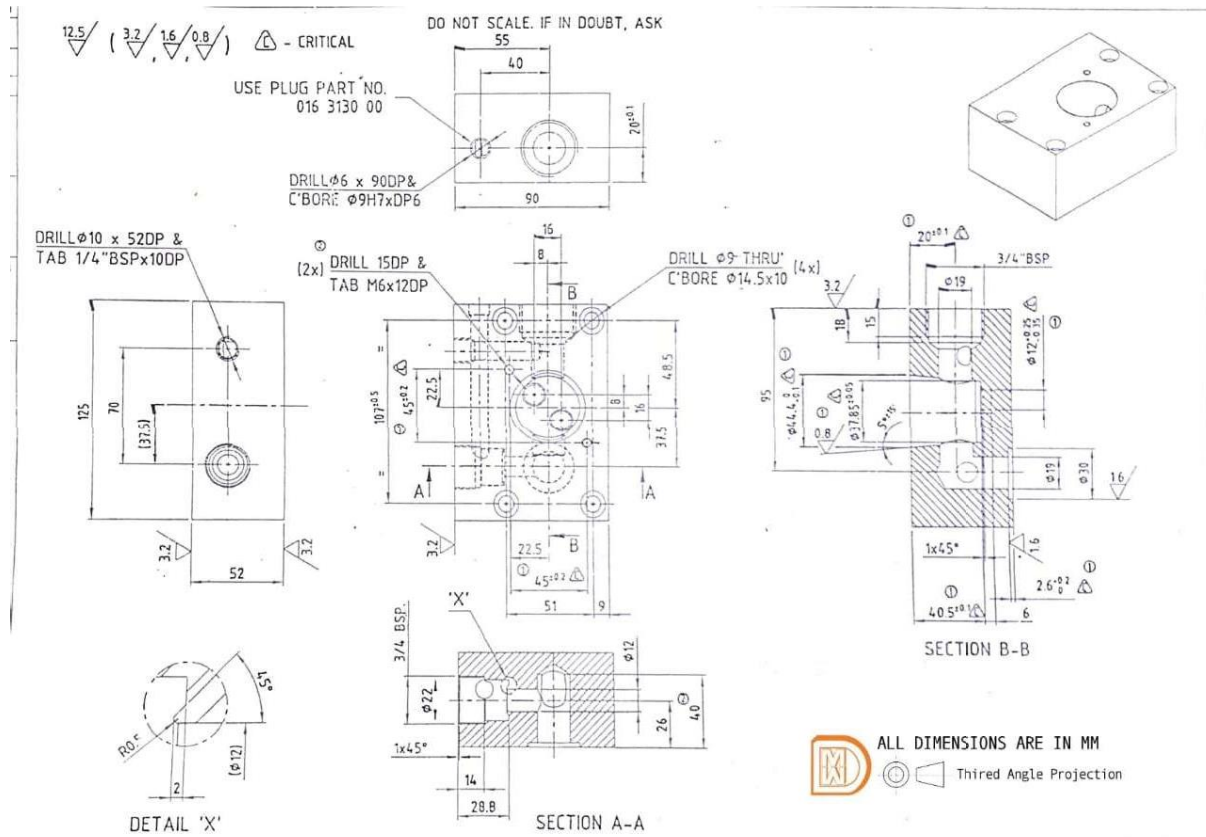
UNIT III   Programming   and   Operations   in   CNC   Turning Plan and optimize programs for CNC turning operations - Calculate parameters like speed, feed etc- set a reference for the various operations - Prepare operation and operation sequence for the lathe operations like turning, grooving etc - Prepare & set CNC lathe operations and test run programmed - Execute program and inspect simple geometrical forms / standard parts - Use of various PPE's on CNC lathe machine.

UNIT IV   Programming and Operations in CNC Milling
Plan and optimize programs for CNC Milling operations - Calculate parameters like speed feed, depth of cut etc - Set a reference for the various operations. - Various methods of work process like edge finding, block center etc - Prepare operation and operation sequence for the milling operations like face milling, End milling, Drilling, etc -Prepare & set CNC Milling operations and test run programmed - Execute program and inspect simple geometrical forms / standard parts - Use of various PPE's on CNC milling machine.

UNIT V   Co- ordinate Measuring Machine

Principles of measurement - Limits, fits and Tolerances - Direct measurement such as Vernier Caliper, Vernier Height gauge, Vernier Depth gauge, Outside Micrometer, Inside Micrometer, Depth Micrometer – Introduction to Co-ordinate Measuring Machine and measure all parameters using Co- ordinate Measuring Machine.

Test Projects:

Use Cases :

1) PART NAME - BVI BODY

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

2) PART NAME - COCK BODY

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

3) PART NAME –BODY ADAPTER QUICK
EXHAUST

SECTION B-B

DETAIL A
SCALE 2.000

SECTION A-A

ALL DIMENSIONS ARE IN MM

Thired Angle Projection

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

4) PART NAME - DISTRIBUTOR BODY

101.60 Ref
72.00
44.50
36.00
36.00
36.00
44.50 -0.05

4Nos
Ø 6.80 Drill,
M8x1.25 Tap

0.15
Diameters On Same Centre Line

Ø 60.00
Ø 70.050±0.025
M50x1.5p
Ø 48.50
1.6
1x45° Chamfering
17.55±0.05
33.55±0.05
42.50
44.00
53.55±0.05

SECTION A-A

70.00 Ref
60.00
58.00

SEE DETAIL A

Ø 46.05±0.05
Ø 30.00
Ø 5.00
R1.00

15.00 20.00

SECTION B-B

Ø 20.00   Ø 5.00

45°

ALL DIMENSIONS ARE IN MM
Thired Angle Projection
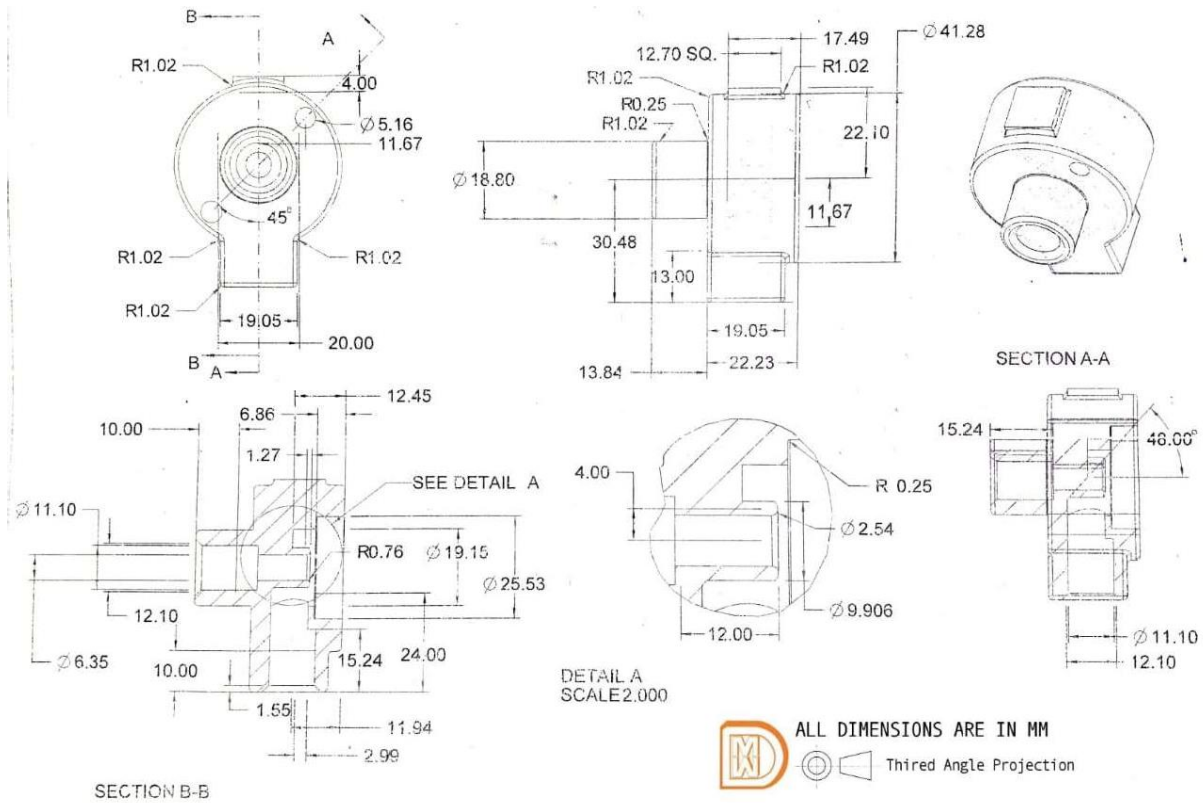
TASK:

1. Production drawing reading

2. Program writing

3. Simulation and analysis

4. Selection of tools and work holding devices

5. Machined component inspection

5) PART NAME - BODY PIPE THD SERIES

10.90 typ — 5.33
SEE DETAIL A
2.39
6.34
25.35
18.16
31.82

1 No
Ø 11.10 Drill
Depth 29.79
1/4"- 18 NPT
Tap Depth 14.10

26.16 — 23.62
12.70
10.42
42.24

1 No
Ø 4.76 Drill
Depth 33.02
Ø 8.70 Drill Depth 10.67
1/8"-27 NPT
Tap Depth 9.00
Chf.45° Major
Ø 10.67

R0.76Max
16.90

R0.76Max

4 Nos
Ø 5.10 Drill &
1/4"-20 UNC - 2B Thru
.0762x45° Chamfering

16.66 typ
16.66 typ
26.16 — 26.16

ALL DIMENTIONS IN THIS VIEW
APPLY BOTH ENDS

2 Nos,
Ø 11.10 Flat
Bottom Drill
Depth 19.81
1/4"- NPT
Chf. 45° Major Ø 14.22

R12.70
R1.00
16.28 typ
6.34 typ

1 No,
Ø 2.38 Drill Thru

2 Nos,
Ø 2.75 Drill
Depth 9.14
138-32-UNC - 2B
.86 Min Full Thd
45° Major Ø 4.06

19.25

1 No,
Ø 2.38 Drill
Depth 12.7

30.00

DETAIL A

R7.11
13.72
R12.70
Ø 44.45
6.86

11.43 12.70
typ typ

ALL DIMENSIONS ARE IN MM
Thired Angle Projection

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
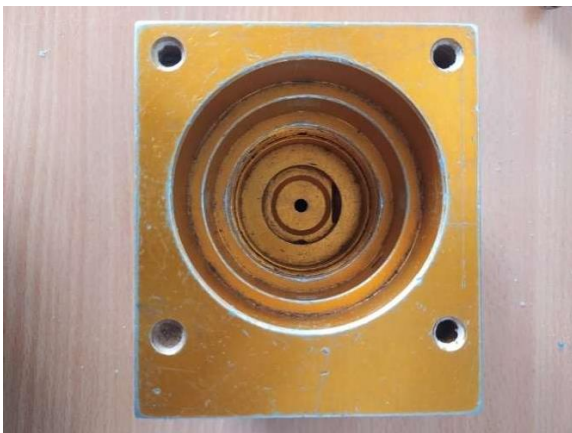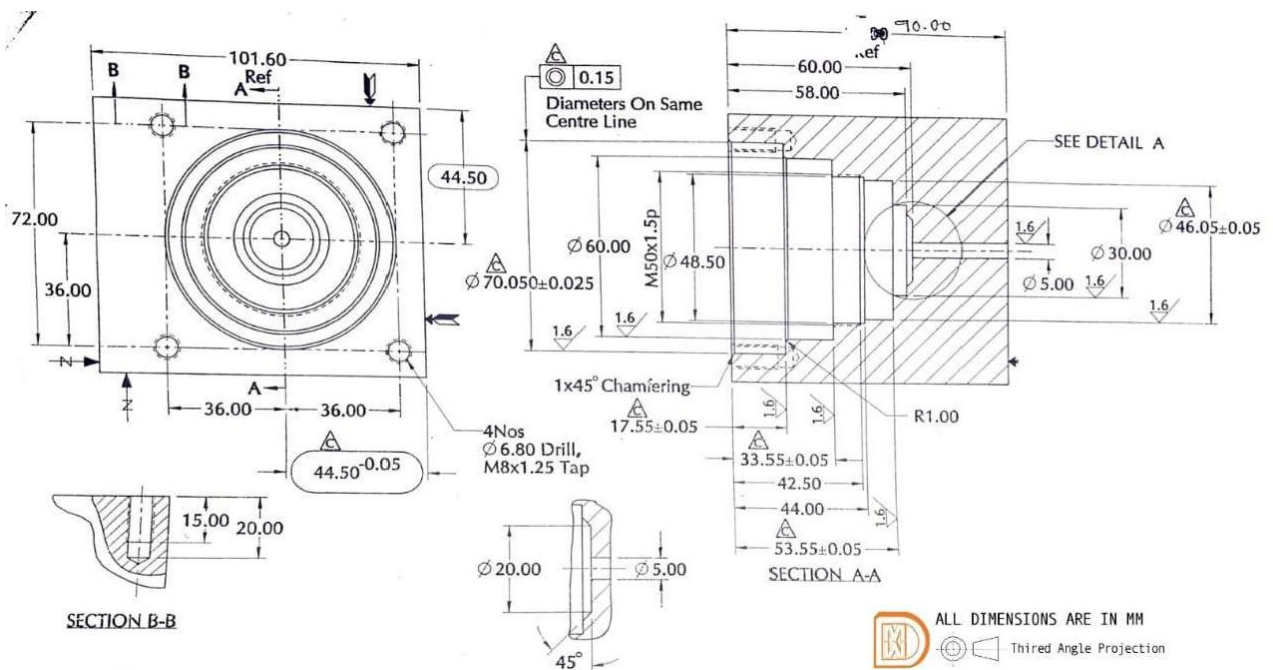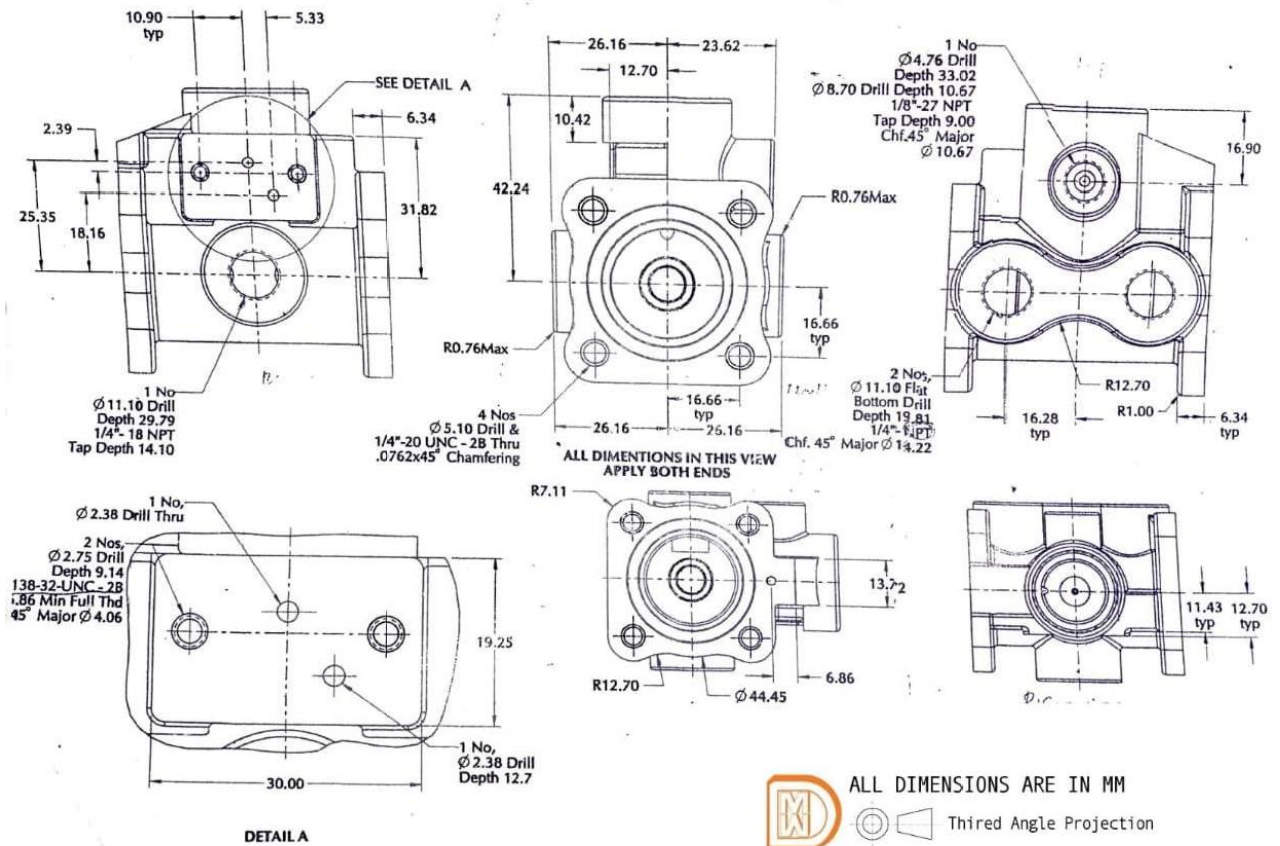5. Machined component inspection

3

R0.51
R3.05
R0.51

DETAIL C

SEE DETAIL D

1 No,
Ø 1/8 Drill
Depth 36.50
From Surface"A"

2.11
typ

SEE DETAIL C

Ø 25.81

Ø 12.70typ

45°

1.52
typ
15.75

A   19.31

0.69
R0.76

R 0.25
:th Ends

2.11typ

B

6.35

1 No,
Ø 2.38 Drill
Depth 25.40

113°   22.86

Ø 7.92 Ø 25.40 Ø 36.65
typ   typ

B

SEE DETAIL B

4.30

12.96

60.00

Ø 8.60
120°

3.56typ

R0.20

Ø 1.17Ref

1 No,
Ø 22.76 Drill
Depth 7.14
23.81-26-UNC - 2B
Depth 6.30
0.76x45° Chf

Ø 28.45

1 No,
Ø 1.17 Drill Open

Ø 15.75

1 No,
Ø 3/16 Drill
Depth 33.02
Tap Drill Ø 8.4
Depth 10.67
1/8"- NPT   Ø 23.88   Ø 23.88

SECTION B-B

ALL DIMENSIONS ARE IN MM
Thired Angle Projection

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
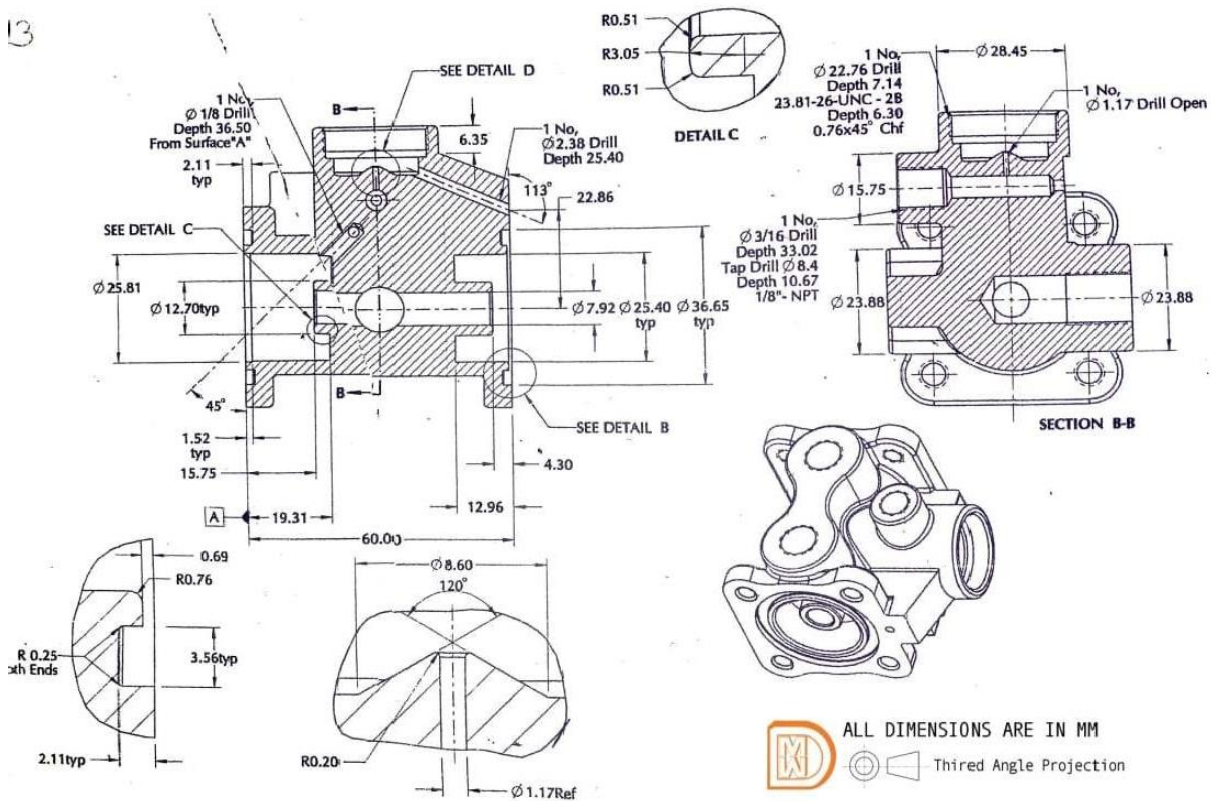5. Machined component inspection

6) PART NAME - MANIFOLD

8.00
3-Places

SECTION C-C

2.60

25.00
3-Places

C

130.00

10.00

36.00

57.00

C

55.00

10.00

20.00

37.00

104.00

15.00

Ø 8.00
3-Places

Ø 15.00
3-Places

75.00

30.00

150.00

ALL DIMENSIONS ARE IN MM

Thired Angle Projection

SL. 13

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
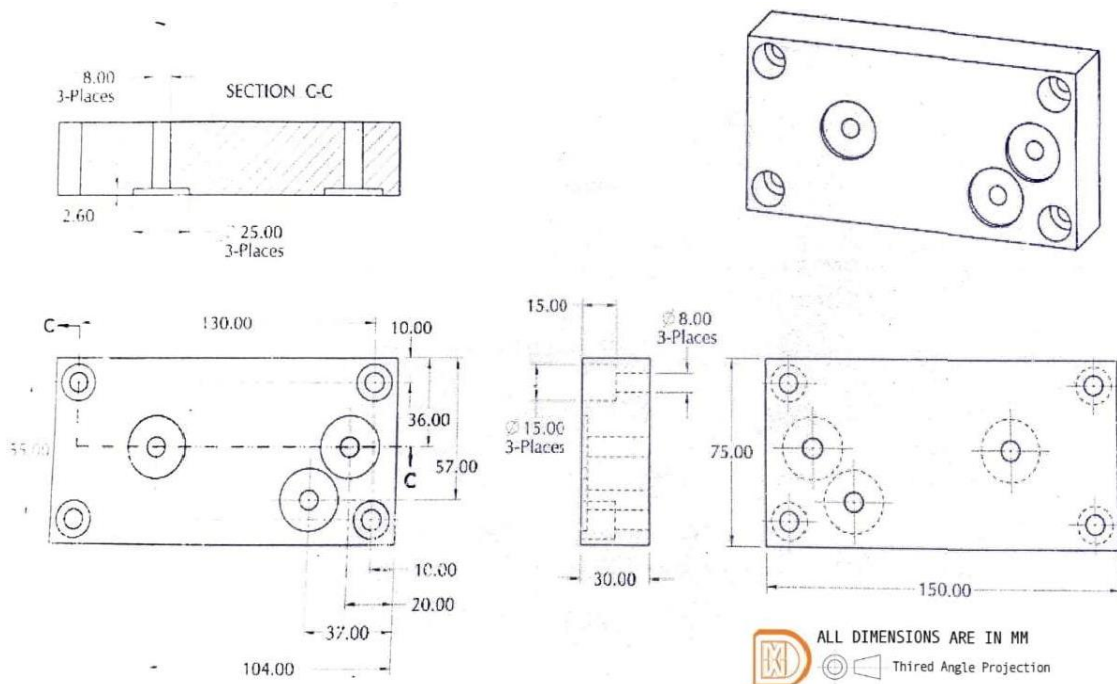4. Selection of tools and work holding devices
5. Machined component inspection

7) PART NAME - SOLENOID CAP

8.00 typ

9.00 typ

Section BB

3x45° Chamfering

52.50

3.00

⌀37.00
⌀25.40
⌀15.00
⌀9.50
⌀8.50

18.50

B A

41.00
27.00

20.50

B A

27.00

37.00

⌀5.00 Drill Thru
4-Places

5.50
4.00
1.50

48.50

⌀9.30
⌀6.50
2.00

⌀3.20

8.00

⌀28.00

⌀32.00

15.00

25.00

1.00

SECTION A-A

ALL DIMENSIONS ARE IN MM
Third Angle Projection

27.00

27.00

18.50

17.00

⌀2.20
2-Places

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
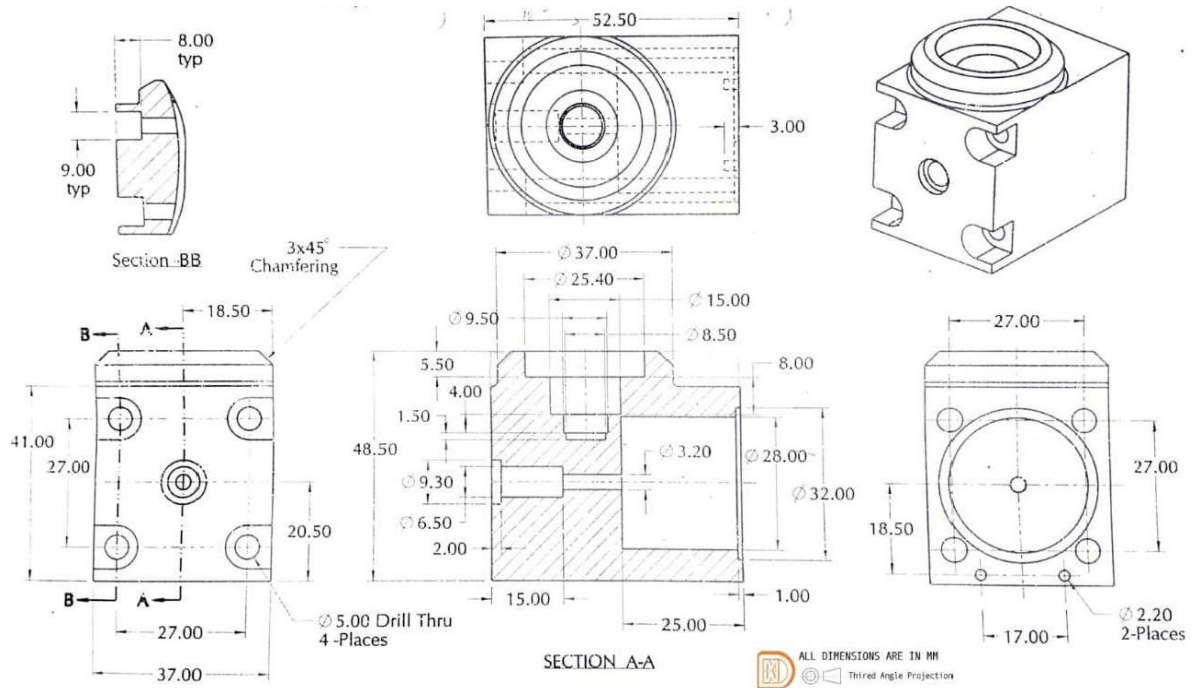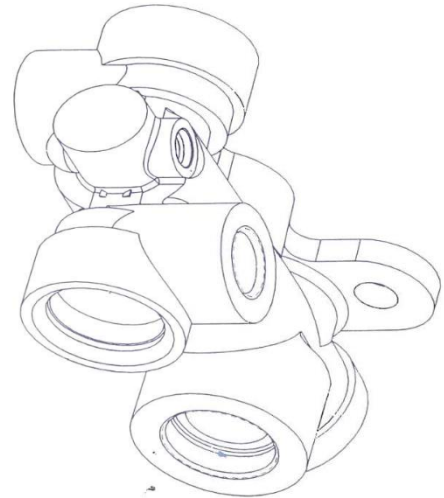5. Machined component inspection

8) PART NAME - BODY BULL

SECTION D-D

Ø4.04
25.80
14.27
Ø14.29 Spot Face
SEE DETAIL A

95.00
24.61
74.61
61.12
Ø31.75
C | D
B
50.80 34.93
B
R5.50
20.64
7.94
Ø9.53
27.78
9.97
C | D
25.40
R12.70
27.78

Chf Major Ø17.06 TYP
45° TYP
47.63
8.71 TYP
27.78 TYP
45°
3.96 TYP
Chf Major Ø28.65 TYP
Ø23.93 TYP
Ø23.01 TYP
19.07 TYP
9.53 TYP
15/16"- 28 UN - 2B Thread Depth 9.53
2 Nos Ø14.50 Drill Depth 19.07 3/8"- 18 NPT Tap Depth 14.00 (Marked at 2 & 3)
6.35
23.81
42.05

SECTION C-C

SECTION B-B

Ø23.93 Drill Depth 1.60
Ø23.00 Drill Depth 20.65
Ø33.34 typ
Ø28.5B typ
2.5x45°
2 Nos Ø12.90 Drill open 9/16"- 18 UNF - 2B Thread 9.525 Min Full Thd
Ø36.51
Ø22.76
Ø17.46
7.14 27.38 2.37
20.65 TYP
23.35
Ø14.29
71.41 TYP
27.15 25.40
44.30
Ø24.61
12.70
118.0°
27.00
7.54 typ
1.0625 - 18 UNEF - 2B Thread Depth 11.91 20.90
1 No
26.18 Chf Major Ø21.00
45°
16.27 typ
1 No Ø17.50 Drill Open 1/2"Taper Reamer Major Ø19.20 1/2"- 14 NPT Tap Open
50.80
67.47
23.81
25.40

1 No Ø6.90 Drill & 5/16"- 24 UNF - 2B Tap Thru
45°
12°
1.6B
R0.25
9.10

DETAIL A

ALL DIMENSIONS ARE IN MM
Thired Angle Projection

Ø22.76 Drill Depth 7.14
15/16 - 26 UNS - 2B Thread 5.56 Min Full Dia
23.18 Pitch Dia.,P.D To Be Perpendicular To Surfaces 'x' & 'Y' With in 0.013 T.I.R
Chf Major Ø24.61
45°
'X'
'Y'
0.80 Min - No TH'D Run Out Allowed For This Dim
R0.51 Max

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
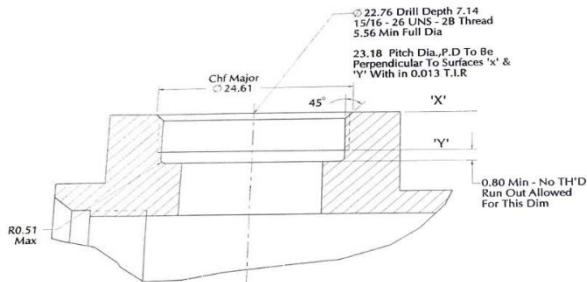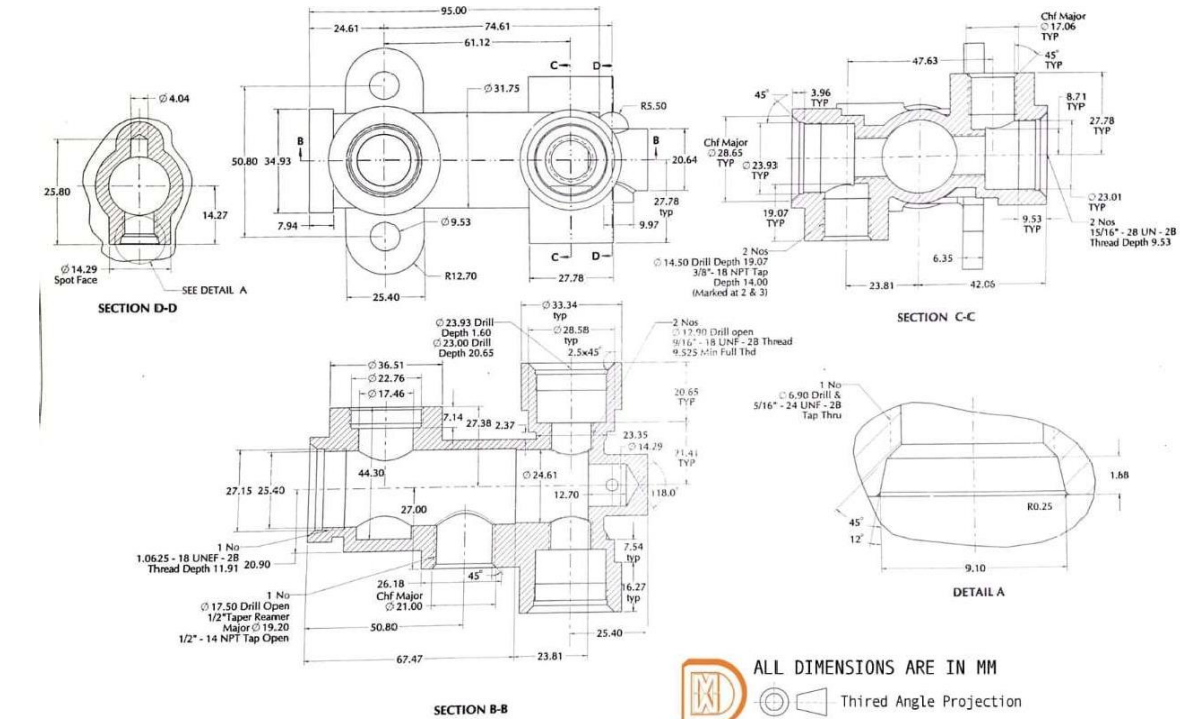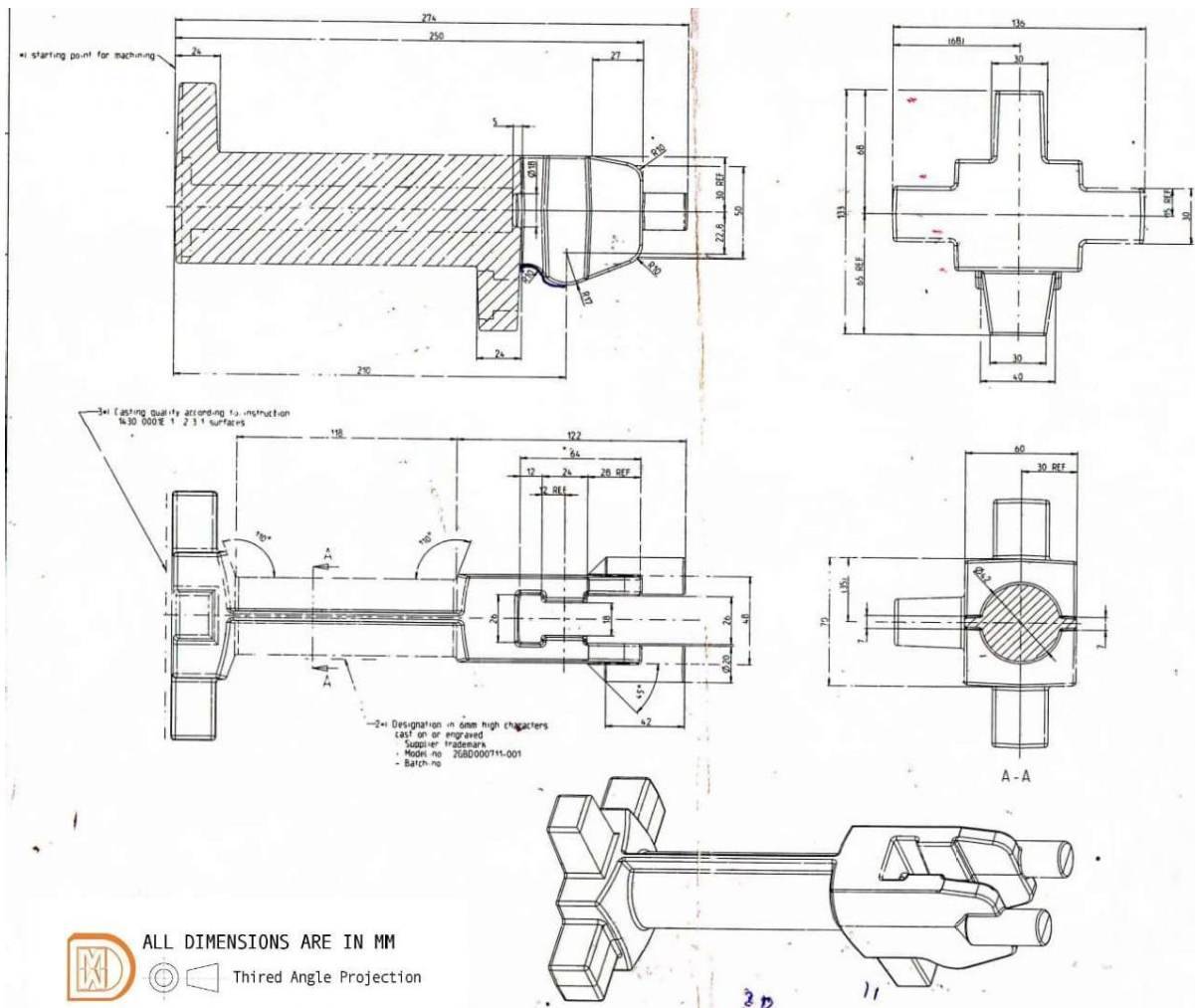5. Machined component inspection

9) PART NAME - SUPPORT

ALL DIMENSIONS ARE IN MM
Thired Angle Projection

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

ALL DIMENSIONS ARE IN MM
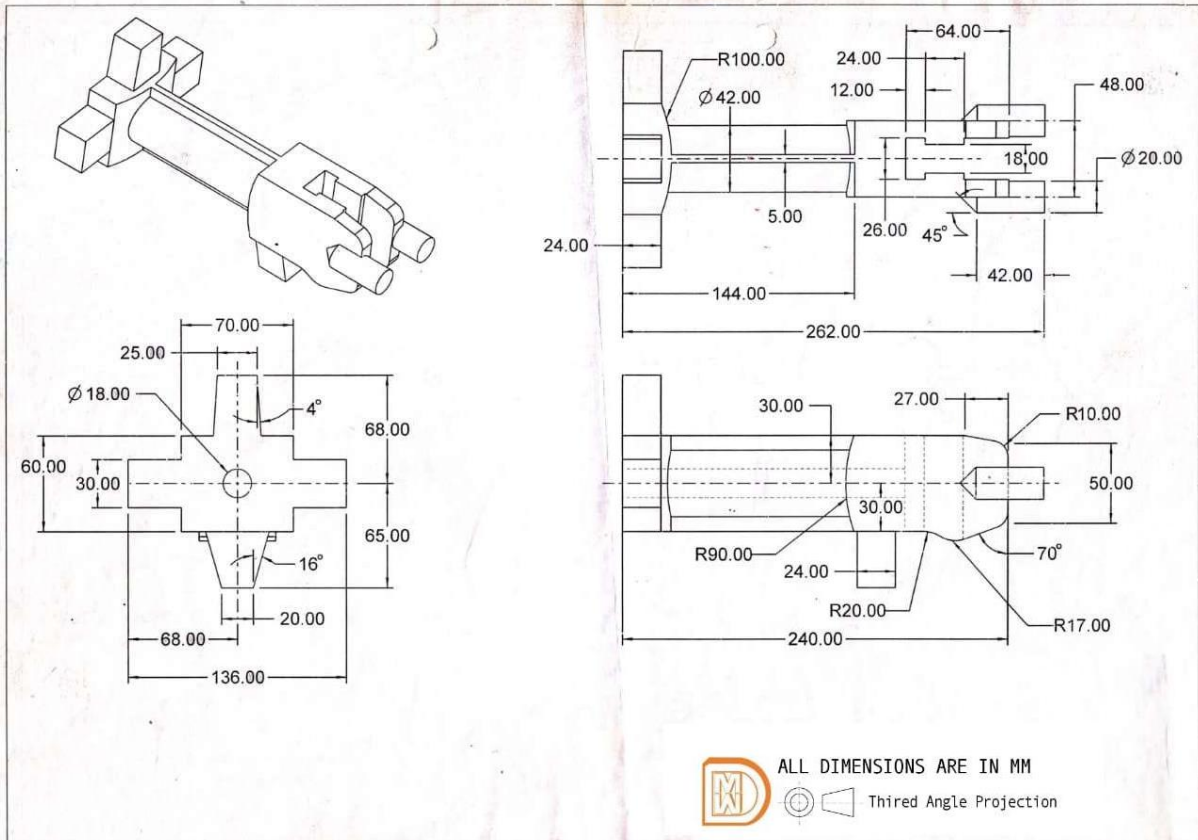
Thired Angle Projection

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection
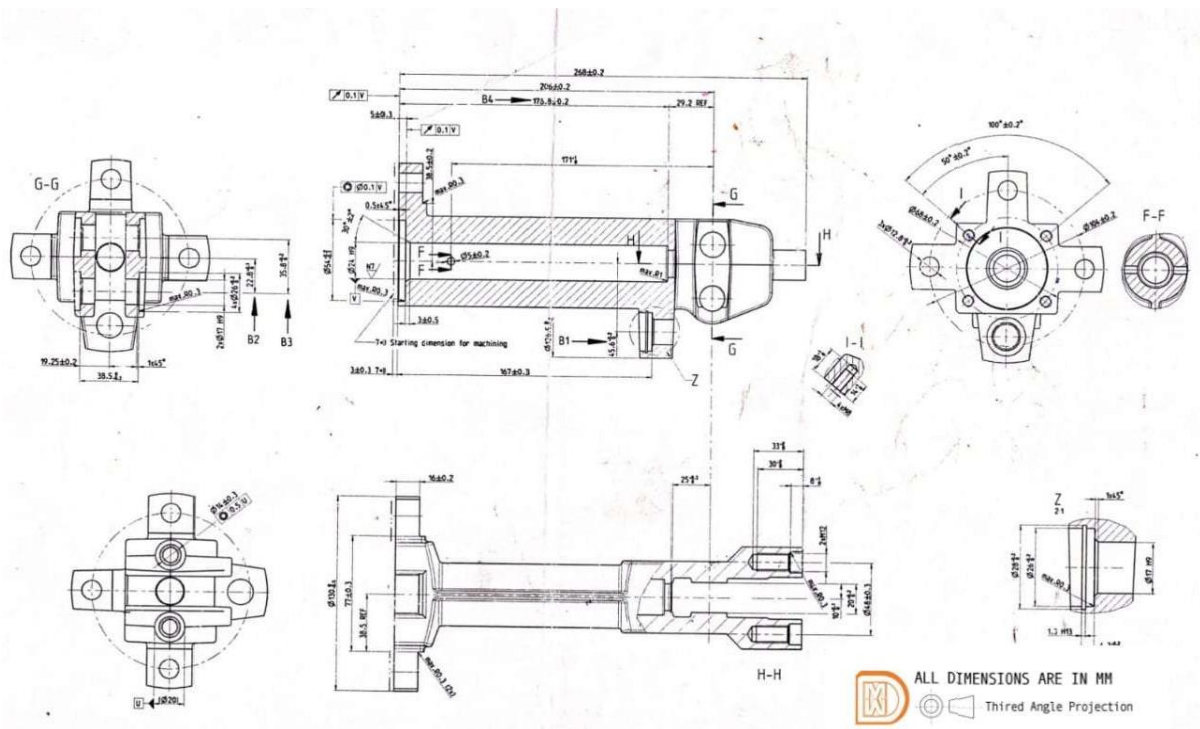
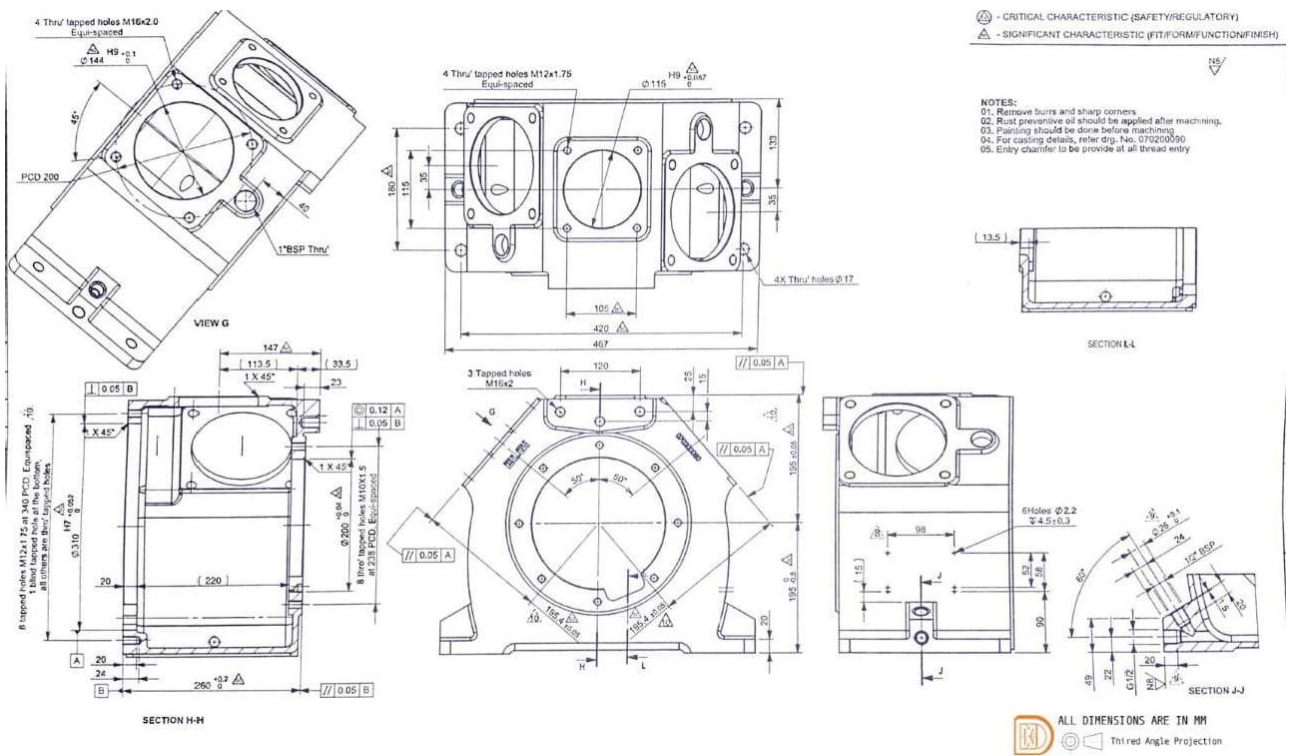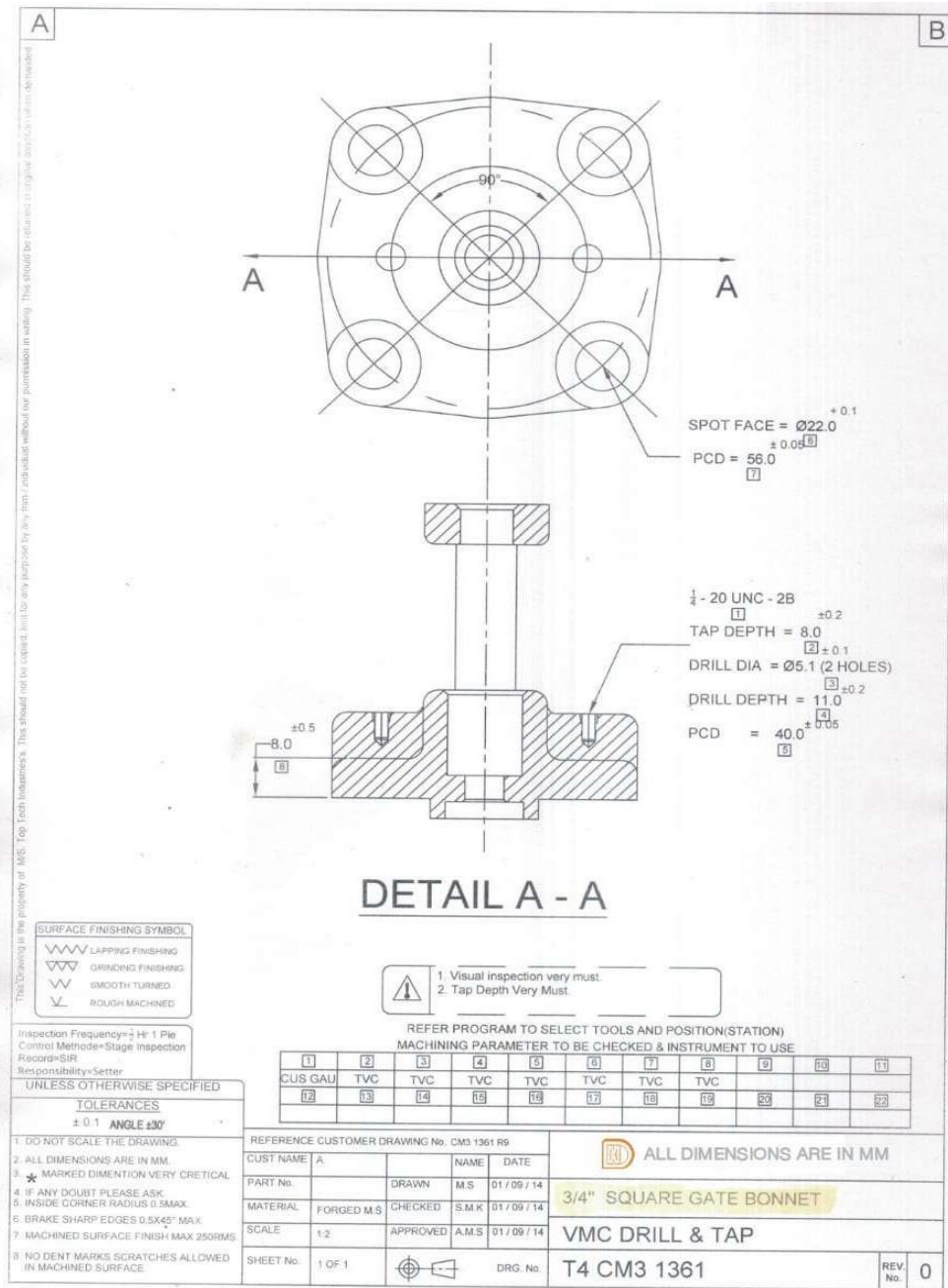# 10) PART NAME - CRANK CASE

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

11) PART NAME - SQUARE GATE BONNET

DETAIL A - A

SPOT FACE = Ø22.0 $^{+0.1}_{0}$ [6]
±0.05

PCD = 56.0 [7]

$\frac{1}{4}$ - 20 UNC - 2B [1] ±0.2

TAP DEPTH = 8.0 [2] ±0.1

DRILL DIA = Ø5.1 (2 HOLES) [3] ±0.2

DRILL DEPTH = 11.0 [4] ±0.2

PCD = 40.0 $^{±0.05}$ [5]

±0.5
-8.0
[8]

90°

SURFACE FINISHING SYMBOL

VVVV LAPPING FINISHING
VVV GRINDING FINISHING
VV SMOOTH TURNED
V ROUGH MACHINED

Inspection Frequency=½ Hr 1 Pie
Control Methode=Stage Inspection
Record=SIR
Responsibility=Setter

UNLESS OTHERWISE SPECIFIED

TOLERANCES
± 0.1 ANGLE ±30'

1. DO NOT SCALE THE DRAWING.
2. ALL DIMENSIONS ARE IN MM.
3. ★ MARKED DIMENTION VERY CRETICAL
4. IF ANY DOUBT PLEASE ASK
5. INSIDE CORNER RADIUS 0.5MAX.
6. BRAKE SHARP EDGES 0.5X45° MAX.
7. MACHINED SURFACE FINISH MAX 250RMS
8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE

1. Visual inspection very must.
2. Tap Depth Very Must.

REFER PROGRAM TO SELECT TOOLS AND POSITION(STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
CUS GAU	TVC	TVC	TVC	TVC	TVC	TVC	TVC			
[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]

REFERENCE CUSTOMER DRAWING No. CM3 1361 R9

CUST NAME	A		NAME	DATE		ALL DIMENSIONS ARE IN MM
PART No.		DRAWN	M.S	01 / 09 / 14		3/4" SQUARE GATE BONNET
MATERIAL	FORGED M.S	CHECKED	S.M.K	01 / 09 / 14		
SCALE	1:2	APPROVED	A.M.S	01 / 09 / 14		VMC DRILL & TAP
SHEET No.	1 OF 1			DRG. No.		T4 CM3 1361 REV. No. 0

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
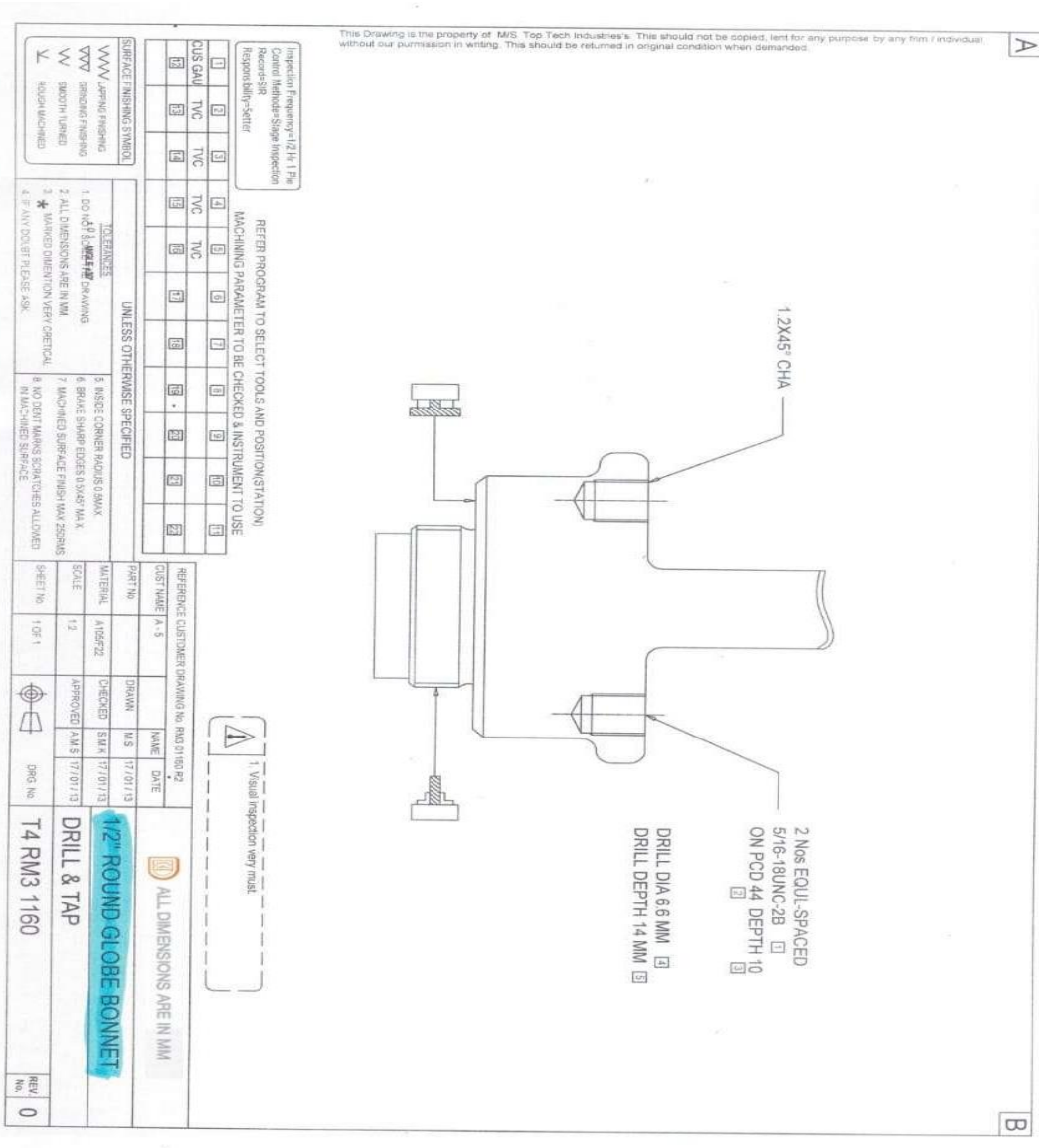4. Selection of tools and work holding devices
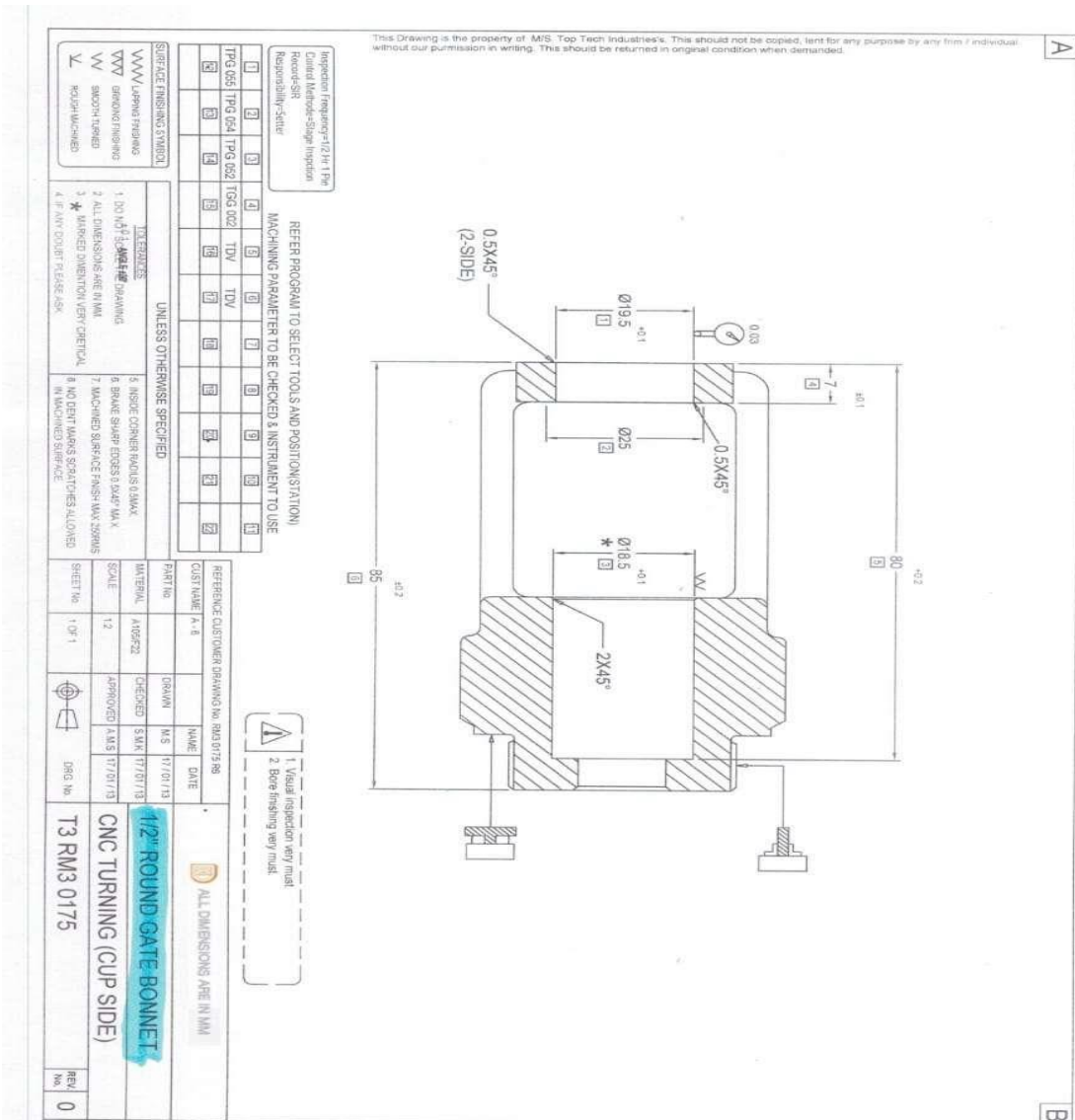5. Machined component inspection

12) PART NAME - ROUND GLOBE BONNET

This Drawing is the property of M/S Top Tech Industries's. This should not be copied, lent for any purpose by any firm / individual without our permission in writing. This should be returned in original condition when demanded.

1.2X45° CHA

2 Nos EQUI-SPACED
5/16-18UNC-2B
ON PCD 44 DEPTH 10

DRILL DIA 6.6 MM
DRILL DEPTH 14 MM

ALL DIMENSIONS ARE IN MM

1. Visual Inspection very must.

REFER PROGRAM TO SELECT TOOLS AND POSITION(STATION)
MACHINING PARAMETER TO BE CHECKED & INSTRUMENT TO USE

TOLERANCES
UNLESS OTHERWISE SPECIFIED

1. DO not SCALE THE DRAWING
2. ALL DIMENSIONS ARE IN MM
3. ✱ MARKED DIMENTION VERY CRITICAL
4. IF ANY DOUBT PLEASE ASK.
5. INSIDE CORNER RADIUS 0.5MAX
6. BRAKE SHARP EDGES 0.5X45° MAX
7. MACHINED SURFACE FINISH MAX 25(Rμm)
8. NO DENT MARKS SCRATCHES ALLOWED IN MACHINED SURFACE

SURFACE FINISHING SYMBOL
∇∇∇ LAPPING FINISHING
∇∇ GRINDING FINISHING
∇ SMOOTH TURNED
∨ ROUGH MACHINED

REFERENCE CUSTOMER DRAWING No. RMD 01160 R2		
CUST NAME A - 5		
PART No	DRAWN	M S	17/01/13
MATERIAL A105P22	CHECKED S.M.K	17/01/13
SCALE 1:2	APPROVED A.M S	17/01/13
SHEET No 1 OF 1	DRG No

1/2" ROUND GLOBE BONNET
DRILL & TAP

T4 RM3 1160

REV No 0

Inspection Frequency=12 Hr 1 Pie
Control Method=Stage Inspection
Record=SR
Responsibility=Setter

CUS GAU | TVC | TVC

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
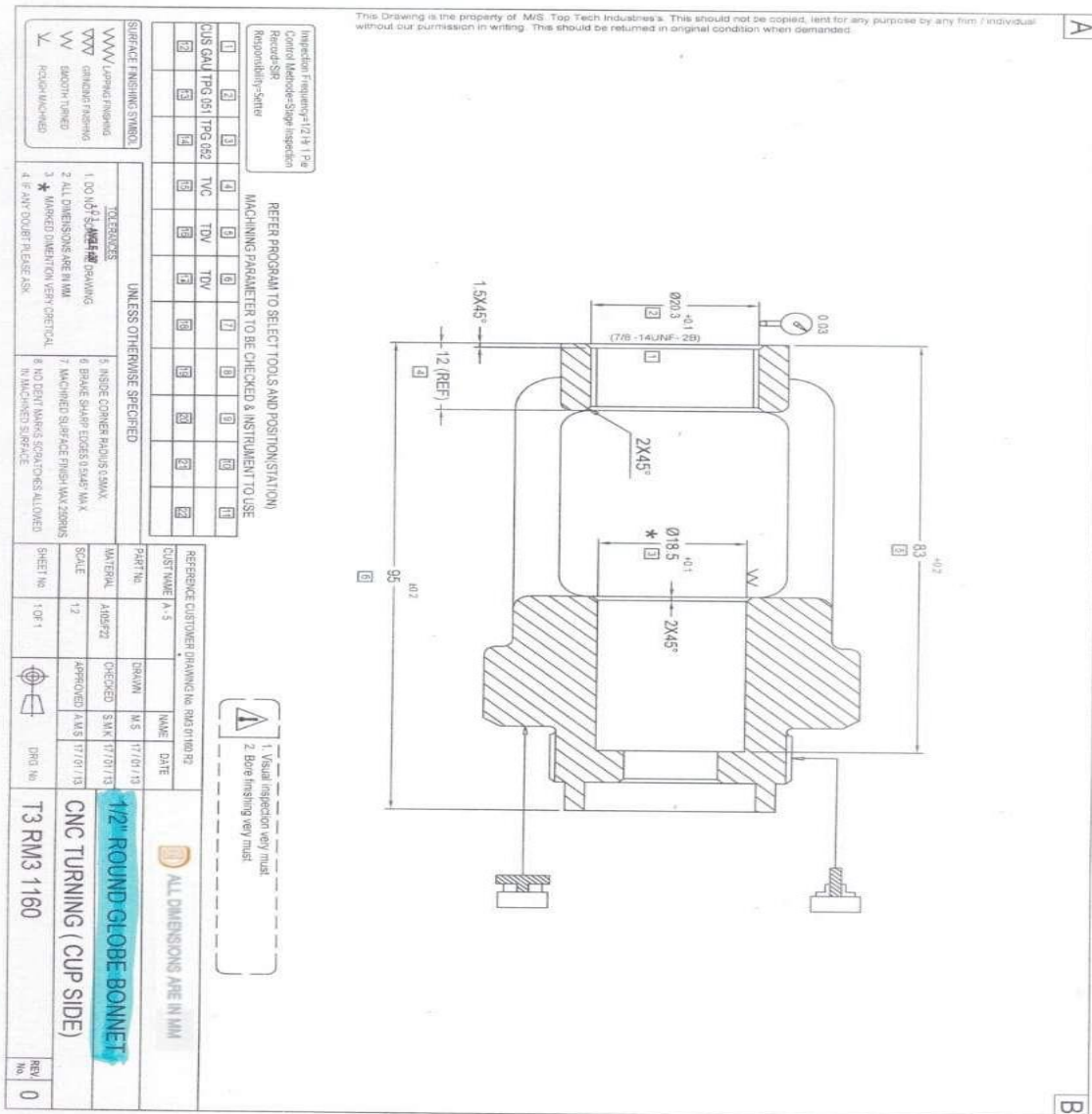5. Machined component inspection

13) PART NAME - GL BODY

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
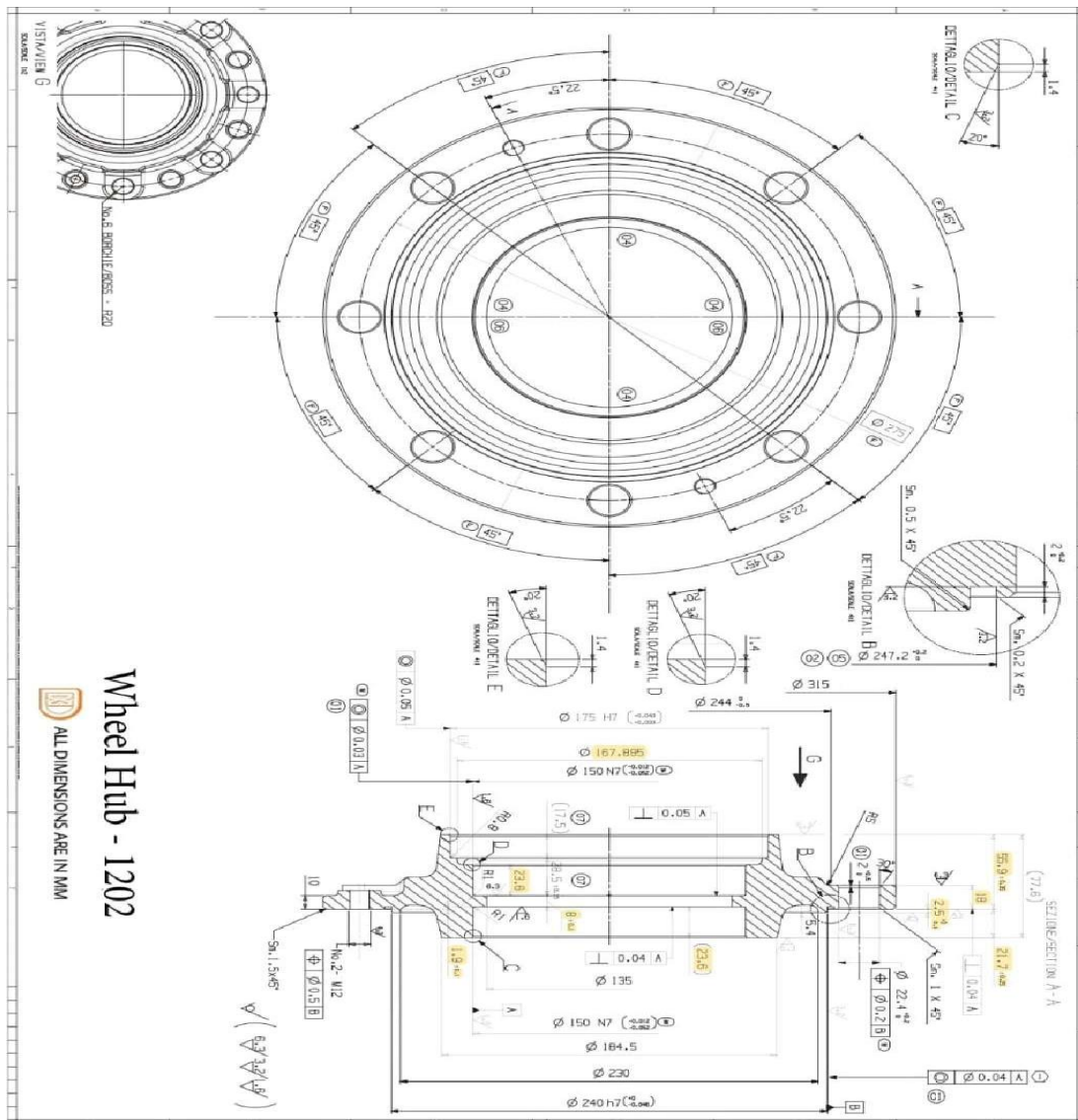5. Machined component inspection

14) PART NAME - ROUND GATE BONNET

TASK:
1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

15) PART NAME –ROUND GLOBE BONNET

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
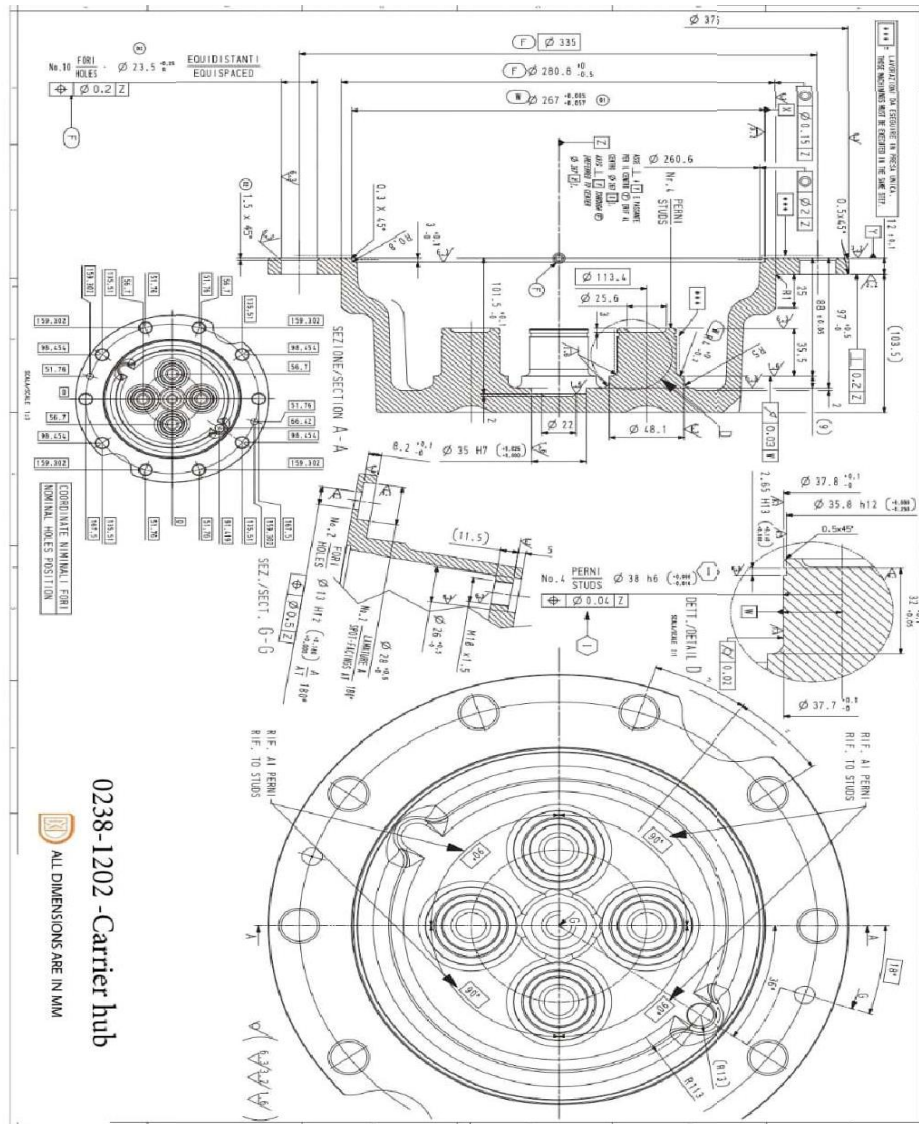5. Machined component inspection

16) PART NAME - SQUARE GATE BONNET

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

17) PART NAME - GL BODY

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

18) PART NAME - WHEEL HUB

Wheel Hub - 1202

ALL DIMENSIONS ARE IN MM

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

19) PART NAME - CARRIER HUB

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

20)   PART NAME - BRAKE COUNTER DISC

Brake counterdisc - 0,015,5388,0

ALL DIMENSIONS ARE IN MM

TASK:

1. Production drawing reading
2. Program writing
3. Simulation and analysis
4. Selection of tools and work holding devices
5. Machined component inspection

Student Assessment Plan:

Each of the above-mentioned test projects will be divided into tasks by the training partner for each specific institution. Such tasks will be jointly evaluated by the faculty and the training partner and the following weightage is to be followed.

- 70% weightage to the external practical assessment.
- 30% weightage to the internal assessment.

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 70%

Details	Marks
Task: 1	20
Task: 2	20
Task: 3	20
Task: 4	20
Task: 5	20

Employment Potential:

This course shall enable mechanical, automobile and allied domain Engineers to get employment in sectors like Manufacturing, Assembly, Maintenance, Automotive industries, Electronics, aerospace industries and etc.