INDUS UNIVERSITY

ENGINEERING GRAPHICS

MANUAL FOR TUTORIAL

MECHANICAL ENGINEERING DEPARTMENT
INDUS INSTITUTE OF TECHNOLOGY &
ENGINEERING AHMEDABAD

INDEX

SYLLABUS – ENGINEERING GRAPHICS

Teaching Scheme				Examination Evaluation Scheme				
Lecture	Tutorial	Practical	Credits	University – Theory Examination	University – Practical Examination	Continuous Internal Evaluation-Theory	Continuous Internal Evaluation-Practical	Total
01	**00**	**04**	**03**	**24/60**	**60**	**16/40**	**40**	**200**

Course Objectives:

- To know and understand the conventions and the methods of engineering drawing.
- To improve their technical communication skill in the form of communicative drawings.
- Interpret engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- To improve their visualization skills so that they can apply these skills in developing new products.
- Comprehend the theory of projection.
- To visualize different views of the object like front, top, side views from isometric drawing
- To construct an isometric view from given orthographic views
- To learn nature of working links in slider crank mechanism, four bar chain mechanism, combined mechanism etc.
- To provide an ability to understand work on different sheet metal job by using development of surfaces

CONTENTS

	UNIT – I	**Hrs.**
1	**Introduction to engineering graphics:** Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions- Dimensioning systems – polygons-types of lines	**2**
2	**Engineering curves:** Classification and application of Engineering Curves, Construction of different methods of Ellipse, parabola and Hyperbola, construction of Conics, Cycloid Curves – Cycloid, Hypocycloid, Epicycloids, Involutes and Spirals.	**6**
3	**PROJECTIONS OF POINTS AND LINES**: Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes.	**6**
	UNIT – II	
4	**PROJECTIONS OF PLANES**: Projections of planes (polygons, circle, and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane	**4**

	method for projections of the plane.	
5	**PROJECTIONS OF SOLIDS**: Classification of solids. Projections of solids (Cylinder, Cone, Pyramid, Prism) along with frustum of cone and pyramid with their inclinations to one reference plane and with two reference planes.	**6**
	UNIT – III	
6	**ORTHOGRAPHIC AND SECTIONAL ORTHOGRAPHIC PROJECTIONS**: Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, introduction of section of objects, full sectional view.	**10**
	UNIT – IV	
7	**ISOMETRIC PROJECTIONS**: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing.	**8**

Text book:

1. P.J. Shah , " A Text Book of Engineering Graphics" Publication: S.Chand

Reference Books:

2. P.J. Shah , " A Text Book of Engineering Graphics" Publication: S.Chand
3. N.D.Bhatt , "Elementary Engineering Drawing", Charotar Publishing House, Anand
4. P.D.Patel, " Engineering Graphics" Publication: Mahajan
5. A text book of Engineering Drawing by R.K.Dhawan, S.Chand & Company Ltd., New Delhi
6. A text book of Engineering Drawing by P.S.Gill, S.K.Kataria & sons, Delhi

SHEET – 1

INTRODUCTION

SHEET'S PROBLEMS

Practice sheet (which includes dimensioning methods, different types of line, preparation of title block, Polygon)

1. Title block
2. Draw polygon of 50 mm sides (Pentagon, Hexagon, Heptagon, and Octagon).
3. Types of Lines
4. Types of dimensioning

ASSIGNMENT-1

1. Title block
2. Draw polygon of 50 mm sides (Pentagon, Hexagon, Heptagon, and Octagon).
3. Types of Lines
4. Types of dimensioning

SHEET – 2

ENGINEERING CURVES-I
(Ellipse, Parabola and Hyperbola)

SHEET'S PROBLEMS (1 to 4)

(1) Draw an Ellipse having major axis 120 mm and minor axis 80 mm. Use Concentric Circle method.

(2) Draw an Ellipse having major axis 100 mm and minor axis 70 mm. Use Arc of Circle method.

(3) Draw parabola with base 100 mm and axis 50 mm, 70^{o} inclined from base by using parallelogram method.

(4) Draw a curve having eccentricity 3:2, the focus F of which is at a distance of 50mm from the directrix. Draw the curve and Name the curve.

ASSIGNMENT-2

(1) Define: (i) Ellipse (ii) parabola (iii) Hyperbola

(2) Construct Ellipse to be inscribed in a parallelogram of dimension 100 mm and 50 mm.

(3) Draw a parabola by Rectangle method with base 100 mm and height 60 mm.

(4) Draw an Ellipse having major axis 120 mm and minor axis 80 mm. Use Oblong method.

(5) If Base is 130 mm and axis length 85 mm, draw parabola by rectangle method.

(6) Draw the parabola by Tangent method with base = 120 mm and Axis length =85 mm.

(7) Motor car head lamp parabolic reflector is having an aperture (opening) of 175 mm and a depth of 135 mm. Draw the shape of the reflector.

SHEET – 3

ENGINEERING CURVES-II
(Cycloid, Hypocycloid, Epicycloids, Involutes, Spirals)

SHEET'S PROBLEMS (1 to 4)

(1) Construct the involute of a hexagon having sides 20 mm.

(2) A rolling circle of r = 27 mm radius is rolling outside a directing circle of R = 81 mm radius without slip, point P is at the contact point of two circles. Draw the locus of point P for one revolution of the rolling circle.

(3) Draw an Archimedean spiral of 1.5 convolutions, the greatest and least radius being 60 mm and 20 mm respectively.

(4) A circle of 25 mm radius is rolling on a straight line without slip. Point P is at the point of contact between generating circle and directing line. Draw the locus of point P and name the curve.

(5) A stick, of length equal to the circumference of a semicircle, is initially tangent to the semicircle of the right side of it. This stick now rolls over the circumference of a semicircle without sliding till it becomes tangent on the left side of the semicircle. Draw the loci of two points of this stick. Name the curve. Take R = 42 mm.

(6) Construct the Archemedian Spiral of two convolutions. The largest radius is 100 mm and the smallest radius is 20 mm.

(7) A point O moves towards another point O, 75 mm from it, and reaches it during 1 1⁄4 revolution around it in clockwise direction. Its movement towards O is uniform with its movement around it. Draw the curve traced out by the point P and name it.

ASSIGNMENT-3

(1) Define: (i) cycloid (ii) Hypocycloid (iii) Epicycloid (iv) involute.

(2) A circle of 30 mm radius is rolling on a straight line without slip. Point P is at the point of contact between generating circle and directing line. Draw the locus of point P and name the curve.

(3) Construct 3 convolution of the involute of 10 mm long line.

(4) A circle of 30 mm dia. Rolls on a vertical line for a half revolution and then on a horizontal line for another half revolution. Draw the curve traced out by a point P on the circumference of the circle.

(5) Show graphically that the hypocycloid is a straight line. When diameter of rolling circle is half of the directing circle.

(6) Draw an Involute for a semi-circle of radius 25 mm.

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SHEET – 4 & 5

PROJECTIONS OF POINTS & LINES

SHEET'S PROBLEMS (1 to 8)

1) Draw the projection of given points on a common reference line.

   i. A, 25 mm above H.P. and 35 mm in front of V.P.
   ii. B, 30 mm above H.P. and 40 mm behind V.P.
   iii. C, 20 mm below H.P. and 45 mm behind V.P.
   iv. D, 35 mm below H.P. and 25 mm in front of V.P.
   v. E, 45 mm above H.P. and in V.P.
   vi. F, 30 mm below H.P. and in V.P.
   vii. G, on H.P. and 35 mm in front of V.P.
   viii. H, on H.P. and 25 mm behind of V.P.

2) Draw the projections of the following points on the same X-Y line
   (i) Point A in V.P. , 30 mm below HP
   (ii) Point B in HP, 20 mm in front of VP
   (iii) Point C 38 mm above HP and 38 mm behind VP.
   (iv) Point D 25 mm below HP and 45 mm behind VP.
   (v) Point E on HP and on VP
   (vi) Point F 35 mm above HP and 15 mm in front of VP.
   (vii) Point G on VP , 35 mm above HP.

3) A line AB, 75 mm long, has its end A 20 mm below H.P. and 25 mm behind V.P. The end B is 50 mm below H.P. and 65 mm behind V.P. Draw the projections of line AB and find its inclinations with H.P. and V.P. find apparent inclinations with H.P. and V.P. Also find PL and EL of line AB.

4) A line PQ 70 mm long has its end P in VP and Q in HP. Line is inclined to HP by 60° and VP by 30°. Draw the projections.

5) A line PQ has its end P, 15 mm above H.P. and 10 mm in front of V.P. The end Q is 60 mm above H.P. The distance between the end projectors is 55 mm. The line is inclined to H.P. by 25°. Draw the projections and find its inclination with V.P. and true length of line PQ. Also find EL, PL and apparent angles with H.P. and V.P.

6) A line CD has its end C is 15 mm above H.P. and 10 mm in front of V.P. The end D is 60 mm above H.P. The distance between the end projectors is 50 mm. The line is inclined to H.P. by 25°. Draw the projections and find its inclination with V.P. and true length of line CD. Find EL, PL and apparent inclinations with H.P. and V.P.

7) A straight line AB has its end A 10 mm above HP and 15 mm infront of V.P. End B 50 mm in front of the V.P. Draw the projections of line AB, if it is inclined to H.P. by 30° and V.P. by 45° and it is 50 mm long.

8) A line AB is 80 mm long. It is inclined at an angle of 45° to the HP and 30° to the VP. The end A is 20 mm above HP and 30 mm in front of VP. Draw the projections of the line AB. Find the elevation length and the plan length of the line. Determine the apparent inclinations of the line AB with HP and VP.

ASSIGNMENT-4 & 5

(1) A line AB, 65 mm long, has its end A 20 mm above HP and 25 mm in front of VP. The end B is 40 mm above HP and 65 mm in front of VP. Draw the projections of AB and show its inclination with HP and VP, also find apparent inclination with HP and VP and find Elevation length and Plan length of line AB.

(2) A line PQ 60 mm long has its end P on V.P. and end Q on H.P. Line is inclined to H.P. by 60° and V.P. by 30° and it is 20 mm away from the profile plane. Draw projections of the Line.

(3) A line PQ 70 mm long has its end P in VP and Q in HP. Line is inclined to HP by 60° and VP by 30°. Draw the projections

(4) A straight line AB has its end A 10 mm above HP and end B 50 mm in front of the V.P. Draw the projections of line AB, if it is inclined to H.P. by 30° and V.P. by 45° and it is 50 mm long.

(5) The top view of 75 mm long line AB measures 65 mm, while the length of its front view is 50 mm. Its one end A is in the H.P. and 12 mm in front of the V.P. Draw the projection of line AB and its inclination with H.P. and the V.P.

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SHEET – 6

PROJECTIONS OF PLANES

SHEET'S PROBLEMS (1 to 3)

(1) Draw the projection of a circle of 70 mm diameter resting on H.P. on a point A of the circumference. Plane is inclined to H.P. such that the plan of it is an ellipse of minor axis 40 mm. The plan of the diameter, through the point A, is making an angle of 45° with the V.P. measure the angle of the plane with the H.P.

(2) A regular hexagonal plate 30 mm side is resting on one of its corners in H.P. The diagonal through that corner is inclined at 40˚ to H.P. and diagonal is inclined at 30˚ to V.P. Draw the projection of Hexagonal plate.

(3) A regular pentagonal plate, of 35 mm sides, has one of its corners in H.P. The plane of the pentagon is inclined at 30° to the H.P. The side of the pentagon which is opposite to the corner, which is on H.P. is inclined at 45° to V.P. Draw the projections of the plate.

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(4) A square plate having size 40 mm, is resting on V.P. with one of its corner . The plane is inclined to V.P. by 40°. The diagonal passing through the point which is on V.P. ,is inclined at 30° to the H.P. Draw its projection.

(5) A semicircular plate of 80mm diameter has its straight edge in the VP and inclined at 45 to HP. The surface of the plate makes an angle of 30 with the VP. Draw its projections.

(6) A pentagon of 40 mm side is resting on one of its corners on the V.P. The edge opposite to that corner makes an angle an angle of 30° to the H.P. The surface of the pentagon is inclined at 45° to the V.P. Draw its projections.

(7) A thin rectangular plate of 60 × 30 mm has its shorter side in the VP and inclined at 30° to the HP. Project top view, if its front view is a square of 30 mm long side.

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ASSIGNMENT-6

(1) A thin hexagonal lamina of 30 mm side with a central hole of 30 mm diameter is resting on H.P. on one of its corner. Draw the projections of lamina when diagonal through resting corner is 30° to both H.P. and V.P.

(2) A circular lamina of 60 mm diameter is resting on H.P. on a point A of the circumference, with its plane inclined at 45° to H.P. and the diameter through point A makes 30° with V.P. Draw projections of the lamina.

(3) A regular hexagonal plane with side 40 mm is resting on one of its sides. Draw the projections of the plane when it is inclined at 30° to H.P. and the side on which it rests on H.P. makes 45° with V.P.

(4) An elliptical plane with major axis 70 mm and minor axis 50 mm is inclined to H.P. such that the top view of the plane is circle. Draw the projections of the plane when the major axis is inclined at 30° to the V.P. Find the inclination of the plane with H.P. Use concentric circle method to draw the top view of the plane in the initial stage.

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SHEET – 7

PROJECTIONS OF SOLIDS

SHEET'S PROBLEMS (1 to 3)

(1) A cone, diameter of base 50 mm and height 60 mm, is resting on H.P. on a point of its periphery of base with the axis making angle of 30° with the H.P. and 45° with V.P. Draw the projection of the cone when apex is away from observer.

(2) A pentagonal prism is resting on one of the corner of its base on HP. The longer edge containing that corner is inclined at 45° to the HP. The plan of prism axis makes an angle of 30° to the VP. Draw the projections of solid. Height of prism is 60 mm and side 30 mm.

(3) A hexagonal pyramid is resting on one of the corner of its base on HP. The corner edge containing that corner is inclined at 45º to the HP. The plan of pyramid axis makes an angle of 30º to the VP. Draw the projections of solid. Height of pyramid is 60 mm and side 30 mm.

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(4) A square prism side of base 30 mm and height 45 mm, is resting on H.P. on one of the edges of the base. The edge on which it rests on H.P. makes 45° with V.P. The axis of the prism makes 60° with H.P. Draw projections of the prism when base is away from the observer.

(5) Pentagonal pyramid is having axis length 80 mm and edge of base 30. The pyramid is resting on one of its base edges on HP. Draw the projections when the axis of the pyramid is inclined at 30° to the H.P. and plan of axis of the pyramid makes 45° with the V.P.

(6) A cylinder, diameter of base 60 mm and height 90 mm, is resting on H.P. on the point of its periphery of the base. The axis of is inclined to H.P. by 30° and top view of the axis inclined at 45° to the V.P. Draw projections of the cylinder.

ASSIGNMENT-7

(1) A cone diameter of base 60 mm and height 90 mm is resting on H.P. on the point of periphery of the base. Axis of the cone makes 60° with the H.P. and 30° with the V.P. Draw the projections of the cone, when the apex is nearer to V.P.

(2) A hexagonal prism is resting on one of its side of base (30 mm), such that axis (60 mm) is inclined at 45° to H.P. and the side on which it is resting is inclined at 30° to V.P. Draw the projections of Hexagonal prism.

(3) A square pyramid, side of base 50 mm and height 64 mm, is freely suspended from one of the corners of the base. Draw its projections when vertical plane containing axis makes an angle of 45° with the V.P.

(4) A cone, 60 mm base diameter and 80 mm long generator is resting on H.P. with one of the points of its base. Draw projections of cone when apex is 55 mm above from the H.P. and plan of the axis inclined at 45° to the V.P.

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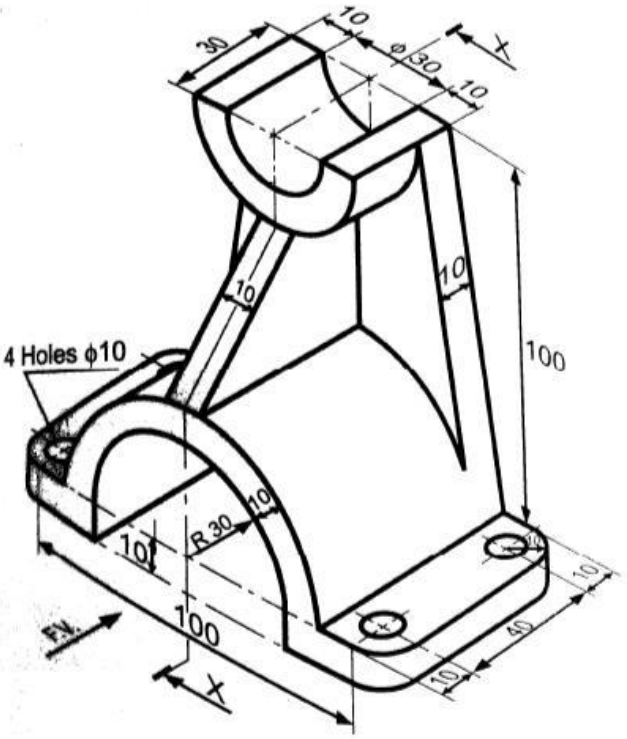
SHEET –8

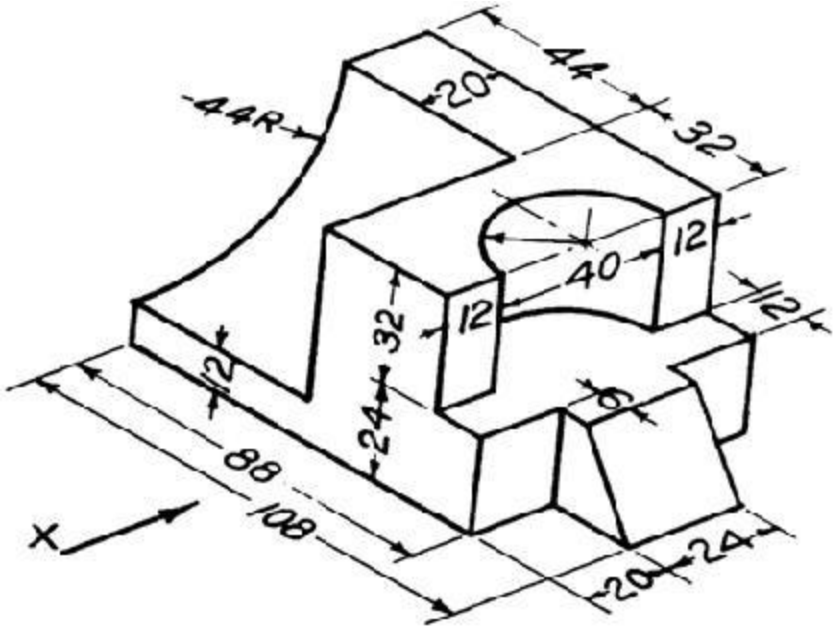
ORTHOGRAPHIC PROJECTIONS

SHEET'S PROBLEMS (1 to 3)

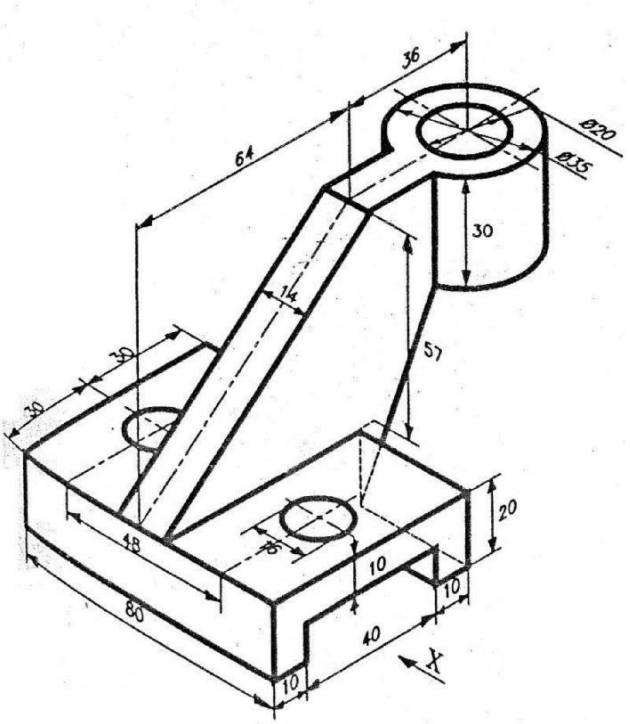
(1) By First angle method, Draw (i) Front view (ii) Top View (iii) RHSV



(2) Draw (i) Front View (ii) Right hand side view (iii) Top View. Use first angle method



(3) Draw (i) Elevation (ii) Plan (iii) LHSV. Use third Angle Method.



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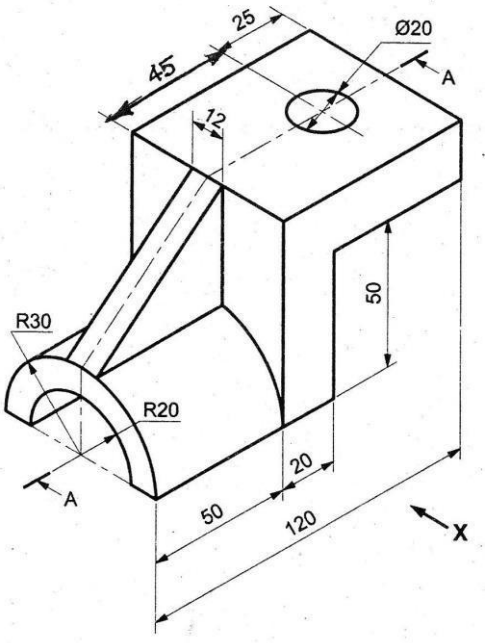
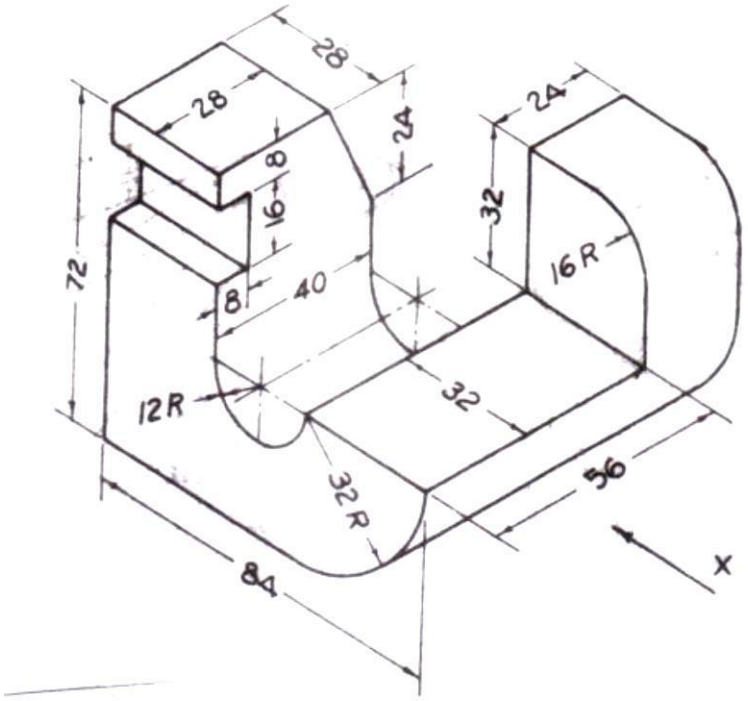
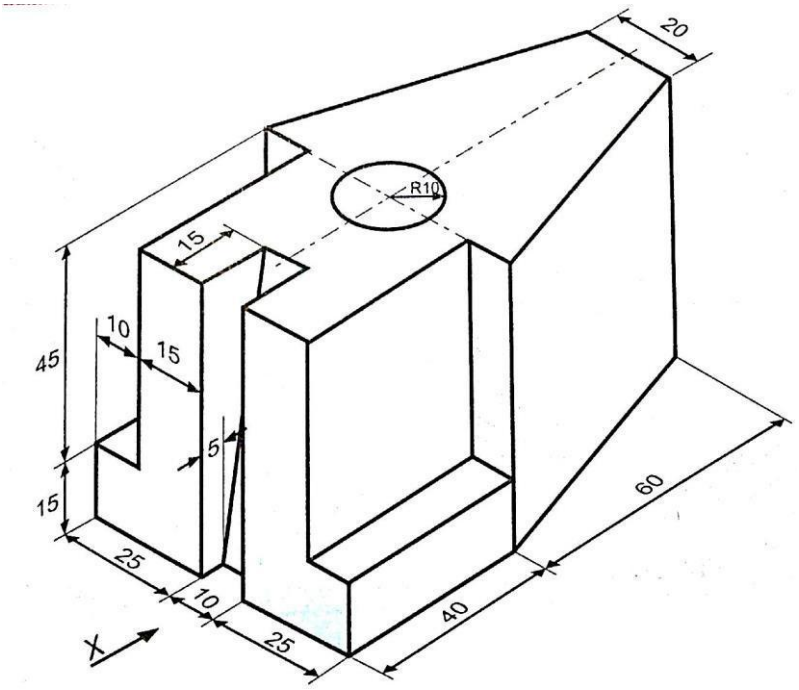
(4) Draw (i) Front view (ii) Top View (iii) LHSV. Use 1st Angle Method.



(5) Draw (i) Front view (ii) Top View (iii) LHSV. Use 1st Angle Method.

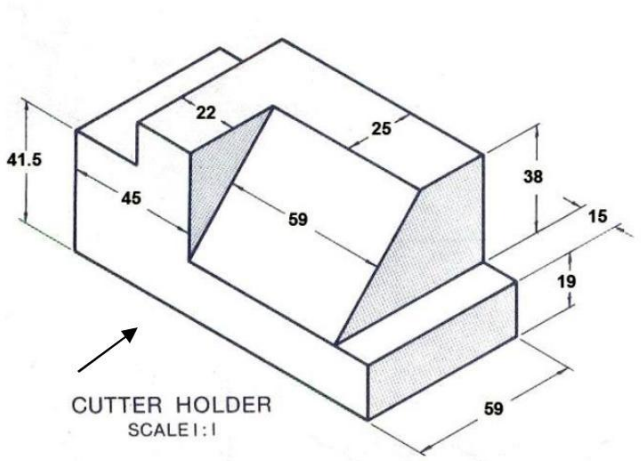


(6) Draw (i) Front view (ii) Top View (iii) RHSV. Use 3rd Angle Method.

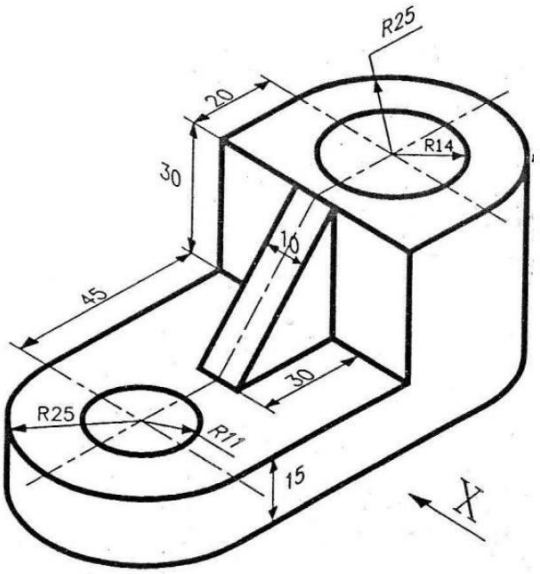


ASSIGNMENT-8

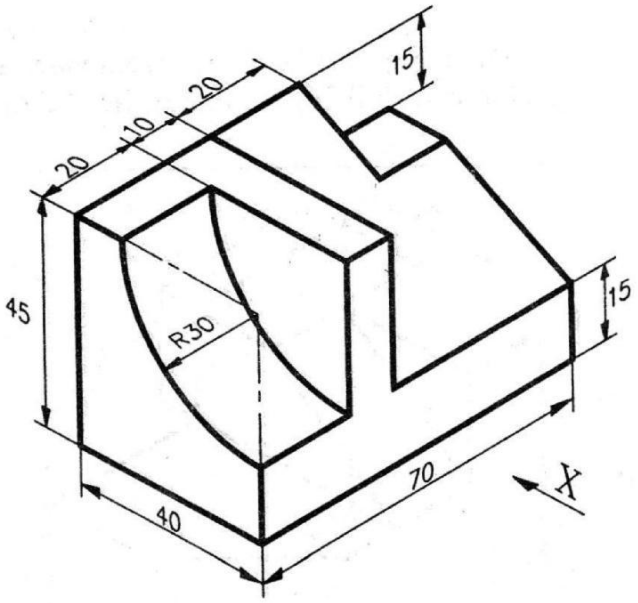
(1) Draw (i) Elevation (ii) Plan (iii) RHSV by First angle method



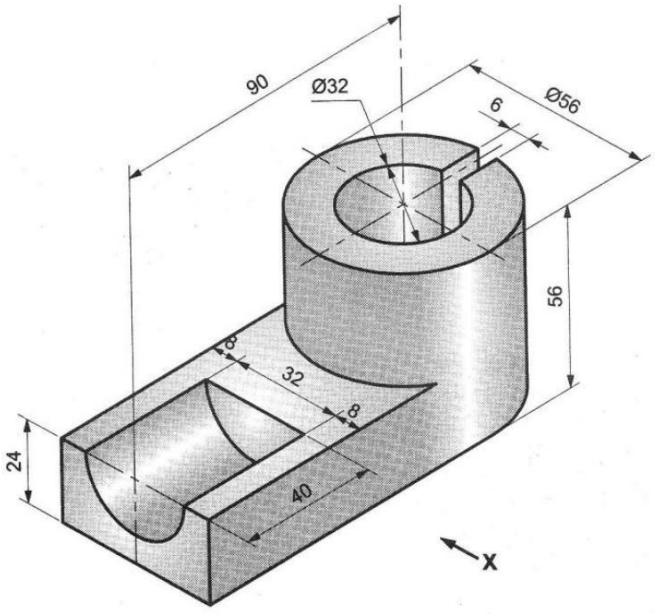
(2) Draw (i) Front View (ii) Top view
(iii) LHSV by 3rd angle method



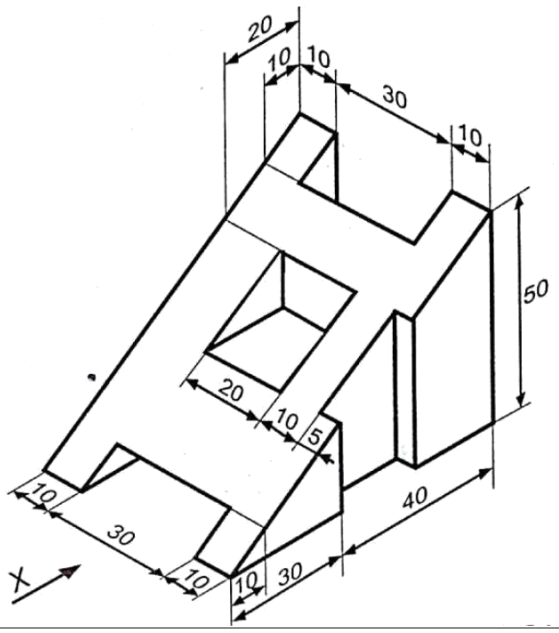
(3) Draw (i) Front view (ii)TV (iii) LHSV by first angle method



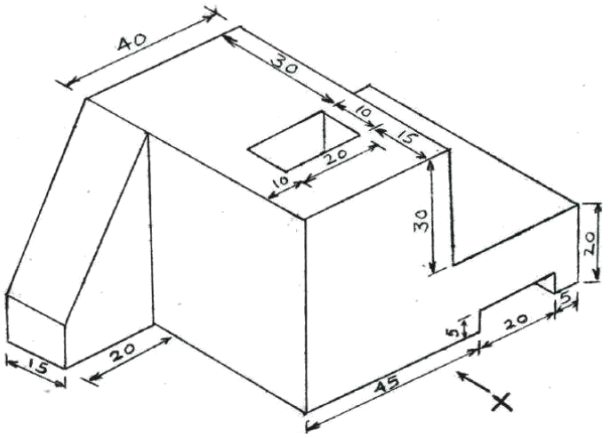
(4) Draw (i) Full sectional Elevation (ii) Plan (iii) LHSV by Third angle method.



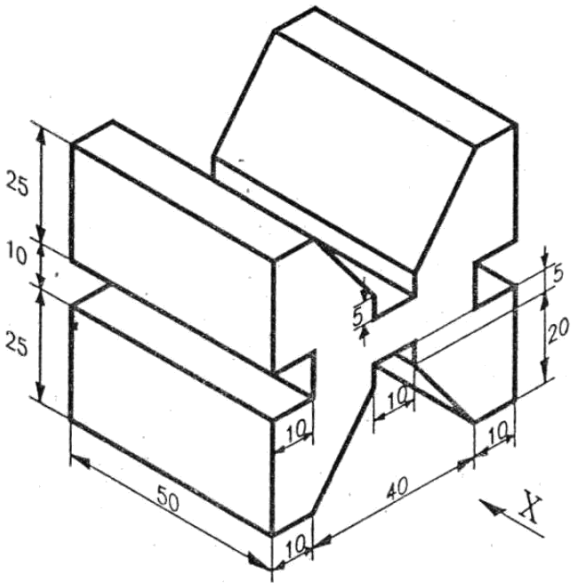
(5) Draw (i) Elevation (ii) Plan (iii) RHSV by First angle method



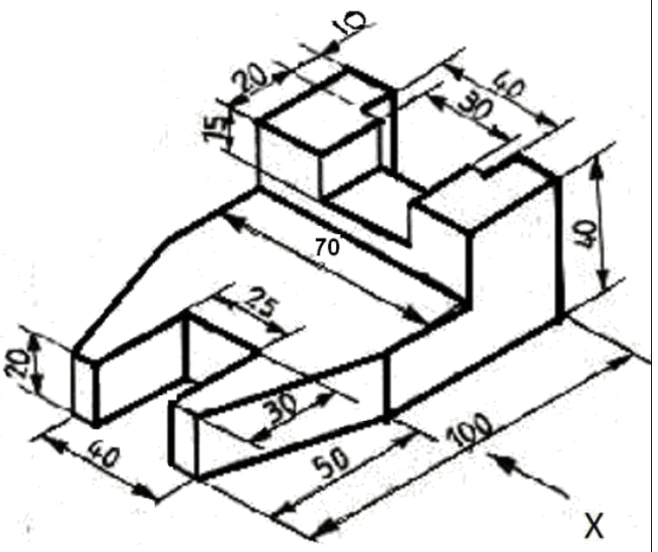
(6) Draw (i) Front View (ii) Top view (iii) LHSV by first angle method



(7) Draw (i) Elevation (ii) Plan (iii) RHSV by First angle method



(8) Draw (i) Front view (ii) Top view (iii) LHSV, by first angle method

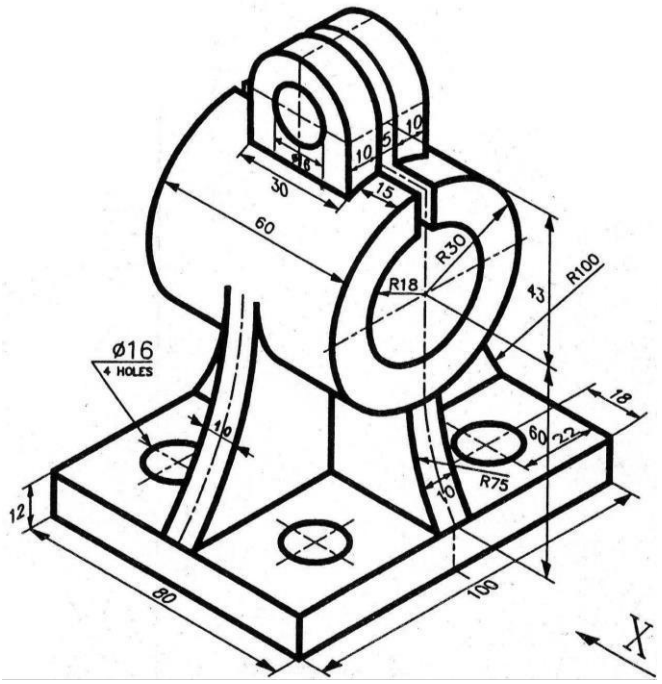


SHEET –9

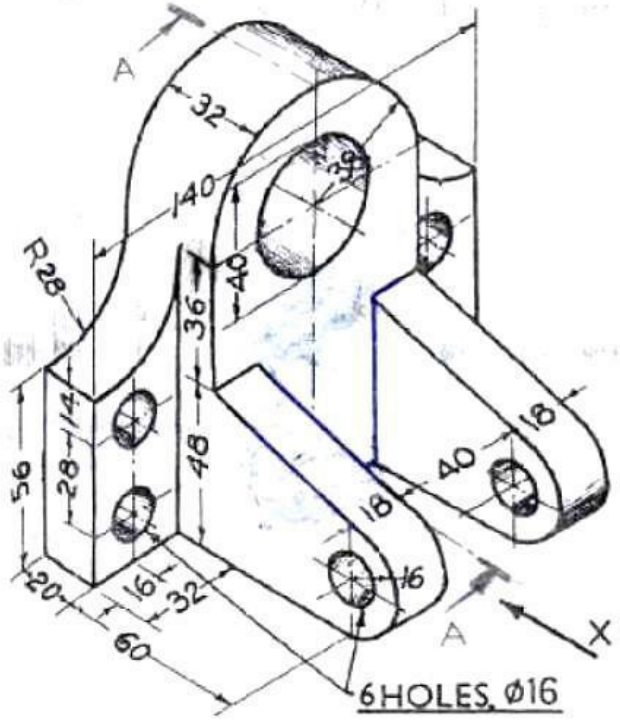
SECTIONAL ORTHOGRAPHIC PROJECTIONS

SHEET'S PROBLEMS (1 to 3)

(1) By third angle method, draw (i) Elevation (ii) Full sectional LHSV



(2) Draw (i) Front view (ii) Top view (iii) Full sectional LHSV. Use 1st angle method



(3) Draw (i) Full Sectional Front view (ii) Top view (iii) LHSV. Use 1st angle method

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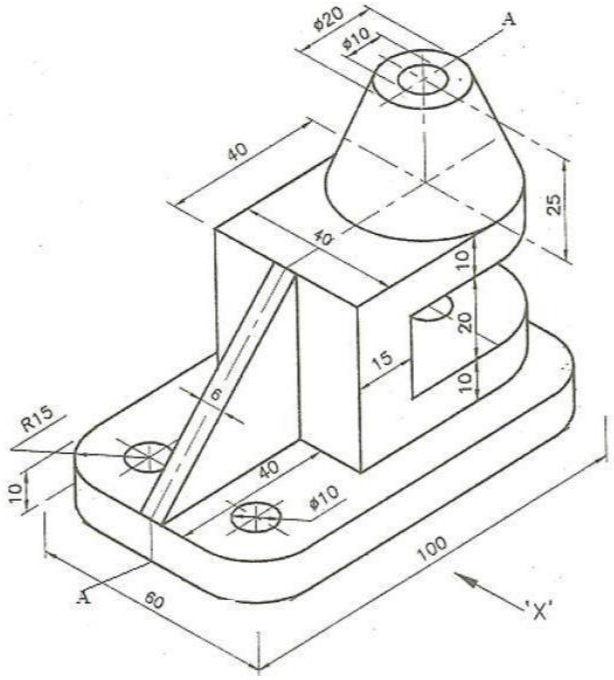

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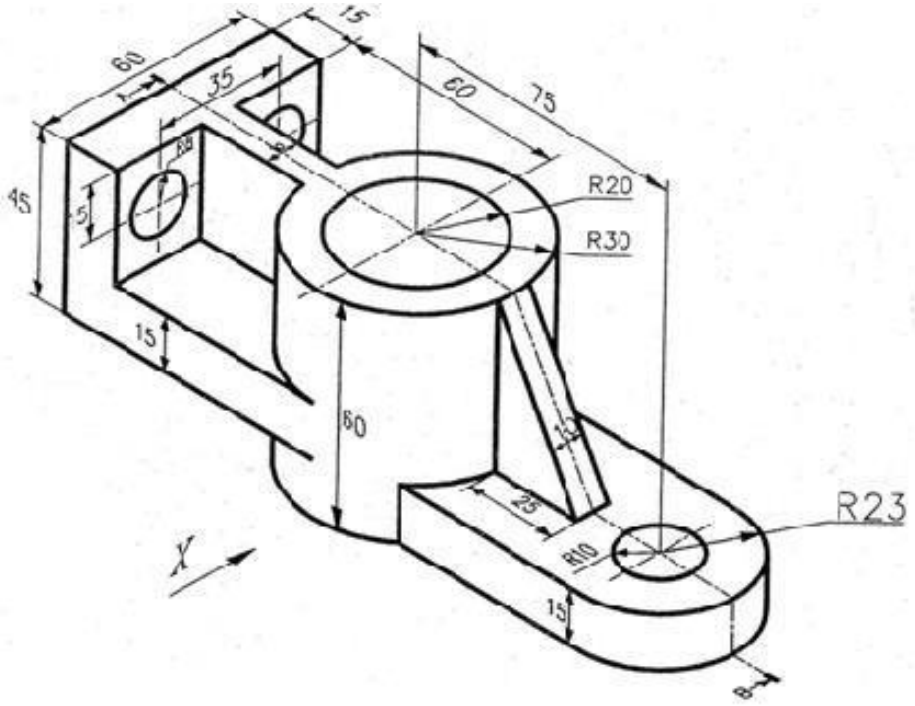
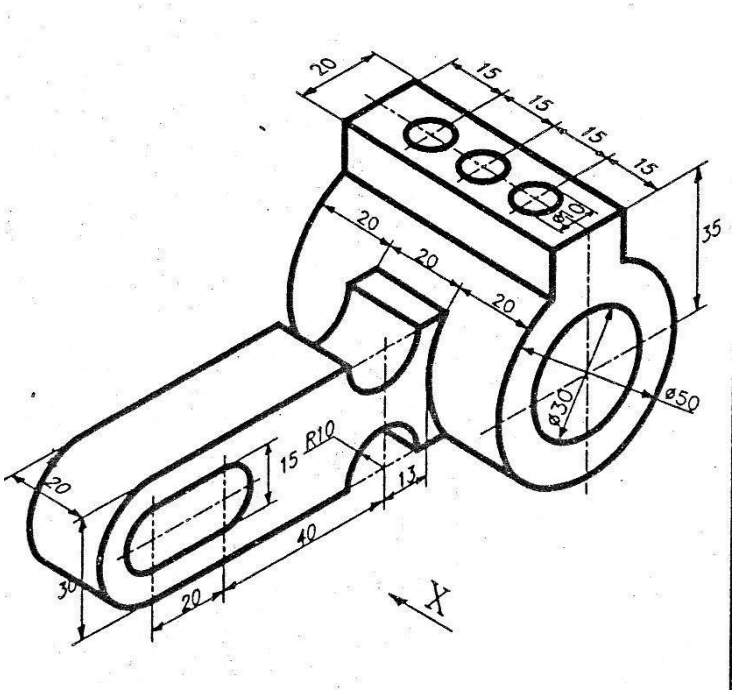
(4) Draw (i) Full sectional Elevation (ii) Plan (iii) RHSV , by third angle method.

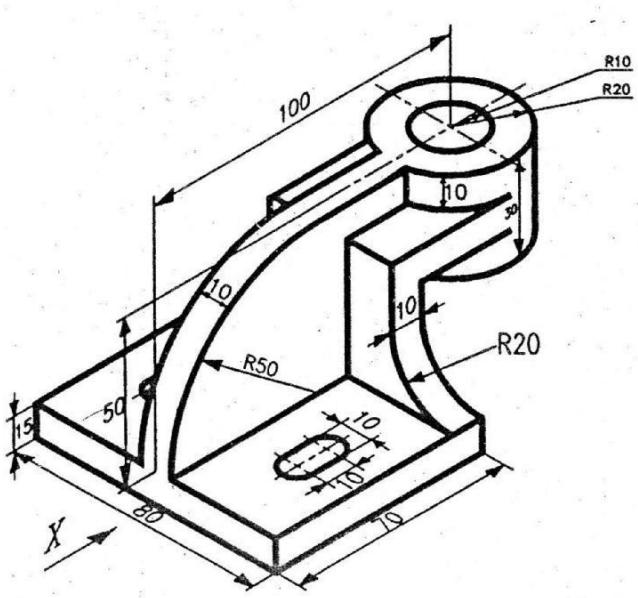


(5) Draw (i) Full sectional Elevation (ii) Plan (iii) LHSV, by first angle method.

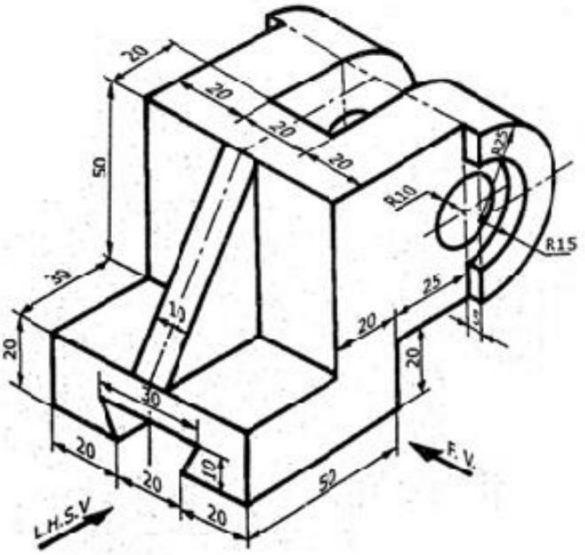


ASSIGNMENT-9

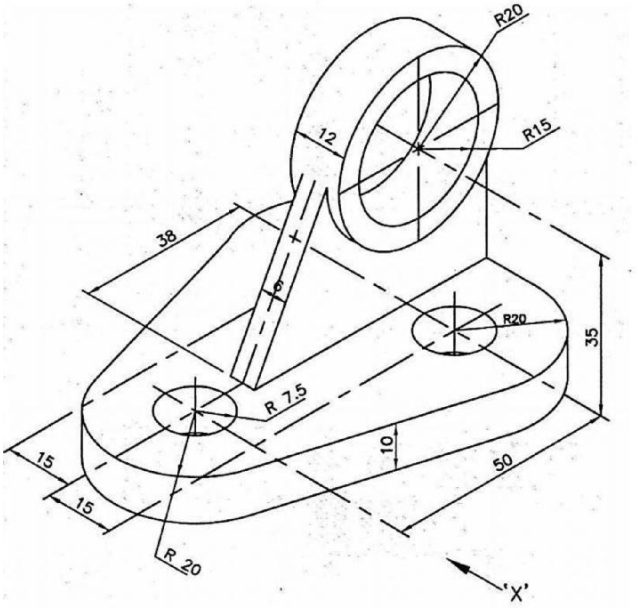
(1) By first angle method, draw (i) front view (ii) top view (iii) full sectional RHSV



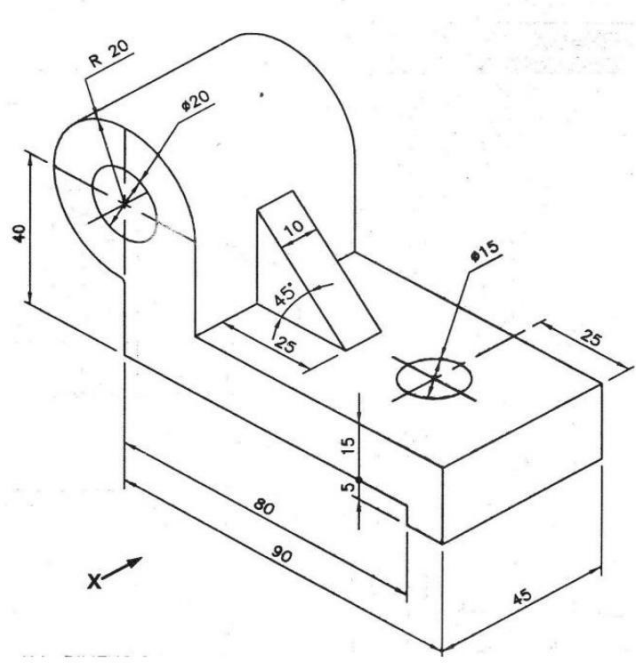
(2) Draw (i) Full sectional FV (ii)TV (iii) LHSV, by first angle method



(3) By third angle method, draw (i) full sectional front view (ii) top view (iii) LHSV



(4) By third angle method, draw (i) full sectional front view (ii) top view (iii) RHSV

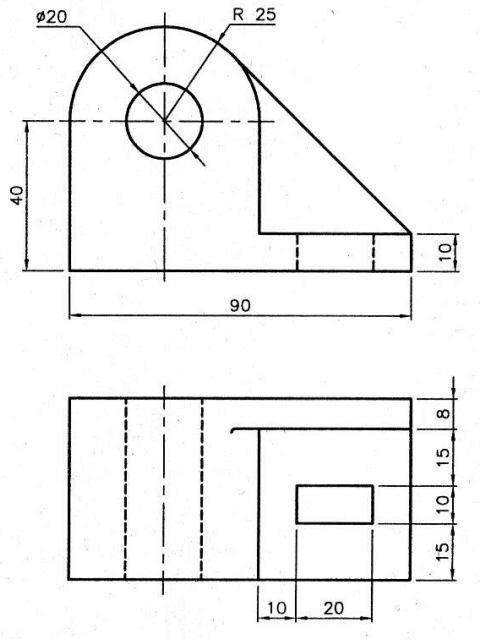


SHEET –10

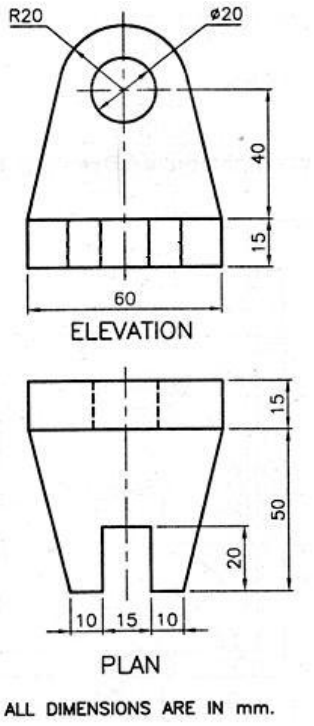
ISOMETRIC VIEW OR PROJECTIONS

SHEET'S PROBLEMS (1 to 3)

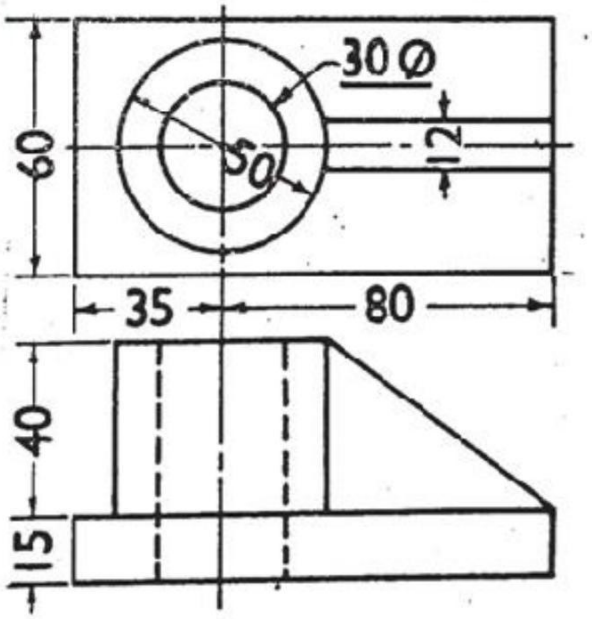
1) Figure shows Elevation and Plan of an object, Draw isometric view



2) Figure shows Elevation and Plan of an object, Draw isometric view



3) Figure shows Elevation and Plan of an object, Draw isometric projection.



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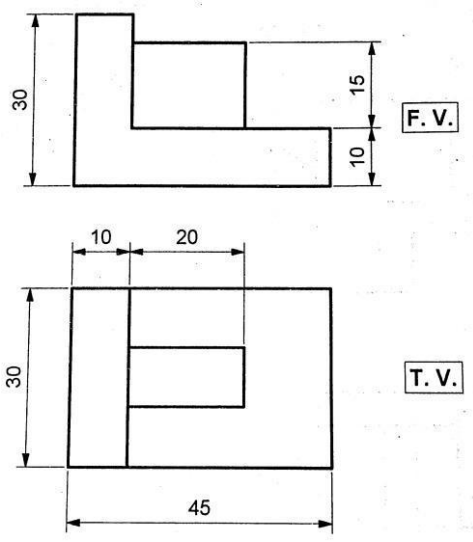
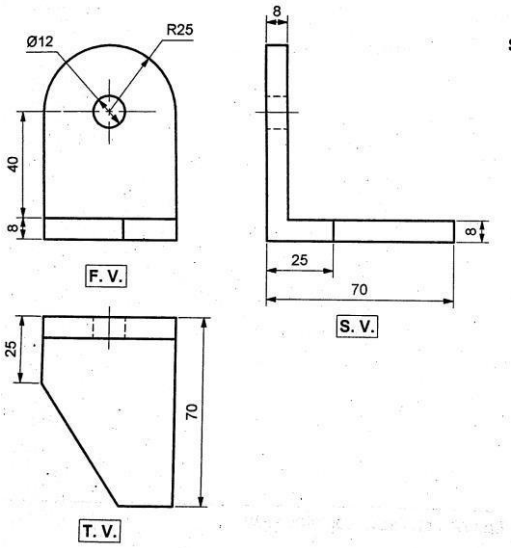
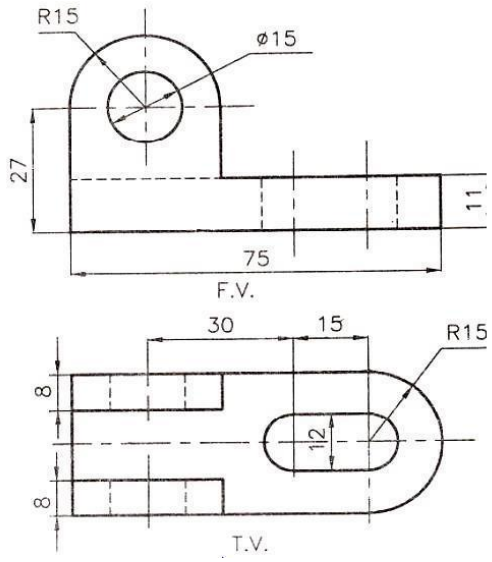
4) Figure shows Elevation and Plan of an object, Draw isometric view



5) Figure shows Elevation, Plan and side view of an object, Draw isometric view

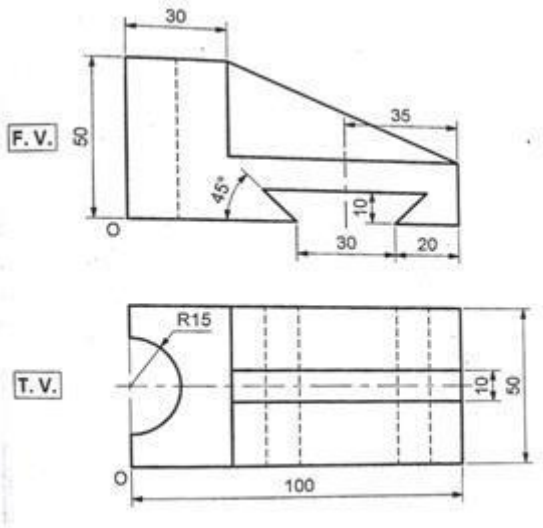


6) Figure shows Elevation and Plan, Draw isometric view.

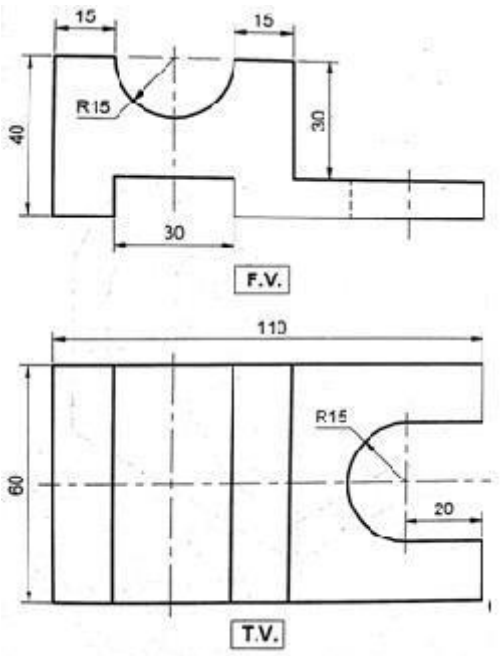


ASSIGNMENT-10

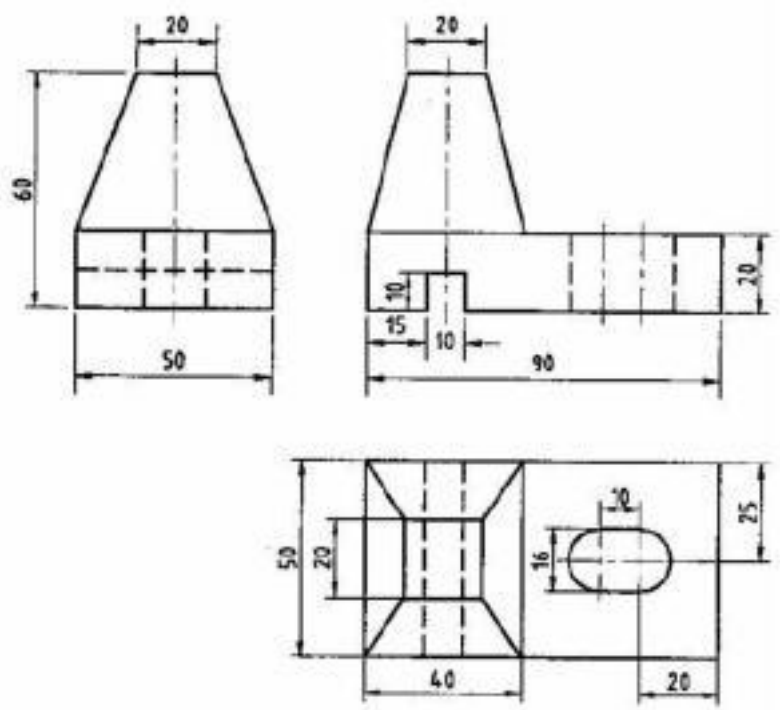
(1) Figure shows Elevation and Plan of an object, Draw isometric view



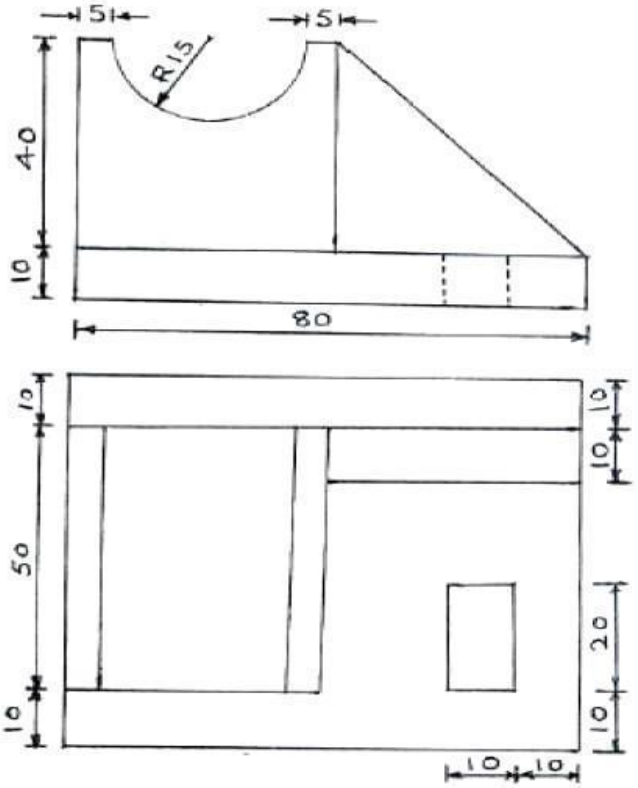
(2) Figure shows Front view and Top view of an object, Draw isometric projection.



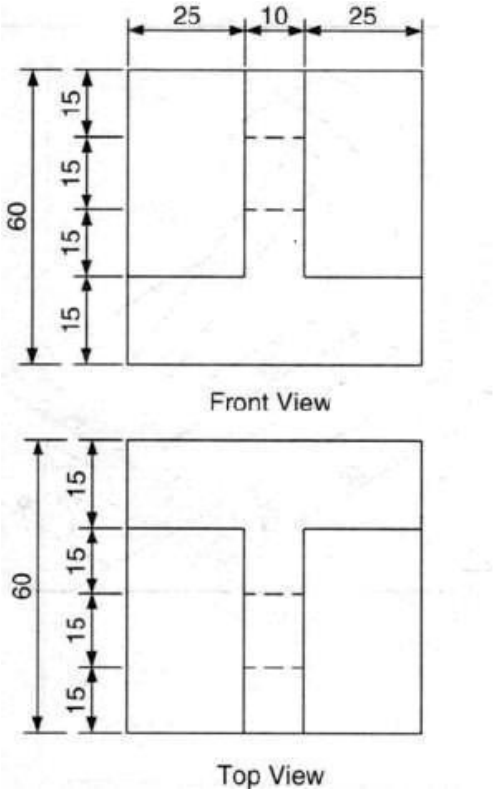
(3) Draw isometric view



(4) Draw isometric view for given Elevation and Plan



(5) Draw isometric view



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