COMPUTER AIDED DESIGNLABORATORY

LAB MANUAL

Subject Code	**:**	**BCCB09**
Regulations	**:**	**IARE-R18**
Semester	**:**	**I**
Branch	**:**	**CAD/CAM**

Prepared By

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MECHANICAL ENGINEERING: CAD / CAM

Program Outcomes	
PO1	Apply advanced level knowledge, techniques, skills and modern tools in the field of computer aided engineering to critically assess the emerging technological issues.
PO2	Have abilities and capabilities in developing and applying computer software and hardware to mechanical design and manufacturing fields.
PO3	Conduct experimental and/or analytical study and analyzing results with modern mathematical / scientific methods and use of software tools.
PO4	Function on multidisciplinary environments by working cooperatively, creatively and responsibly as a member of a team.
PO5	Write and present a substantial technical report / document.
PO6	Independently carry out research / investigation and development work to solve practical problems
PO7	Design and validate technological solutions to defined problems and recognize the need to engage in lifelong learning through continuing education.

Attainment of Program Outcomes

Exp. No.	Experiment	Program Outcomes Attained
1	Drafting **:** Development of part drawings for various components in the form of orthographic andisometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script,DXE AND IGES FILES.	PO1, PO2, PO3, PO5
2	Part Modeling **:** Generation of various 3D Models through Protrusion, revolve, shell sweep.Creation of various features. Study of parent child relation. Feature based and Boolean based modeling surface and Assembly Modeling. Study of various standard Translators. Design simple components.	PO1, PO2, PO3, PO5
3	Determination of deflection and stresses in 2D and 3D trusses and beams.	PO1, PO2, PO3, PO5
4	Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.	PO1, PO2, PO3, PO5
5	Determination of stresses in 3D and shell structures (at least one example in each case)	PO1, PO2, PO3, PO5
6	Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.	PO1, PO2, PO3, PO5
7	Steady state heat transfer Analysis of plane and Axisymmetric components.	PO1, PO2, PO3, PO5
8	Development of process sheets for various components based on tooling Machines.	PO1, PO2, PO3, PO5
9	Development of manufacturing and tool management systems.	PO1, PO2, PO3, PO5
10	Study of various post processors used in NC Machines.	PO1, PO2, PO3, PO5
11	Development of NC code for free form and sculptured surfaces using CAM packages.	PO1, PO2, PO3, PO5
12	Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232	PO1, PO2, PO3, PO5
13	Quality Control and inspection.	PO1, PO2, PO3, PO5

SYLLABUS :

I Semester: CAD/CAM								
Course Code	Category	Hours / EXPERIMENT			Credits	Maximum Marks		
BCCB09	Core	L	T	P	C	CIA	SEE	Total
		0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

OBJECTIVES:

The course should enable the students to:

1. Basic understanding of modern trends in design and manufacturing using CAD/CAM.
2. Advanced aspects of enabling computer aided technologies used in design.
3. Application of thermal analysis software.

EXPERIMENT-1	**INTRODCUTION TO CAD AND TOOLS :Part -1**
Creation of working drawing, creating geometry, constraining the profile, extracting a part using tools, creating pattern of hole.	
EXPERIMENT-2	**INTRODUCTION TO CAD AND TOOLS:Part-2**
Translating Rotating, Mirroring, Managing The Specification Tree. Creating Sheets And Views, Creating Text And Dimensions.	
EXPERIMENT-3	**ASSEMBLY OF PART DRAWING :Part -1**
Creating an assembly, moving components, assembling existing components, creating bill of materials	
EXPERIMENT-4	**ASSEMBLY OF PART DRAWING :Part -2**
Creating wire frame and surface geometry using generative shape design and sweep tools.	
EXPERIMENT-5	**GENERATION OF SURFACES :Part -1**
Generation of Ferguson’s cubic surface patches, Bezier surface patches	
EXPERIMENT-6	**GENERATION OF SURFACES :Part-2**
Generation of Coon’s patch, import and export of drawing from other software.	
EXPERIMENT-7	**ANALYSIS OF MODEL :Part -1**
Linear static analysis :Automatic calculation of rigid body modes using specified Eigen value shift, lumped and consistent mass matrices	
EXPERIMENT-8	**ANALYSIS OF MODEL:Part-2**
Buckling Analysis: Jacobi inverse iteration techniques, steady state harmonic response, and mode superposition method, overall structural and damping. Linear dynamic analysis: Non linear static analysis, Non-linear dynamic analysis. Steady state heat transfer analysis problems.	
EXPERIMENT-9	**THERMAL ANALYSIS :Part -1**
Transient Heat Transfer Analysis: Familiarity with element library, Defining Boundary conditions, multipoint constraint familiarity with different types of loads.	
EXPERIMENT-10	**THERMAL ANALYSIS:Part-2**
Solution techniques, direct and iterative solver. Results and analysis. Design optimization.	

Text Books:

1. Farid Amirouche, “Principles of Computer-Aided Design and Manufacturing, Pearson, 2nd Edition, 2004.
2. P. Radha Krishnan, “CAD/ CAM/ CIM”, New Age International, 4th Edition, 2016.
3. Warren. S. Seames, “Computer Numerical Control Concepts and Programming”, Delmar Cengage Learning, 4th Edition, 2013.

EXPERIMENT – 1

INTRODCUTION TO CAD AND TOOLS :Part -1

CAD Lab

CAD (Computer Aided Design) provides a convenient means to create designs for almost every engineering discipline. It can be used for architectural design, landscape design, interior design, civil and surveying, mechanical design, electrical engineering, plant design, industrial design, duct design, electronic circuit design,plumbing design, textile design and product design.

The following are the main objectives of CAD Lab:

- To present an overview of CADD and describe its applications in different fields.
- To describe common terms associated with CADD hardware and software.
- To outline the basic principles associated with CADD and to demonstrate common drafting techniques and shortcuts used by professionals.
- To introduce the advanced capabilities of CADD and how they can be used to increase productivity.
- To provide information about the CADD industry resources.

CAM Lab

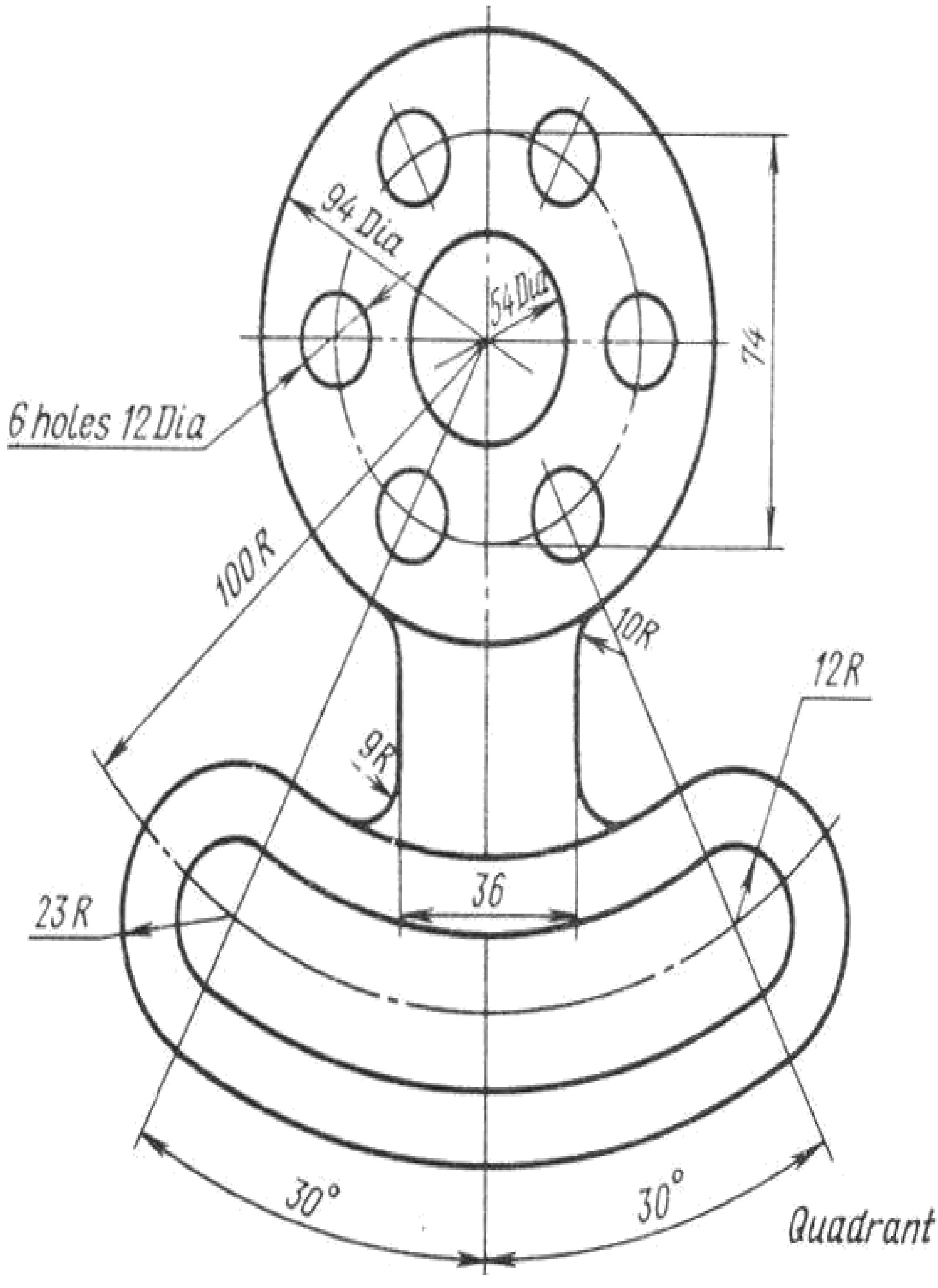
Computer-aided manufacturing (CAM) is the use of computer -based software tools that assist engineers and machinists in manufacturing or prototyping product components. Its primary purpose is to create a faster production process and components with more precise dimensions and material consistency, which in some cases, uses only the required amount of raw material (thus minimizing waste), while simultaneously reducing energy consumption. CAM is a programming tool that makes it possible to manufacture physical models using computer-aided design (CAD) programs. CAM creates real life versions of components designed within a software package.

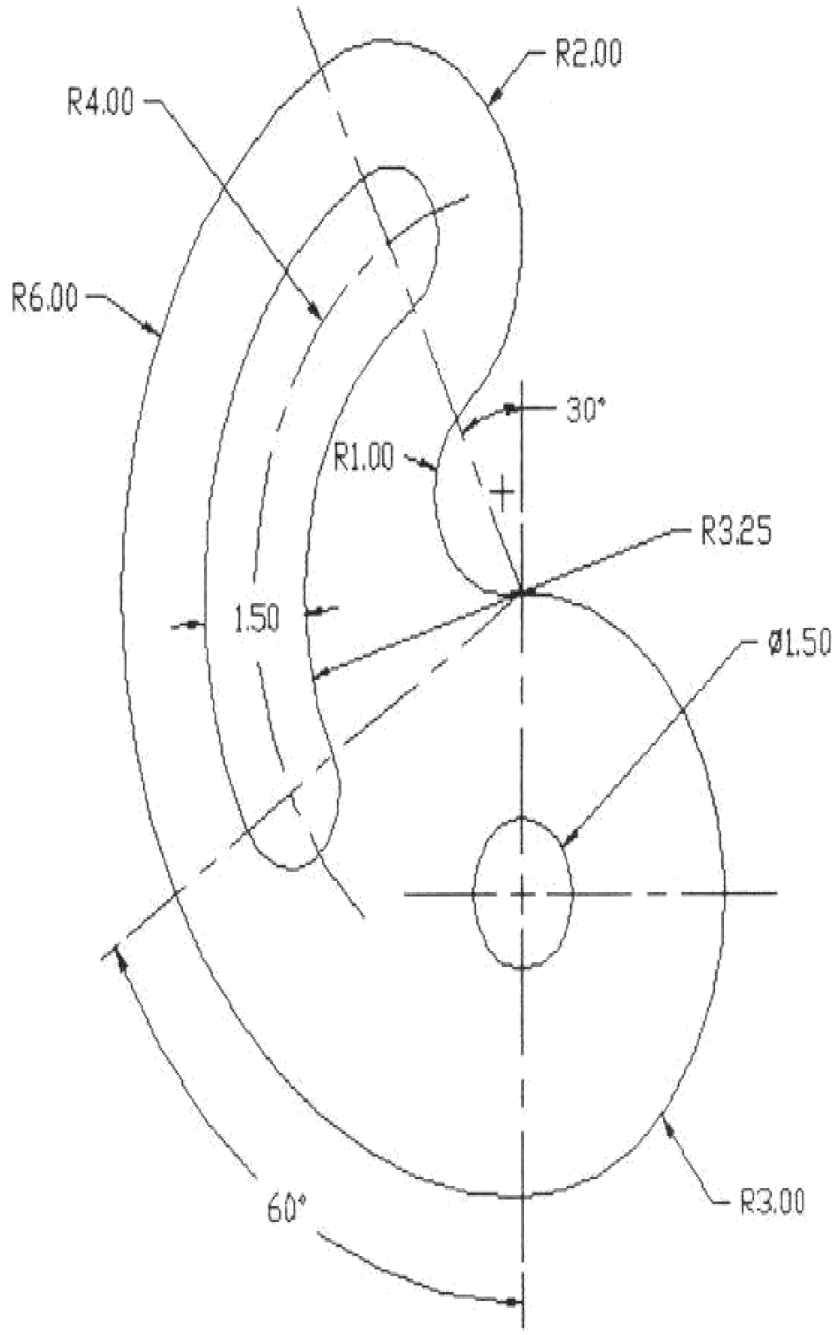
OUTCOMES:

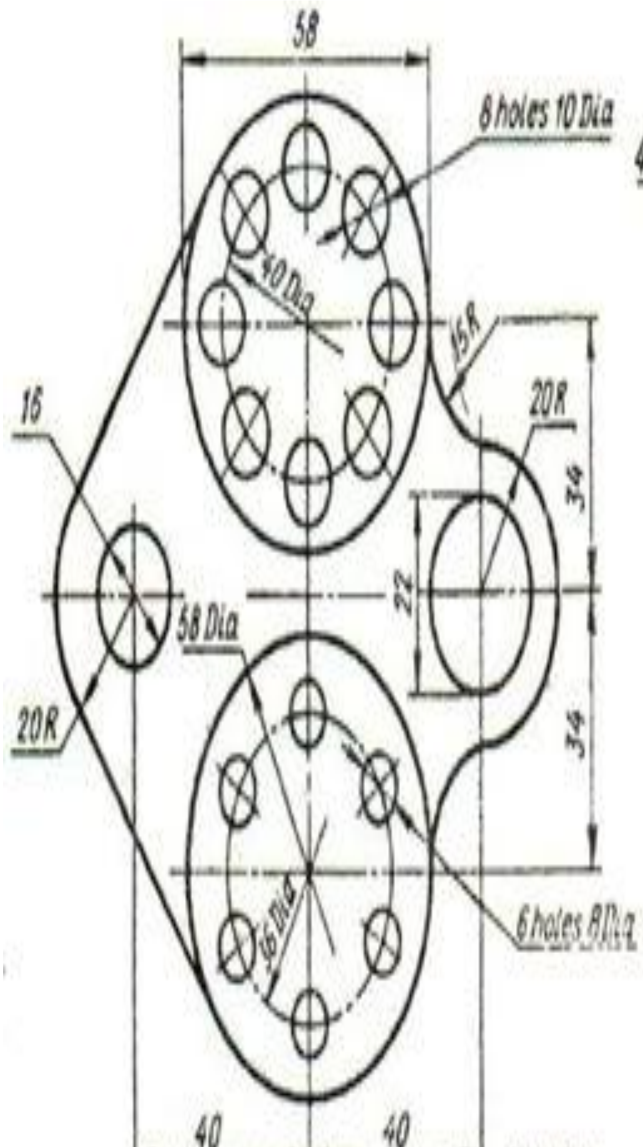
Upon the completion of Computer aided design and manufacturing practical course, the student will be able to:

1. **Draw** the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings.
2. **Understand** the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
3. **Improve** visualization ability of machine components and assemblies before their actual fabrication through modeling.
4. **Apply** animation, shading, rendering, lighting and coloring.
5. **Model** complex shapes including freeform curves and surfaces.
6. **Understand** the possible applications of the CAD/CAM systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering.
7. **Execute** CNC programs for milling and turning machining operations.
8. **Create** a computer aided manufacturing (CAM) model and generate the machining codes automatically using the CAM system.

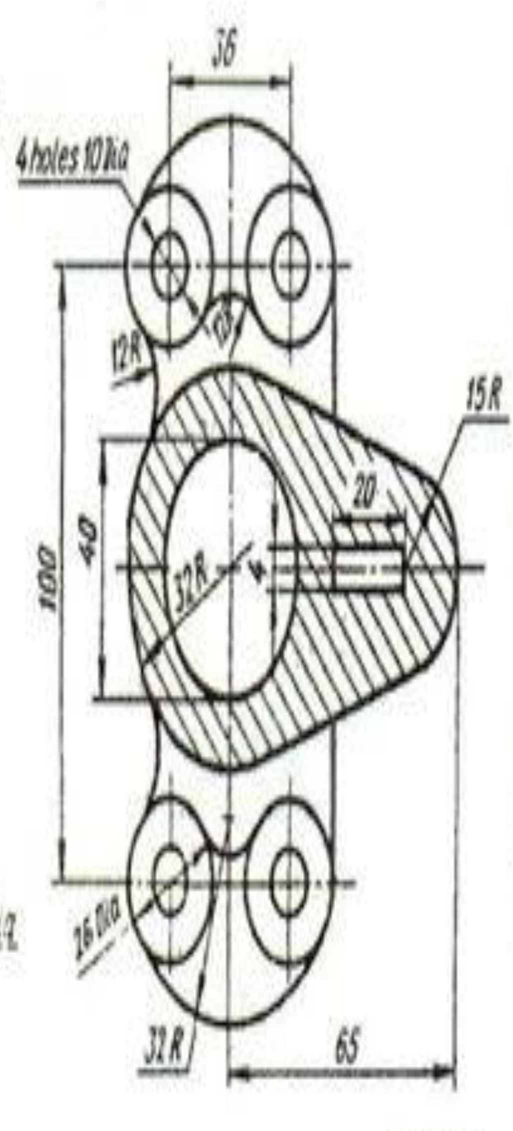
9. **Integrate** the CAD system and the CAM system by using the CAD system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information.



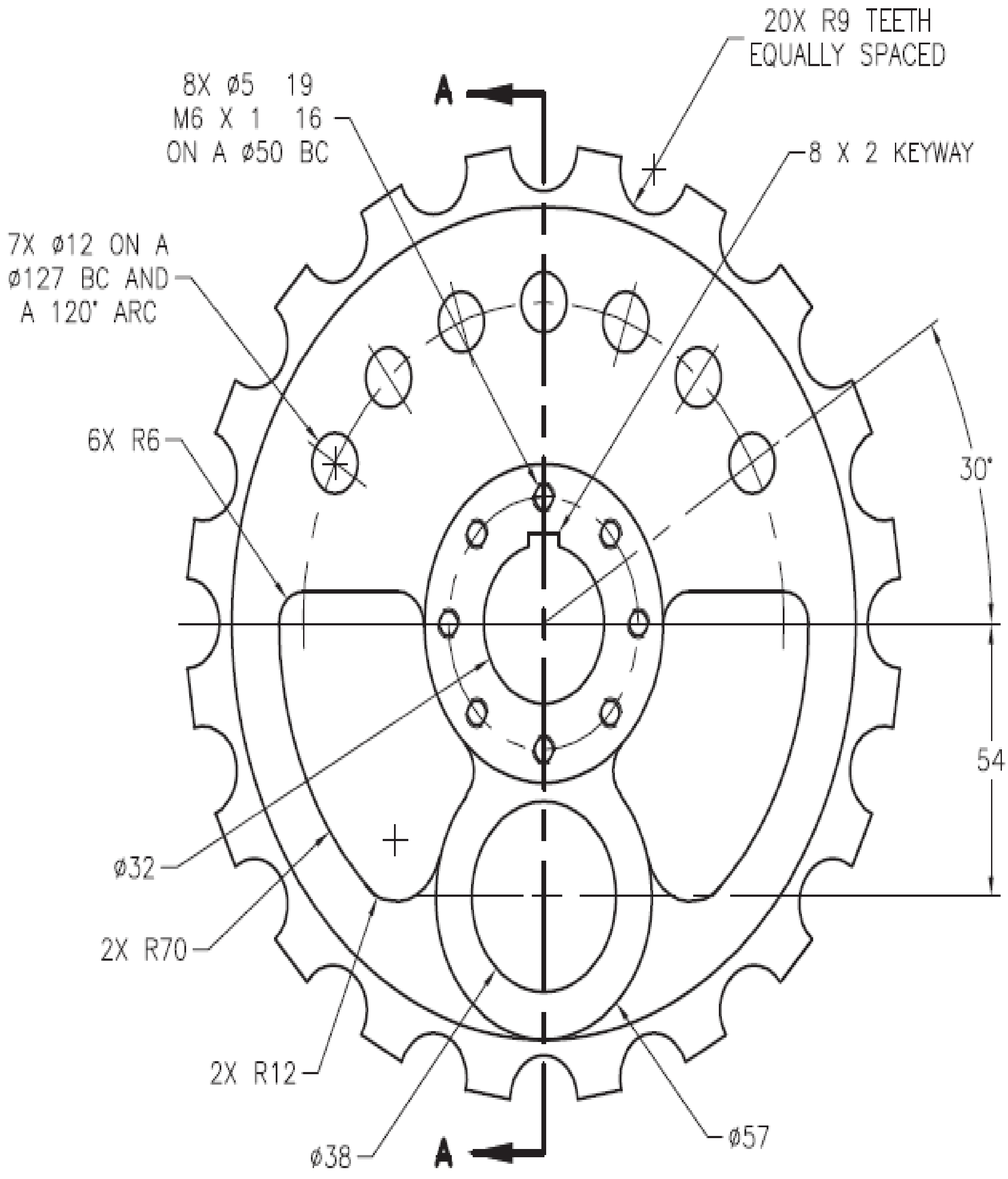

R2.00
R4.00
R6.00
30°
R1.00
R3.25
1.50
Ø1.50
60°
R3.00



Housing

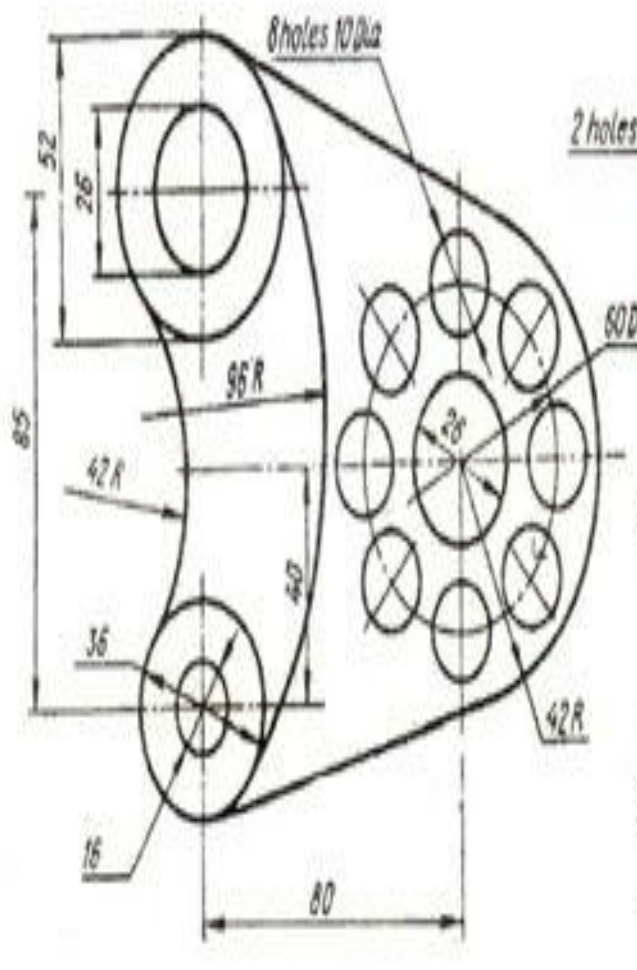


Bracket

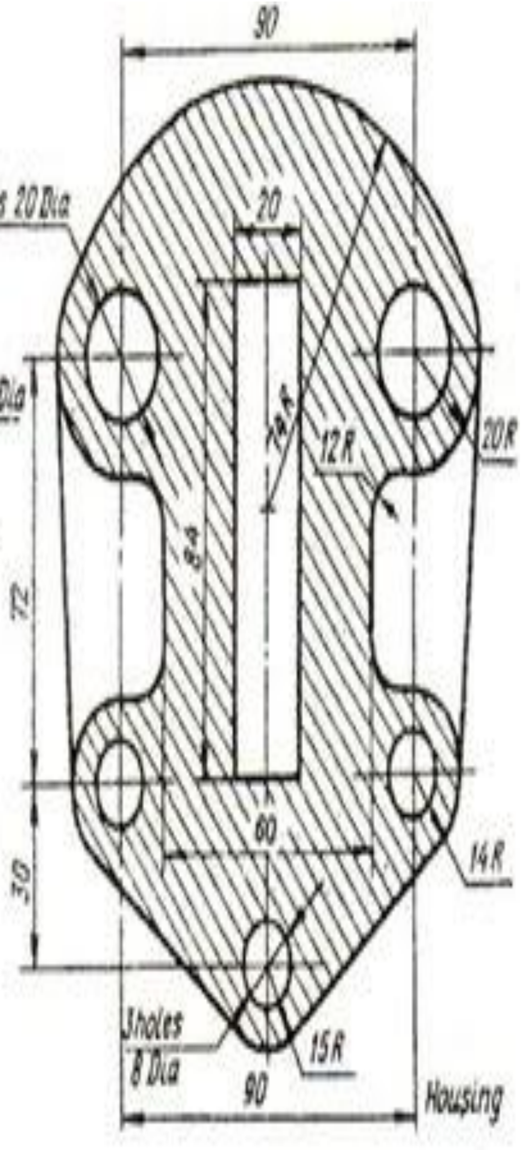

20X R9 TEETH
EQUALLY SPACED
8X ø5 19
M6 X 1 16
ON A ø50 BC
A
8 X 2 KEYWAY
7X ø12 ON A
ø127 BC AND
A 120° ARC
6X R6
30°
54
ø32
2X R70
2X R12
ø38
A
ø57

EXPERIMENT - 2

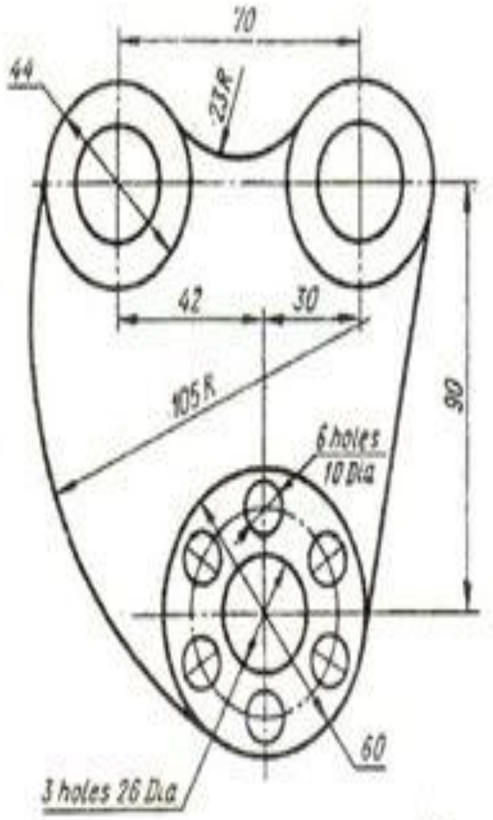
INTRODUCTION TO CAD AND TOOLS:Part-2



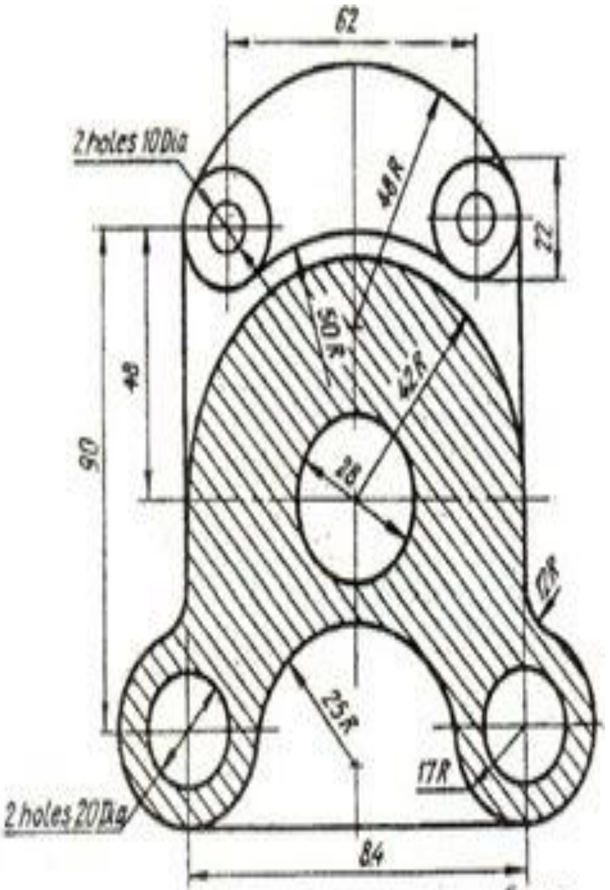
Plate



Housing


70
44
23 R
42
30
105 R
90
6 holes
10 Dia
60
3 holes 26 Dia

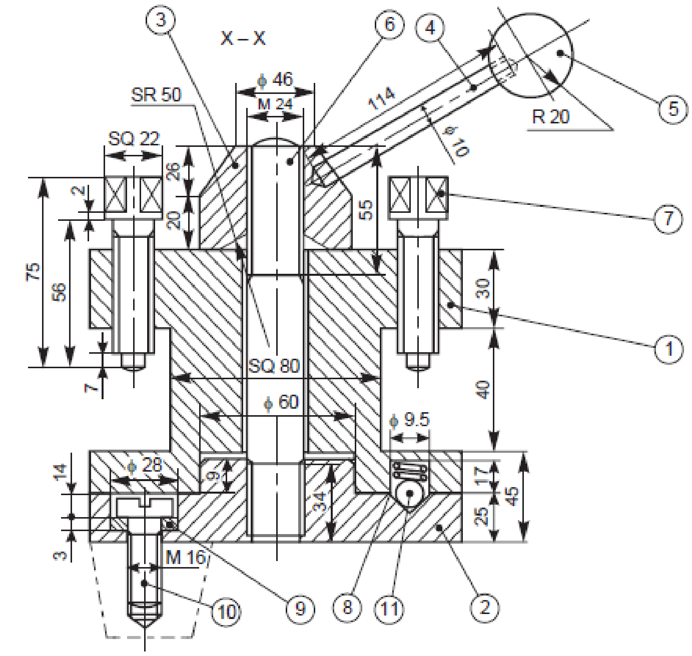
Eye

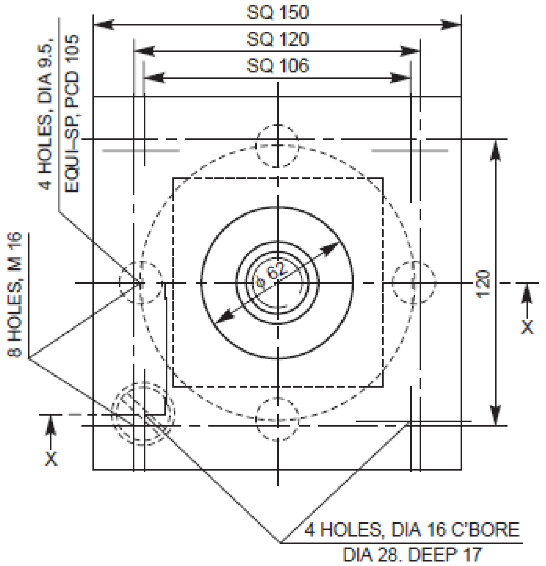

62
2 holes 10 Dia
48 R
22
50 R
42 R
48
90
28
12 R
25 R
17 R
2 holes 20 Dia
84

Frame

EXPERIMENT -3

ASSEMBLY OF PART DRAWING :Part -1

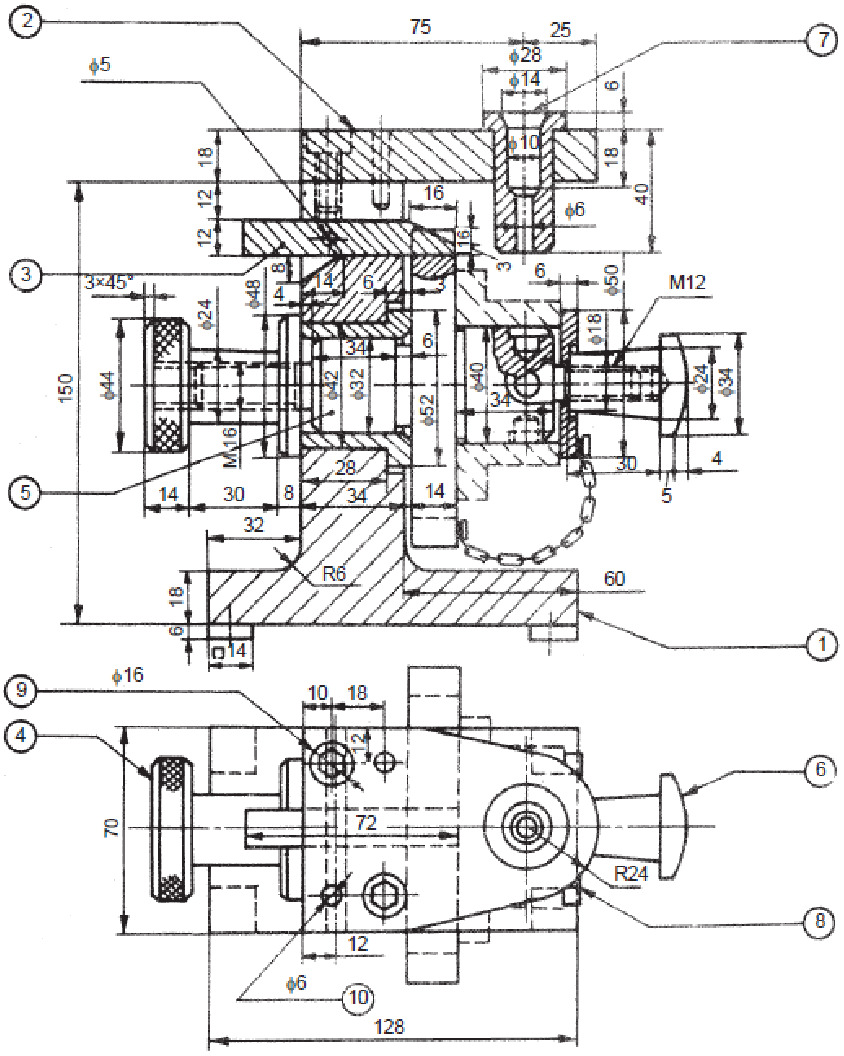




S. No.	Name	Material	Qty
1	Tool holder	Steel	1
2	Base plate	Steel	1
3	Clamp	Steel	1
4	Handle	Steel	1
5	Knob	Ebonite	1
6	Stud	MS	1
7	Screw	Steel	8
8	Spring	Steel	4
9	Spring washer	Steel	4
10	Machine screw	MS	4
11	Ball	Steel	4

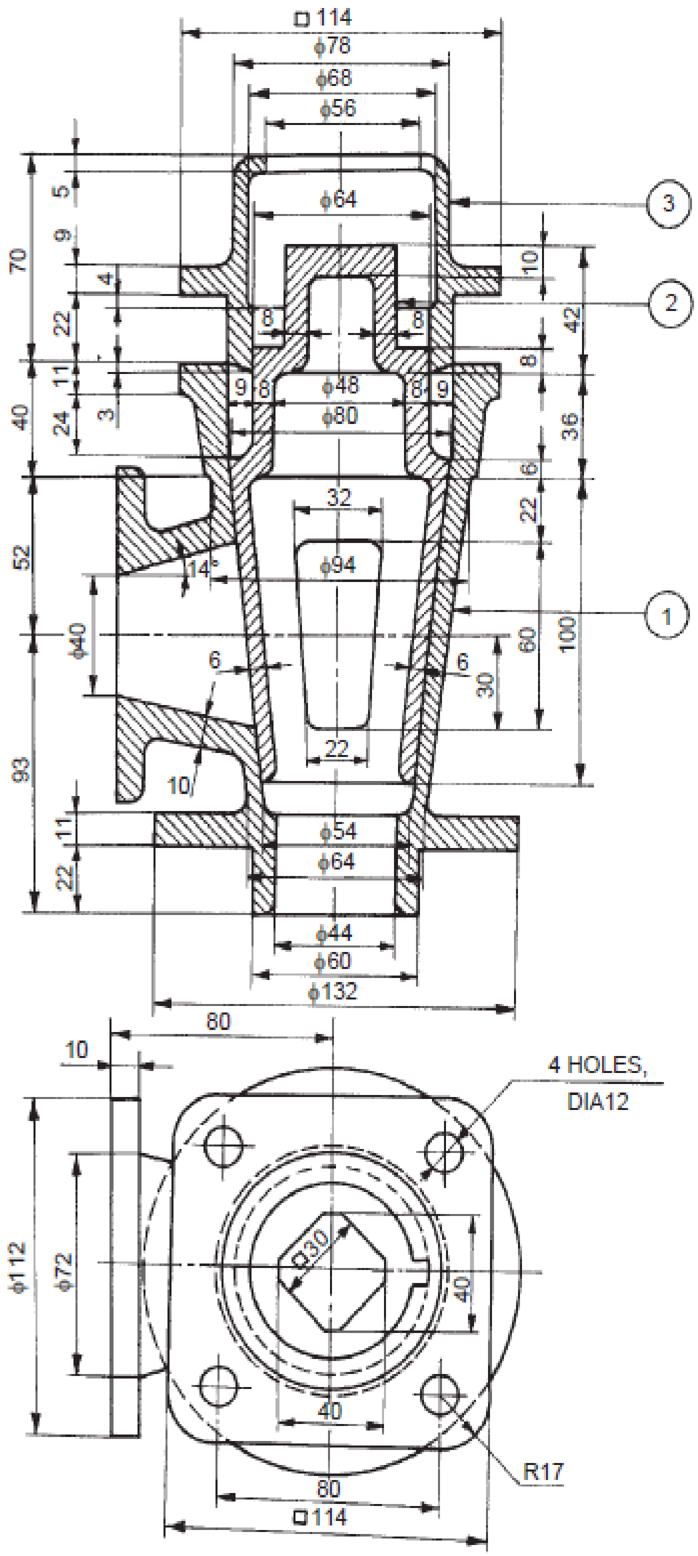
EXPERIMENT - 4

ASSEMBLY OF PART DRAWING :Part -2



Parts list

Part No.	Name	Matl.	Qty.	Part No.	Name	Matl.	Qty.
1	Jig body	CI	1	6	Clamp	CI	1
2	Bush plate	CI	1	7	Drill bush	HCS	1
3	Indexing lever	MS	1	8	C washer	MS	1
4	Locking screw	MS	1	9	Locating pin	HCS	2
5	Rotating pin	MS	1	10	Dowel pin	HCS	2

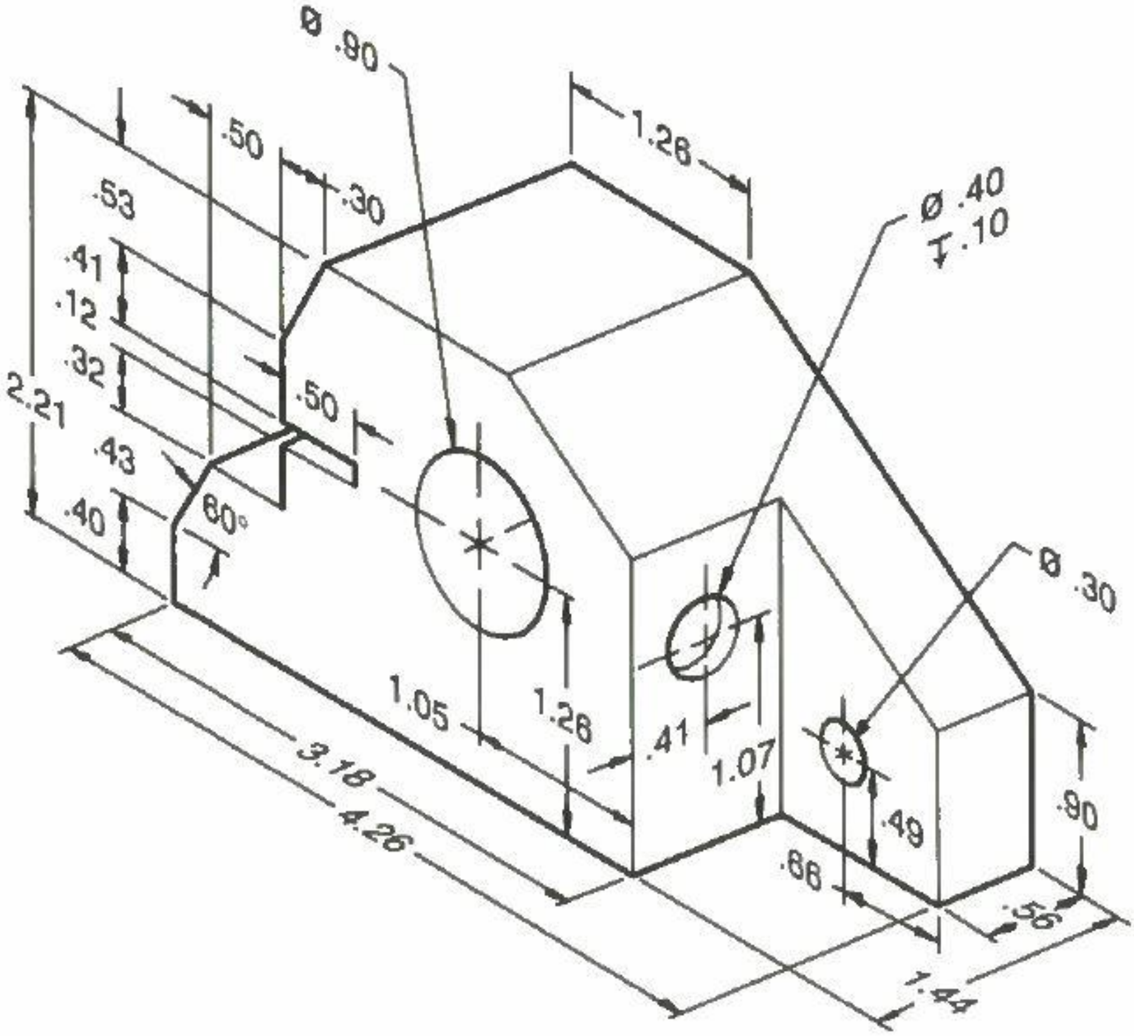


Parts list

Part No.	Name	Matl.	Qty.
1	Body	CS	1
2	Cock	GM	1
3	Gland	CS	1

EXPERIMENT -5

GENERATION OF SURFACES :Part -1



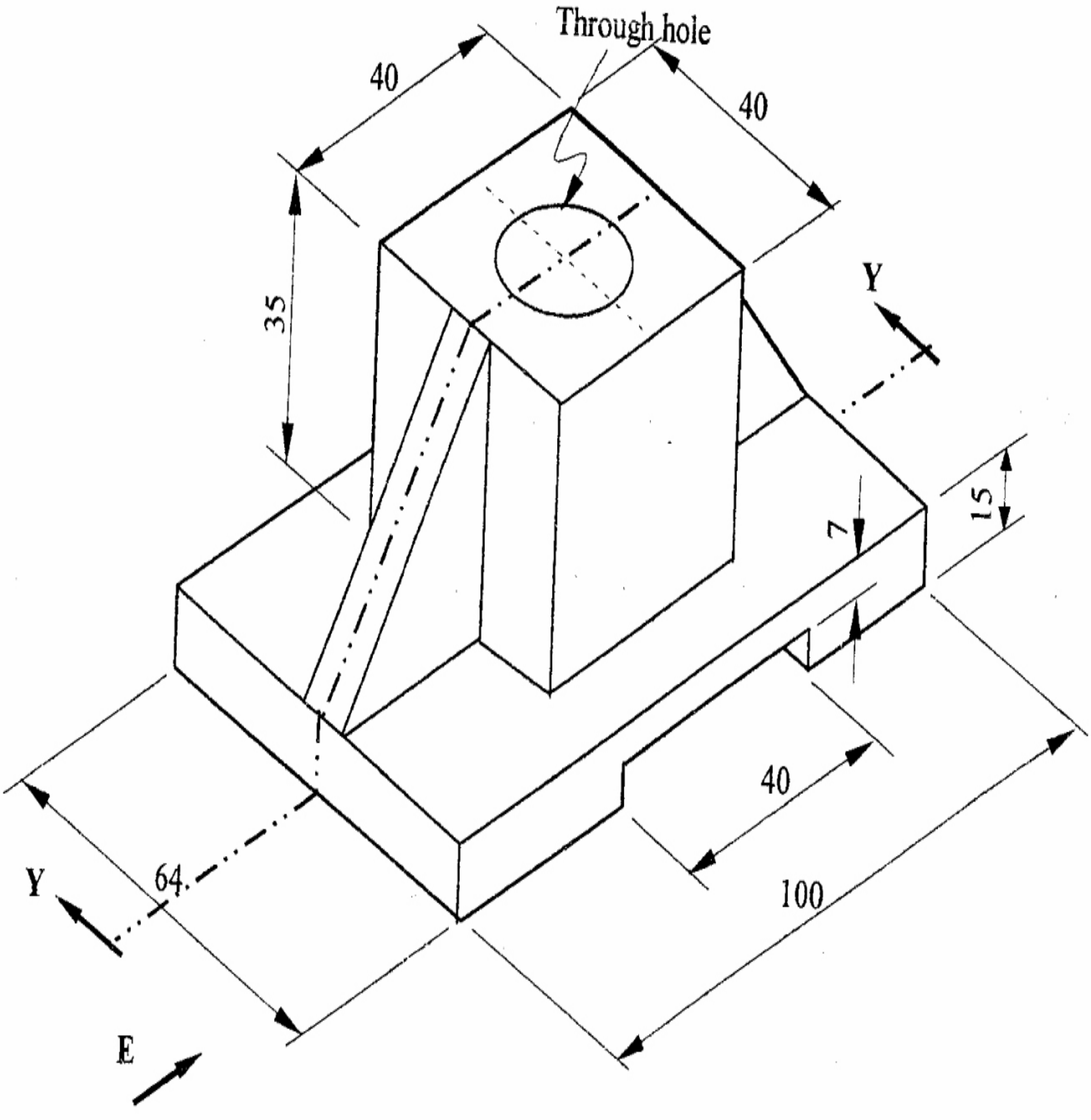
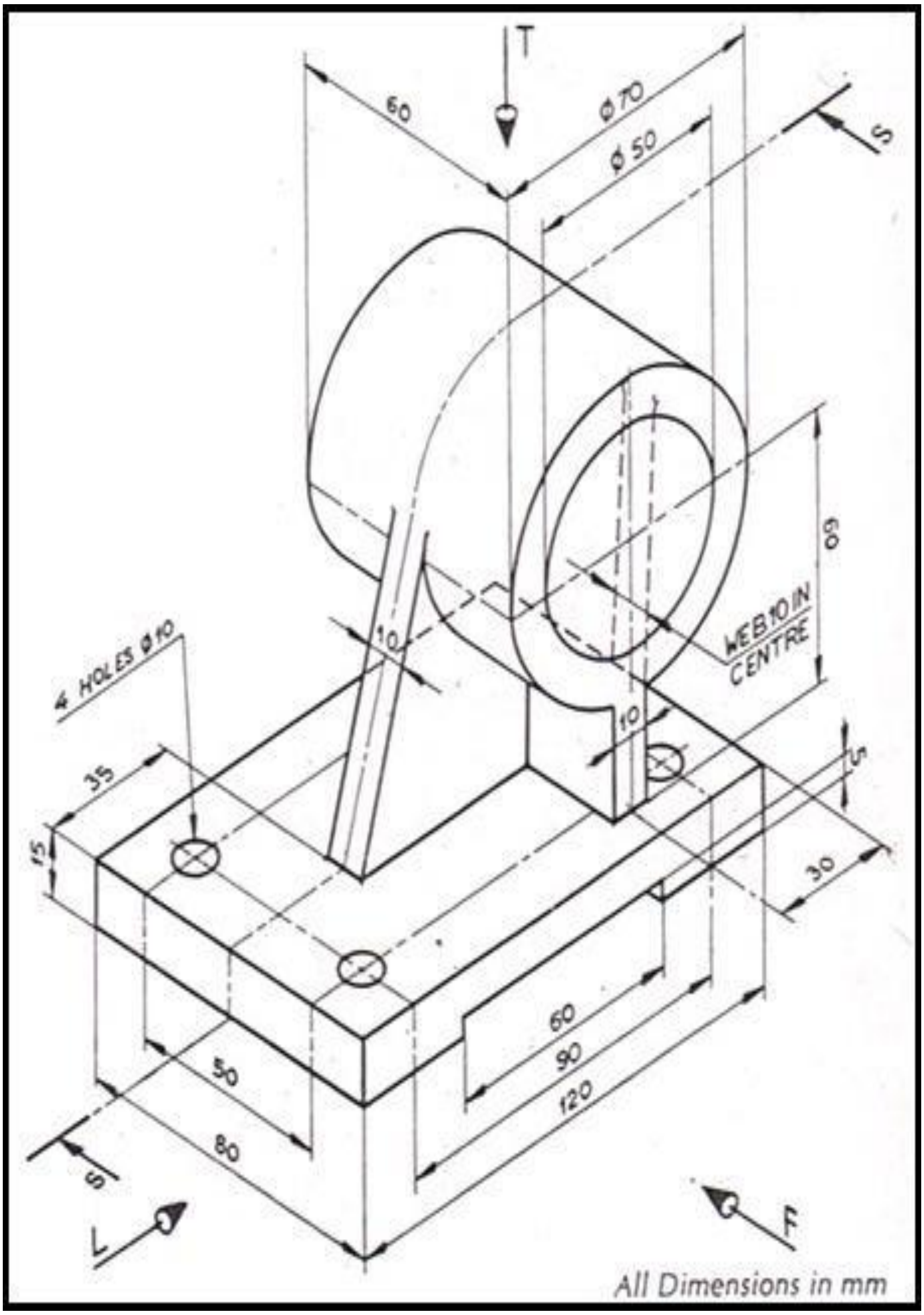
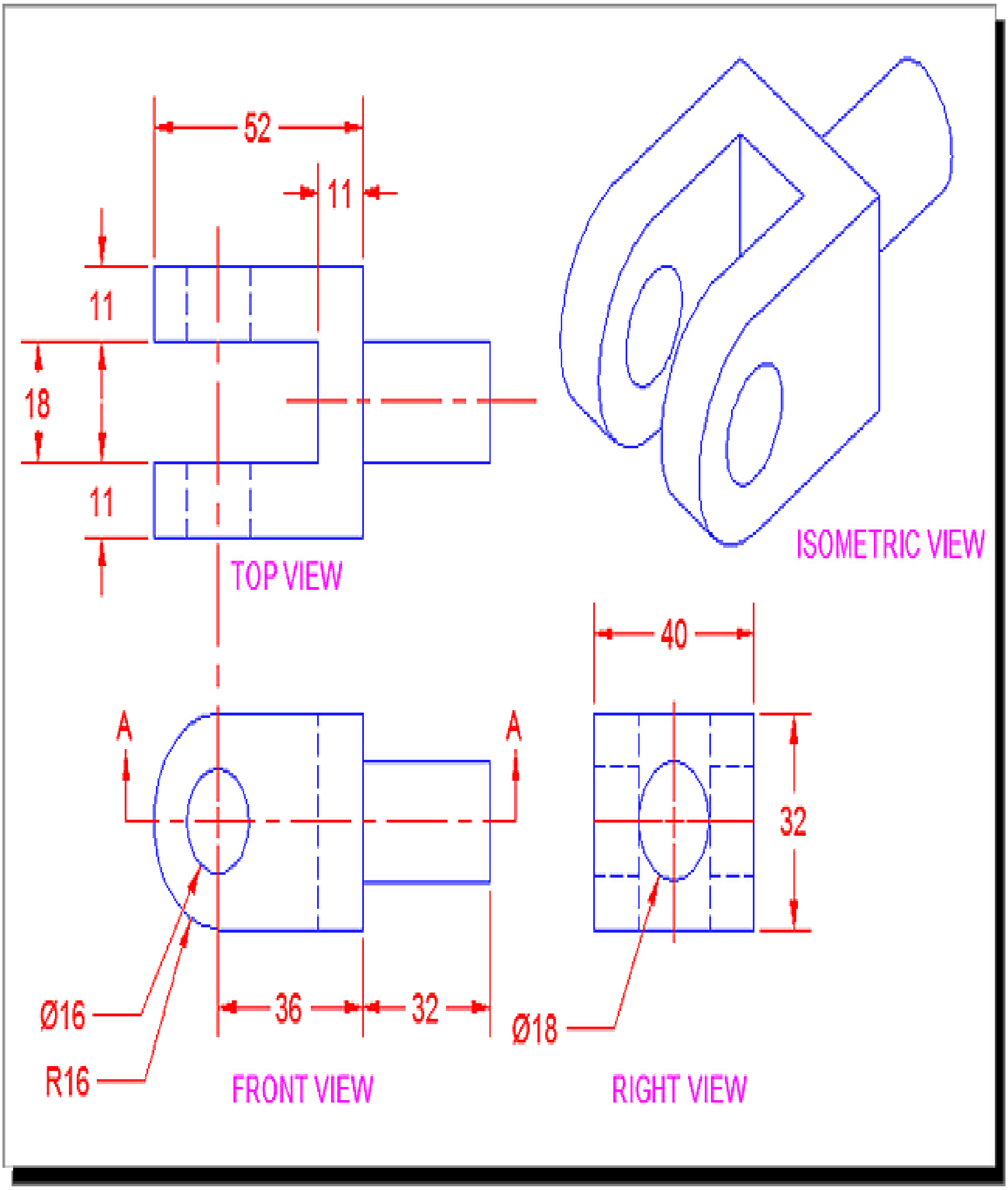


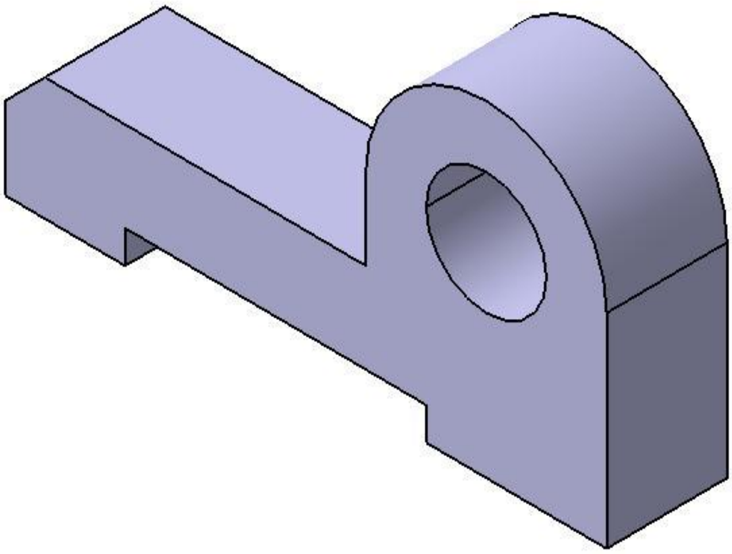
Figure 4

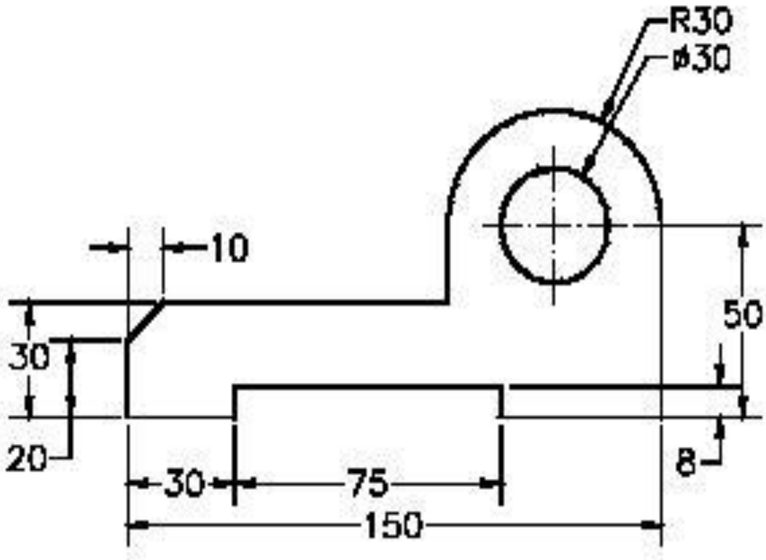
EXPERIMENT – 6

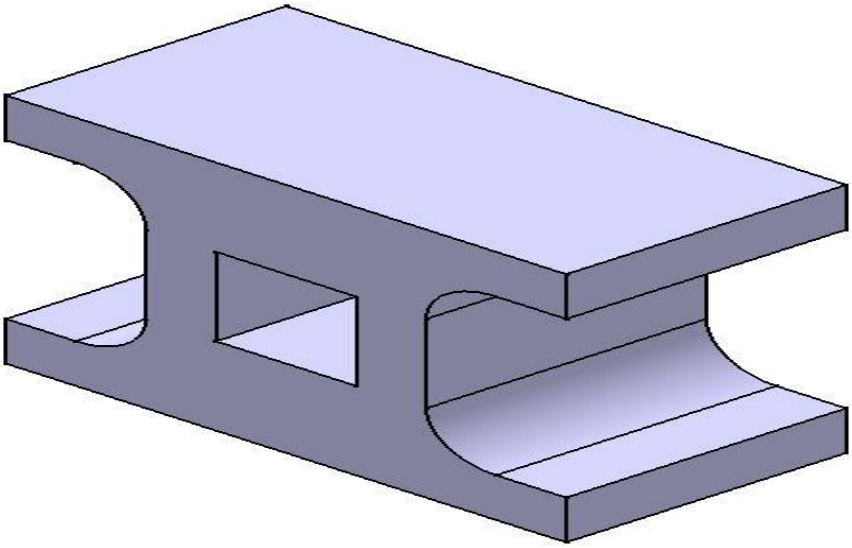
GENERATION OF SURFACES :Part -2

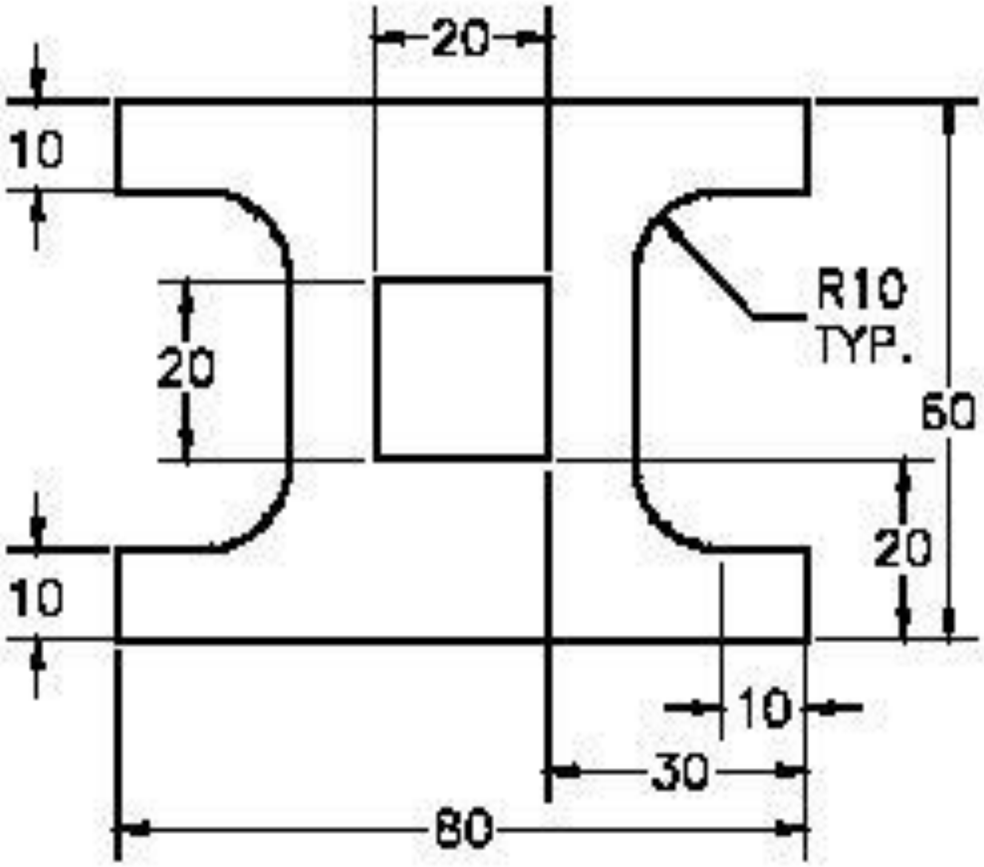



52
11
11
18
11
TOP VIEW
ISOMETRIC VIEW
40
A
A
32
Ø16
R16
36
32
Ø18
FRONT VIEW
RIGHT VIEW

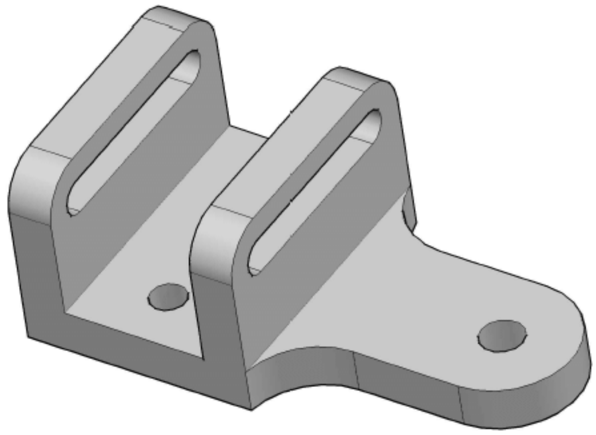


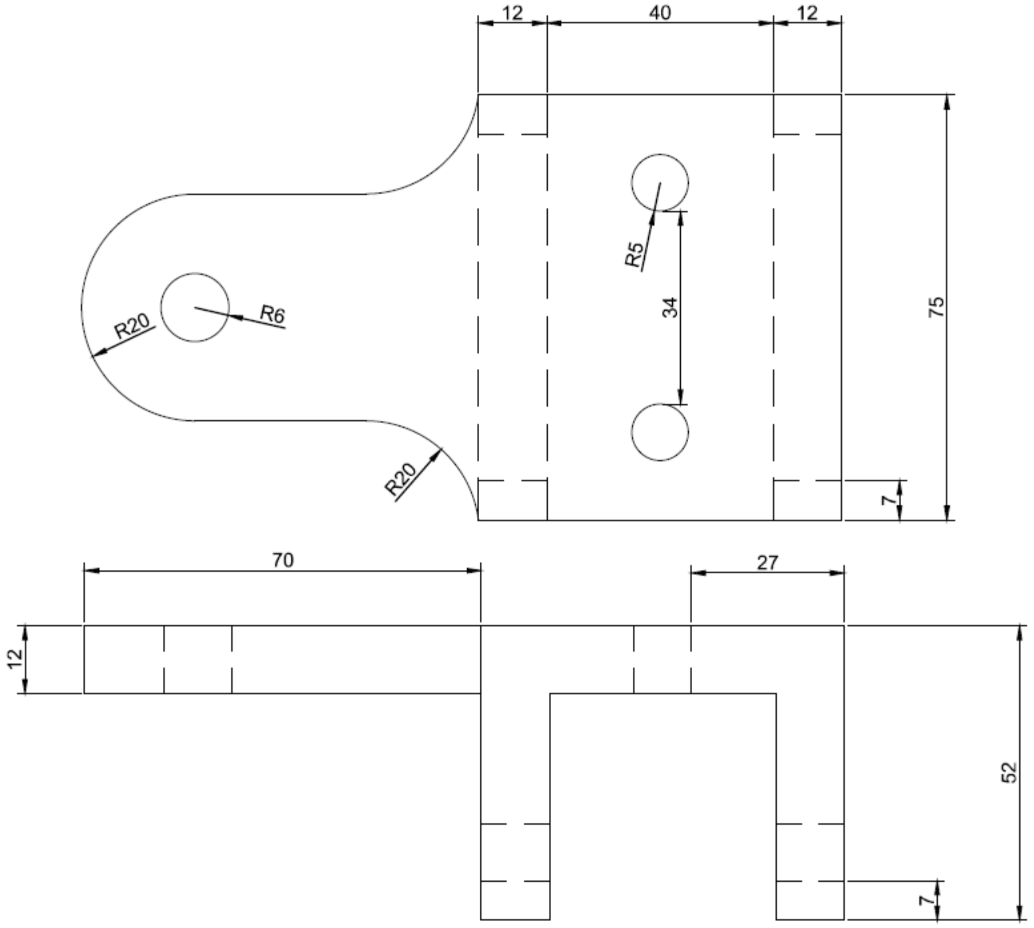

R30
ø30
10
50
30
20
8
30
75
150

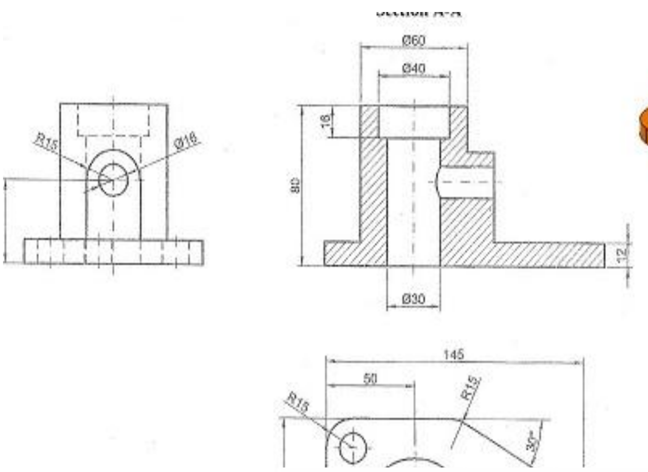


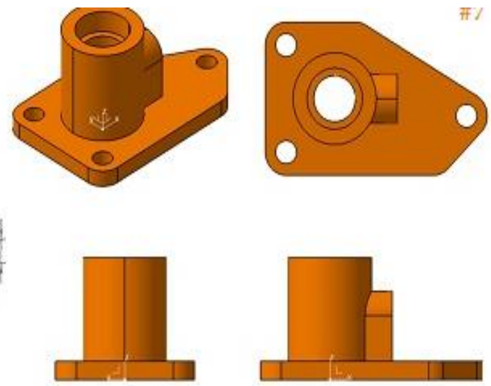


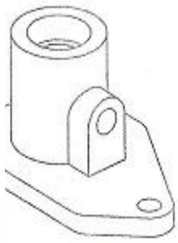
20
10
R10
TYP.
20
60
20
10
10
30
80

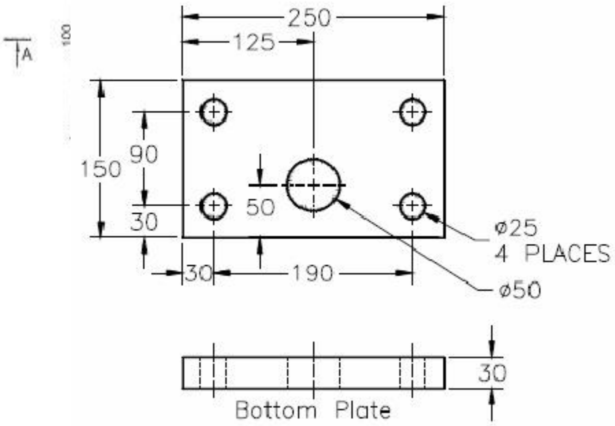


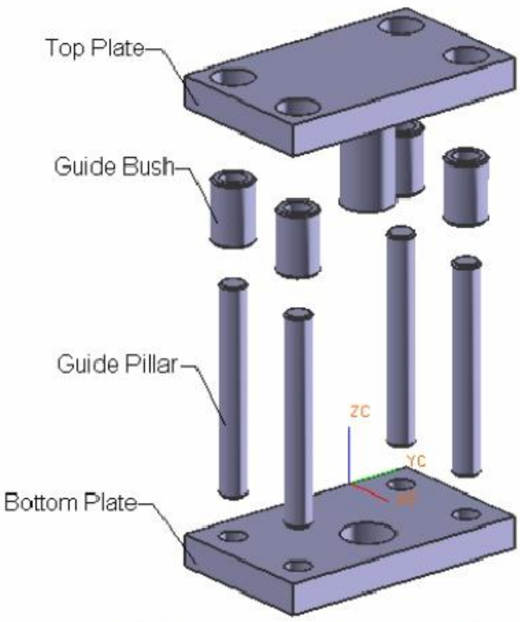

12
40
12
R5
34
75
R20
R6
R20
7
70
27
12
52
7



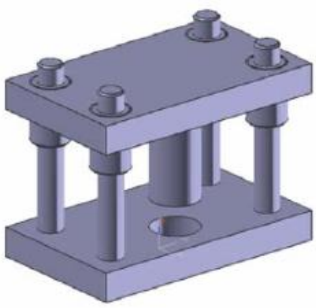


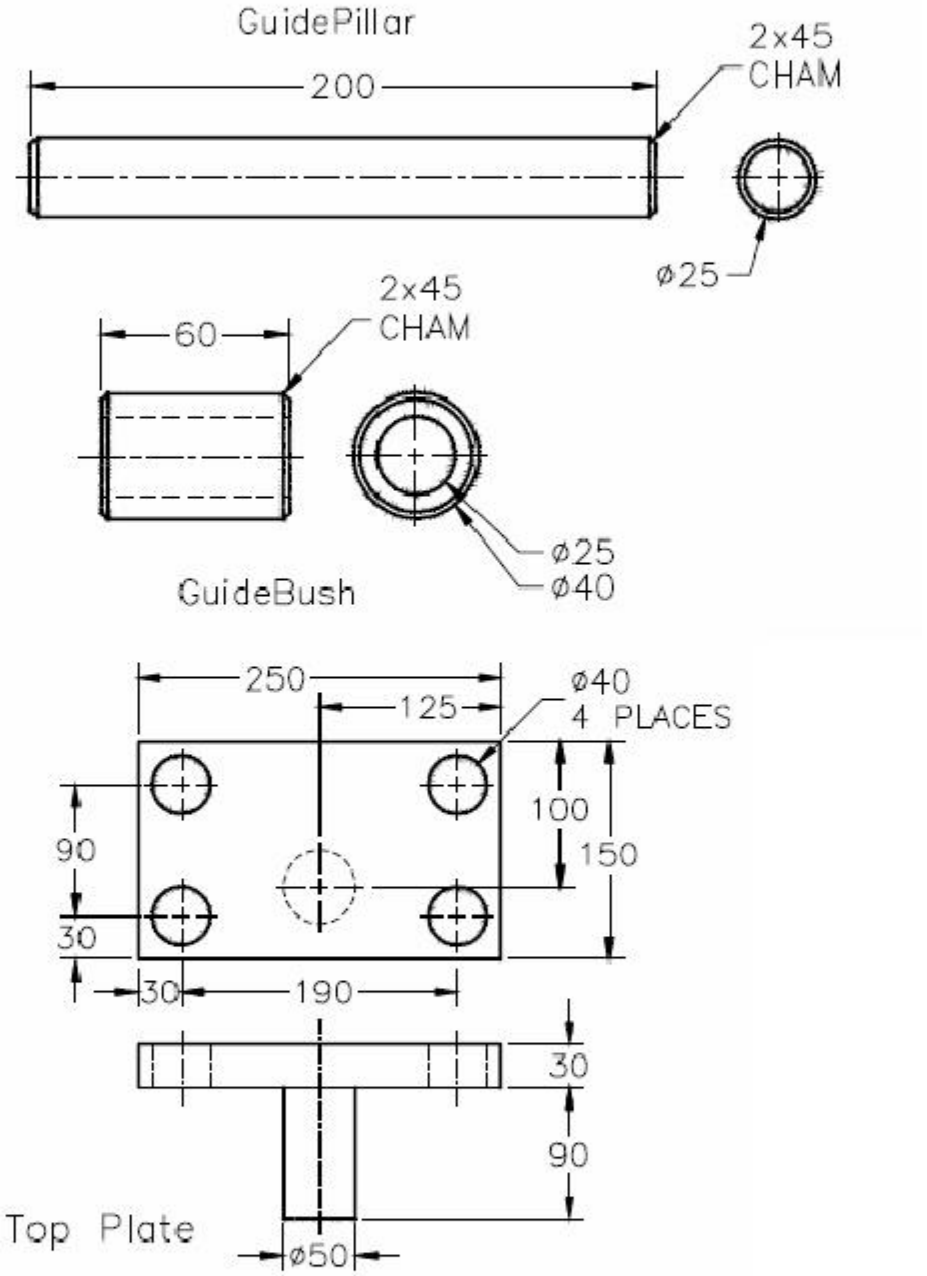






The exploded view of the Press Tool

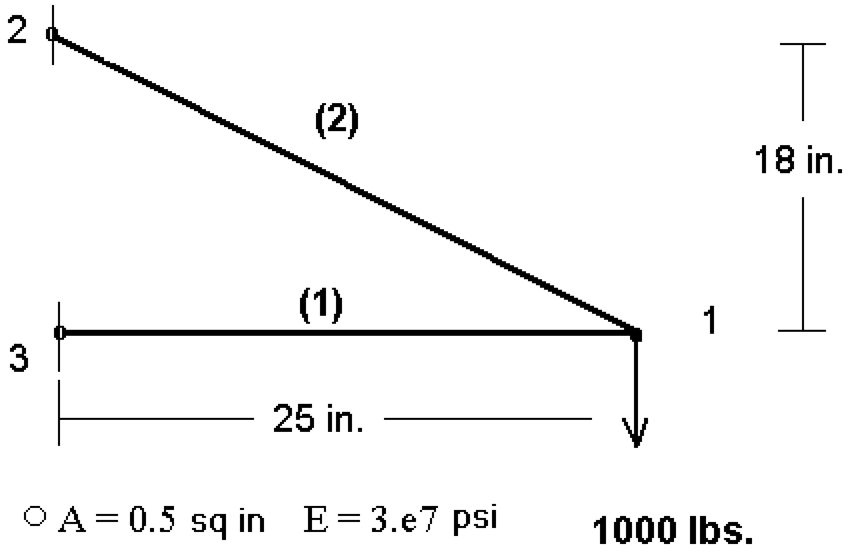



GuidePillar
200
2x45
CHAM
ø25
60
2x45
CHAM
ø25
ø40
GuideBush
250
125
ø40
4 PLACES
100
150
90
30
30
190
30
90
Top Plate
ø50

EXPERIMENT – 7

ANALYSIS OF MODEL :Part -1

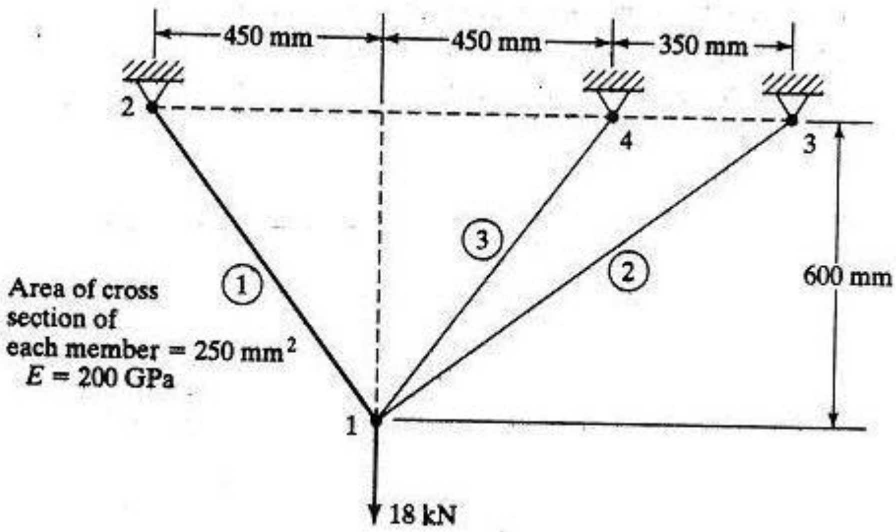
Find the solution for displacements and stresses in this truss.



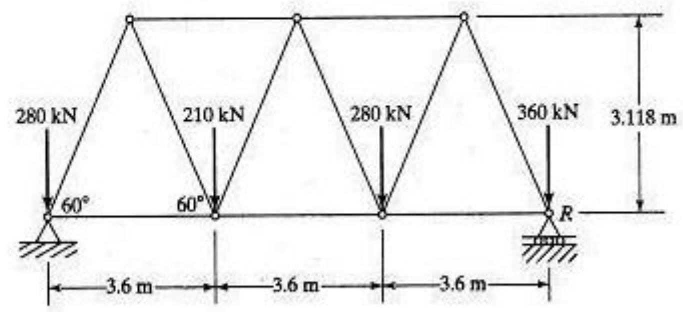
ANSYS

EXERCISE -20

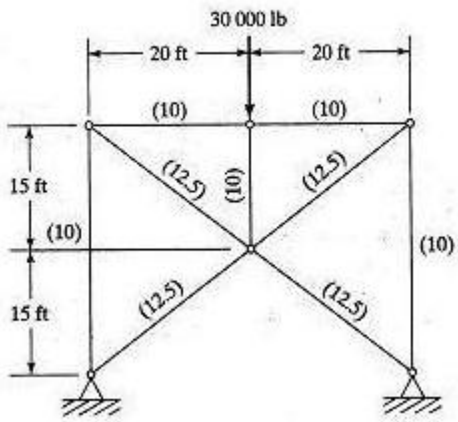
For the three-bar truss shown in Fig. determine the displacements of node 1 and the stress in element 3.



A small railroad bridge is constructed of steel members, all of which have a cross-sectional area of 3250 mm^2. A train stops on the bridge, and the loads applied to the truss on one side of the bridge are as shown in Fig. Estimate how much the point R moves horizontally because of this loading. Also determine the nodal displacements and element stresses.



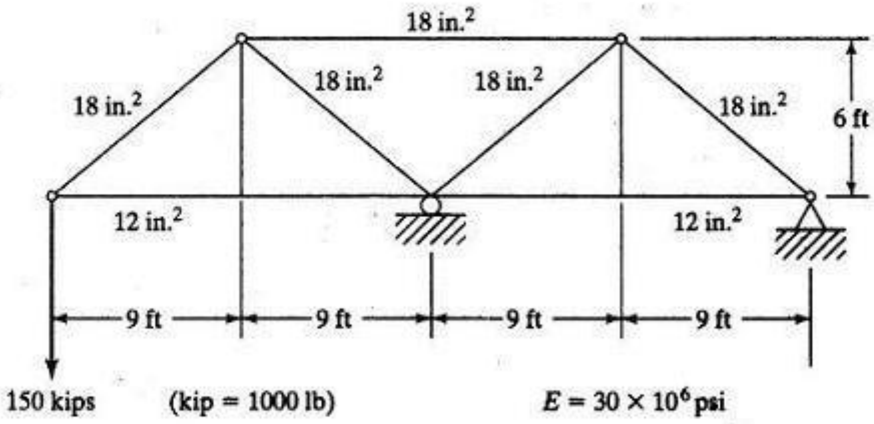
Consider the truss in Fig. loaded as shown. Cross-sectional areas in square inches are shown in parentheses. Consider symmetry and model only one-half of the truss shown. Determine displacements and element stresses. Let $E = 30 \times 10^6$ psi.



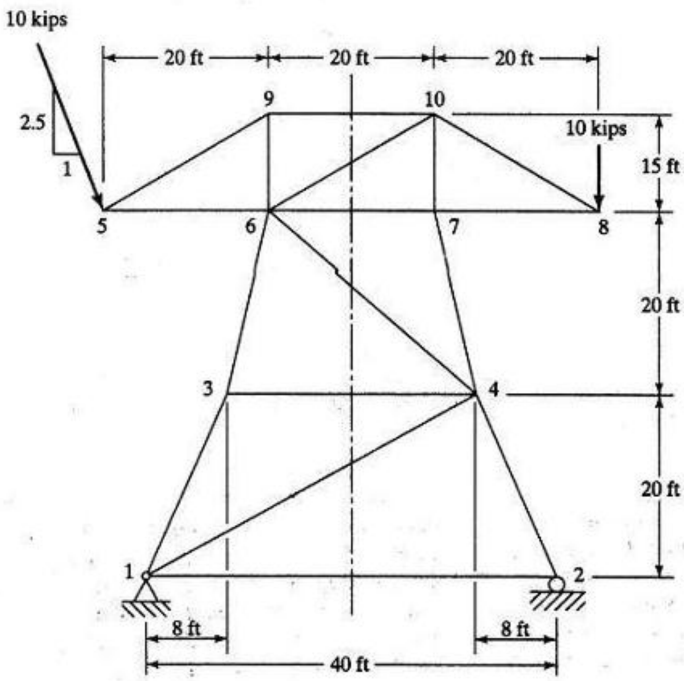
EXPERIMENT – 8

ANALYSIS OF MODEL :Part -2

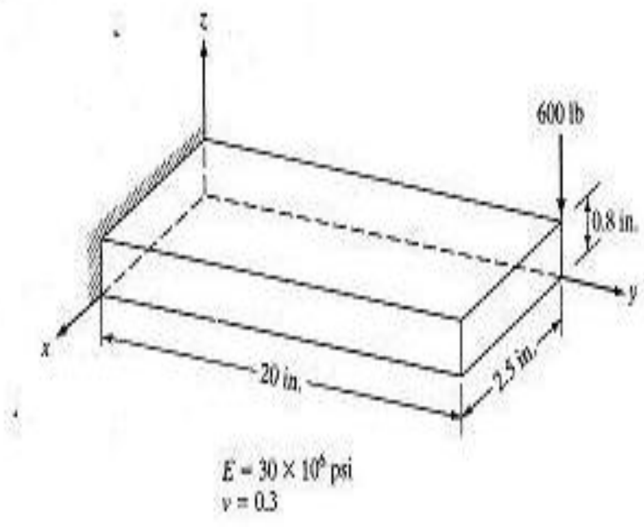
Find deflections at nodes, stresses in members, and reactions at supports for the truss shown in Fig. when the 150-kip load is applied.



Find the deflections at the nodes for the truss configuration shown in Fig. Area = 8 in.^{2} for each member.



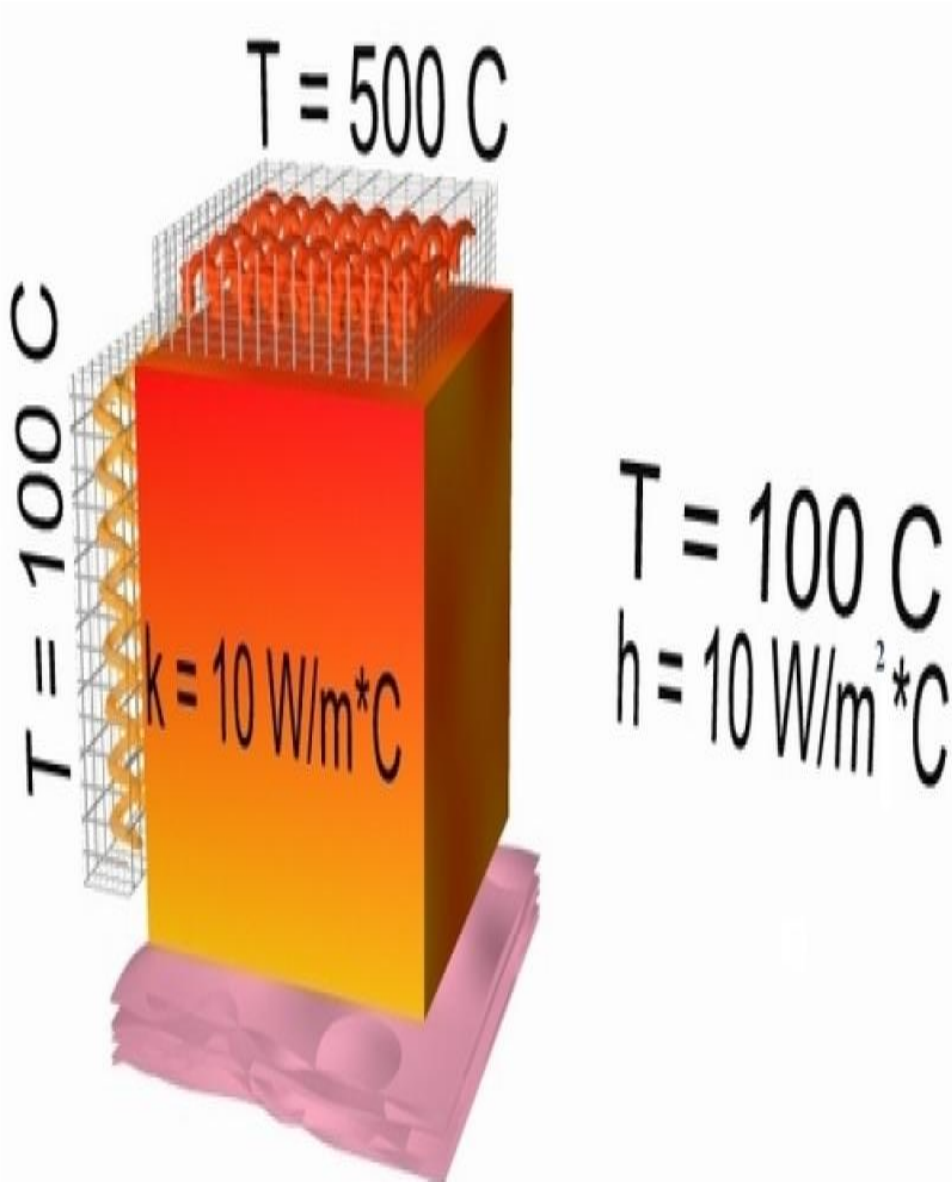
Determine the deflections at the corner points of the steel cantilever beam shown in Fig. P9.1.



A steel cylinder with inner radius 5 inches and outer radius 10 inches is 40 inches long and has spherical end caps. The interior of the cylinder is kept at 75 deg F, and heat is lost on the exterior by convection to a fluid whose temperature is 40 deg F. The convection coefficient is 0.56 BTU/hr-sq.in-F. Calculate the stresses in the cylinder caused by the temperature distribution.

EXPERIMENT – 9

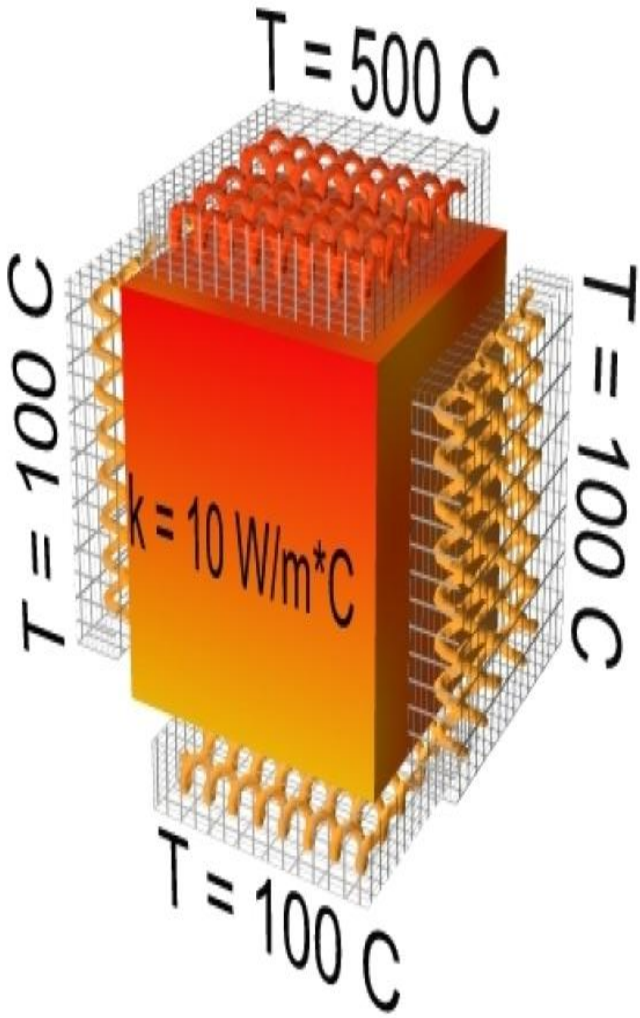
THERMAL ANALYSIS :Part -1



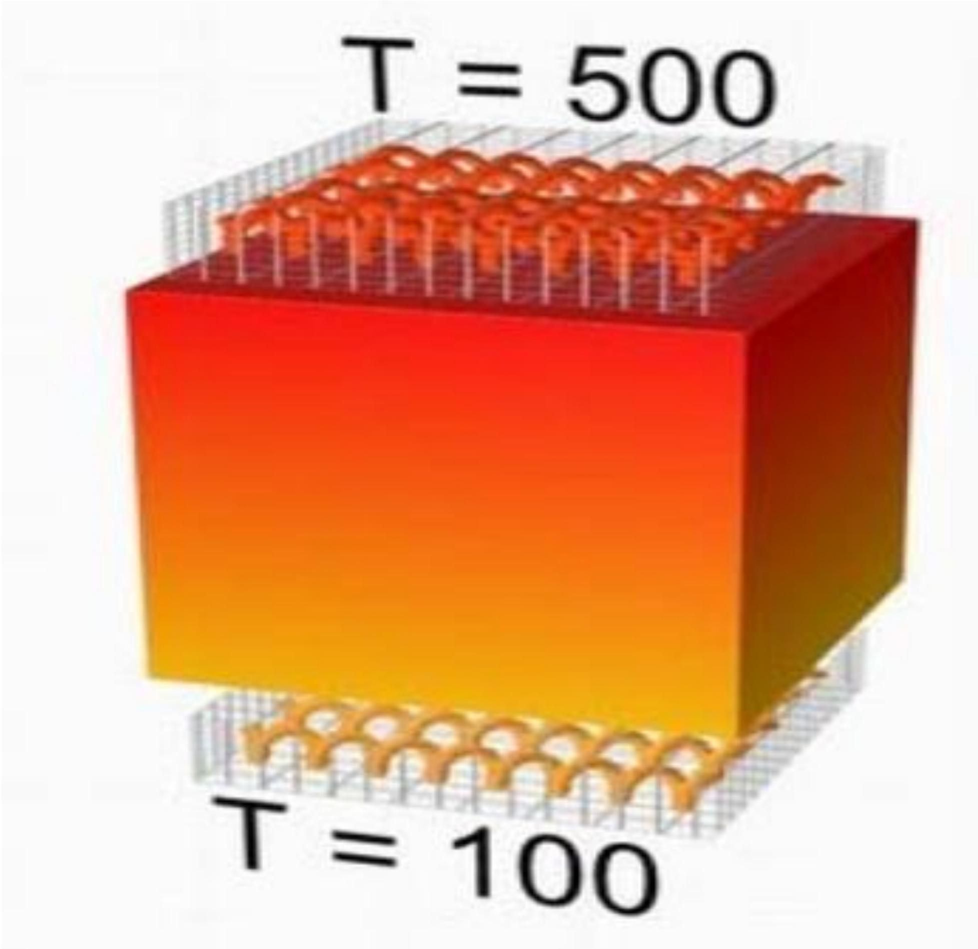
EXPERIMENT - 10

THERMAL ANALYSIS :Part -2

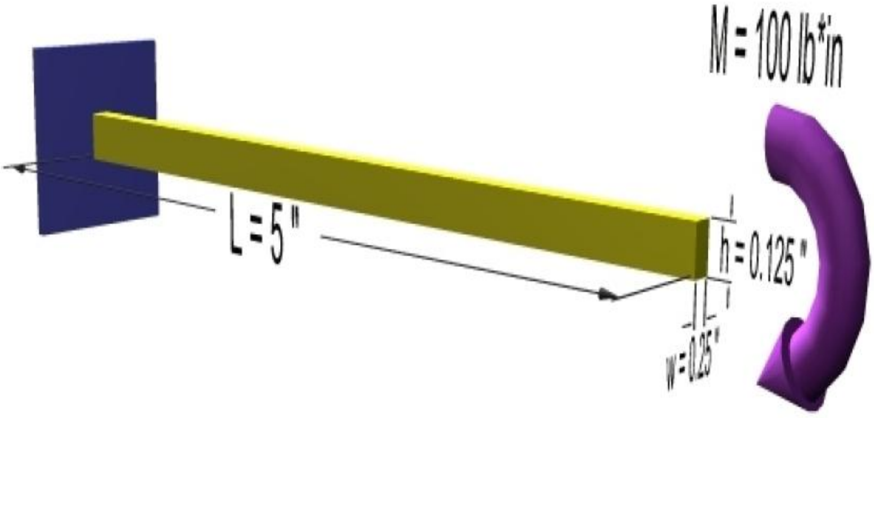
The Simple Conduction Example is constrained as shown in the following figure. Thermal conducti the material is 10 W/m*C and the block is assumed to be infinitely long.



The example is constrained as shown in the following figure. Thermal conductivity (k) of the material is 5 W/m*K and the block is assumed to be infinitely long. Also, the density of the material is 920 kg/m^3 and the specific heat capacity (c) is 2.040 kJ/kg*K.



This tutorial was created using ANSYS 7.0 The purpose of this tutorial is to outline the steps required to do a simple nonlinear analysis of the beam shown below.



The problem to be solved in this example is the analysis of a bicycle frame. The problem to be modeled in tl example is a simple bicycle frame shown in the following figure. The frame is to be built of hollow aluminu tubing having an outside diameter of 25mm and a wall thickness of 2mm.