EXPERIMENT NO. : 01

TITLE :- USE CAD SOFTWARE TO DRAW SIMPLE 2-D ENTITIES.

1.1. INTRODUCTION

Computer Aided Drafting is a process of preparing a drawing of an object on the screen of a computer. There are various types of drawings in different fields of engineering and sciences. In the fields of mechanical or aeronautical engineering, the drawings of machine components and the layouts of them are prepared. In the field of civil engineering, plans and layouts of the buildings are prepared. In the field of electrical engineering, the layouts of power distribution system are prepared. In all fields of engineering use of computer is made for drawing and drafting.

The use of CAD process provides enhanced graphics capabilities which allows any designer to

- Conceptualize his ideas
- Modify the design very easily
- Perform animation
- Make design calculations
- Use colors, fonts and other aesthetic features.

1.2. REASONS FOR IMPLEMENTING A CAD SYSTEM

1. **Increases the productivity of the designer**: CAD improves the productivity of the designer to visualize the product and its component, parts and reduces the time required in synthesizing, analyzing and documenting the design
2. **Improves the quality of the design**: CAD system improves the quality of the design. A CAD system permits a more detailed engineering analysis and a larger number of design alternatives can be investigated. The design errors are also reduced because of the greater accuracy provided by the system
3. **Improves communication:** It improves the communication in design. The use of a CAD system provides better engineering drawings, more standardization in the drawing, and better documentation of the design, few drawing errors and legibility.
4. **Create data base for manufacturing:** In the process of creating the documentation for these products, much of the required data base to manufacture the products is also created.
5. **Improves the efficiency of the design:** It improves the efficiency of the design process and the wastage at the design stage can be reduced.

1.3. APPLICATION OF CAD:

There are various processes which can be performed by use of computer in the drafting process.

1. **Automated drafting**: This involves the creation of hard copy engineering drawings directly from CAD data base. Drafting also includes features like automatic dimensioning, generation of cross – hatched areas, scaling of the drawing and the capability to develop sectional views and enlarged views in detail. It has ability to perform transformations of images and prepare 3Ddrawings like isometric views, perspective views etc.,

2. **Geometric modeling**: concerned with the computer compatible mathematical description of the geometry of an object. The mathematical description allows the image of an object to be displayed and manipulated on a graphics terminal through signals from the CPU of the CAD system. The software that provides geometric modeling capabilities must be designed for efficient use both by computer and the human designer.

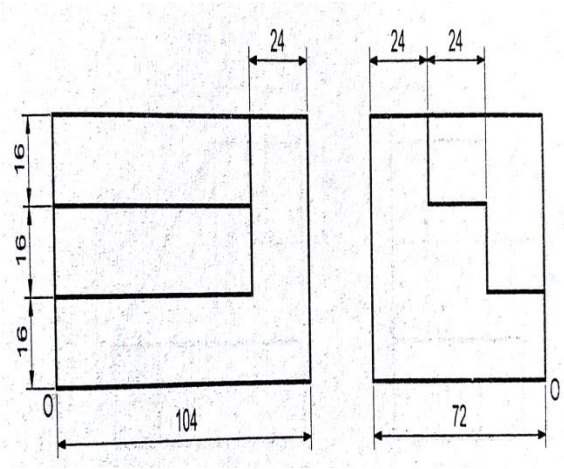
1.4. AUTO CAD

Auto CAD package is suitable for accurate and perfect drawings of engineering designs. The drawing of machine parts, isometric views and assembly drawings are possible in AutoCAD. The package is suitable for 2D and 3D drawings.

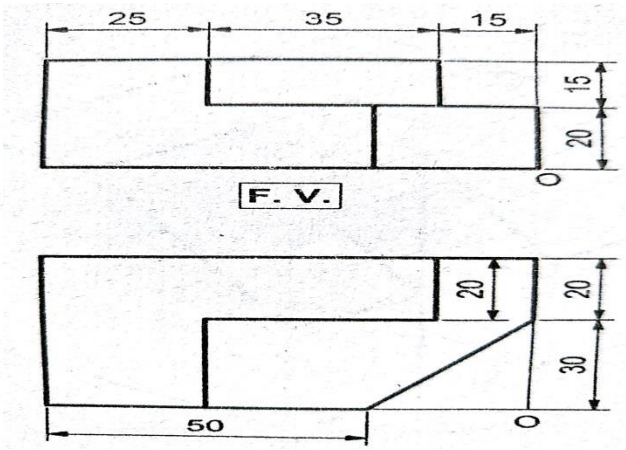
1.5. Questions:

Answer Q……..Q……..Q…….(Question numbers to be allotted by the teacher)

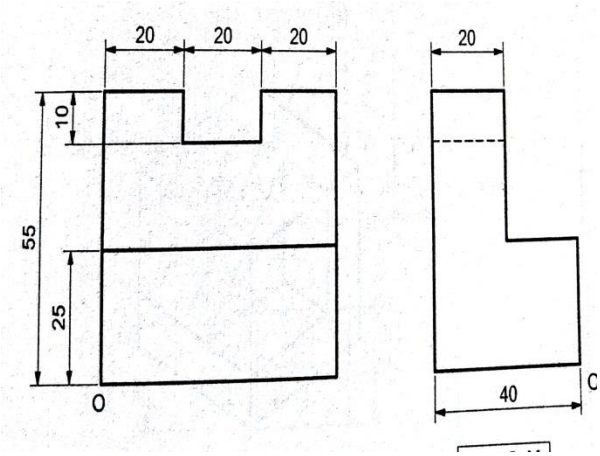
Q.1



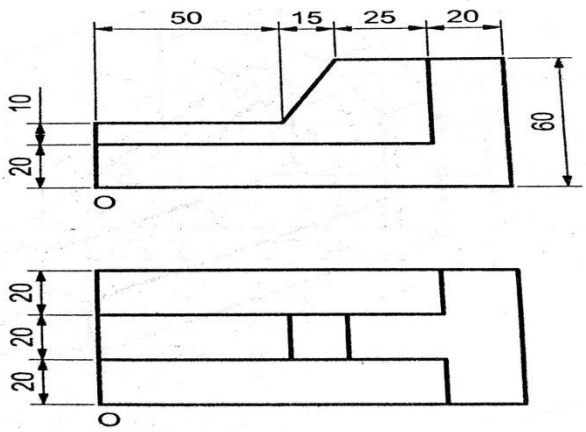
Q.2



Q.3



Q.4



(Space for printouts.)

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPERIMENT NO. 02

TITLE:- USE CAD SOFTWARE TO PREPARE TEMPLATE FOR YOUR INSTITUTE WITH TITLE BLOCK AND INSTITUTE LOGO.

2.1. TEXT WITH CAD

Text can be created and added to your drawing through the keyboard.

Selecting the text font and height:

- Select the text style command from the Format Pull-Down menu, and then make allthe necessary changes on the text style dialog box, such as: Text height, text font. ect.

Creating single and multiple line text:

- Select the text command from the draw pull-down menu, then select Single linetext or Multiple line, or

- Type Dtext or DT at the command line, or

- Select the text icon **A** from the Draw toolbar.

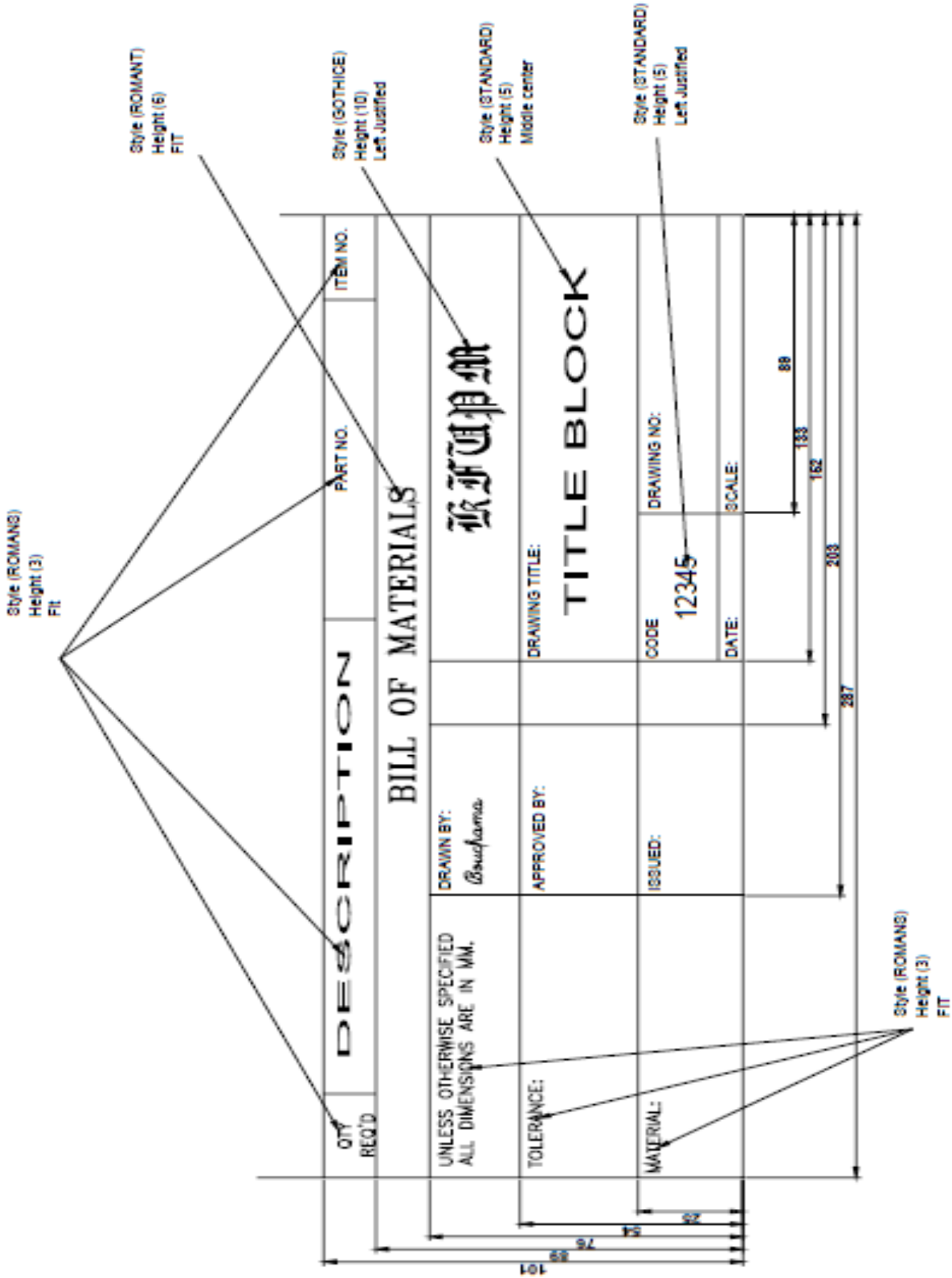

Style (ROMANS)
Height (3)
Fit
Style (ROMANT)
Height (6)
FIT
Style (GOTHICE)
Height (10)
Left Justified
Style (STANDARD)
Height (5)
Middle center
Style (STANDARD)
Height (5)
Left Justified
ITEM NO.
PART NO.
DESCRIPTION
QTY REQ'D
BILL OF MATERIALS
TITLE BLOCK
DRAWING TITLE:
DRAWING NO:
CODE
12345
SCALE:
DATE:
DRAWN BY:
APPROVED BY:
ISSUED:
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MM.
TOLERANCE:
MATERIAL:
Style (ROMANS)
Height (3)
FIT
89
133
162
203
287
101
89
76
51
25

Plate 2

2.2. Questions:

1. To prepare bill of material table (given by teacher)

2. Prepare a template for your institute with title block and institute logo.

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPERIMENT NO. 03

TITLE:- USE CAD SOFTWARE TO DRAW COMPLEX 2-D ENTITIES USING DRAW, EDIT, AND MODIFY COMMANDS.

3.1. Drawing lines with CAD

CAD Entry Commands:

You can draw lines by using anyone of the five coordinate entry methods below:
- Absolute Rectangular Coordinates; (100, 0)
- Relative Rectangular Coordinates; @ (100, 0)
- Absolute Polar Coordinates; 100< 90º
- Relative Polar Coordinates; @ 100< -90º
- Direct Distance Entry; 100

Steps to begin drawing a line:

1- Type L at the command prompt and press the Enter key, or
2- Click le Line icon tool from the Draw toolbar.
In any case, CAD will prompt you with a message asking you to specify the first point to begin your line.
- You can type the coordinates (x, y) of a point, and press enter to start the line, (Cartesian coordinate entry).
3- After you have selected the first point CAD will ask you to specify the next point: Enter @ 45, 0 to extend the line 45 units to the right from the last point, (Relative Cartesian coordinate entry); then - Enter @55< 30º to extend the line 55 units 30º upward from the last point, (relative polar coordinate entry).
- Move the cursor horizontally to the right, and then enter 100 at the command prompt
to extend the line 100 units in the horizontal direction, (direct distance entry).
4- Press Enter to terminate the line command.

Drawing Hidden lines

- From the object properties toolbar, choose the line type command, and then select
Hidden
- Proceed as above

3.2. Drawing circles with AutoCAD

You can draw circles by specifying one of the options cited below:
• The center and the radius or the diameter of the circle.
• 2 points (2P option). The two points are located on the circle.
• 3 points (3P option). The three points are located on the circle.

• 2 tangents and a radius, (TTR option).
• 3 tangents, (TTT option).

Steps to begin drawing a Circle:

1- Type C at the command prompt and press the Enter key, or
2- Click le Circle icon tool from the Draw toolbar.
In any case, CAD will prompt you with a message asking you to select one of the options cited above

A- Center Radius or Diameter Option**:**

a- You can type the coordinates (x, y) of a center point, or
b- Select a point on the screen, using the mouse.
c- After you have selected the center point CAD will ask you to specify the radiusof the circle.
d- Press Enter to terminate the command.

B- 2P (two points) Option**:**

CAD will ask you to specify 2 points (first end point of the diameter and then the second end point of the diameter).

C- 3P (three points) Option**:**

CAD will ask you to specify 3 points (first point on the circle, second point on thecircle and third point on the circle).

D- Tangent, Tangent, Radius Option**:**

CAD will ask you to specify the first point on an object for the first tangent, thesecond point on an object for the second tangent of the circle.

E- Tangent, Tangent, Tangent Option**:**

CAD will ask you to specify 3 points.

3.3 Drawing Arcs with AutoCAD

You can draw arcs by specifying one of the following options:
• Drawing an Arc by specifying 3 points on the screen.
• Drawing an Arc by specifying, the starting point, the center of the arc and the ending point.
• Drawing an Arc by specifying the Starting point, the Center of the arc, and the Angle.
• Drawing an Arc by specifying the Starting point the Center of the arc, and the Length of the arc.
• Drawing an Arc by specifying the Starting point, the End point, and the Direction of the arc.

• Drawing an Arc by using the option continue to join two lines by an arc. (See example)

3.4. GEOMETRIC CONSTRUCTION WITH CAD

Geometric construction is based on plane geometry, including; points, lines, circles, arcs and polygons. CAD provides powerful commands for creating complex geometric figures.

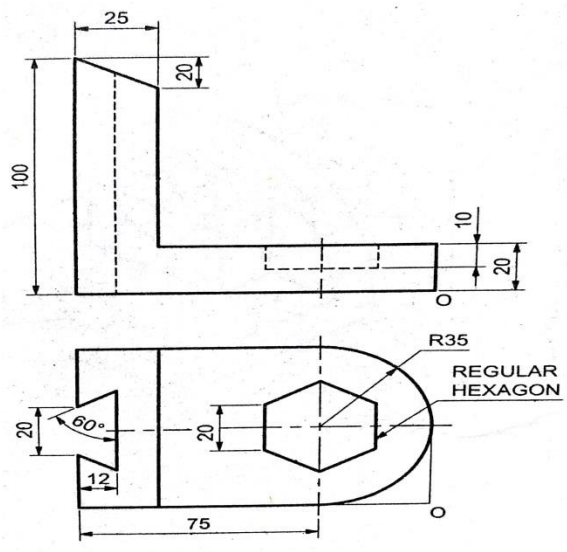
CAD commands used in this section are: **Circle** command with the TTR option (Tangent, Tangent and Radius); **Fillet** command, **Trim** command **Offset** command and **Polygon** command. Every command is explained and examples are shown during the lecture session.

The techniques and applications explained are used throughout the class work and homework assignments

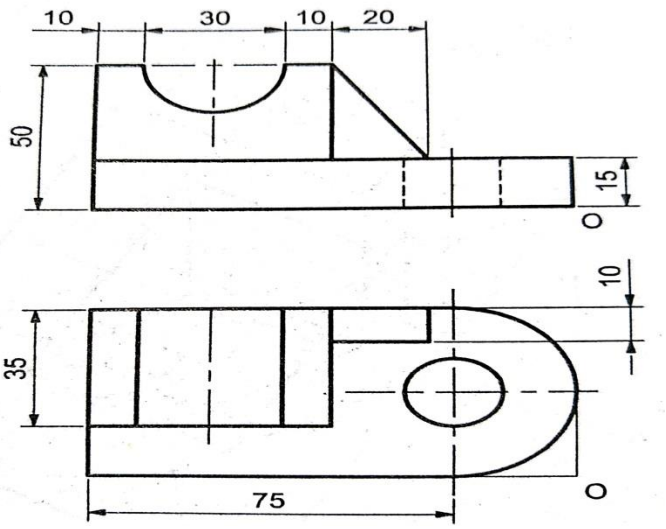
3.5. Questions:

Answer Q……..Q……..Q…….(Question numbers to be allotted by the teacher)

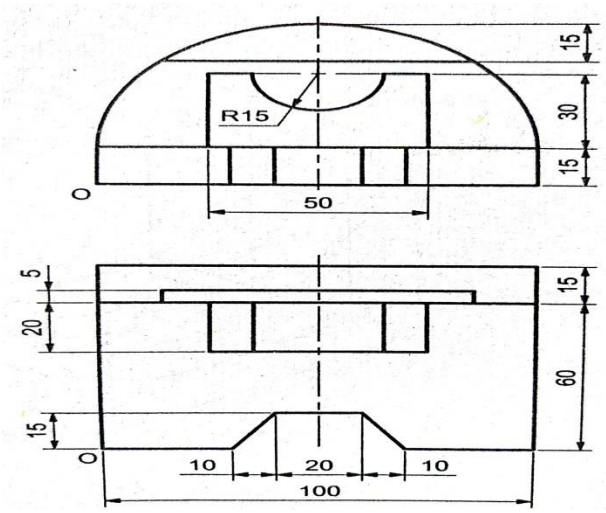
Q.1



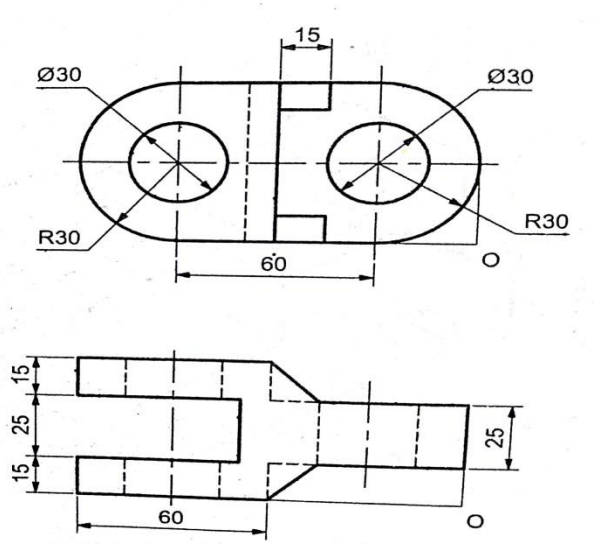
Q.2



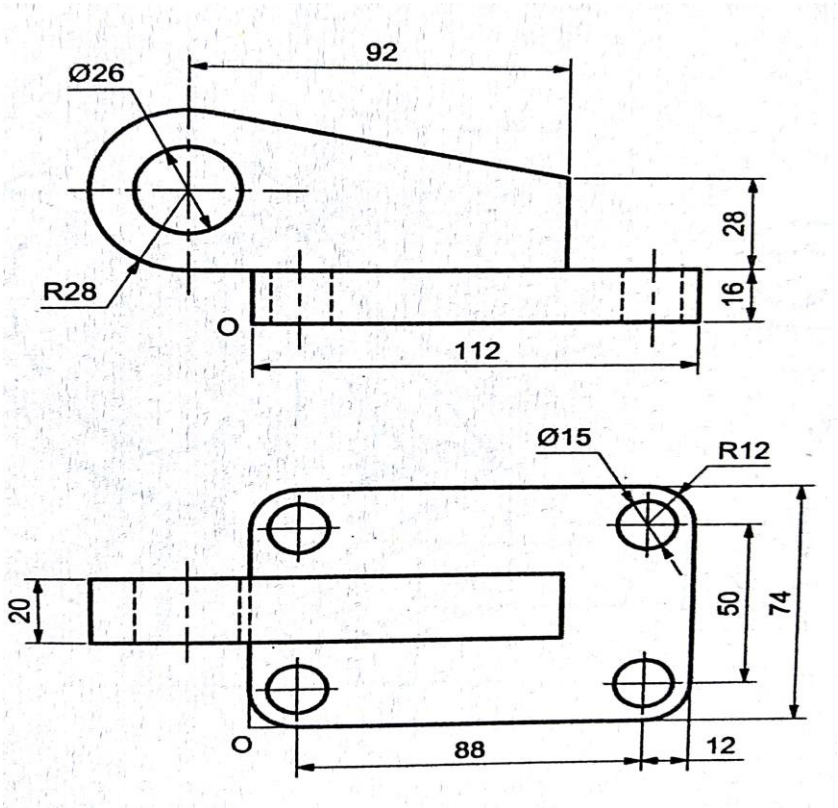
Q.3


15
30
15
R15
50
5
20
15
60
15
10
20
10
100

Q.4


15
Ø30
Ø30
R30
R30
60
15
25
15
25
60

Q.5


92
Ø26
28
R28
16
112
Ø15
R12
20
50
74
88
12

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPRIMENT NO. 04

TITLE : USE CAD SOFTWARE TO CREAT PROBLEMS OF ORTHOGRAPHIC PROJECTIONS USING FIRST ANGLE METHOD OF PROJECTION.

4.1. ORTHOGRAPHIC PROJECTIONS.

Definition:

Orthographic projection is a drawing representation using the front, the top, and the left or the right side views of an object.

This drawing representation is designed to describe the object through its principle views, the relation between them, the size and the location dimensions of each one and how they are related compared to the pictorial view. The emphasis is placed mainly on the visualization of the object.

One of the most efficient methods of creating orthographic views with AutoCAD is through the use of AutoCAD Drawing and Editing Commands, such as: **Line, Circle, Erase, Copy**, **Offset**, **Mirror**, **Block**, ect.

The understanding of orthographic projection is essential for the topics that follow such as: Auxiliary views, Sectioning and Surface Intersections.

4.2. PROBLEMS FOR ORTHOGRAPHIC PROJECTIONS.

Q.1

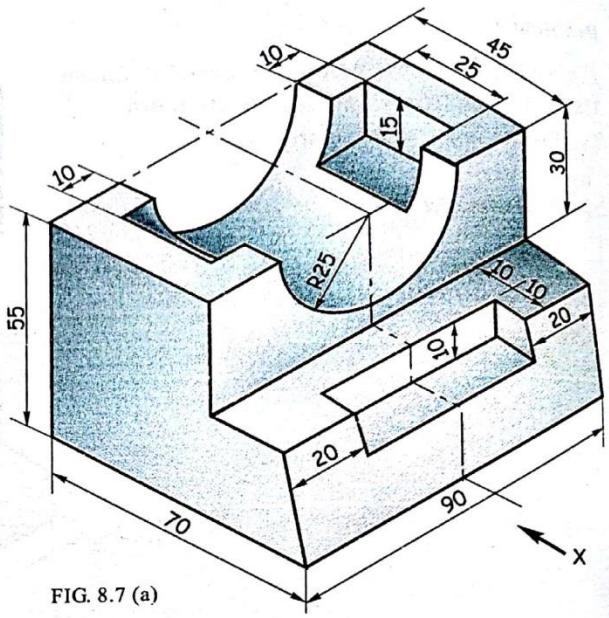
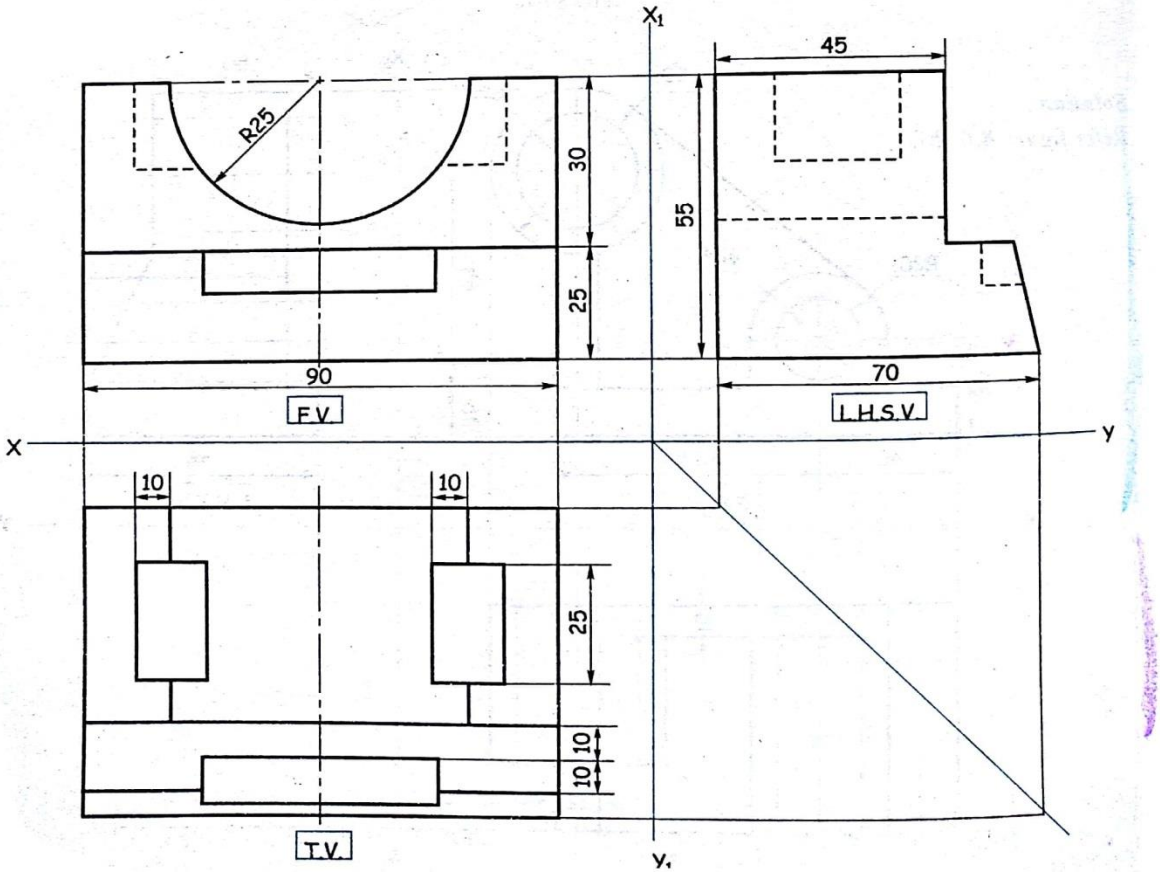


FIG. 8.7 (a)



Q.2

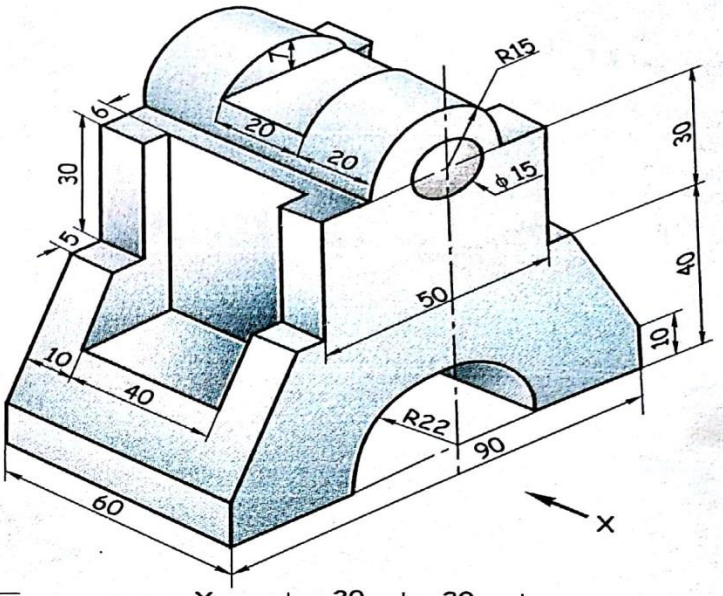
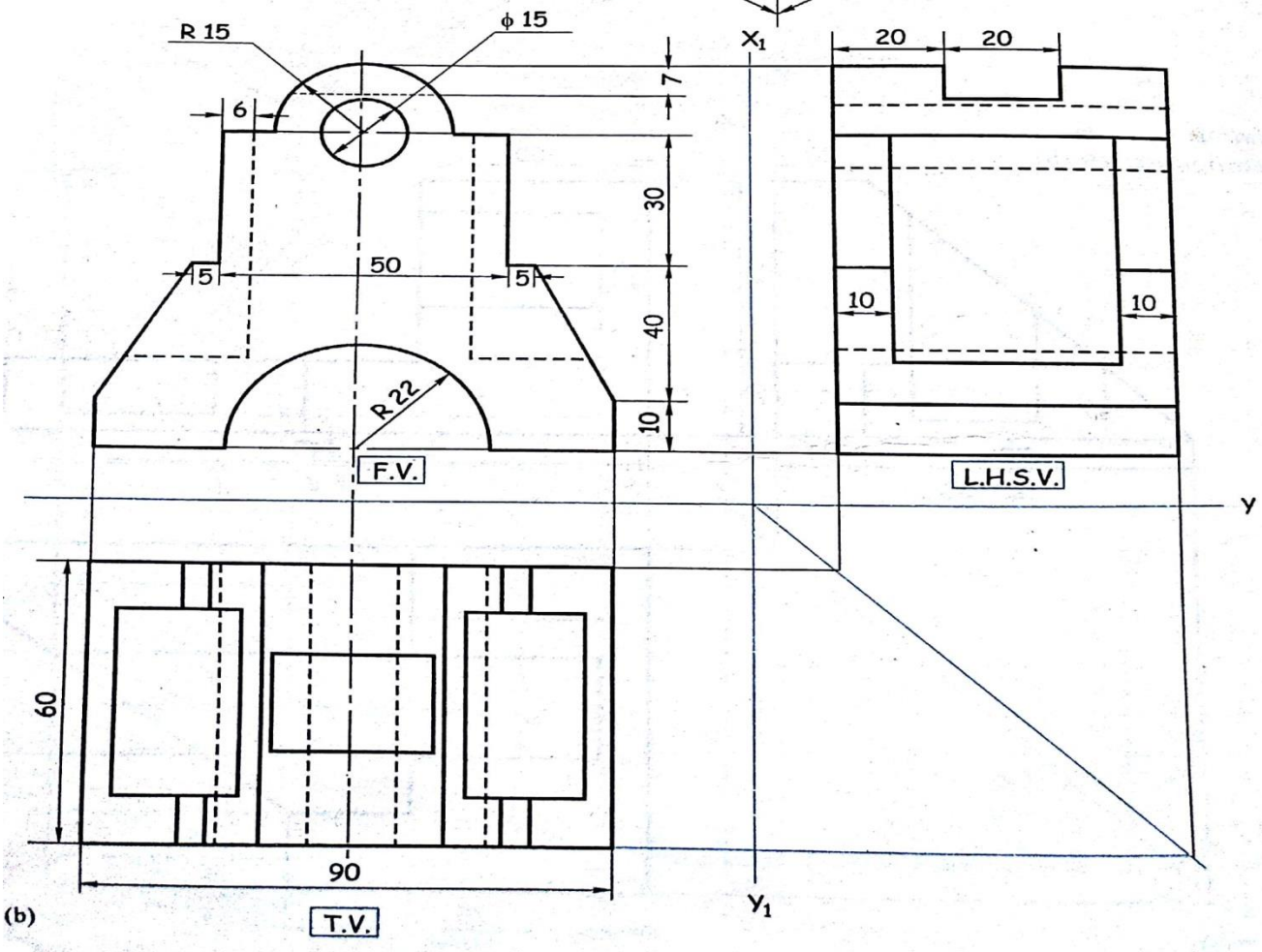

R15
6
20
20
30
30
5
φ 15
50
40
10
10
40
R22
90
60
X

FIG. 8.21 (a)


R 15
φ 15
X1
20
20
7
6
30
50
5
5
40
10
10
10
R22
F.V.
L.H.S.V.
Y
60
90
T.V.
Y1
(b)

Q.3

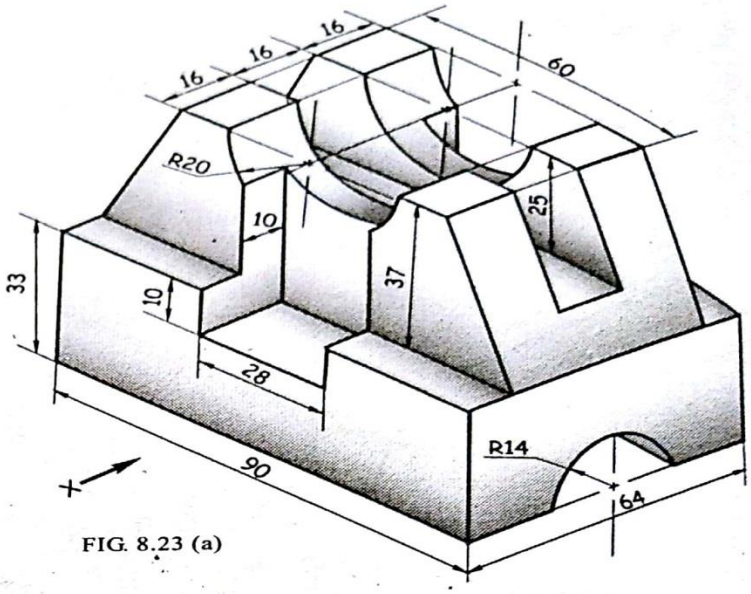
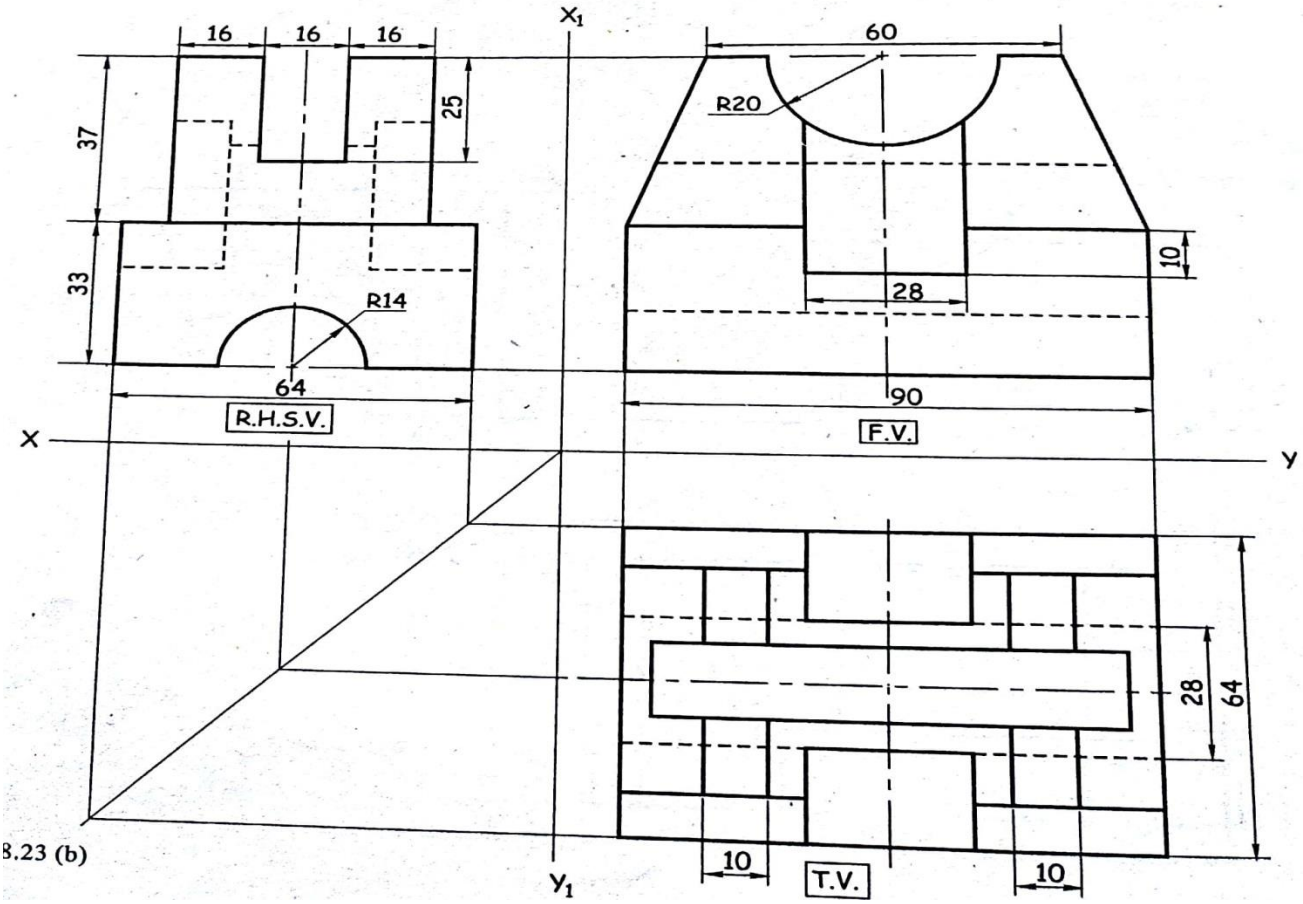


FIG. 8.23 (a)



8.23 (b)

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

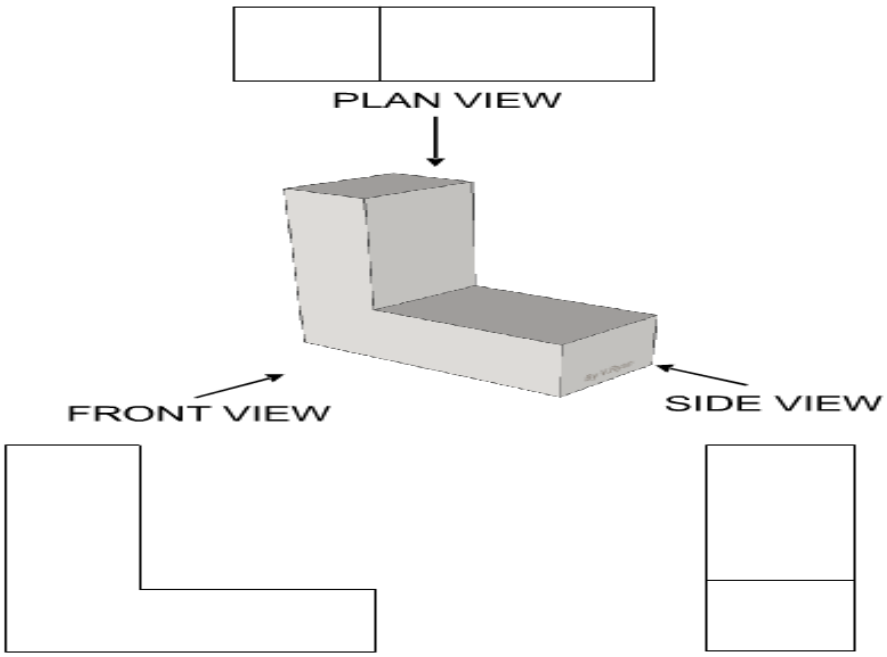
EXPERIMENT NO. 05

TITLE : USE CAD SOFTWARE TO CREAT PROBLEMS OF ORTHOGRAPHIC PROJECTIONS USING THIRD ANGLE METHOD OF PROJECTION.

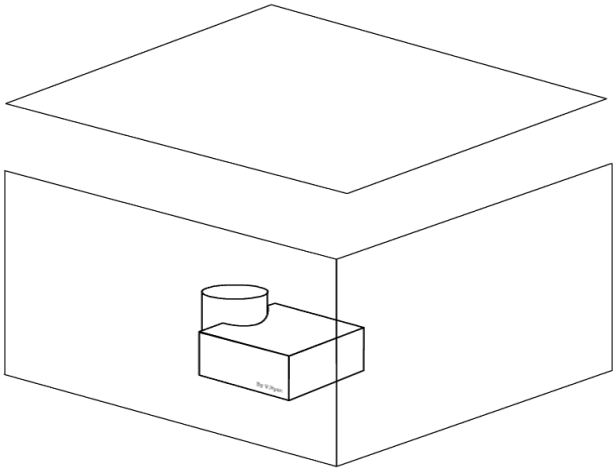
5.1. *Orthographic Projection* is a way of drawing an object from different directions. Usually a front, side and plan view are drawn so that a person looking at the drawing can see all the important sides. Orthographic drawings are useful especially when a design has been developed to a stage whereby it is almost ready to manufacture. There are two ways of drawing in orthographic - *First Angle* and *Third Angle*. They differ only in the position of the plan, front and side views. Below is an example of **third angl**e projection.

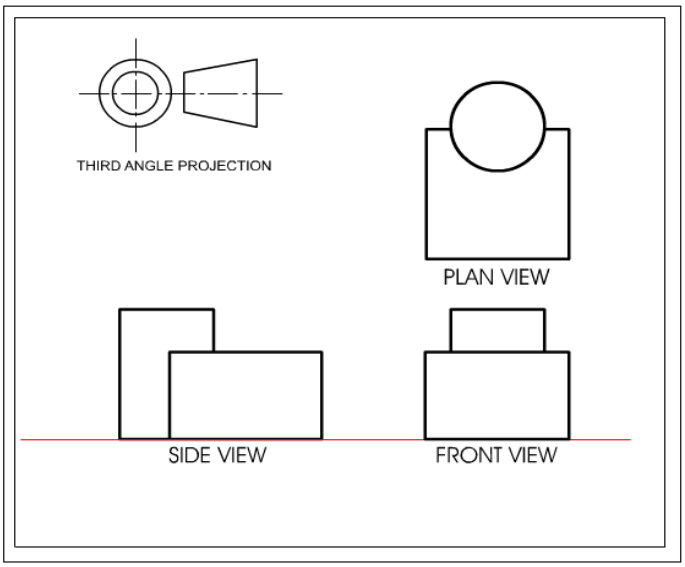
An L-shaped object

The Plan View of the L-shape is drawn as a 'birds eye' view, a view from above. The Front View is drawn as if stood in front of the L-shape. The Side View is drawn as if stood at the side.



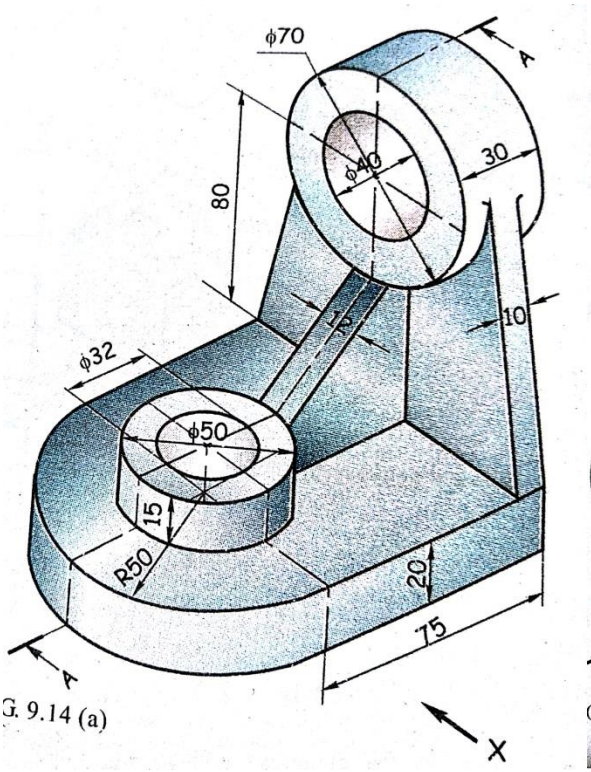
Another example of *third angle* orthographic projection is shown below.





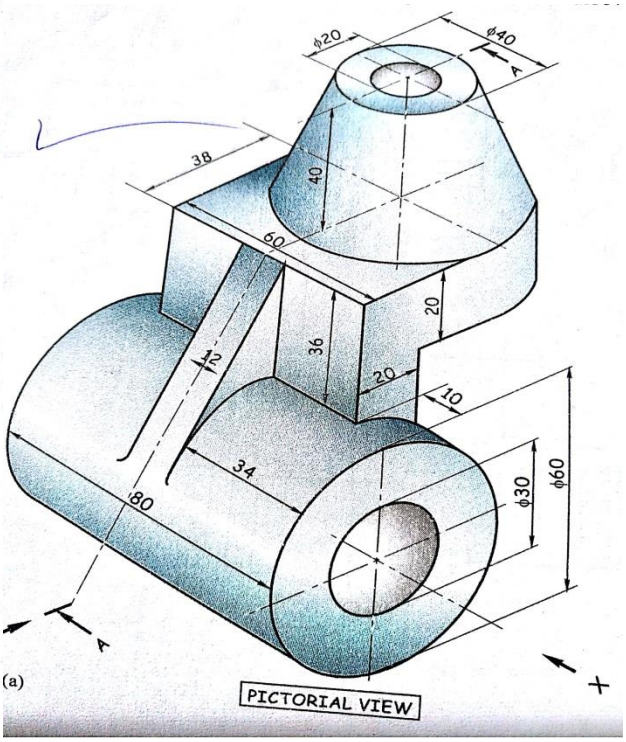
5.2. PROBLEMS FOR ORTHOGRAPHIC PROJECTIONS.(Third angle method.)

Q.1

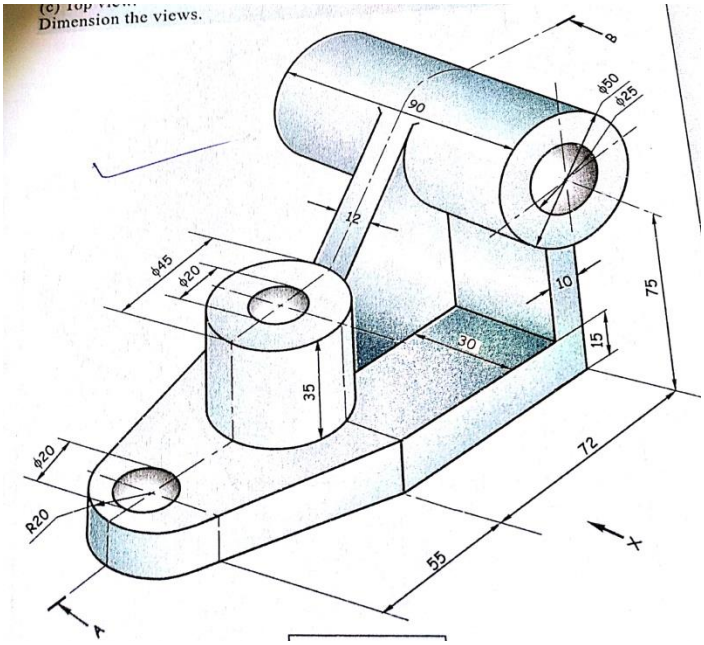


G. 9.14 (a)

Q.2



Q.3



(Space for printouts.)

	Performance Indicators	Weightage in %
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPERIMENT NO. 06

TITLE : USE CAD SOFTWARE TO CREAT PROBLEMS OF SECTIONAL ORTHOGRAPHIC PROJECTIONS.(FIRST ANGLE METHOD.)

6.1. There are three type of sections used in engineering graphics:

a. Full Section.

b. Offset Section.

c. Half Section.

Each section is distinguished through its cutting plane line

The use of sectional views in engineering graphics is to make orthographic views less complicated to visualize. Cutting the view to reveal the interior will eliminate all hidden lines which will make the view easier to understand and to draw.

CAD has several hatch patterns stored as a built-in library. The setting for patterns, scale for pattern, angle for pattern and object selection can be done through the hatching dialog box.

Procedure:

- Select Hatch command from the Draw pull-menu,

- Select the desired pattern,

- Set the scale pattern,

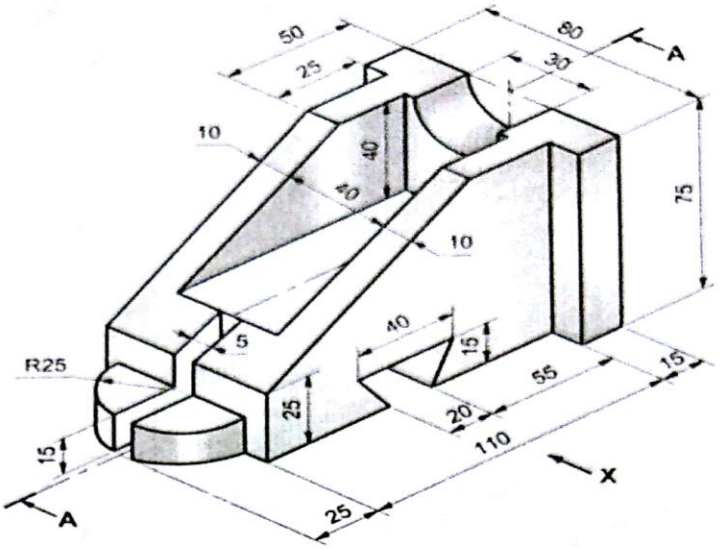
- Set the angle pattern,

- Select the area to hatch,

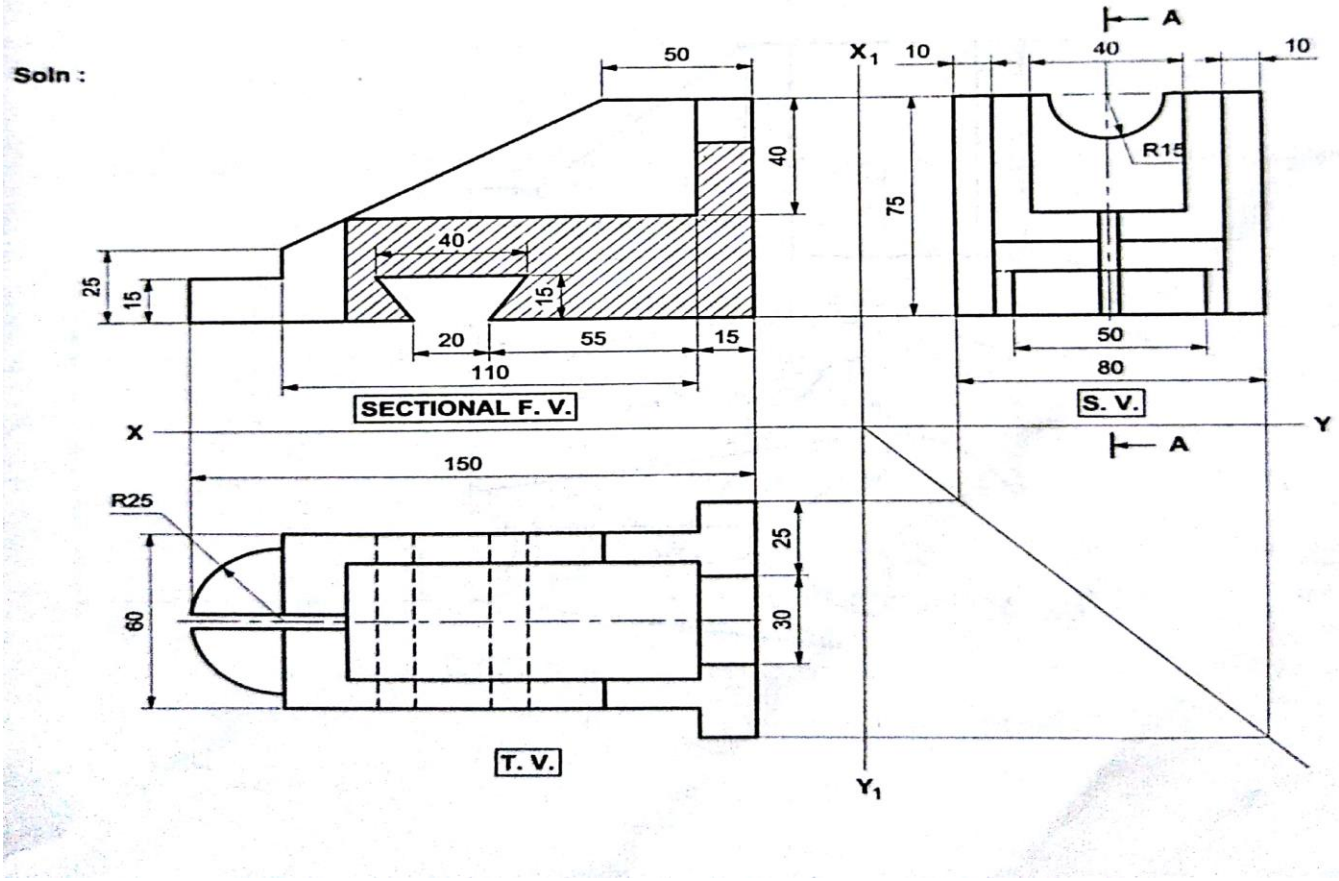
- Press enter to terminate the Hatch command.

6.2. Question:

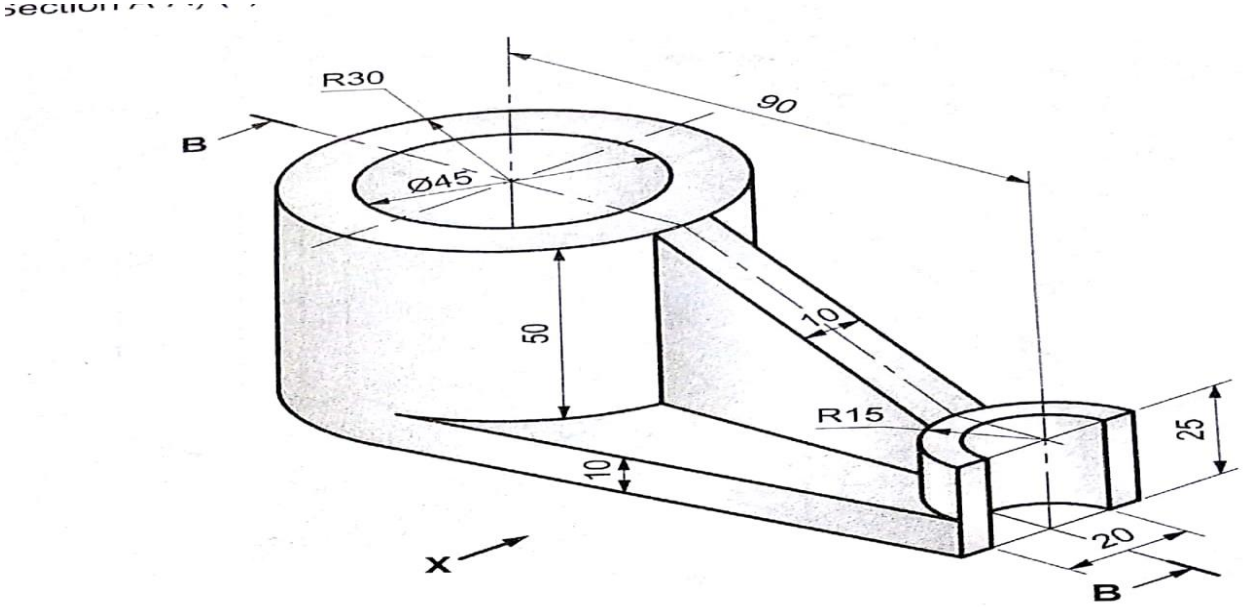
Q.1

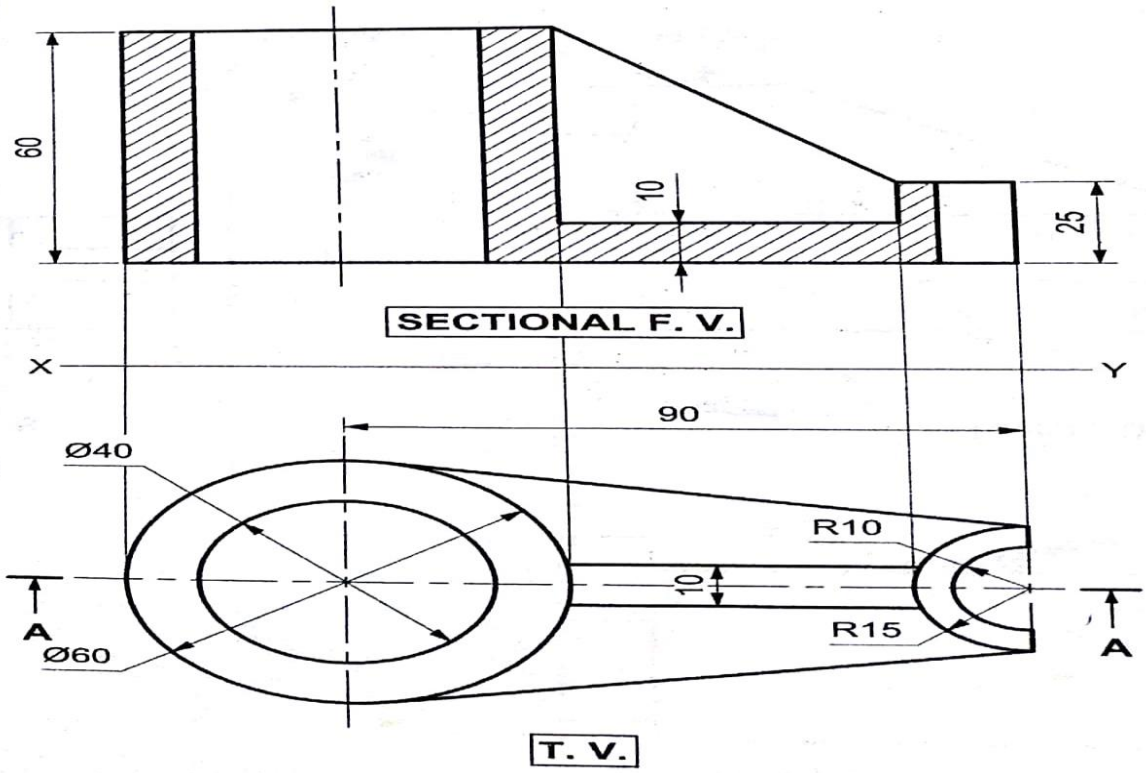


Soln :

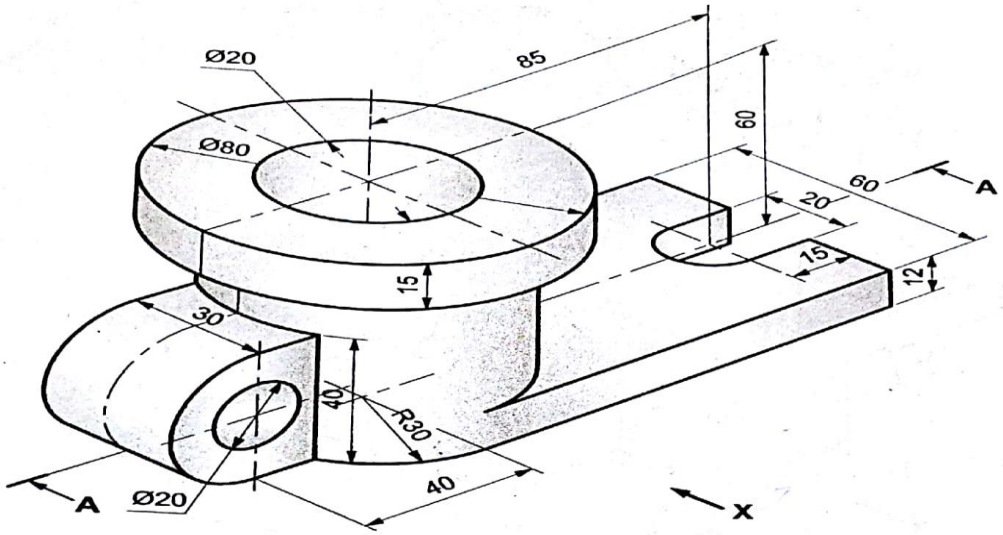


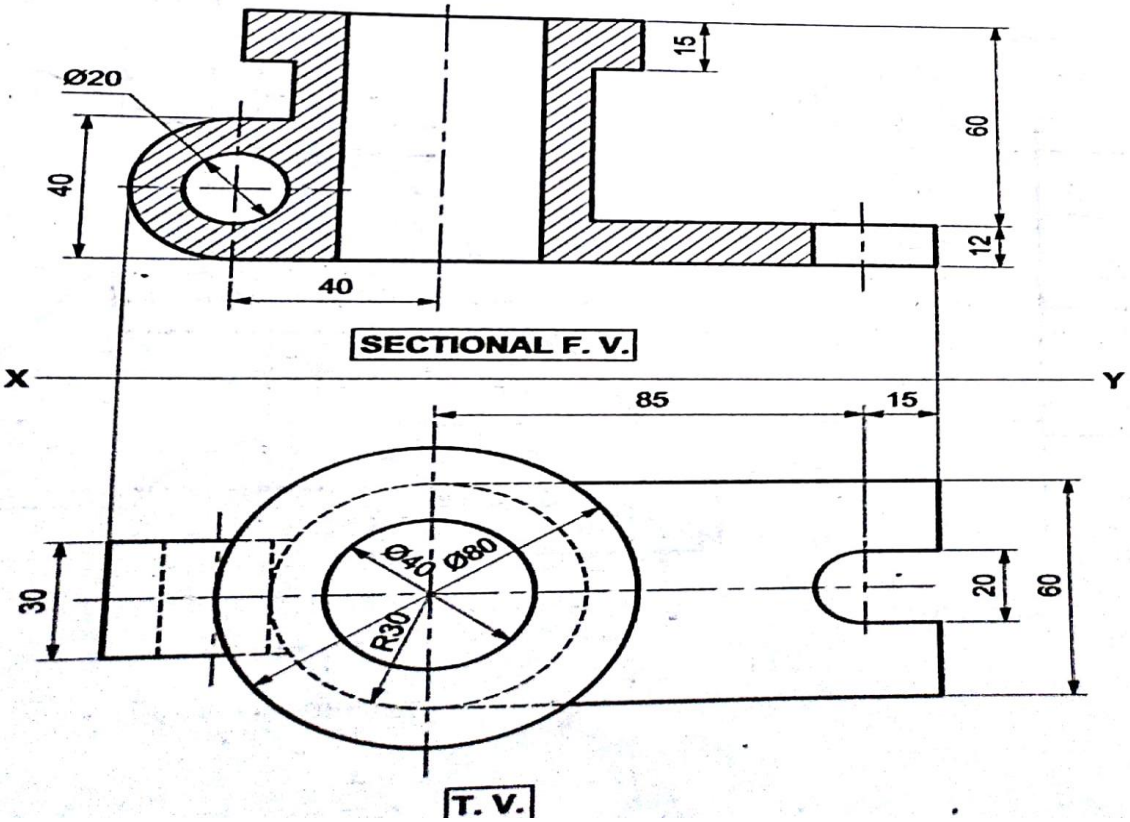
Q.2


R30
B
90
Ø45
50
10
R15
25
10
20
X
B

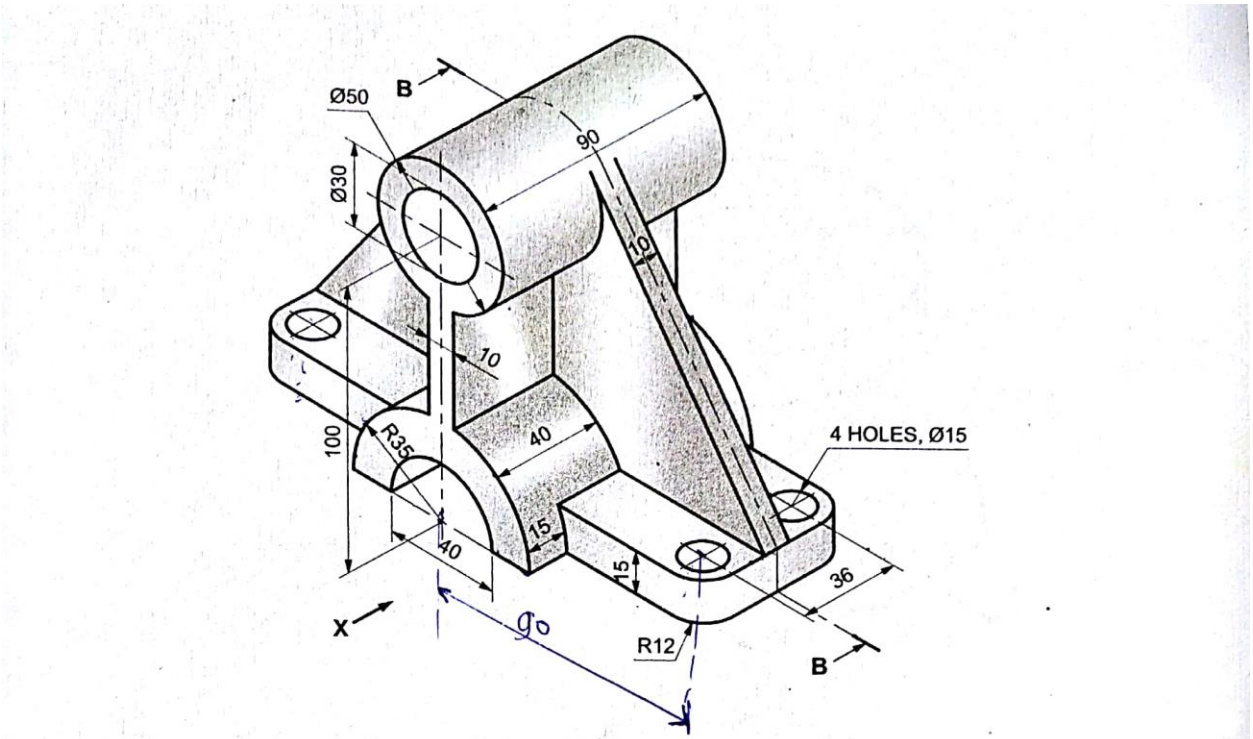

60
10
25
SECTIONAL F. V.
X
Y
90
Ø40
R10
10
A
Ø60
R15
A
T. V.

Q.3

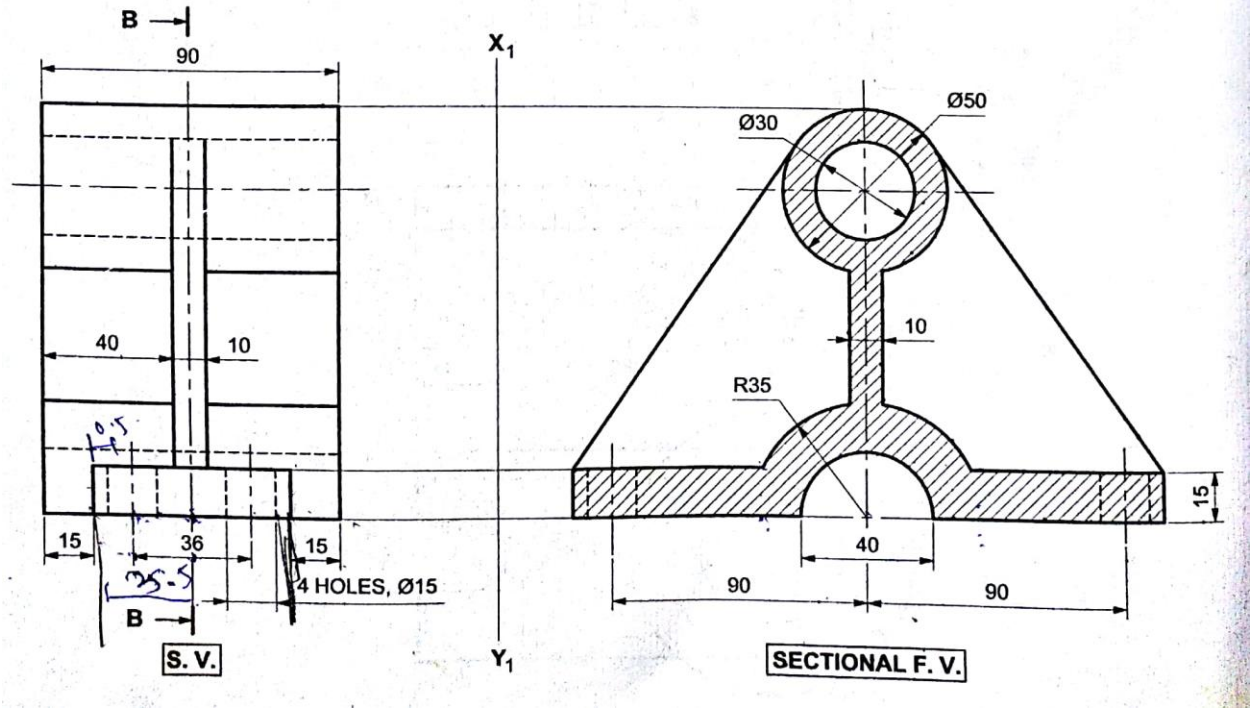

Ø20
85
Ø80
60
60
A
20
15
12
15
30
40
R30
A
Ø20
40
X


Ø20
15
60
40
12
40
SECTIONAL F. V.
X
Y
85
15
Ø40
Ø80
R30
30
20
60
T. V.

Q.4


Ø50
B
90
Ø30
10
10
100
R35
40
4 HOLES, Ø15
15
40
15
36
X
R12
B

ɔln :


B
90
X1
Ø50
Ø30
40
10
10
R35
15
15
36
15
40
4 HOLES, Ø15
90
90
B
S. V.
Y1
SECTIONAL F. V.

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPERIMENT NO. 07

TITLE : USE CAD SOFTWARE TO CREAT PROBLEMS OF SECTIONAL ORTHOGRAPHIC PROJECTIONS.(THIRD ANGLE METHOD.)

7.1. There are three type of sections used in engineering graphics:

a. Full Section.

b. Offset Section.

c. Half Section.

Each section is distinguished through its cutting plane line

The use of sectional views in engineering graphics is to make orthographic views less complicated to visualize. Cutting the view to reveal the interior will eliminate all hidden lines which will make the view easier to understand and to draw.

CAD has several hatch patterns stored as a built-in library. The setting for patterns, scale for pattern, angle for pattern and object selection can be done through the hatching dialog box.

Procedure:

- Select Hatch command from the Draw pull-menu,

- Select the desired pattern,

- Set the scale pattern,

- Set the angle pattern,

- Select the area to hatch,

- Press enter to terminate the Hatch command.

7.2. Question:

Q.1

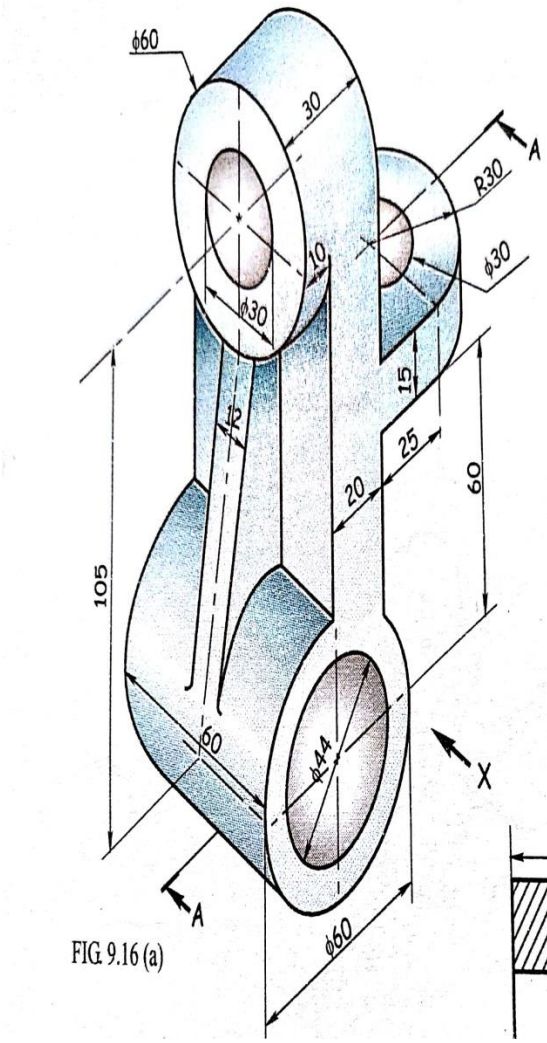
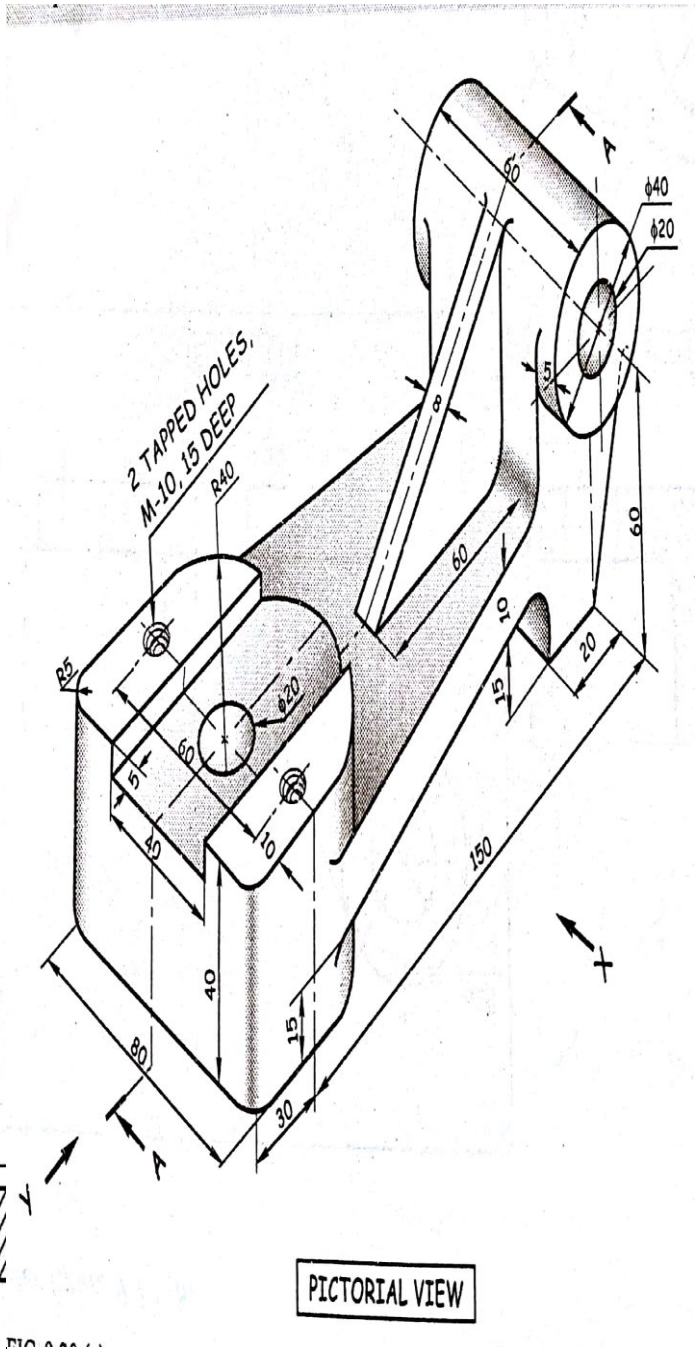


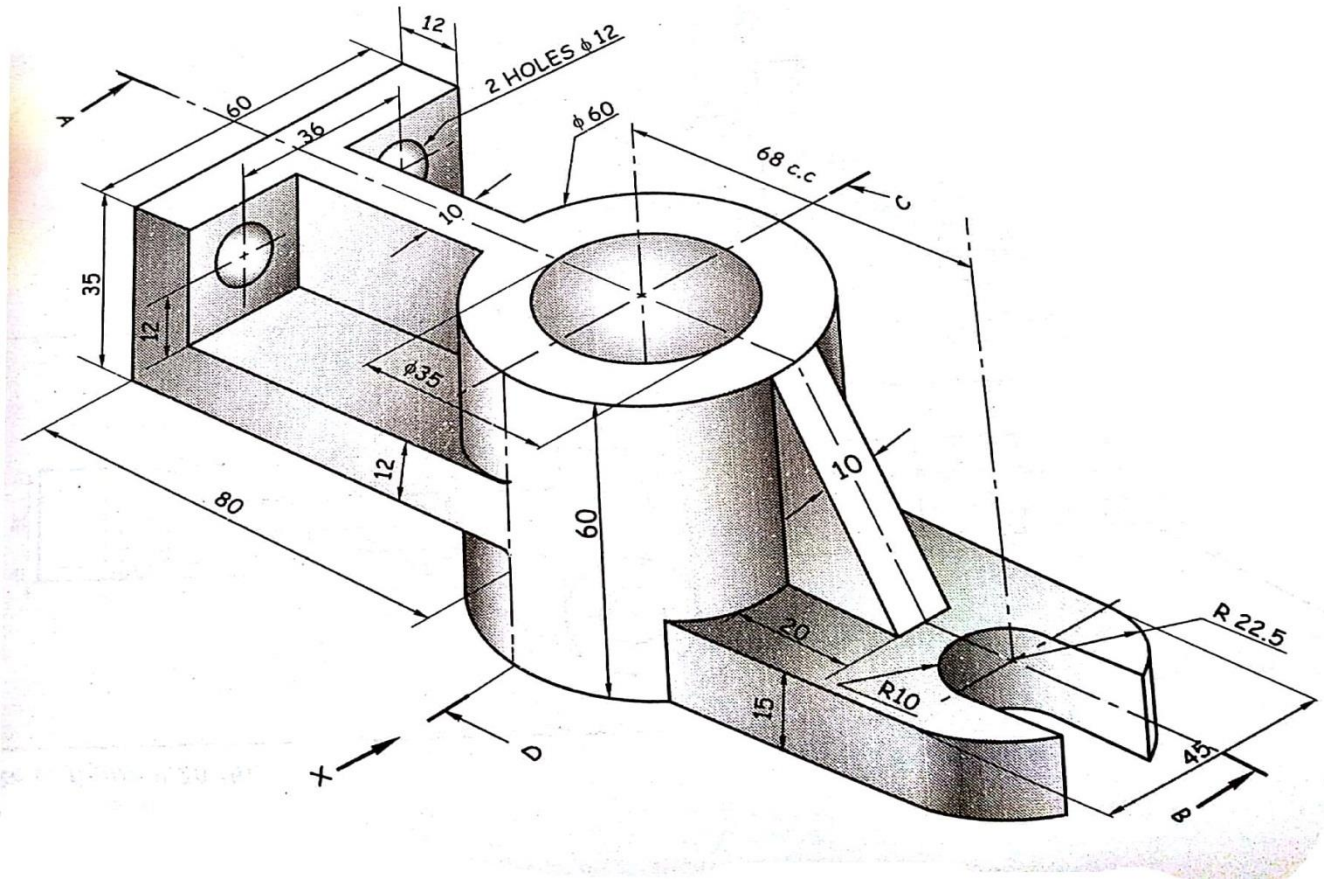
FIG. 9.16 (a)

Q.2



PICTORIAL VIEW

Q.3



(Space for printouts.)

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPRIMENT NO. 08

TITLE : USE CAD SOFTWARE TO DRAW ISOMETRIC VIEWS OF GIVEN OBJECTS.

8.1 Isometric Drawing with CAD

CAD provides the following commands to help you draw an isometric drawing: - Isometric snap grid, - Three isoplanes; Left, Top and Right. You can switch from one isoplane to another by the function key F5 or Control + E.

Procedures:

A. Lines.

a. Select the SNAP command.

b. Select STYLE from the snap prompt.

c. Standard/Isometric: Type I and press Enter, this will display an isometric grid on the screen.

d. Turn the grid on by pressing F7.

e. Use line command to draw a cube.

B. Isometric circles.

a. Select Ellipse command from the Draw menu.

b. Select Isocircle.

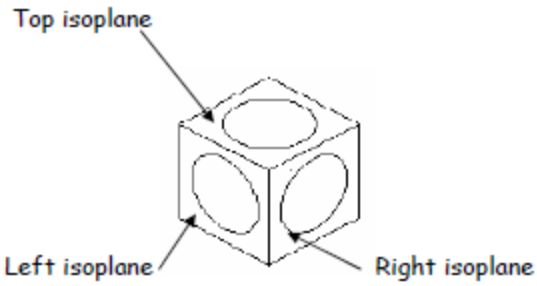
c. Enter centre of the circle.

d. Enter the Radius of the circle.

e. Use F5 to change from one isoplane to another.

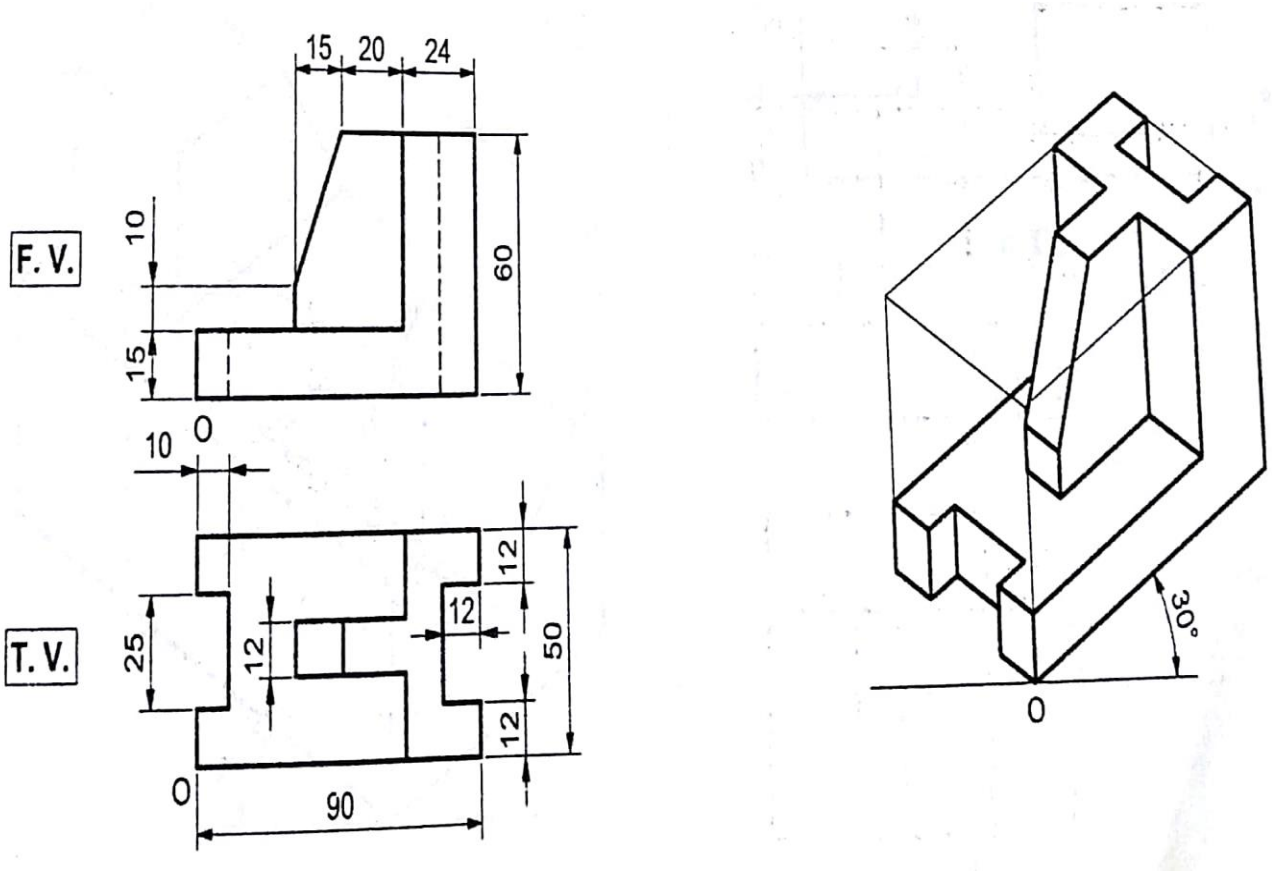
Once you learn how to get into the isometric mode an toggle from one isoplane to another, isometric drawings become considerably easier with AutoCAD. Most the commands you have learned previously can be used for isometric.

Isometric drawing is the first step to 3D drawing.

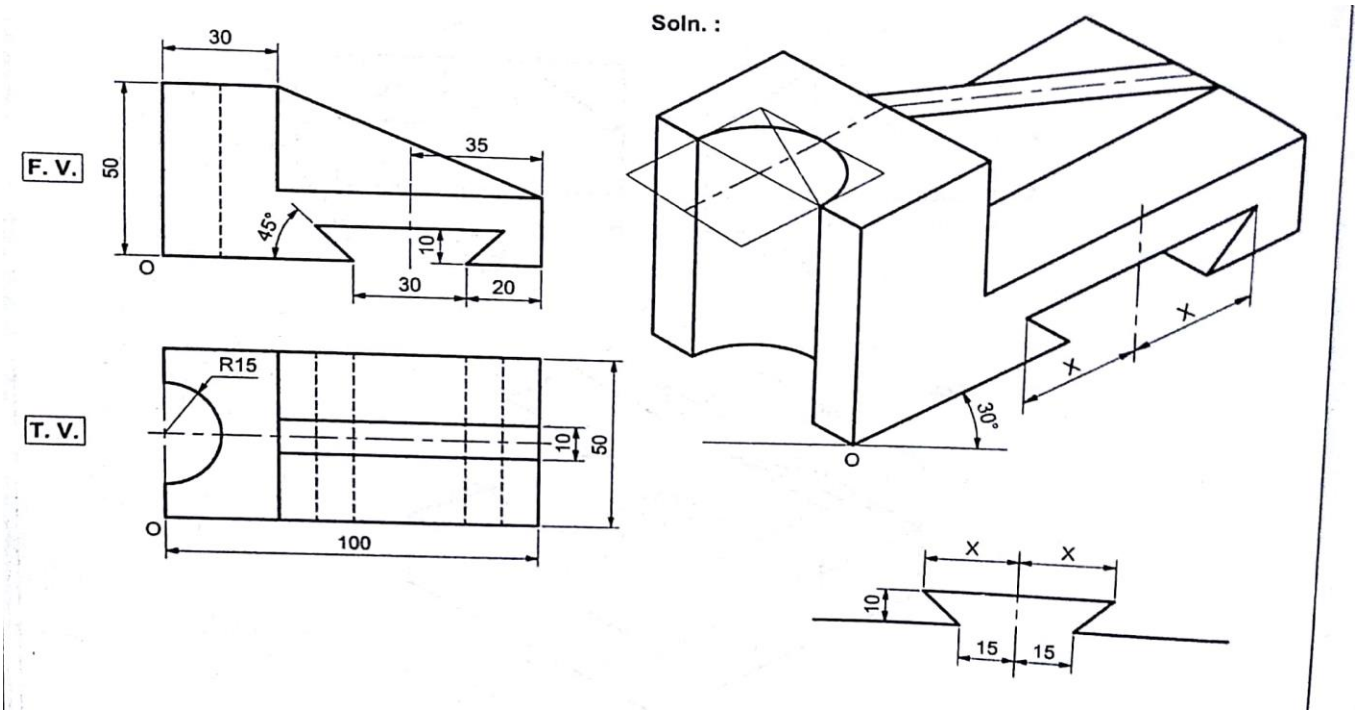


8.2. Question:

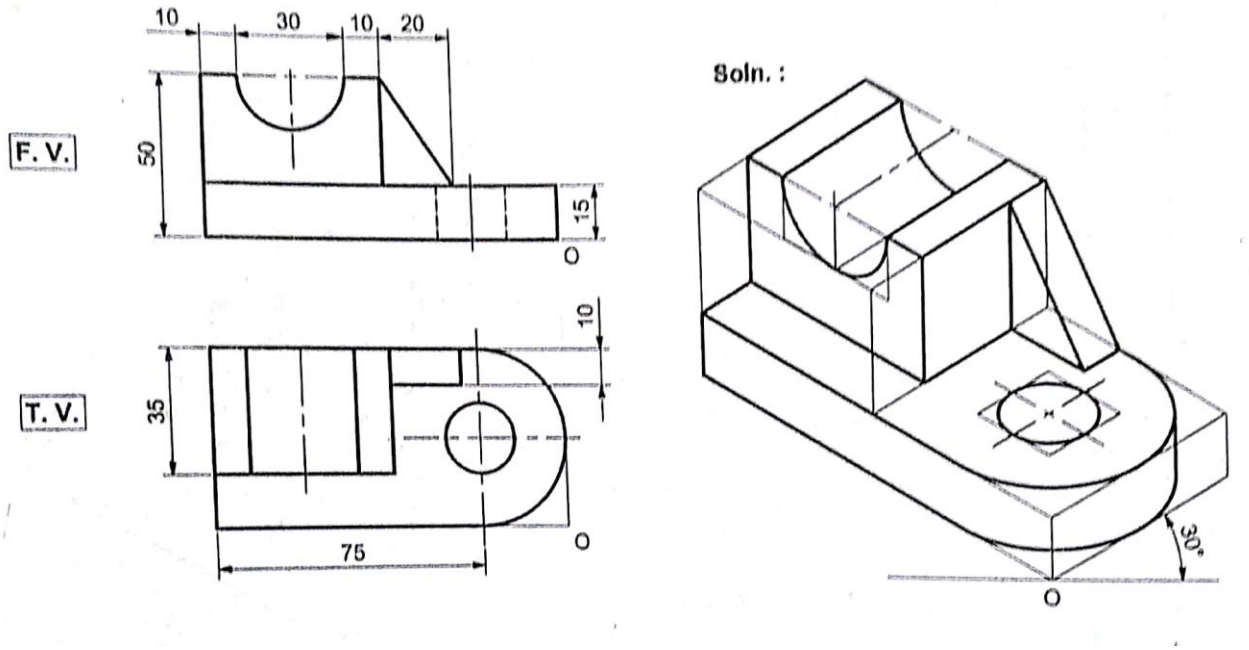
Q.1



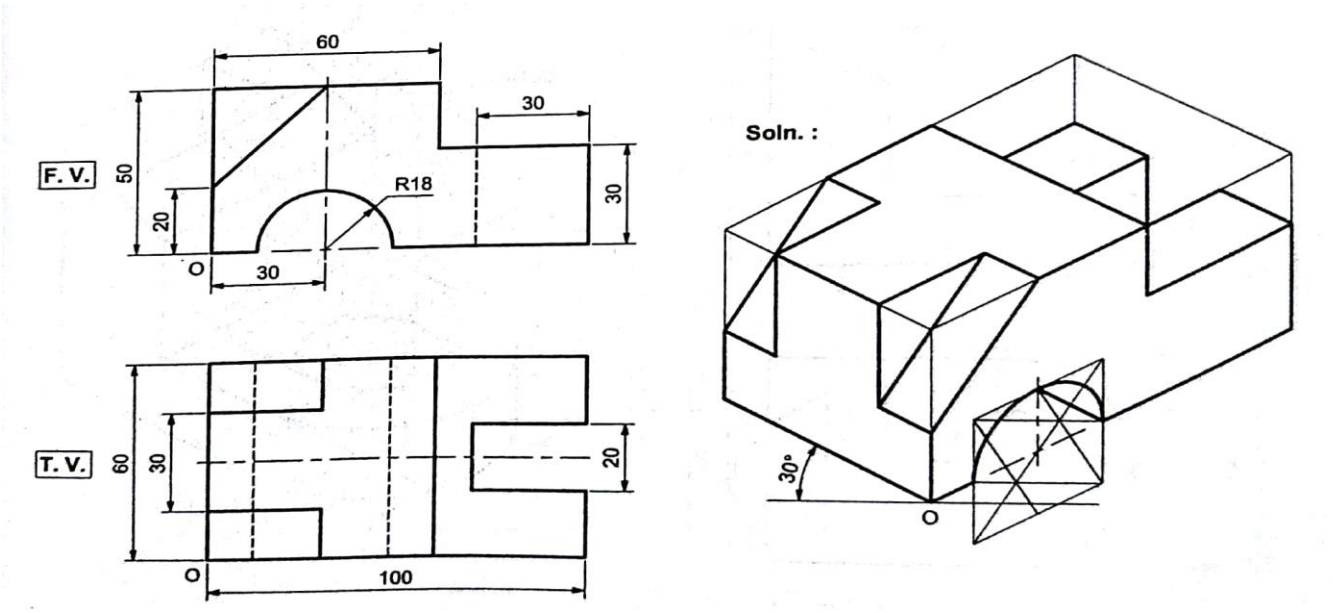
Q.2


F. V.
T. V.
30
50
35
45°
10
30
20
R15
10
50
100
O
Soln. :
X
X
X
30°
10
15
15

Q.3


F. V.
T. V.
10
30
10
20
50
15
35
10
75
O
Soln. :
30°

Q.4



(Space for printouts.)

	Performance Indicators	Weightage in %
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPRIMENT NO. 09

TITLE : USE CAD SOFTWARE TO DRAW AN ASSEMBLY DRAWING FROM THE GIVEN DETAILED DRAWING.

9.1 Assembly drawings

Assembly drawings can be used to represent items that consist of more than one component. They show how the components fit together and may include, orthogonal plans, sections and elevations, or three-dimensional views, showing the assembled components, or an exploded view showing the relationship between the components and how they fit together.

They may be used to show how to assemble parts of a kit such as furniture, how to assemble a complex part of a building (an assembly), or to show the relationship between a number of details.

The location of assemblies may be shown on general arrangement drawings, or sometimes on detail drawings. The components that form the assembly may be shown shop drawings that allow their fabrication.

Assembly drawings may include instructions, lists of the component parts, reference numbers, references to detail drawings or shop drawings, and specification information. However, they should not duplicate information provided elsewhere, as this can become contradictory and may cause confusion. They may also include dimensions, notation and symbols. It is important that these are consistent with industry standards so that their precise meaning is clear and can be understood.

Assembly drawings may be referred to as:

- General assembly drawings, showing an overall assembly.
- Outline assembly drawings, showing the exterior shape.
- Diagrammatic assembly drawings, representing the assembly with the use of symbols.
- Unit assembly or sub-assembly drawings, showing in more detail a part of the overall assembly.
- Fitted assembly drawings, showing the completed assembly.
- Exploded assembly drawing, showing the relationship between the separated parts.

The scale at which drawings are prepared should reflect the level of detail of the information they are required to convey. Different line thicknesses can be used to provide greater clarity for certain elements.

Assembly drawings may be drawn to scale by hand, or prepared using Computer Aided Design(CAD) software. However, increasingly, building information modelling (BIM) is being used to create 3 dimensional representations of buildings and their components.

BS EN ISO 7519:1997 Technical drawings. Construction drawings. General principles of presentation for general arrangement and assembly drawings establishes general principles of presentation to be applied to construction drawings for general arrangement and assembly. This standard compliments the ISO 128 series on technical drawings.

9.2. Question:

Q.1

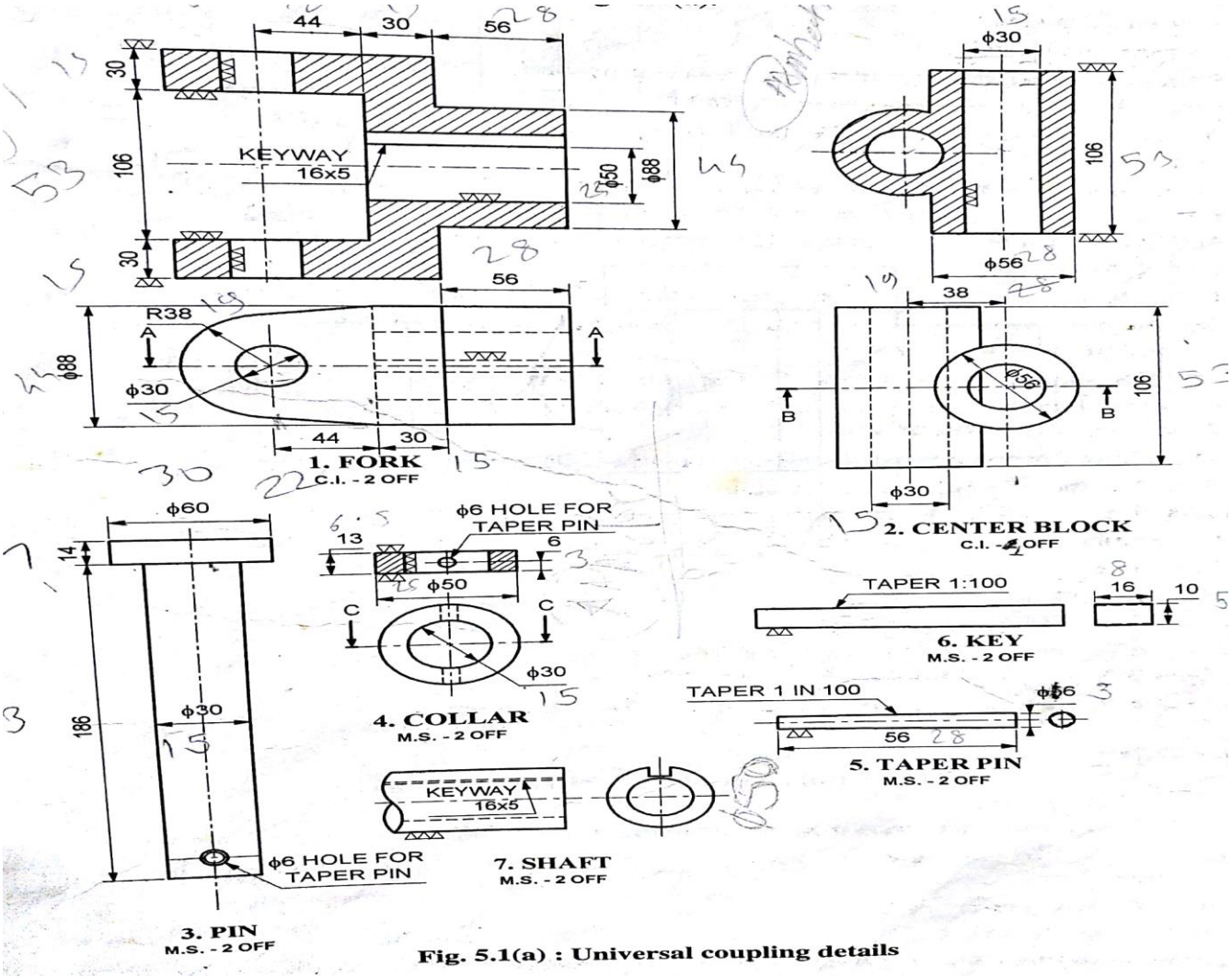
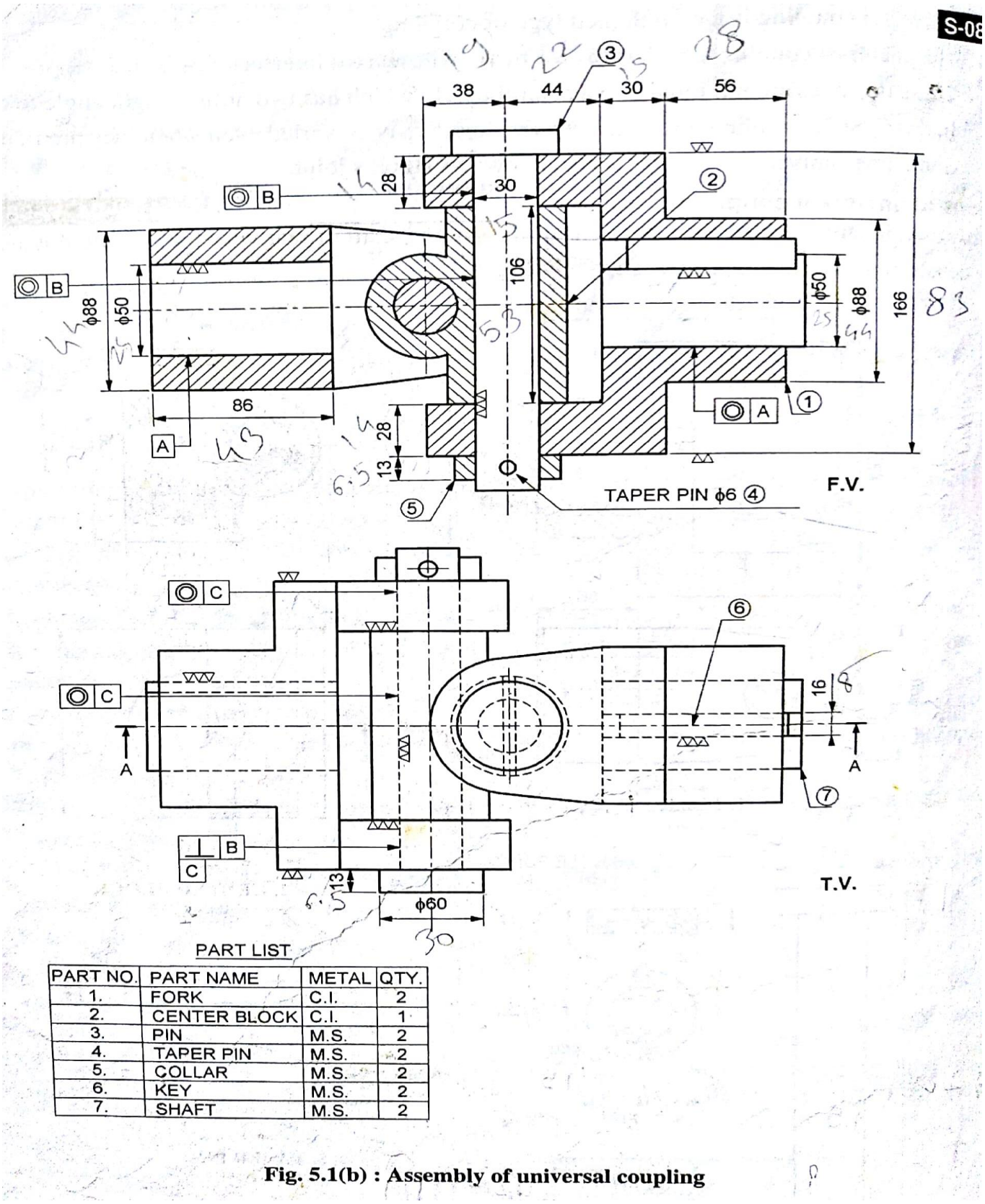


Fig. 5.1(a) : Universal coupling details



PART LIST

PART NO.	PART NAME	METAL	QTY.
1.	FORK	C.I.	2
2.	CENTER BLOCK	C.I.	1
3.	PIN	M.S.	2
4.	TAPER PIN	M.S.	2
5.	COLLAR	M.S.	2
6.	KEY	M.S.	2
7.	SHAFT	M.S.	2

Fig. 5.1(b) : Assembly of universal coupling

Q.2

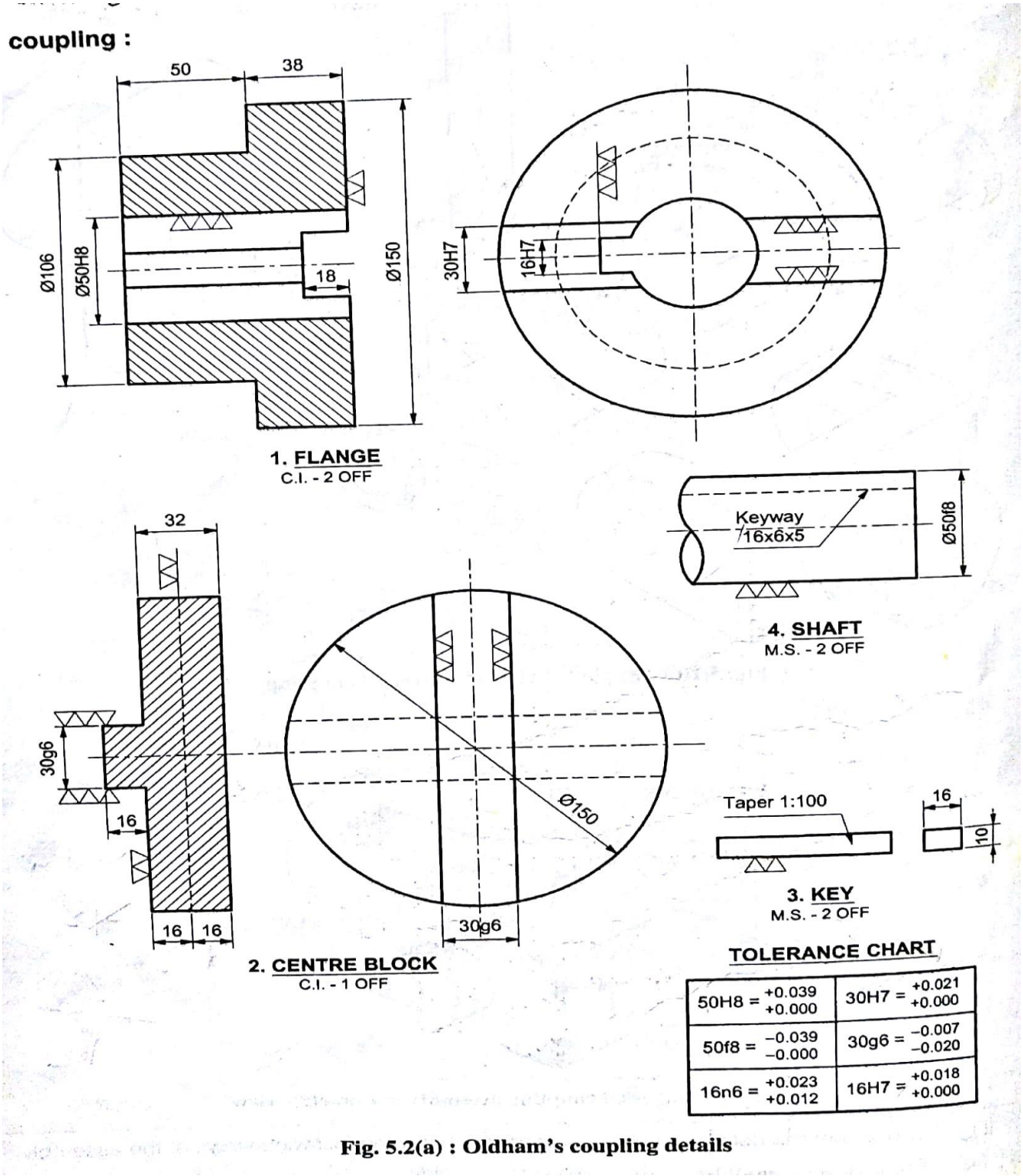
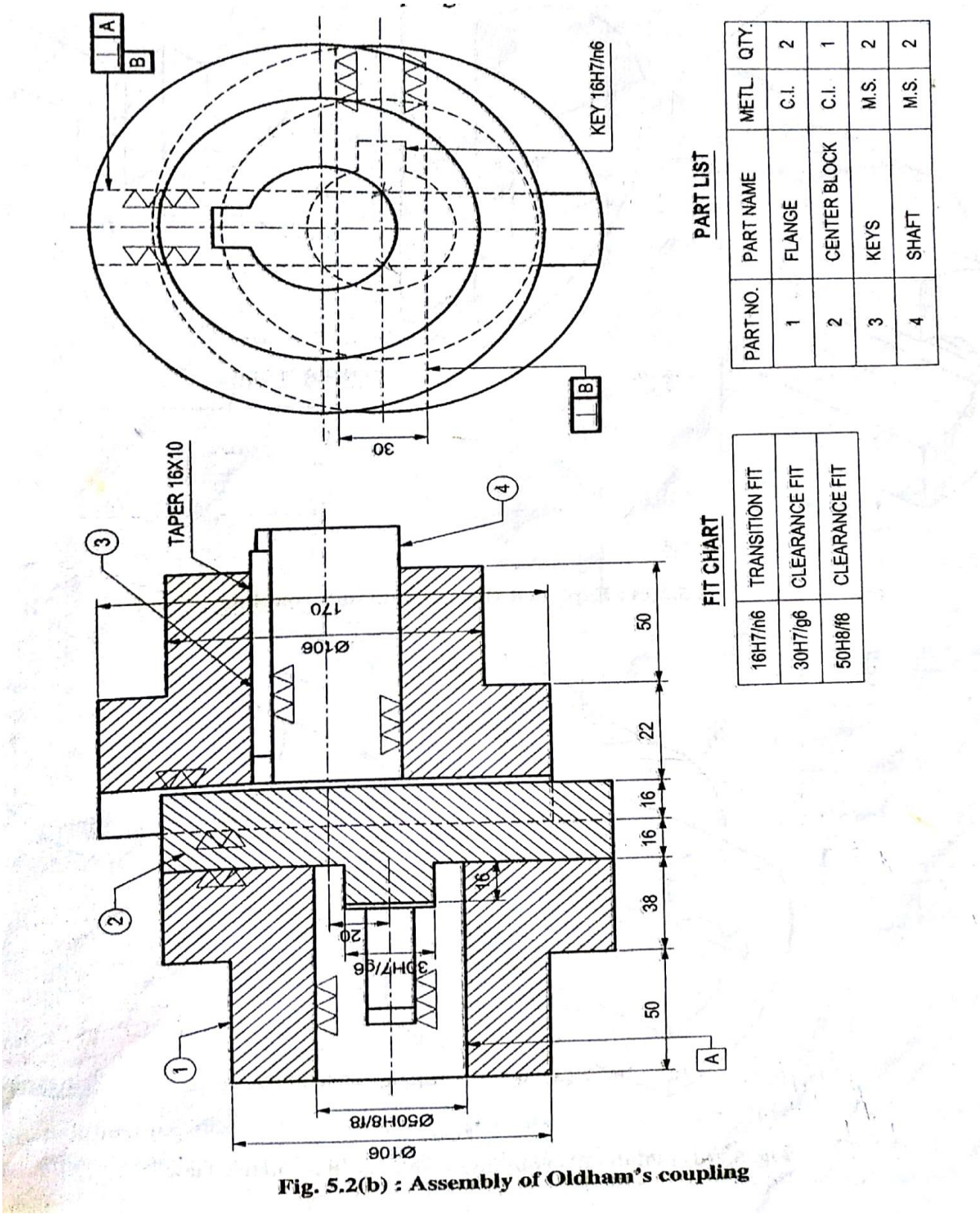


Fig. 5.2(a) : Oldham's coupling details



PART LIST

PART NO.	PART NAME	METL.	QTY.
1	FLANGE	C.I.	2
2	CENTER BLOCK	C.I.	1
3	KEYS	M.S.	2
4	SHAFT	M.S.	2

FIT CHART

16H7/n6	TRANSITION FIT
30H7/g6	CLEARANCE FIT
50H8/f8	CLEARANCE FIT

Fig. 5.2(b) : Assembly of Oldham's coupling

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	

EXPERIMENT NO. 10

TITLE : USE CAD SOFTWARE TO DRAW WORKING DRAWING FROM GIVEN ASSEMBLY DRAWING.

10.1. WORKING DRAWING

Production information is '...the information prepared by designers, which is passed to a construction team to enable a project to be constructed' (ref. CPIC The importance of production information). Production information is incorporated into tender documentation and then the contract documents for the construction works.

Production information may include:

- Drawings, such as working drawings.
- Specifications.
- Bills of quantities or schedules of work.

Working drawings provide dimensioned, graphical information that can be used; by a contractor to construct the works, or by suppliers to fabricate components of the works or to assemble or install components. They may include architectural drawings, structural drawings, civil drawings, mechanical drawings, electrical drawings, and so on.

Traditionally, working drawings consist of two-dimensional orthogonal projections of the building or component they are describing, such as plans, sections and elevations. These may be drawn to scale by hand, or prepared using Computer Aided Design (CAD) software.

However, increasingly, building information modelling (BIM) is being used to create three-dimensional representations of buildings and their components for construction. This may be described as a virtual construction model (VCM) and can comprise a number of different models prepared by different members of the project team.

Working drawings may include title blocks, dimensions, notation and symbols. It is important that these are consistent with industry standards so that their precise meaning is clear and can be understood. Specification information can be included on working drawings or in a separate specification, but information should not be duplicated as this can become contradictory and may cause confusion.

The scale at which drawings are prepared should reflect the level of detail of the information they are required to convey. Different line thicknesses can be used to provide greater clarity for certain elements.

It is important that the purpose of the drawings and the people that will use them are considered. Working drawings might be prepared for; statutory approvals, for contractors to plan the construction works, to provide instructions on site, for the procurement of components, for the preparation of shop drawings, for the appointment of subcontractors and so on.

Drawings must be structured carefully so that they convey necessary information to carry out particular parts of the works. To give greater clarity, they may be separated into packages, so that information is specifically tailored to separate parts of the works, specific components, or separate suppliers or trades.

It may be necessary to produce some packages earlier than others, for example, for items with long manufacturing times such as switchgear, chiller units, lifts, escalators or bespoke claddingsystems, or for front-end construction such as service diversions, demolition, setting outdetails, underground drainage, piling and groundworks.

The quality of production information is extremely important. Unless it is prepared and co-ordinated properly, there will be disputes and delays on site, and costs will be incurred. Common problems with working drawings include:

- Poor co-ordination of information.
- Errors and omissions.
- Information not getting to the right people.
- Poor presentation.

Responsibility for the preparation of production information will depend on the selected system of procurement and the chosen form of contract. On traditional contracts (and management contracts and construction management contracts), production information may be produced by a consultant team, working for the client.

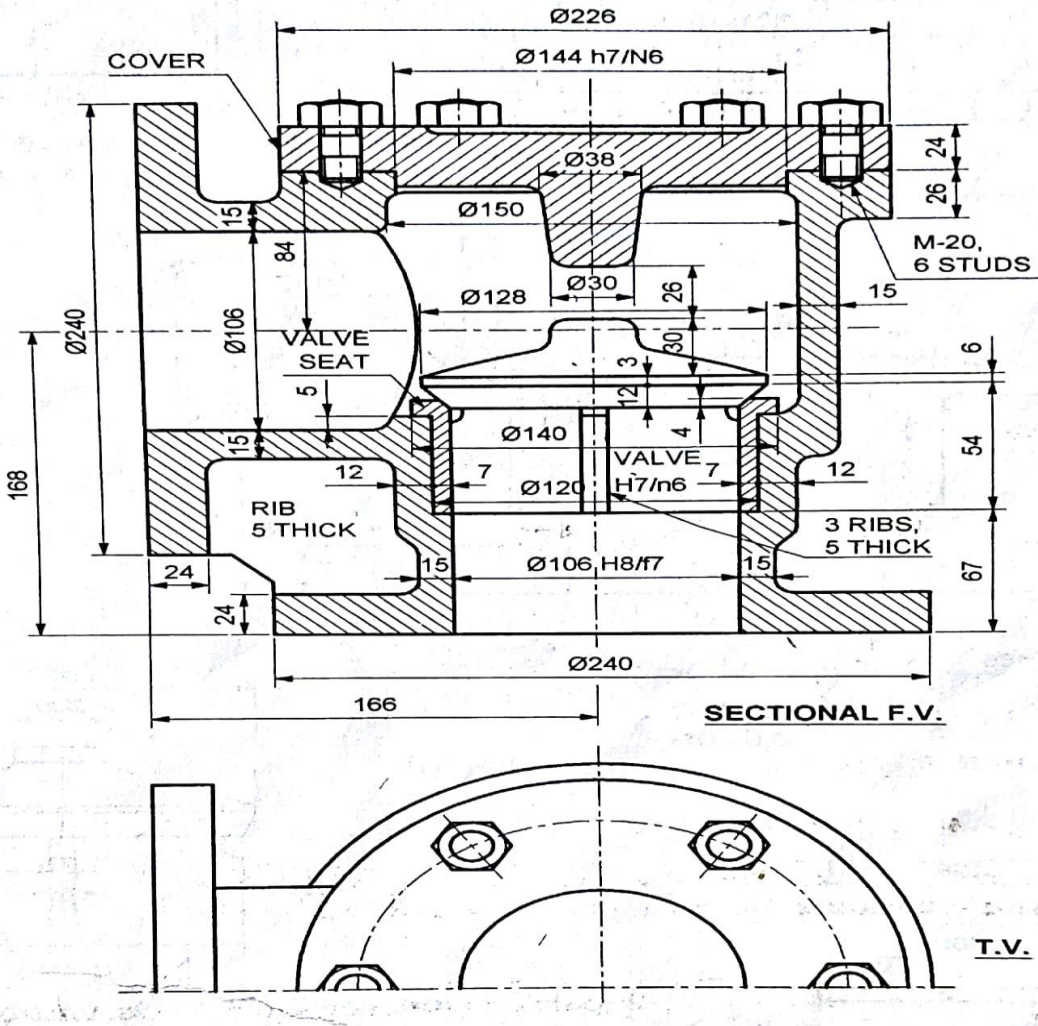
Some specialist elements of production information may be produced by specialist contractors, co-ordinated by the lead designer. On other forms of contract, such as design and build, responsibility for preparing and co-ordinating production information may lie with the main contractor.

Working drawings may be updated when the works are complete to show ‘as constructed’ information, reflecting changes to the works that may have occurred during the constructionprocess.

Carefully prepared working drawings can be very beautiful and the very best have been exhibited as works of art.

10.2. Questions:

Q.1



PART LIST

PART NO.	PART NAME	MATERIAL	QTY.
1	BODY	C.I.	1
2	VALVE SEAT	G.M.	1
3	VALVE	G.M.	1
4	COVER	C.I.	1
5	STUD WITH NUT	M.S.	6

Fig. 6.7(a) : Assembly of non-return valve

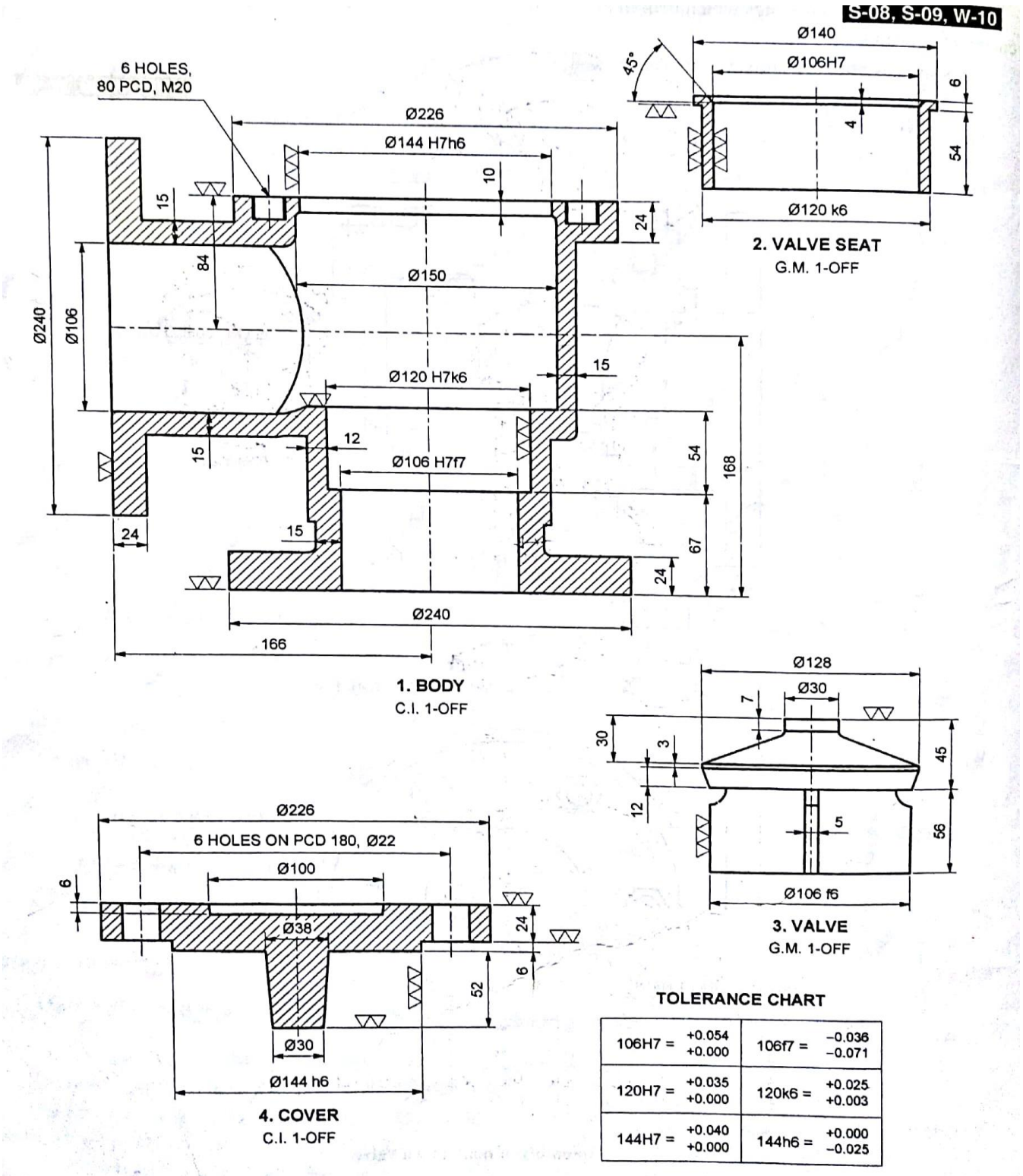


Fig. 6.7(b) : Details of non-return valve

Q.2

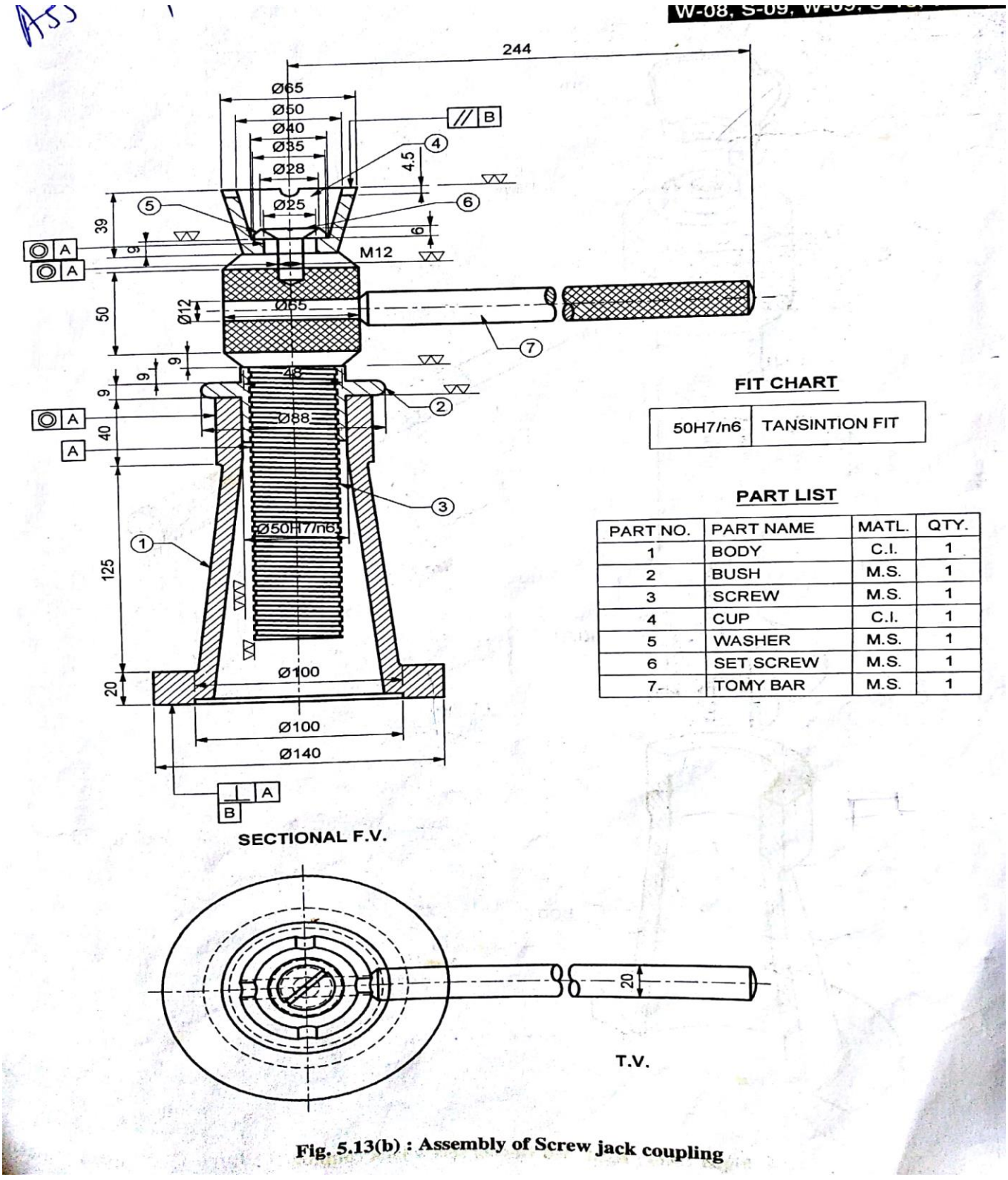


Fig. 5.13(b) : Assembly of Screw jack coupling

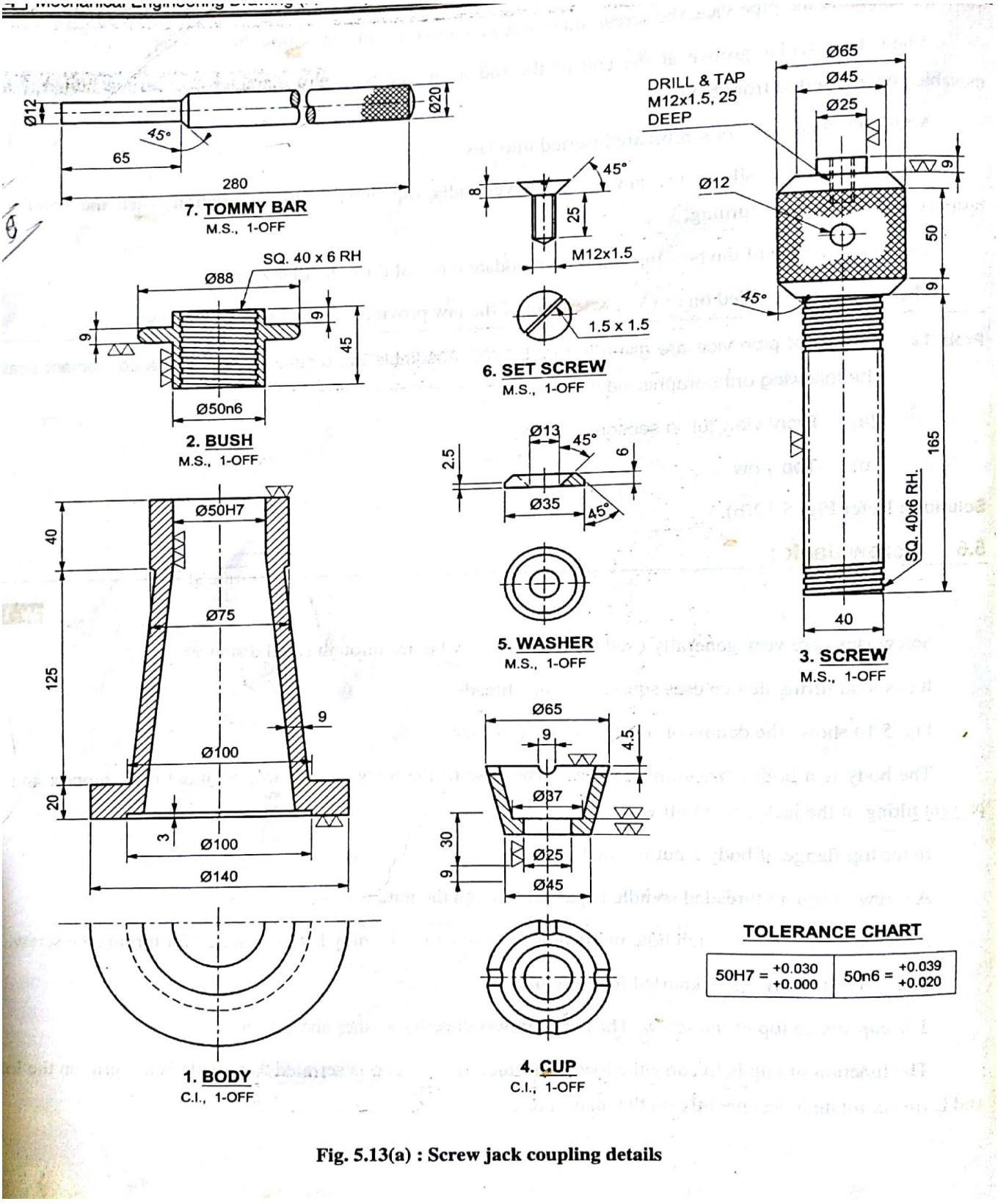


Fig. 5.13(a) : Screw jack coupling details

(Space for printouts.)

	Performance Indicators	**Weightage in %**
1	Developing/using institute template	20%
2	Selecting relevant set up parameters	05%
3	Creating given drawing using relevant commands.	40%
4	Dimensioning the given drawing and writing text using blocks and layers effectively.	15%
5	Answer to sample questions.	10%
6	Submission of digital drawing file/plot in time.	10%
	Total(25Marks)	**100%**

Marks obtained			Dated sign. Of Teacher
Process Related(10)	Product Related(15)	Total(25)	