KG REDDY
College of Engineering
& Technology

Course File

On

ENGINEERING GRAPHICS

By

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Assistant Professor

Department of Mechanical Engineering

(2019-20)

HOD

Mechanical Engineering

Principal

KGRCET

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COURSE FILE

Subject Name	: ENGINEERING GRAPHICS
Faculty Name	: Mrs. K Kalpana
Designation	: Assistant Professor
Regulation /Course Code	: R18 / ME104ES
Year / Semester	: I/I
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1. VISION, MISSION, PEO's, PO's & PSOs

Vision:

To establish a strong foundation in basic sciences such as Mathematics, Physics. Chemistry, which in turn help the students to excel in their core engineering discipline and also train to acquire proficiency in English language communication.

Mission

- To provide academic excellence in basic sciences in the perspective of engineering.
- Students and faculty are provided learning environment where they can master in engineering discipline by applying knowledge from basic sciences.
- Inculcate research culture through project based assignments

Program Educational Objectives (PEO's)

PEOs	Description
PEO1	To apply deep working knowledge of technical fundamentals in areas related to thermal, production, design, materials, system engineering areas of Mechanical Engineering.
PEO2	To develop innovative ideas and fine solutions to various mechanical engineering problems.
PEO3	To communicate effectively as members of multidisciplinary teams.
PEO4	To be sensitive to professional and societal context and committed to ethical action.
PEO5	To lead in the conception, design and implementation of new products, processes, services and systems.

Course Objectives

At the end of this course, the student will be able to:

CO1: The fundamentals of engineering drawing and represent various points.

CO2: Construct plain diagonal and vernier scales

CO3: Gain knowledge on types of projections and draw Orthographic projections of Lines, Planes, and Solids

CO4: Construct isometric scale, isometric projections and views.

CO5: Convert pictorial views to orthographic views.

CO6: Convert orthographic views to isometric views.

Program Outcomes (PO's)

PO's	Description
PO1	*Engineering knowledge:* Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	*Problem analysis:* Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	*Design/development of solutions:* Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	*Conduct investigations of complex problems*: Use research-based knowledge and research methods including design of experiments, analysis and

	interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	*Modern tool usage:* Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	*The engineer and society:* Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	*Environment and sustainability:* Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	*Ethics:* Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	*Individual and team work:* Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	*Communication:* Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	*Project management and finance:* Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	*Life-long learning:* Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO's):

PSO's	Description
PSO 1	Apply the knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.
PSO 2	Successfully evaluates the principle of design, analysis and implementation of mechanical systems / processes which have been learned as a part of the curriculum.
PSO 3	Develop and implement new ideas on product design and development with the help of modern CAD / CAM tools, while ensuring best manufacturing practices.

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2. SYLLABUS (UNIVERSITY COPY)

ME104ES/ME204ES: ENGINEERING GRAPHICS

B.Tech. I Year I Sem.

L	T	P	C
1	0	4	3

Pre-requisites: Nil

Course objectives:

- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

Course Outcomes: At the end of the course, the student will be able to:

- Preparing working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

UNIT – I

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

UNIT- II

Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.

UNIT – III

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

UNIT – IV

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

UNIT – V

Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions

Introduction to CAD: (For Internal Evaluation Weightage only):

Introduction to CAD Software Package Commands.- Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package

TEXTBOOKS:

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

REFERENCE BOOKS:

1. Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah. B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

Topic Outcomes

Lecture no.	Topics to be covered	Topic outcome (students will be able to)
	UNIT I	
L1	Introduction to engineering drawing	Define the overall view of the subject and by this they will estimate the future scope of the subject.
L2	Principles of engineering drawing & Significance, various drawing instruments, conventions in drawing.	Demonstrate the principles of engineering drawing, various drawing instruments, and conventions in drawing.
L3	Lettering practice, BIS conventions.	Distinguish the types of letters used in engineering drawing as per BIS convections.
L4	Construction of curves used in engineering practice: conics	Classify various curves used in engineering practice.
L5	Ellipse, parabola	Design Ellipse, parabola
L6	Rectangular hyperbola	Design rectangular hyperbola.
L7	Cycloid	Construct cycloid, and hypocycloid.
L8	Epicycloids	Construct epicycloids
L9	Hypocycloid	Construct hypocycloid
L10	Involutes	Identify the various involutes and its constructions.
L11	Scales: plain scales	Classify various scales used in engineering practice and construction of plain scale.
L12	Diagonal scales	Construct the diagonal scale.
	UNIT II	
L13	Orthographic projections in first angle:	Estimate the types of projections used in engineering. Drawing and they are able to distinguish the orthographic projections in first angle.
L14	Projections: principles of orthographic projections, conventions, first and third angle projections.	Demonstrate the principles of orthographic projections & convections, and they are able to differentiate first and third angle projections.
L15	Projection of points: including points in all four quadrants	Examine the projection of points in all four quadrants.
L16	Projection of lines: parallel and perpendicular to one plane	Differentiate projection of lines parallel and perpendicular to one plane.
L17	Projection of line inclined to one plane	Draw projection of line inclined to one plane.
L18	Projection of line inclined to both the planes.	Construct projection of line inclined to both the planes.

L19	Traces of a line	Demonstrate traces of a line used in engineering practice.
L20	Projection of planes: parallel and perpendicular to one plane	Differentiate projection of planes parallel and perpendicular to one plane.
L21	Inclined to one plane	Draw projection of plane inclined to one plane.
L22	Inclined to both the planes.	Draw projection of plane inclined to both the planes.
	UNIT III	
L23	Projection of solids: projections of regular solids, cube	Demonstrate the projection of solids used in engineering. Drawing practice and they are able to construct projections of regular solids, cube.
L24	Projection of prism	Construct projection of prism
L25	Projection of pyramids	Design projection of pyramids
	MID EXAMINATION – I	
L26	Projection of cylinder	Construct projection of cylinder
L27	Projection of cone	Analyze and construct projection of cone
L28	Pyramid – use of auxiliary views	Apply and define pyramid – use of auxiliary views
L29	Sections and sectional views: right regular solids-prisms, cylinders and cone	Demonstrate and design sections and sectional views: right regular solids- prisms, cylinders and cone
L30	Pyramid – use of auxiliary views	Apply and define pyramid – use of auxiliary views
L31	Section of sphere	Construct Section of sphere
	UNIT IV	
L32	Development of surfaces; development of surfaces of right regular solids-prisms	Demonstrate the development of surfaces of right regular solids-and construction of prisms
L33	Cylinder	Construction of cylinder
L34	Pyramids	Construction of pyramids
L35	Cone	Design of cone
L36	Intersection of Solids: Intersection of – Prism vs Prism	Construct Intersection of – Prism vs Prism
L37	Cylinder Vs Cylinder	Construct Intersection of – Cylinder Vs Cylinder
	UNIT V	
L38	Isometric projections: principles of isometric projections, isometric scale, isometric views, conventions	Explain and demonstrate principles of isometric projections, isometric scale, isometric views, conventions
L39	Plane figures	Design plane figures
L40	Simple and compound solids	Illustrate and construct simple and compound solids

L41	Isometric projections of objects having non-isometric lines	Detect and design isometric projections of objects having non-isometric lines
L42	Isometric projection of parts with spherical surfaces.	Demonstrate and construction of isometric projection of parts with spherical surfaces.
L43	Transformation of projections: conversion of isometric views to orthographic views	Define transformation of projections: and they are able to differentiate conversion of isometric views to orthographic views
L44	Conversion of orthographic view to isometric view	Categorize the conversion of orthographic view to isometric view
L45	Creation of 2D Sketches by CAD Package	Identify various types of commands, basic principles of 2D to 3D conversions using CAD software
MID EXAMINATION – II		

3. COURSE PRE-REQUISITES

1. Engineering Mathematics
2. Drawing Skills

5. COs & POs MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	3	3	-	-	2	1	3	-	3
CO2	3	3	-	3	2	-	-	1	-	-	-	3
CO3	3	3	3	2	-	-	-	2	-	-	-	1
CO4	3	3	3	3	3	3	-	3	2	1	-	3
CO5	3	3	3	3	3	2	-	2	1	3	-	3
CO6	3	3	3	3	3	2	-	2	1	3	-	3

Legends: 1- Low, 2- Medium, 3-High

6. COURSE INFORMATION SHEET

(a) Course Description

Programme: B. Tech. (Humanity and science)	Degree: B. Tech
Course: Engineering Graphics	Year: IV Sem. : I Credits: 3
Course Code: ME104ES Regulation: R 18	Course Type: Core
Course Area/Domain: Fundamentals and Design	Contact Hours: 6 Hours / Week.
Corresponding Lab Course Code (If Any): Nil	Lab Course Name: Nil

(b) Syllabus

Unit	Details	Hours
I	**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.	12
II	**Orthographic Projections:** Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.	10
III	Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere	09
IV	Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder	06
V	**Isometric Projections:** Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions **Introduction to CAD: (For Internal Evaluation Weightage only):**	08

	Introduction to CAD Software Package Commands.- Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package	
	Contact classes for syllabus coverage	45
	Total No. of classes	**45**

(c) Gaps in the Syllabus - To Meet Industry / Profession Requirements: NIL

(d) Topics beyond the Syllabus / Advanced Topics: NIL

(e) Web Source References

S.N.	Name of book / website
a.	http://nptel.ac.in/courses/112103019/
b.	http://nptel.ac.in/courses/112104172/

(f) Delivery / Instructional Methodologies

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES
☑ LCD/SMART BOARDS	☑ STUD. SEMINARS	☐ ADD-ON COURSES

(g) Assessment Methodologies - Direct

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☑ MINI / MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

(h) Assessment Methodologies – Indirect

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

(i) Text / Reference Books

T / R	BOOK TITLE/AUTHORS/PUBLICATION
Text Book	Engineering Drawing N.D. Bhatt / Charotar
Text Book	Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford
Reference Book	Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill
Reference Book	Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
Reference Book	Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

7. MICRO LESSON PLAN

Lecture no.	Topics to be covered	Schedule date	Actual Date
L1	**UNIT-1** Introduction to engineering drawing	19/08/2019	19/08/2019
L2	Principles of engineering drawing & Significance, various drawing instruments, conventions in drawing.	20/08/2019	20/08/2019
L3	Lettering practice, BIS conventions.	26/08/2019	26/08/2019
L4	Construction of curves used in engineering practice: conics	27/08/2019	27/08/2019
L5	Ellipse, parabola	02/09/2019	02/09/2019
L6	Rectangular hyperbola	03/08/2019	03/09/2019
L7	Cycloid	09/09/2019	09/09/2019
L8	Epicycloids	10/09/2019	10/09/2019
L9	Hypocycloid	16/09/2019	16/09/2019
L10	Involutes	17/09/2019	17/09/2019
L11	Scales: plain scales	23/09/2019	23/09/2019
L12	Diagonal scales	24/08/2019	24/08/2019
L13	**UNIT-2** Orthographic projections in first angle:	30/09/2019	30/09/2019
L14	Projections: principles of orthographic projections, conventions, first and third angle projections.	01/10/2019	1/10/2019
L15	Projection of points: including points in all four quadrants	07/10/2019	07/10/2019
L16	Projection of lines: parallel and perpendicular to one plane	08/10/2019	8/10/2019
L17	Projection of line inclined to one plane	14/10/2019	14/10/2019
L18	Projection of line inclined to both the planes.	15/10/2019	15/10/2019
L19	Traces of a line	21/10/2019	21/10/2019
L20	Projection of planes: parallel and perpendicular to one plane	22/10/2019	22/10/2019
L21	Inclined to one plane	28/10/2019	28/10/2019

L22	Inclined to both the planes.	29/10/2019	29/10/2019
L23	**UNIT-3** Projection of solids: projections of regular solids, cube	04/10/2019	04/10/2019
L24	Projection of prism	05/11/2019	05/11/2019
L25	Projection of pyramids	11/11/2019	11/11/2019
L26	Projection of cylinder	12/11/2019	12/11/2019
L27	Projection of cone	18/11/2019	18/11/2019
L28	Pyramid – use of auxiliary views	25/11/2019	25/11/2019
L29	Sections and sectional views: right regular solids- prisms, cylinders and cone	26/11/2019	26/11/2019
L30	Pyramid – use of auxiliary views	26/11/2019	26/11/2109
L31	Section of sphere	26/11/2019	26/11/2019
L32	**UNIT IV** Development of surfaces; development of surfaces of right regular solids-prisms	26/11/2019	26/11/2019
L33	Cylinder	03/12/2019	03/12/2019
L34	Pyramids	03/12/2019	03/13/2019
L35	Cone	03/12/2019	03/12/2019
L36	Intersection of Solids: Intersection of – Prism vs Prism	04/12/2019	04/12/2019
L37	Cylinder Vs Cylinder	04/12/2019	04/12/2019
L38	**UNIT V** Isometric projections: principles of isometric projections, isometric scale, isometric views, conventions	04/12/2019	04/12/2019
L39	Plane figures	05/12/2019	05/12/2019
L40	Simple and compound solids	06/12/2019	06/12/2019
L41	Isometric projections of objects having non-isometric lines	07/12/2019	07/12/2019
L42	Isometric projection of parts with spherical surfaces.	09/12/2019	09/12/2019
L43	Transformation of projections: conversion of isometric views to orthographic views	10/12/2019	10/12/2019
L44	Conversion of orthographic view to isometric view	11/12/2019	11/12/2019
L45	Creation of 2D Sketches by CAD Package	12/12/2019	12/12/2019

MID EXAMINATION – II	

8. TEACHING SCHEDULE

Subject	ENGINEERING GRAPHICS			
	Text Books			
Book 1	Engineering Drawing N.D. Bhatt / Charotar			
	Reference Books			
Book 2	Engineering Drawing / Basant Agrawal and McAgrawal/ McGraw Hill			
Unit	**Topic**	**Chapters Nos.**		**No. of classes**
		Book 1	**Book 2**	
I	**Introduction to Engineering Drawing:** Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid.	3,5,6	2,3,5	8
	Scales – Plain & Diagonal.	4	4	4
II	**Orthographic Projections:** Principles of Orthographic Projections – Conventions – Projections of Points	8,9	7,8	4
	Projections of lines	10	9	3
	Projections of Plane regular geometric figures.—Auxiliary Planes.	11,12	10	3
III	Projections of Regular Solids – Auxiliary Views	13	11	3
	Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere	14	12	3
	Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone,	15	13	3
	Intersection of Solids: Intersection	16	14	6

IV	of – Prism vs Prism- Cylinder Vs Cylinder			
V	**Isometric Projections:** Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions	17	15	6
	Introduction to CAD: (For Internal Evaluation Weightage only): Introduction to CAD Software Package Commands.- Free Hand Sketches of 2D- Creation of 2D Sketches by CAD Package	26		2
			Contact classes for syllabus coverage	45
			Total No. of classes	**45**

9. UNIT WISE NOTES

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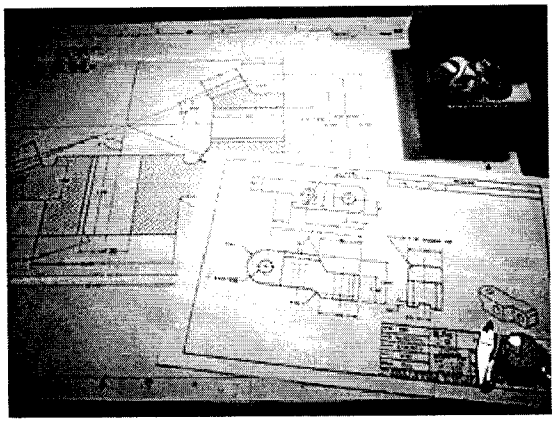
Engineering Graphics

UNIT 1:

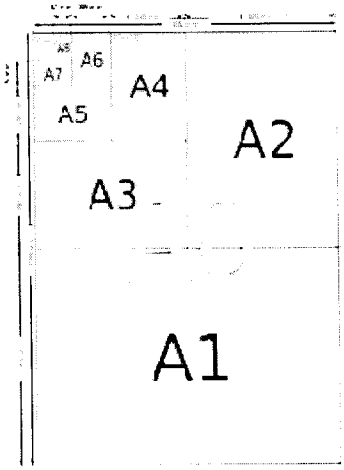
INTRODUCTION TO ENGINEERING DRAWING:

Principles of Engineering Drawing/Graphics and their significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid.
Involute. Scales-Plain, Diagonal, Vernier scale.



Engineering Graphics or drawing, a type of technical drawing, is used to fully and clearly define requirements for engineered items. It is also a language—a graphical language that communicates ideas and information from one mind to another.Most specially, it communicates all needed information from the engineer who *designed* a part to the workers who will *make* it.

Sizes of drawings typically comply with either of two different standards, ISO (World Standard) or ANSI/ASME Y14 (American), according to the following tables:



SO paper sizes

ISO A Drawing Sizes (mm)

A4 210 X 297

A3 297 X 420

A2 420 X 594
A1 594 X 841
A0 841 X 1189

LINES AND DIMENSIONING

Lines

Lines are one important aspect of technical drawing. Lines are always used to construct meaningful drawings. Various types of lines are used to construct drawing, each line used in some specific sense. Lines are drawn following standard conventions mentioned in BIS (SP46:2003). A line may be curved, straight, continuous, segmented. It may be drawn as thin or thick. A few basic types of lines widely used in drawings are shown in Table 1.

Table 1.
Types of letters used in engineering drawing.

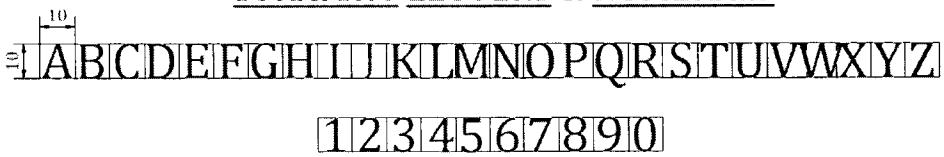
Illustration	Application
Thick	Outlines, visible edges, surface boundaries of objects, margin lines
Continuous thin	Dimension lines, extension lines, section lines leader or pointer lines, construction lines, boarder lines
Continuous thin wavy	Short break lines or irregular boundary lines – drawn freehand
Continuous thin with zig-zag	Long break lines
Short dashes, gap 1, length 3 mm	Invisible or interior surfaces
Short dashes	Center lines, locus lines Alternate long and short dashes in a proportion of 6:1,
Long chain thick at end and thin elsewhere	Cutting plane lines

LETTERING

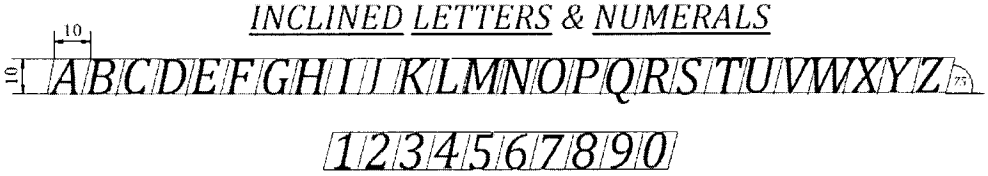
Lettering

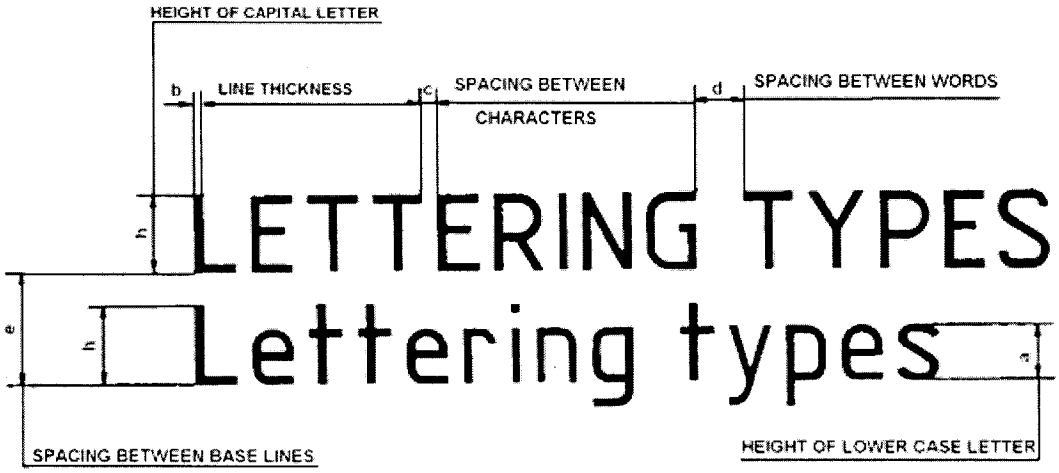
- The size of letter is specified by its height.
- Generally the ratio of height to width for most of the **capital letters** are taken as **6:5** and for most of the **lower case letters** are taken as **4:4**.
- Main letter are generally written in 10 mm to 12 mm
- Subtitle is written in 3 mm to 6 mm
- Notes, Dimension fig etc. written in 3 mm to 4 mm.
- Space between the words is generally 2 to 5 mm in lettering.
- Inclined latter write in an inclination of 75^0.

STRAIGHT LETTERS & NUMERALS

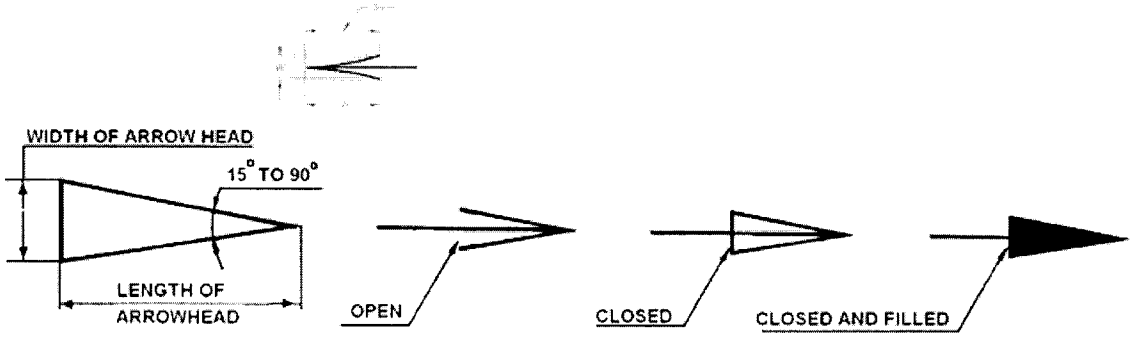


INCLINED LETTERS & NUMERALS





Arrows – 3 mm wide and should be 1/3rd as wide as they are long - symbols placed at the end of dimension lines to show the limits of the dimension. Arrows are uniform in size and style, regardless of the size of the drawing. Various types of arrows used for dimensioning is shown in figure



DIMENSIONING

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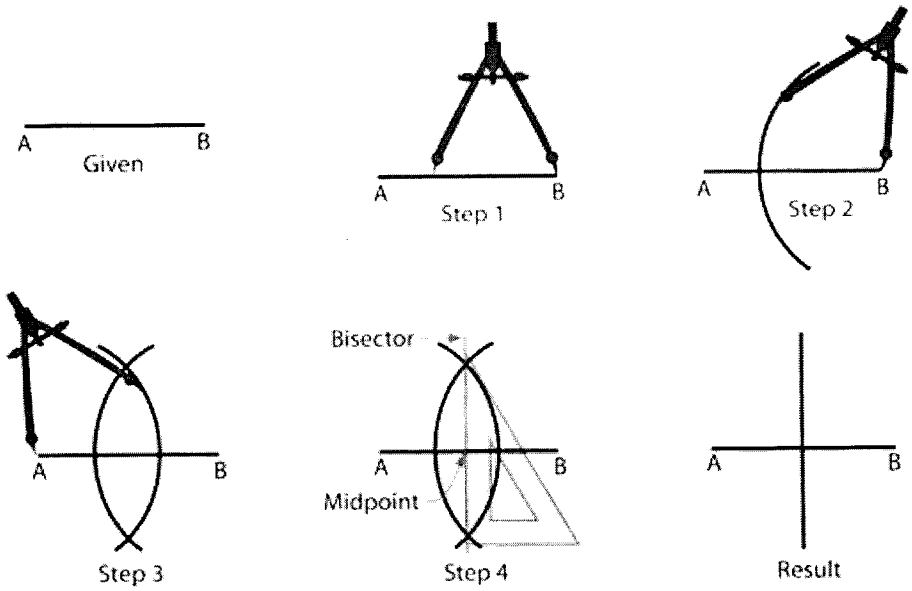
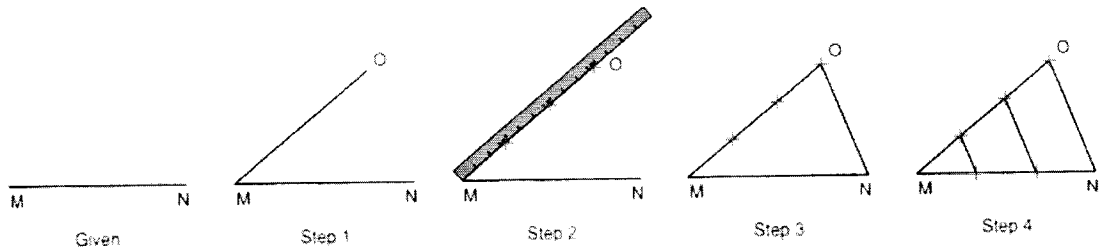
GEOMETRICAL CONSTRUCTIONS

1. Bisecting a line:



2. Dividing a line into equal parts

The method of dividing a line MN into equal number of parts is illustrated in figure.

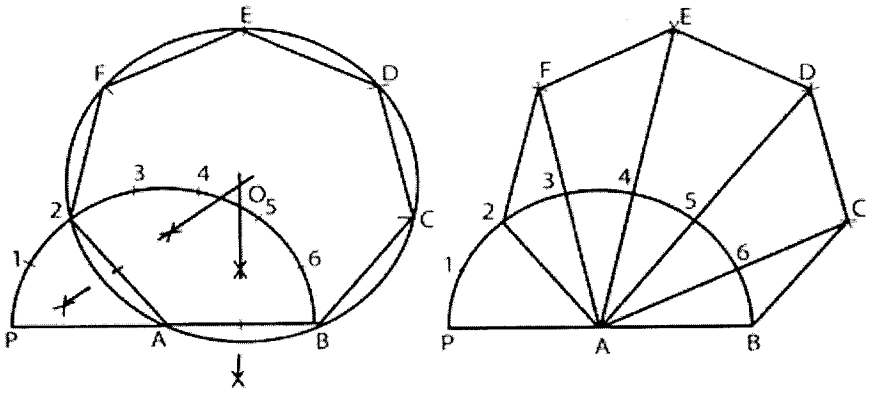


- Draw a line MN of any length
- Draw a line MO at any convenient angle (preferably an acute angle) from point M.
- From M and along MO, cut off with a divider equal divisions (say three) of any convenient length.
- Draw a line joining ON.
- Draw lines parallel to MO through the remaining points on line MO.

The intersection of these lines with line MN will divide the line into (three) equal parts.

3 construction of Regular Polygon of given length AB

To construct a regular polygon with length of edge AB us shown in figure

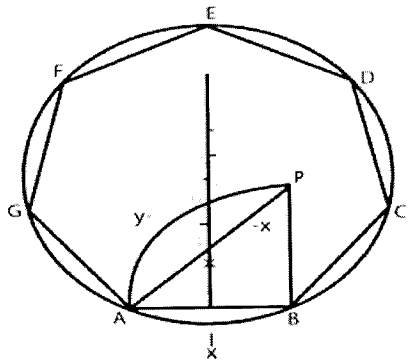


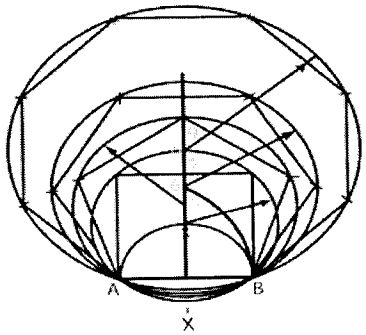
Construction of a regular polygon with a given length of edge.

- Draw a line of length AB. With A as centre and radius AB, draw a semicircle.
- With the divider, divide the semicircle into the number of sides (example of number of side 7 is shown in figure) of the polygon.
- Draw a line joining A with the second division-point 2.
- The perpendicular bisectors of A2 and AB meet at O. Draw a circle with centre O and radius OA.
- With length A2, mark points F, E, D & C on the circumferences starting from 2 (*Inscribe circle method*)
- With centre B and radius AB draw an arc cutting the line A6 produced at C. Repeat this for other points D, E & F (*Arc method*)

4. General method of drawing any polygon

A more general method of drawing any polygon with a given length of edge is shown in figure

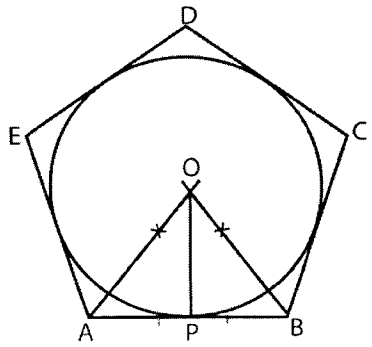




- Draw AB = given length of polygon
- At B, Draw BP perpendicular & = AB
- Draw Straight line AP
- With center B and radius AB, draw arc AP.
- The perpendicular bisector of AB meets the line AP and arc AP in 4 and 6 respectively.
- Draw circles with centers as 4, 5,&6 and radii as 4B, 5B, & 6B and inscribe a square, pentagon, & hexagon in the respective circles.
- Mark point 7, 8, etc with 6-7,7-8,etc. = 4-5 to get the centers of circles of heptagon and octagon, etc.

5. Inscribe a circle inside a regular polygon

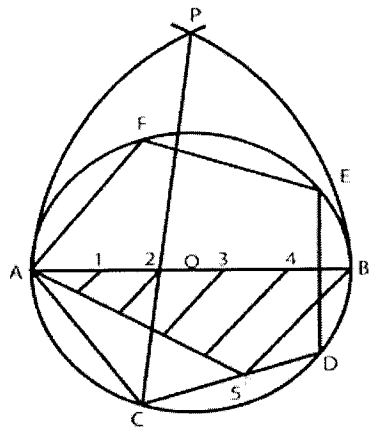
The method of inscribing a circle inside a regular polygon is illustrated in figure



1. Bisect any two adjacent internal angles of the polygon.
2. From the intersection of these lines, draw a perpendicular to any one side of the polygon (say OP).
3. With OP as radius, draw the circle with O as center

6. Inscribe a regular polygon of any number of sides (say n = 5), in a circle

Figure shows the method of inscribing a regular polygon of any number of sides.



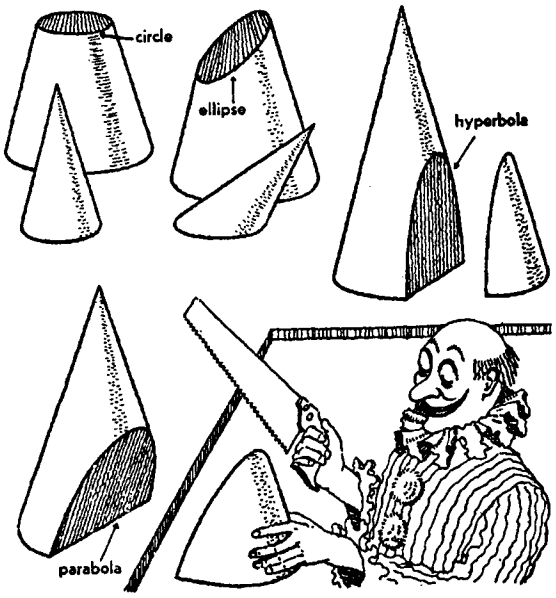
- Draw the circle with diameter AB.
- Divide AB in to "n" equal parts
- Number them.
- With center A & B and radius AB, draw arcs to intersect at P.
- Draw line P2 and produce it to meet the circle at C.
- AC is the length of the side of the polygon.

KG REDDY
College of Engineering
& Technology

CONIC SECTION

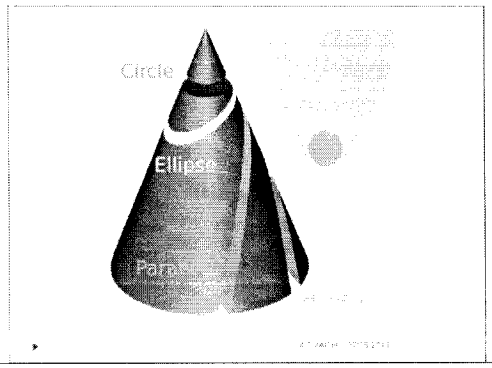
CONIC SECTION

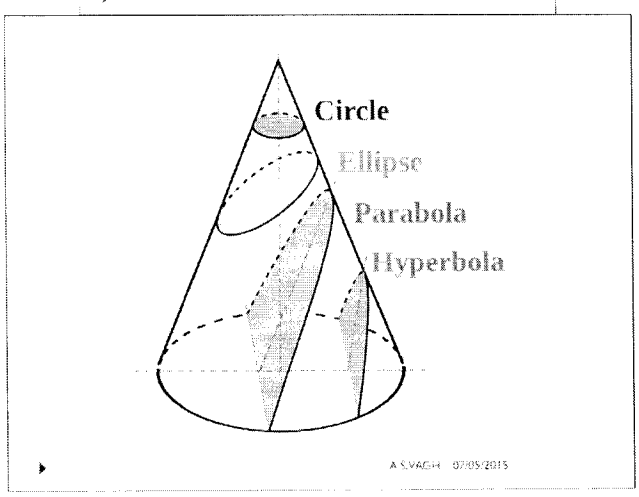
Sections of a right circular cone obtained by cutting the cone in different ways



Conic sections have different shapes and different names.

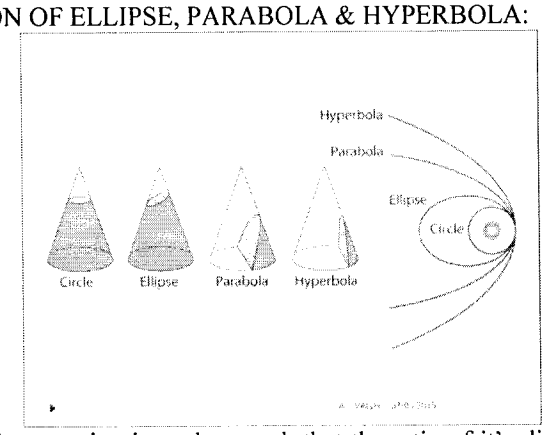
Depending on the position of the cutting plane relative to the axis of cone, three conic sections can be obtained – parabola – ellipse, and – hyperbola



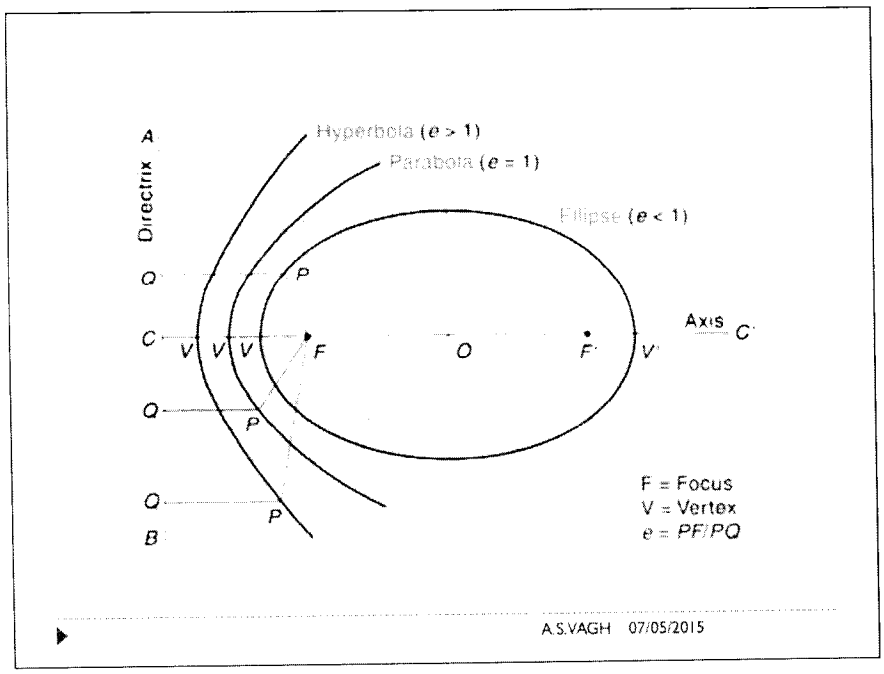


Conic sections are the intersections of a right regular cone, by a cutting plane in different positions, relative to the axis of the cone.

COMMON DEFINATION OF ELLIPSE, PARABOLA & HYPERBOLA:



These are the loci of points moving in a plane such that the ratio of it's distances from a fixed point And a fixed line always remains constant.
The Ratio is called ECCENTRICITY. (E)
A) For Ellipse E< 1
B) For Parabola E=1
C) For Hyperbola E>1



ELLIPSE:

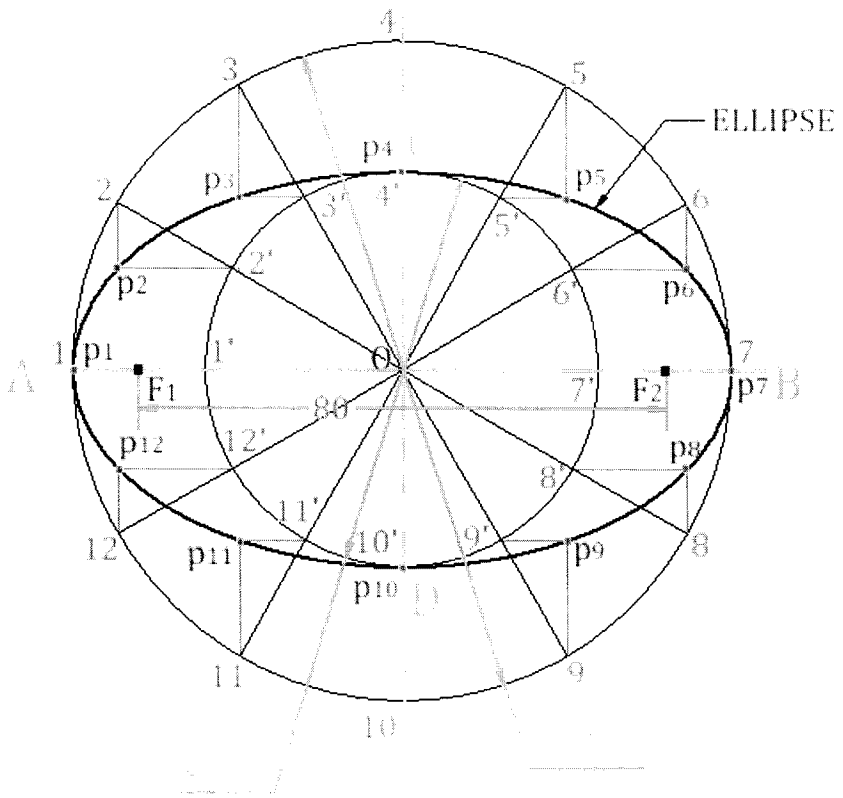
It is a locus of a point moving in a plane such that the SUM of it's distances from TWO fixed points always remains constant.

• An ellipse is obtained when a section plane A–A, inclined to the axis cuts all the generators of the cone

CONCENTRIC CIRCLE METHOD

Problem 1:

Engineering Curves – Focal points of the ellipse are at 80 mm apart and the minor axis is of 60 mm length. Determine the length of major axis and draw the ellip

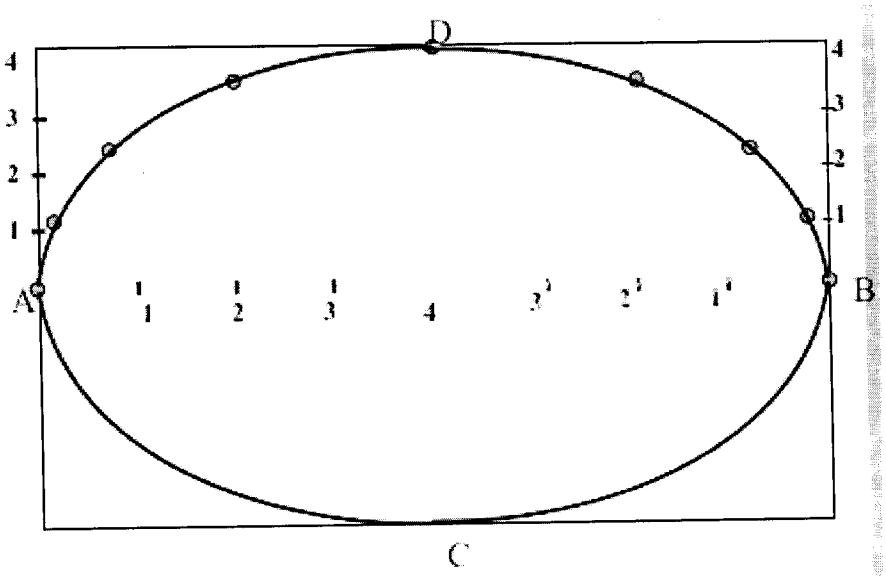


se by concentric circle method.

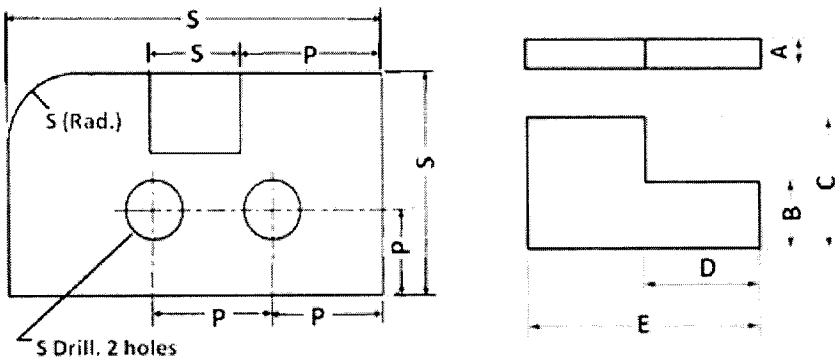
Step-1 Draw a horizontal axis of some suitable length. And mark a point O on it.
Step-2 Draw a vertical axis, perpendicular to the horizontal axis & passing through the point O of the length equal to the length of minor axis, which is 60 mm and give points C & D as shown into the figure.
Step-3 Mark the points F_1 & F_2 Which are focal points on the horizontal axis and are 80 mm apart from each other.
Step-4 Measure the distance between the point F_1 & C or D and with this distance keep O as center and cut the horizontal axis on both the sides and give points A & B, which is the major axis of the ellipse. Hence the distance of the major axis is 100 mm.
Step-5 Taking their intersecting point as a center, draw two concentric circles considering both as respective diameters.
Step-6 Divide both circles in 12 equal parts & name as shown.
Step-7 From all points of outer circle draw vertical lines downwards and upwards respectively.
Step-8.From all points of inner circle draw horizontal lines to intersect those vertical lines.
Step-9 Mark all intersecting points properly as those are the points on ellipse.
Step-10 Join all these points along with the ends of both axes in smooth possible curve. It is required ellipse.

RECTANGLE METHOD

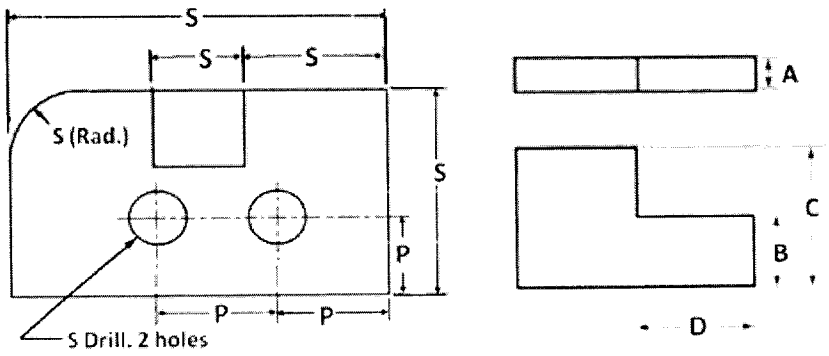
Problem 2:
Draw ellipse by Rectangle method. Take major axis 100 mm and minor axis 70 mm long .



Construction
Step-1 Draw a rectangle taking major100 and minor 70 axes as sides.
Step-2 . In this rectangle draw both axes as perpendicular bisectors of each other..
Step-3 For construction, select upper left part of rectangle. Divide vertical small side and horizontal long side into same number of equal parts.(here divided in four parts)
Step-4Name those as shown..
Step-5 Now join all vertical points 1,2,3,4, to the upper end of minor axis. And all horizontal points i.e.1,2,3,4 to the lower end of minor axis.
Step-6 Then extend C-1 line up to D-1 and mark that point. Similarly extend C-2, C-3, C-4 lines up to D-2, D-3, & D-4 lines.
Step-7 Mark all these points properly and join all along with ends A and D in smooth possible curve. Do similar construction in right side part. Along with lower half of the rectangle. Join all points in smooth



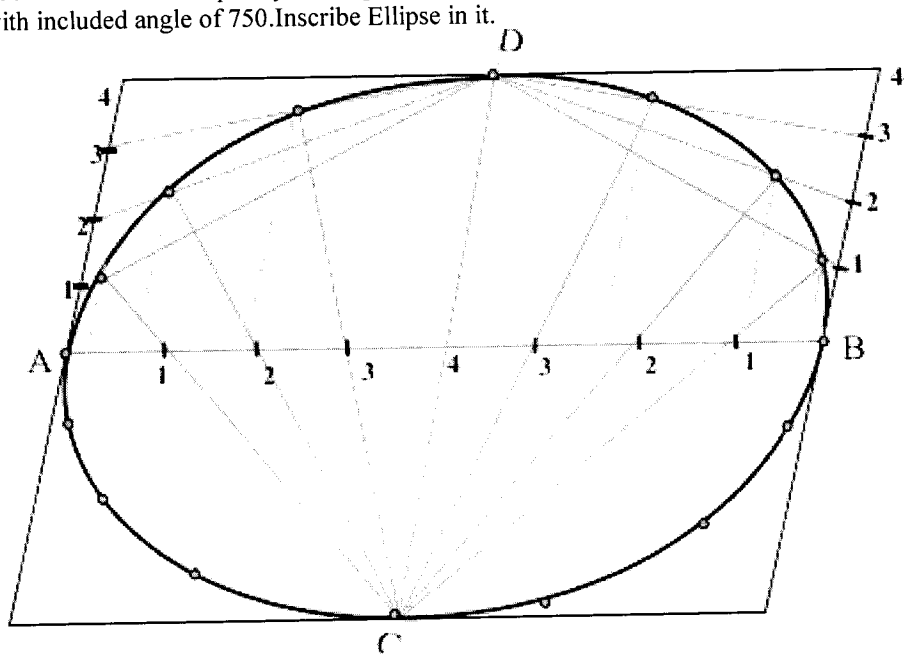
(a) Aligned system



(b) Unidirectional system

OBLONG METHOD

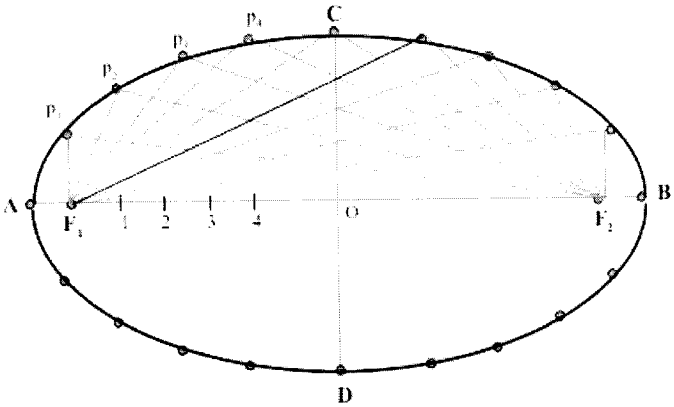
Problem 3: Draw ellipse by Oblong method. Draw a parallelogram of 100 mm and 70 mm long sides with included angle of 750.Inscribe Ellipse in it.

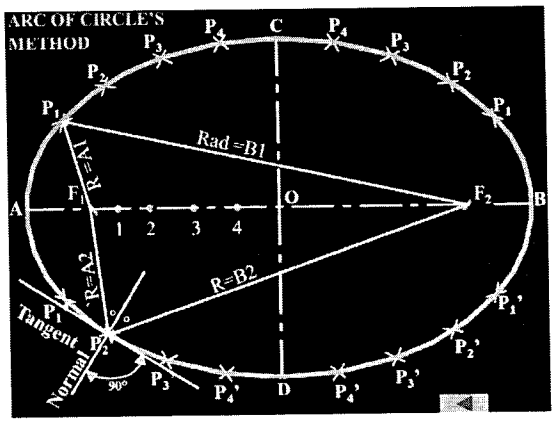


STEPS ARE SIMILAR TO THE PREVIOUS CASE (RECTANGLE METHOD) ONLY IN PLACE OF RECTANGLE, HERE IS A PARALLELOGRAM.

ARCS OF CIRCLE METHOD

problem 4. Major axis AB & Minor axis CD are 100 and 70mm long respectively .draw ellipse by arcs of cirles method.



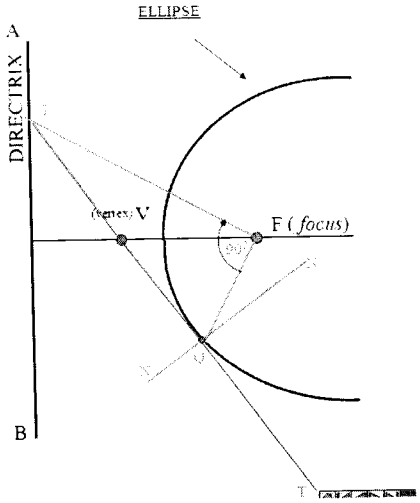


Step-1 .Draw both axes as usual. Name the ends & intersecting point
Step-2 Taking AO distance I.e.half major axis, from C, mark F1 & F2 On AB . (focus 1 and 2.)
Step-3On line F1 - O taking any distance, mark points 1,2,3, & 4
Step-4 .Taking F1 center, with distance A-1 draw an arc above AB and taking F2 center, withB-1 distance cut this arc. Name the point p1
Step-5 .Repeat this step with same centers but taking now A-2 & B-2 distances for drawing arcs. Name the point p2
Step-6 Similarly get all other P points. With same steps positions of P can be located below AB.
Step-7 .Join all points by smooth curve to get an ellipse/

DIRECTRIX-FOCUS METHOD

PROBLEM 5:-

Point f is 50 mm from a line AB.A point P is moving in a plane such that the ratio of it's distances from F and line AB remains constant and equals to 2/3 draw locus of point p.
{ eccentricity = 2/3 }

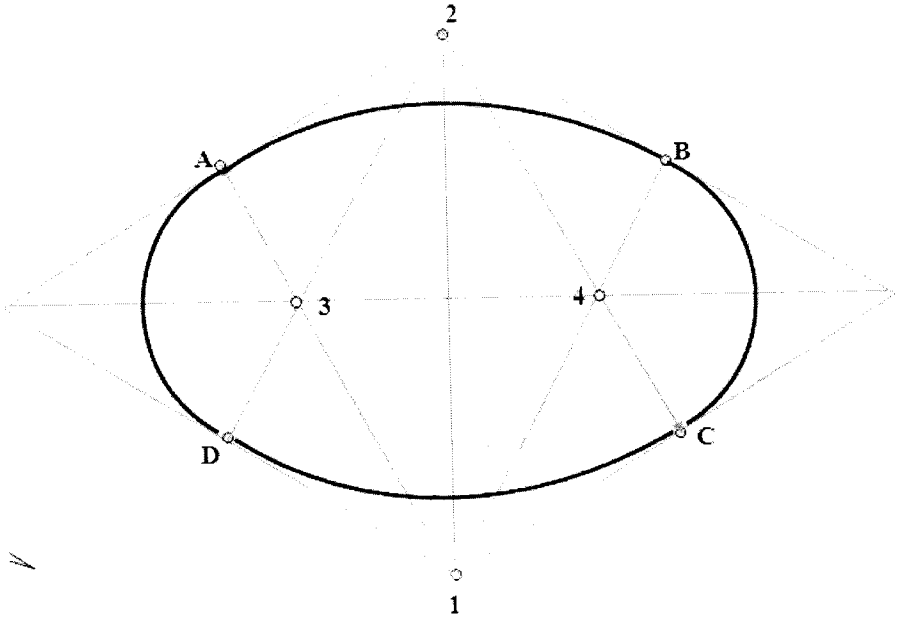


Step-1 .Draw a vertical line AB and point F 50 mm from it.
Step-2Divide 50 mm distance in 5 parts.
Step-3 Name 2nd part from F as V. It is 20mm and 30mm from F and AB line resp. It is first point giving ratio of it's distances from F and AB 2/3 i.e 20/30
Step-4 Form more points giving same ratio such as 30/45, 40/60, 50/75 etc.
Step-5 .Taking 45,60 and 75mm distances from line AB, draw three vertical lines to the right side of it.
Step-6 . Now with 30, 40 and 50mm distances in compass cut these lines above and below, with F as center.
Step-7 Join these points through V in smooth curve. This is required locus of P.It is an ELLIPSE.

RHOMBUS METHOD

PROBLEM 6

Draw Rhombus OF 100 mm & 70 mm long diagonals and inscribe an Ellipse in it



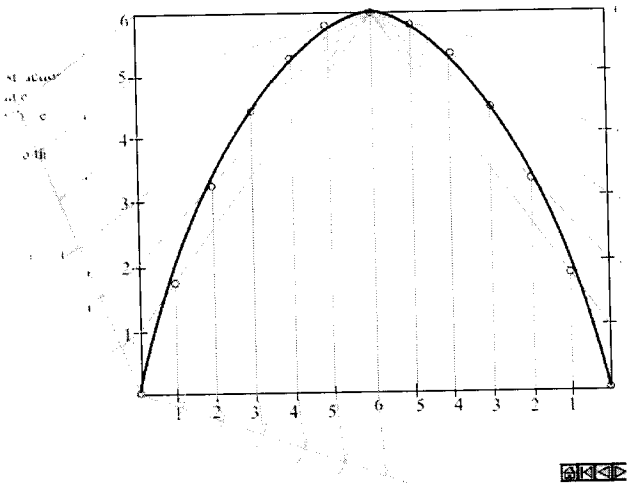
Step-1 . Draw rhombus of given dimensions.
Step-2 Mark mid points of all sides & name Those A,B,C,& D
Step-3 Join these points to the ends of smaller diagonals.
Step-4 . Mark points 1,2,3,4 as four centers.
Step-5 . Taking 1 as center and 1-A radius draw an arc AB.
Step-6 Take 2 as center draw an arc CD.
Step-7 Similarly taking 3 & 4 as centers and 3-D radius draw arcs DA & BC.

PARABOLA

The parabola is a conic section, the intersection of a right circular conical surface and a plane to a generating straight line of that surface. Given a point (the focus) and a corresponding line (the directrix) on the plane, the locus of points in that plane that are equidistant from them is a parabola.

RECTANGLE METHOD

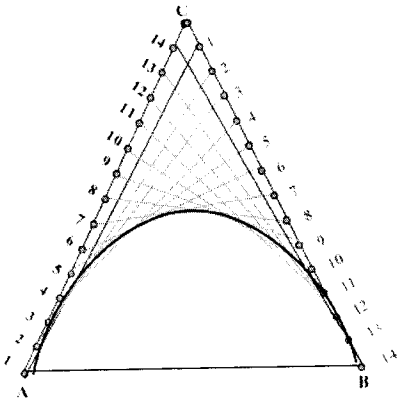
PROBLEM 1:
A ball thrown in air attains 100 m height and covers horizontal distance 150 m on ground. Draw the path of the ball (projectile)-



Step-1 .Draw rectangle of above size and divide it in two equal vertical parts
Step-2 .Consider left part for construction. Divide height and length in equal number of parts and name those 1,2,3,4,5& 6
Step-3.Join vertical 1,2,3,4,5 & 6 to the top center of rectangle
Step-4 Similarly draw upward vertical lines from horizontal1,2,3,4,5 And wherever these lines intersect previously drawn inclined lines in sequence Mark those points and further join in smooth possible curve. ***Step-5*** Repeat the construction on right side rectangle also
.Join all in sequence. This locus is Parabola.

METHOD OF TANGENTS

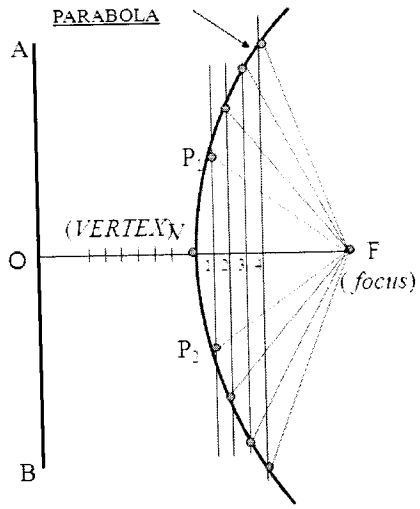
Problem no.2:
Draw an isosceles triangle of 100 mm long base and 110 mm long altitude.Inscribe a parabola in it by method of tangents



Step-1 .. Construct triangle as per the given dimensions.
Step-2 .Divide it's both sides in to same no.of equal parts.
Step-3 .Name the parts in ascending and descending manner, as shown.
Step-4 .Join 1-1, 2-2,3-3 and so on.
Step-5 .Draw the curve as shown i.e.tangent to all these lines. The above all lines being tangents to the curve, it is called method of tangents.

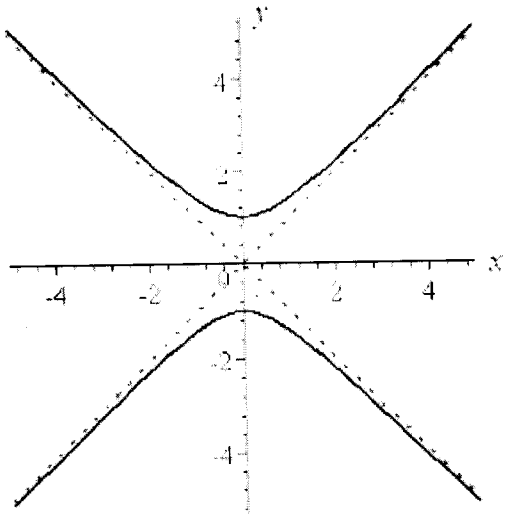
DIRECTRIX-FOCUS METHOD

PROBLEM 3:
Point F is 50 mm from a vertical straight line AB. Draw locus of point P, moving in a plane such that it always remains equidistant from point F and line AB.



Step-1 .Locate center of line, perpendicular to AB from point F. This will be initial point P and also the vertex.
Step-2 .Mark 5 mm distance to its right side, name those points 1,2,3,4 and from those draw lines parallel to AB.
Step-3 Mark 5 mm distance to its left of P and name it 1.
Step-4 .Take O-1 distance as radius and F as center draw an arc cutting first parallel line to AB. Name upper point P1 and lower point P2 . (FP1=O1)
Step-5 .Similarly repeat this process by taking again 5mm to right and left and locate P3 P4 .
Step-6 It is similar to parabola which has he eccentricity greater than 1

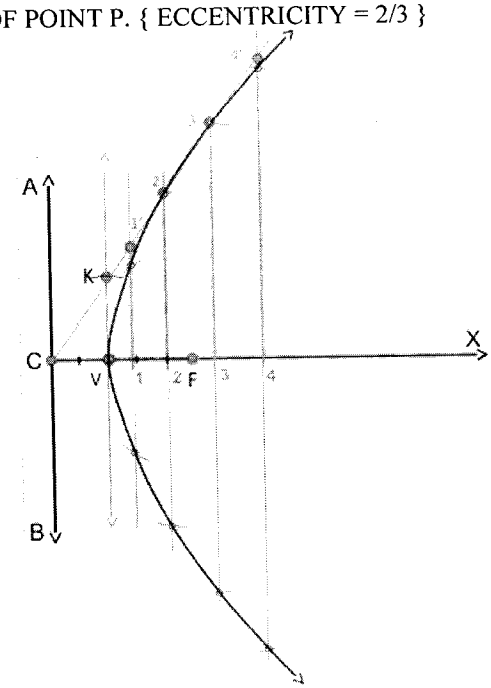
HYPERBOLA



DIRECTRIX FOCUS METHOD

Problem No.1:

POINT F IS 50 MM FROM A LINE AB.A POINT P IS MOVING IN A PLANE SUCH THAT THE RATIO OF IT'S DISTANCES FROM F AND LINE AB REMAINS CONSTANT AND EQUALS TO 2/3 DRAW LOCUS OF POINT P. { ECCENTRICITY = 2/3 }

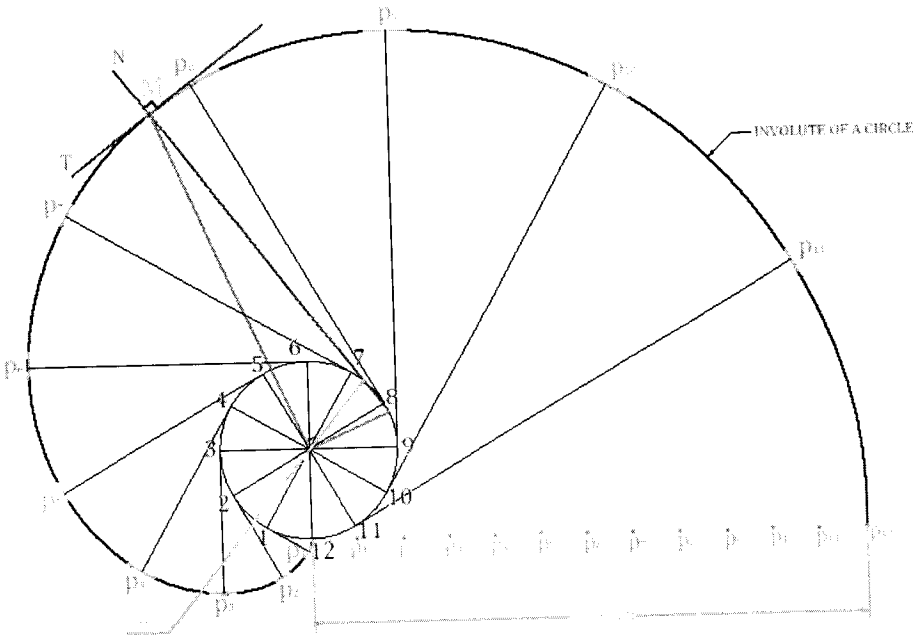


STEPS: 1 .Draw a vertical line AB and point F 50 mm from it.

2 .Divide 50 mm distance in 5 parts.
3 .Name 2nd part from F as V. It is 20mm and 30mm from F and AB line resp. It is first point giving ratio of it's distances from F and AB 2/3 i.e 20/30
4 Form more points giving same ratio such as 30/45, 40/60, 50/75 etc.
5.Taking 45,60 and 75mm distances from line AB, draw three vertical lines to the right side of it.
6. Now with 30, 40 and 50mm distances in compass cut these lines above and below, with F as center.
7. Join these points through V in smooth curve.

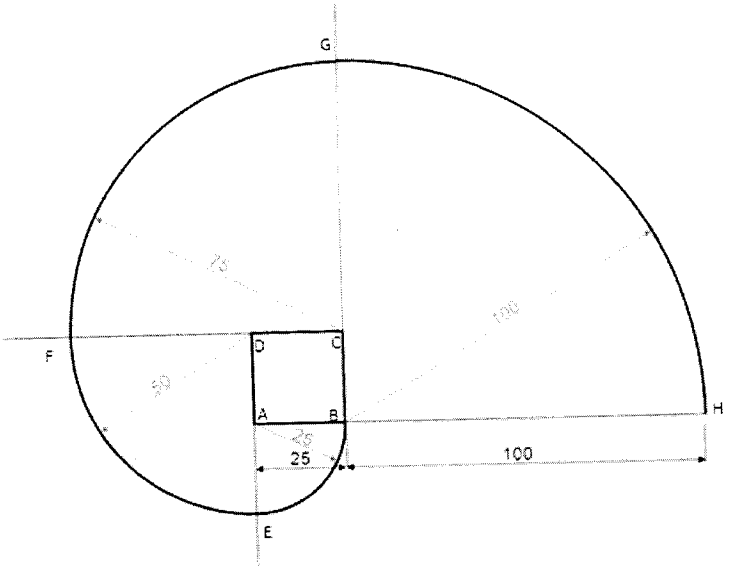
INVOLUTE OF A CIRCLE

Draw Involute of a circle. String length is equal to the circumference of circle



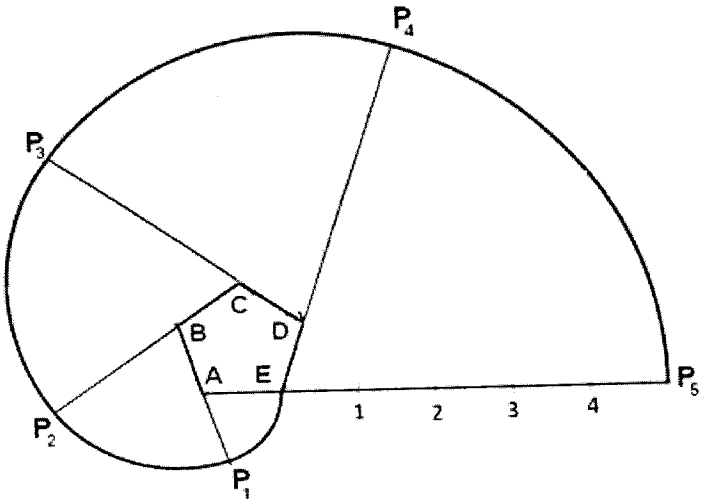
1) Point or end P of string AP is D distance away from A. πexactly Means if this string is wound round the circle, it will completely cover given circle. B will meet A after winding. D (AP) distance into 8π
2) Divide number of equal parts.
3) Divide circle also into 8 number of equal parts.
4) Name after A, 1, 2, 3, 4, etc. up D line AP as well as onπto 8 on circle (in anticlockwise direction).
5) To radius C-1, C-2, C-3 up to C-8 draw tangents (from 1,2,3,4,etc to circle).
6) Take distance 1 to P in compass and mark it on tangent from point 1 on circle (means one division less than distance AP).
7) Name this point P1
8) Take 2-B distance in compass and mark it on the tangent from point 2. Name it point P2.
9) Similarly take 3 to P, 4 to P, 5 to P up to 7 to P distance in compass and mark on respective tangents and locate P3, P4, P5 up to P8 (i.e. A) points and join them in smooth curve it is an INVOLUTE of a given circle.

Problem: Draw involute of a square of 25 mm sides



Given square ABCD, extend all sides any convenient length.
With AB as a radius and A as a center, draw arc bE.
With DE as a radius and D as a center, draw arc EF.
Repeat this procedure until you complete a figure of the desired size

In volute of a regular pentagon



Draw the pentagon A-B-C-D-E.
Extend line AE to P6 such that length E-P6 is equal to 5 times AE.
Extend line BA, CB, DC, and ED.
With A as centre and radius equal to AE draw an arc to intersect the line BA extended at P1.
Next with B as centre and radius equal to A-1, draw an arc to intersect the line BA extended at P2.
With C as centre and radius equal to A-2, draw an arc to intersect the line DC extended at P3.

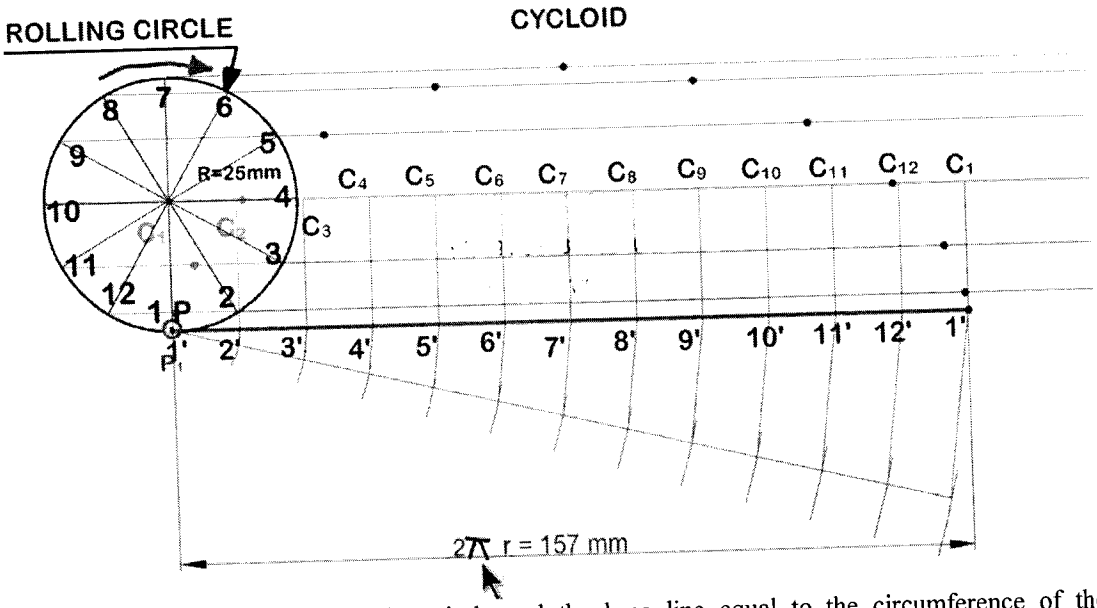
The procedure is repeated till point P5 is obtained.
Draw a smooth curve passing through P1, P2, P3, …, P5 to obtain the involute of the pentagon.

Cycloid

A cycloid is a curve generated by a point on the circumference of the circle as the circle rolls along a straight line with out slipping..

The moving circle is called the "Generating circle" and the straight line is called the "Directing line" or the "Base line".

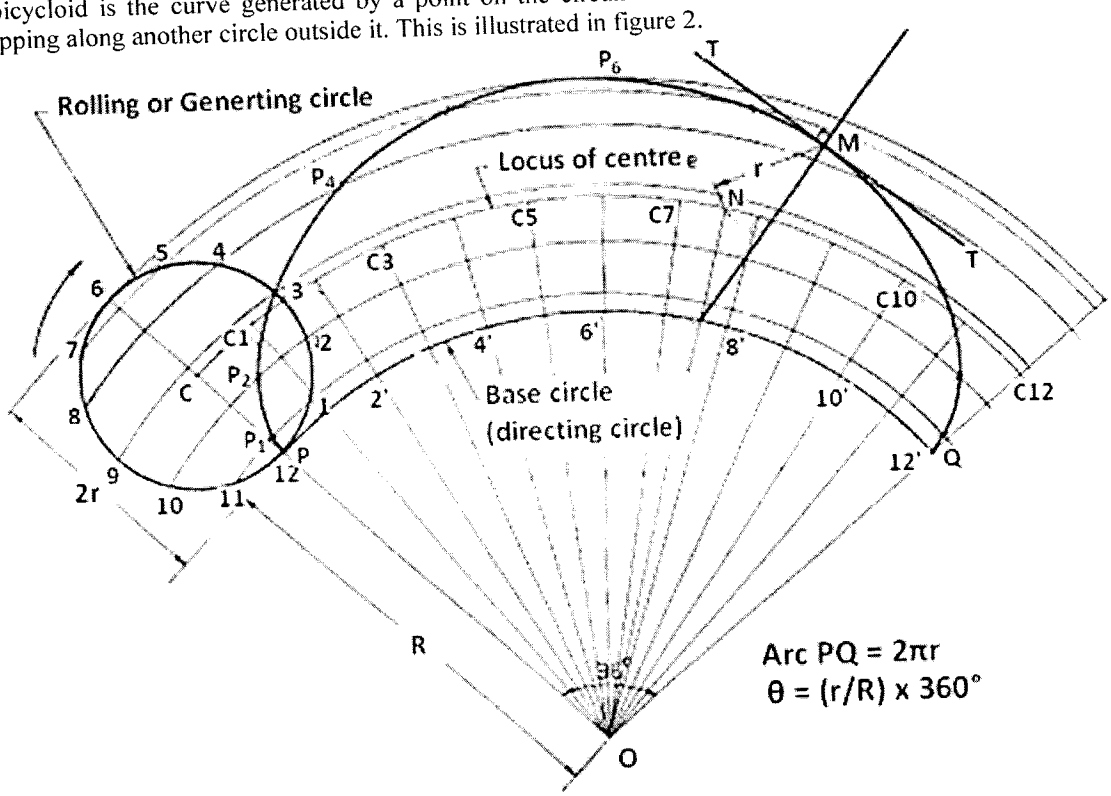
The point on the Generating circle which generates the curve is called the "Generating point"



- Step1: Draw the generating circle and the base line equal to the circumference of the generating circle
- Step 2 : Divide the circle and the base line in to equal number of parts. also erect the perpendicular lines from the division of the line
- Step 3: with your compass set to the radius of the circle and centers as C1,C2,C3,.... etc cut the arcs on the lines from circle through 1,2,3, .. etc.
- Step 4: locate the points which are produced by cutting arcs and joining by a smooth curve.
- By joining these new points you will have created the locus of the point P for the circle as it rotates along the straight line with out slipping

Epicycloids

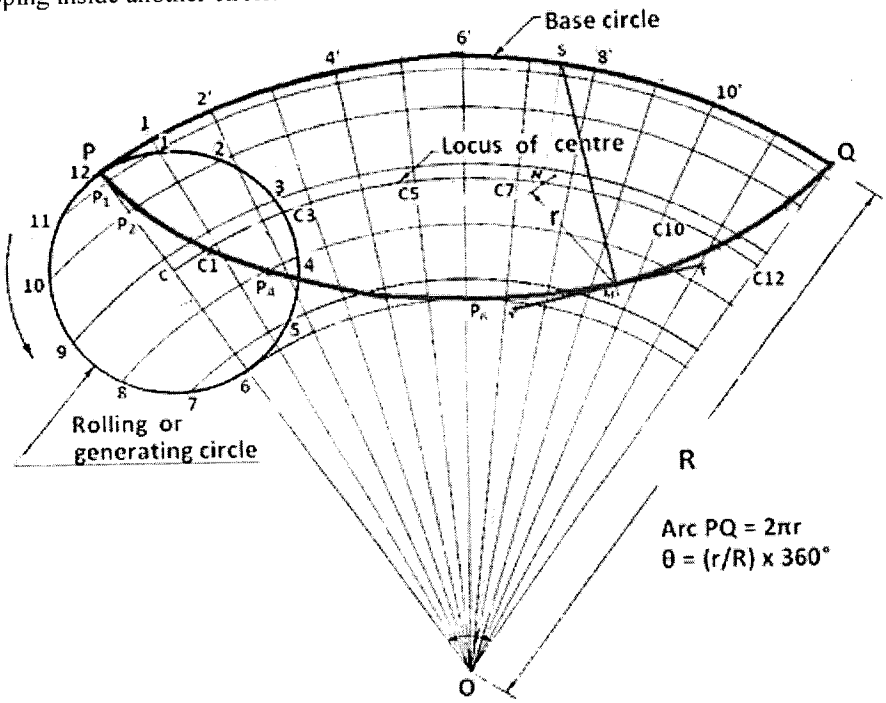
Epicycloid is the curve generated by a point on the circumference of a circle which rolls without slipping along another circle outside it. This is illustrated in figure 2.



With O as centre and radius OP (base circle radius), draw an arc PQ.
The included angle θ = (r/R) x 360°. With O as centre and OC as radius, draw an arc to represent locus of centre.
Divide arc PQ in to 12 equal parts and name them as 1', 2', …., 12'.
Join O1', O2', … and produce them to cut the locus of centres at C1, C2, ….C12.
Taking C1 as centre, and radius equal to *r*, draw an arc cutting the arc through 1 at P1.
Taking C2 as centre and with the same radius, draw an arc cutting the arc through 2 at P2Similarly obtain points P3, P3, …., P12.
Draw a smooth curve passing through P1, P2….. , P12, which is the required epiclycloid.

Hypocycloid

Hypocycloid is the curve generated by a point on the circumference of a circle which rolls without slipping inside another circle.



With O as centre and radius OP (base circle radius), draw an arc PQ.
The included angle θ = (r/R) x 360°. With O as centre and OC as radius, draw an arc to represent locus of centre.
Divide arc PQ in to 12 equal parts and name them as 1', 2', …., 12'.
Join O1', O2', …, O12' so as to cut the locus of centres at C1, C2, ….C12.
Taking C1 as centre, and radius equal to *r*, draw an arc cutting the arc through 1 at P1.
Taking C2 as centre and with the same radius, draw an arc cutting the arc through 2 at P2.
Similarly obtain points P3, P3, …., P12.
Draw a smooth curve passing through P1, P2….. , P12, which is the required hypocycloid.

Scales

Scales:

There is a wide variation in sizes for engineering objects. Some are very large (eg. Aero planes, rockets, etc) Some are vey small (wrist watch, MEMs components)
There is a need to reduce or enlarge while drawing the objects on paper. Some objects can be drawn to their actual size. The proportion by which the drawing of aan object is enlarged or reduced is called the scale of the drawing.
Definition
A scale is defined as the ratio of the linear dimensions of the object as represented in a drawing to the actual dimensions of the same.

- Drawings drawn with the same size as the objects are called full sized drawing.
- It is not convenient, always, to draw drawings of the object to its actual size. e.g. Buildings,
- Heavy machines, Bridges, Watches, Electronic devices etc.
- Hence scales are used to prepare drawing at

  - Full size
  - Reduced size
  - Enlarged size

BIS Recommended Scales are shown in table 1.
Table 1. The common scales recommended.

Reducing scales 1:Y (Y>1)	1:2 1:20 1:200 1:2000	1:5 1:50 1:500 1:5000	1:10 1:100 1:1000 1:10000
Enlarging scales X:1 (X>1)	50:1 5:1	20:1 2:1	10:1
Full size scales			1:1

Intermediate scales can be used in exceptional cases where recommended scales can not be applied for functional reasons.

Types of Scale :-

Engineers Scale : The relation between the dimension on the drawing and the actual dimension of the object is mentioned numerically (like 10 mm = 15 m).

Graphical Scale:_ Scale is drawn on the drawing itself. This takes care of the shrinkage of the engineer's scale when the drawing becomes old.
Types of Graphical Scale :-

- Plain Scale
- Diagonal Scale

- Vernier Scale
- Comparative scale
- Scale of chords

Representative fraction (R.F.) :-

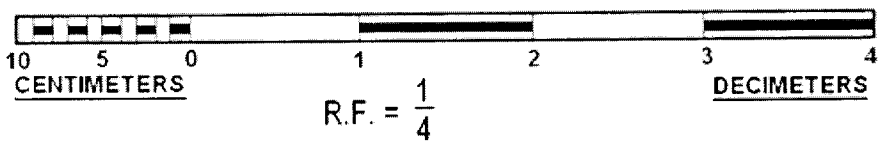
$$R.F. = \frac{\text{Length of an object on the drawing}}{\text{Actual Length of the object}}$$

When a 1 cm long line in a drawing represents 1 meter length of the object

$$RF = \frac{1cm}{1m} = \frac{1cm}{1x\,100cm} = \frac{1}{100}$$

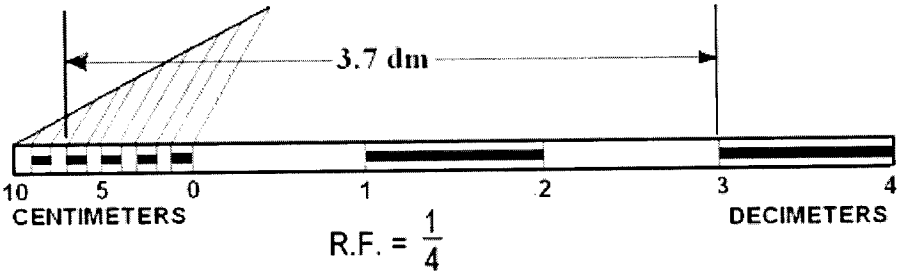
Length of scale = RF x Maximum distance to be represented
Plain scale :-

- A plain scale is used to indicate the distance in a unit and its nest subdivision.
- A plain scale consists of a line divided into suitable number of equal units. The first unit is subdivided into smaller parts.
- The zero should be placed at the end of the 1st main unit.
- From the zero mark, the units should be numbered to the right and the sub-divisions to the left.
- The units and the subdivisions should be labeled clearly.
- The R.F. should be mentioned below the scale.



Construct a plain scale of RF = 1:4, to show centimeters and long enough to measure up to 5 decimeters.

- R.F. = ¼
- Length of the scale = R.F. × max. length = ¼ × 5 dm = 12.5 cm.
- Draw a line 12.5 cm long and divide it in to 5 equal divisions, each representing 1 dm.
- Mark 0 at the end of the first division and 1, 2, 3 and 4 at the end of each subsequent division to its right.
- Divide the first division into 10 equal sub-divisions, each representing 1 cm.
- Mark cm to the left of 0 as shown.
- Draw the scale as a rectangle of small width (about 3 mm) instead of only a line.
- Draw the division lines showing decimeters throughout the width of the scale.
- Draw thick and dark horizontal lines in the middle of all alternate divisions and sub-divisions.
- Below the scale, print DECIMETERS on the right hand side, CENTIMERTERS on the left hand side, and R.F. in the middle.

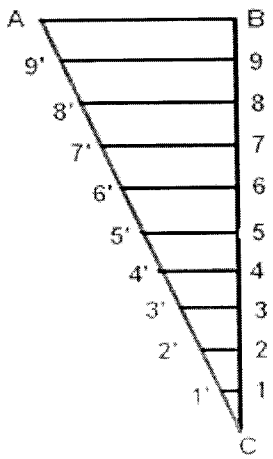


Diagonal Scale :-

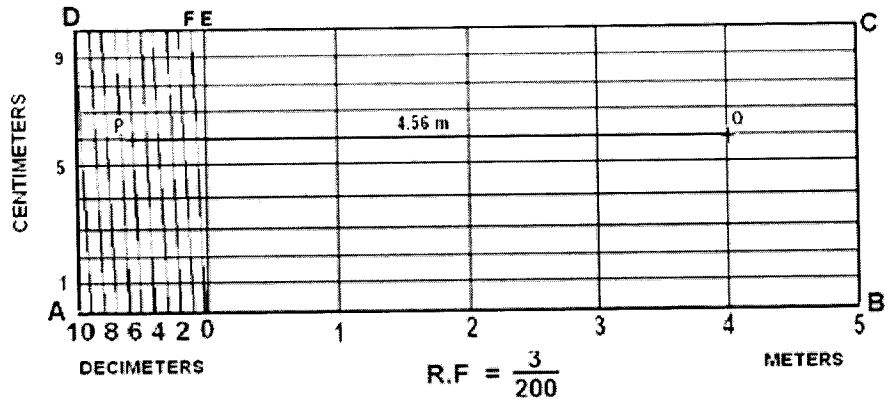
- Through Diagonal scale, measurements can be up to second decimal places (e.g. 4.35).
- Are used to measure distances in a unit and its immediate two subdivisions; e.g. *dm, cm & mm,* or *yard, foot & inch.*
- Diagonal scale can measure more accurately than the plain scale.

Diagonal scale.....Concept

- At end B of line AB, draw a perpendicular.
- Step-off ten equal divisions of any length along the perpendicular starting from B and ending at C.
- Number the division points 9,8,7,.....1.
- Join A with C.
- Through the points 1, 2, 3, etc., draw lines parallel to AB and cutting AC at 1′, 2′, 3′, etc.
- Since the triangles are similar; 1′1 = 0.1 AB, 2′2 = 0.2AB, ... 9′9 = 0.9AB.
- Gives divisions of a given short line AB in multiples of 1/10 its length, e.g. 0.1AB, 0.2AB, 0.3AB, etc.

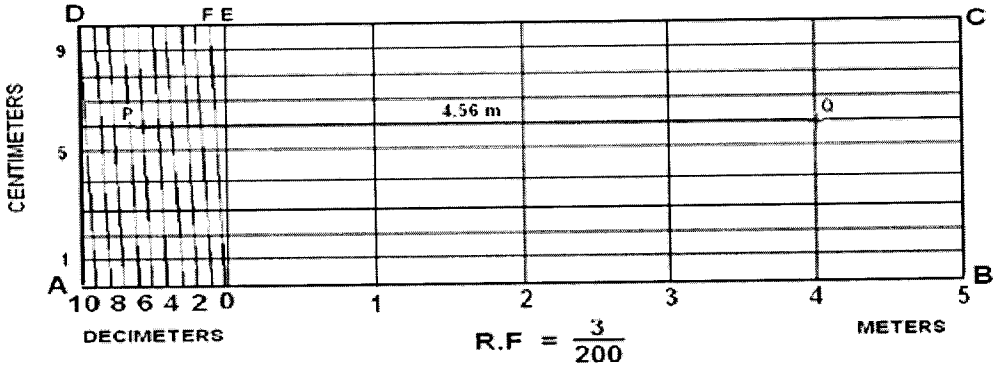


Construct a Diagonal scale of RF = 3:200 showing meters, decimeters and centimeters. The scale should measure up to 6 meters. Show a distance of 4.56 meters



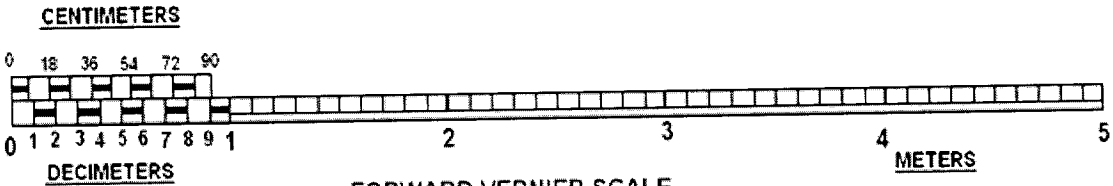
- Length of the scale = (3/200) x 6 m = 9 cm
- Draw a line AB = 9 cm . Divide it in to 6 equal parts.
- Divide the first part A0 into 10 equal divisions.
- At A draw a perpendicular and step-off along it 10 equal divisions, ending at D.

Diagonal Scale

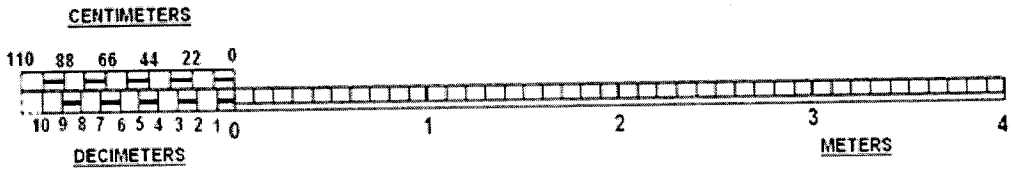


- Complete the rectangle ABCD.
- Draw perpendiculars at meter-divisions i.e. 1, 2, 3, and 4.
- Draw horizontal lines through the division points on AD. Join D with the end of the first division along A0 (i.e. 9).
- Through the remaining points i.e. 8, 7, 6, … draw lines // to D9.
- PQ = 4.56 meters

Vernier Scale



FORWARD VERNIER SCALE



BACKWARD VERNIER SCALE

- Similar to Diagonal scale, Vernier scale is used for measuring up to second decimal.
- A Vernier scale consists of (i) a main scale and (ii) a vernier.
- The main scale is a plain scale fully divided in to minor divisions. A subdivision on the mail scale is called the main scale division (MSD) .
- The graduations on the vernier are derived from those on the primary scale. A subdivision on the verscale is called the vernier scale division (VSD).

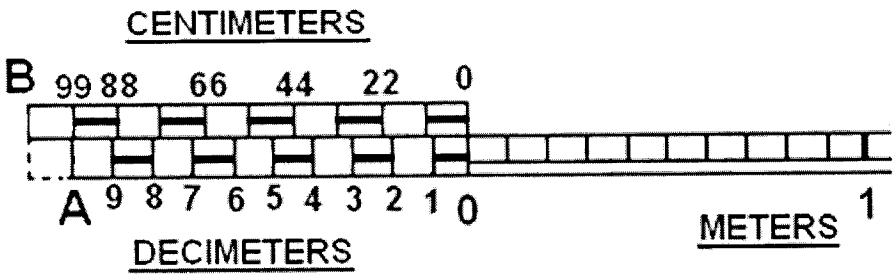
Least Count (LC) is the minimum length that can be measured precisely by a given vernier scale. This can be determined by the following expression:
LC = MSD – VSD (if MSD > VSD)
LC = VSD – MSD (if VSD > MSD)
The LC is mentioned as a fraction of the MSD.
If the MSD of a scale represents 1 mm and LC is 0.1 mm,
LC = 0.1 mm = (1/10) MSD

1. Assume MSD > VSD
LC = MSD –VSD
1/10 MSD = MSD –VSD
i.e., VSD = MSD – 1/10 MSD
10 VSD = 9 MSD
i.e., Length of VSD = 9 MSD.

This length must be divided in to 10 equal parts so that LC = 0.1 mm

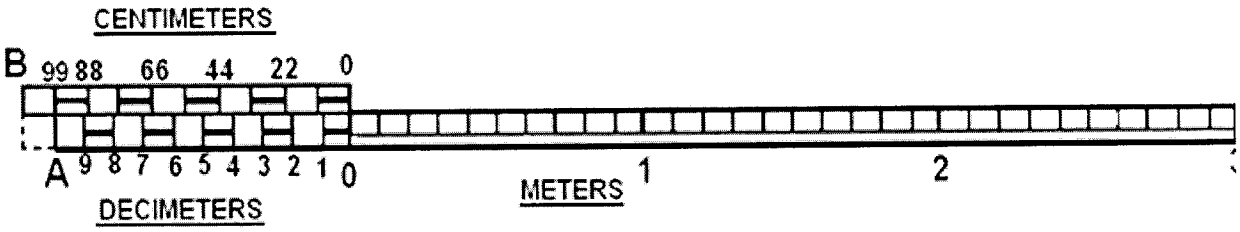
1. Assume VSD > MSD
LC = VSD – MSD
1/10 MSD = VSD – MSD
i.e., VSD = 1/10 MSD + MSD
10 VSD = 11 MSD
This length is to be divided in to 20 equal parts so that LC = 0.1 mm

Backward Vernier scale



- Length A0 represents 10 cm and is divided in to 10 equal parts each representing 1 cm.
- B0 = 11 (i.e. 10+1) such equal parts = 11 cm.
- Divide B0 into 10 equal divisions. Each division of B0 will be equal to 11/10 = 1.1 cm or 11 mm.
- Difference between 1 part of *A0* and one part of *B0* = 1.1 cm -1.0 cm = 0.1cm or 1 mm.

Question: Draw a Vernier scale of R.F. = 1/25 to read up to 4 meters. On it show lengths 2.39 m and 0.91 m

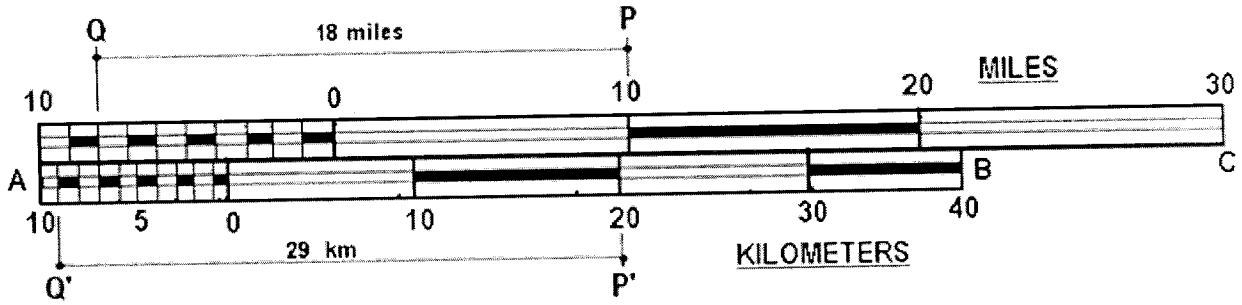


- Length of Scale = (1/25) × (4 × 100) = 16 cm
- Draw a 16 cm long line and divide it into 4 equal parts. Each part is 1 meter. Divide each of these parts in to 10 equal parts to show decimeter (10 cm).
- Take 11 parts of dm length and divide it in to 10 equal parts. Each of these parts will show a length of 1.1 dm or 11 cm.
- To measure 2.39 m, place one leg of the divider at *A* on 99 cm mark and other leg at *B* on 1.4 mark. (0.99 + 1.4 = 2.39).
- To measure 0.91 m, place the divider at *C* and *D* (0.8 +0.11 = 0.91).

Comparative Scales

- Comparative Scale consists of two scales of the same RF, but graduated to read different unit,constructed separately or one above the other.
- Used to compare distances expressed in different systems of unit e.g. kilometers and miles,
- centimeters and inches.The two scales may be plain scales or diagonal scales or Vernier scales.

1 Mile = 8 fur. = 1760 yd = 5280 ft
Construct a plain comparative Scales of RF = 1/624000 to read up to 50 kms and 40 miles. On these show the kilometer equivalent to 18 miles



$$RF = \frac{1}{625000}$$

Kilometer scale

LOS = (1/625000) x 50 x 1000 x 100 = 8 cm

Mile Scale

LOS = (1/625000) x 40 x 1760 x 3 x 12 = 4 in

Draw a 4 in. line AC and construct a plain scale to represent mile and 8cm line AB and construct the kilometer scale below the mile scale.
On the mile scale, determine the distance equal to 18 miles (PQ)
Mark P'Q' = PQ on the kilometer scale such that P' will coincide with the appropriate main division. Find the length represented by P'Q'.
P'Q' = 29 km. (1Mile = 1.60934 km)

Scale of chords
Scale of chords is used to measure angles when a protractor is not available, by comparing the angles subtended by chords of an arc at the centre of the arc.
Draw a line AO of any suitable length.
At O, erect a perpendicular OB such that OB – OA
With O as centre, draw an arc AB
Divide the arc in to 9 equal parts by the following method.

1. On arc AB, mark two arcs with centers A and B and radius – AO. By this the arc AB is divided in to three equal parts.
2. By trial and error method, divide each of these three parts in to three equal subdivisions.

The total length of AB is now divided in to 9 equal parts. Number the divisions as 10, 20, 30, 40 ,etc.
Transfer all the divisions on the arc to th line AO by drawing arcs with A as a centre and radii equal to the chords A-10, 10-20, 20-30, ... AB.
Construct the linear degree scale by drawing the rectangles below AC. Mark the divisions in the rectangle with zero below A and number the divisions subsequently as 10°, 20°, 30°, 40°, ..., 90°

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10. PPT (SOFT / HARD COPIES)

SCALES

DIMENSIONS OF LARGE OBJECTS MUST BE REDUCED TO ACCOMMODATE ON STANDARD SIZE DRAWING SHEET.THIS REDUCTION CREATES A SCALE OF THAT REDUCTION RATIO, WHICH IS GENERALLY A FRACTION.

SUCH A SCALE IS CALLED REDUCING SCALE

AND

THAT RATIO IS CALLED REPRESENTATIVE FACTOR.

SIMILARLY IN CASE OF TINY OBJECTS DIMENSIONS MUST BE INCREASED FOR ABOVE PURPOSE. HENCE THIS SCALE IS CALLED ENLARGING SCALE. HERE THE RATIO CALLED REPRESENTATIVE FACTOR IS MORE THAN UNITY.

FOR FULL SIZE SCALE R.F.=1 OR (1:1) MEANS DRAWING & OBJECT ARE OF SAME SIZE.

Other RFs are described as

1:10, 1:100, 1:1000, 1:1,00,000

USE FOLLOWING FORMULAS FOR THE CALCULATIONS IN THIS TOPIC.

A REPRESENTATIVE FACTOR (R.F.) = $\dfrac{\text{DIMENSION OF DRAWING}}{\text{DIMENSION OF OBJECT}}$

$= \dfrac{\text{LENGTH OF DRAWING}}{\text{ACTUAL LENGTH}}$

$= \sqrt{\dfrac{\text{AREA OF DRAWING}}{\text{ACTUAL AREA}}}$

$= \sqrt[3]{\dfrac{\text{VOLUME AS PER DRWG.}}{\text{ACTUAL VOLUME}}}$

B LENGTH OF SCALE = R.F. X MAX. LENGTH TO BE MEASURED.

BE FRIENDLY WITH THESE UNITS.

1 KILOMETRE = 10 HECTOMETRES

1 HECTOMETRE = 10 DECAMETRES

1 DECAMETRE = 10 METRES

1 METRE = 10 DECIMETRES

1 DECIMETRE = 10 CENTIMETRES

1 CENTIMETRE = 10 MILIMETRES

TYPES OF SCALES:

1. PLAIN SCALES (FOR DIMENSIONS UP TO SINGLE DECIMAL)
2. DIAGONAL SCALES (FOR DIMENSIONS UP TO TWO DECIMALS)
3. VERNIER SCALES (FOR DIMENSIONS UP TO TWO DECIMALS)
4. COMPARATIVE SCALES (FOR COMPARING TWO DIFFERENT UNITS)
5. SCALE OF CORDS (FOR MEASURING/CONSTRUCTING ANGLES)

PLAIN SCALE:- This type of scale represents two units or a unit and it's sub-division.

PROBLEM NO.1:- Draw a scale 1 cm = 1m to read decimeters, to measure maximum distance of 6 m. Show on it a distance of 4 m and 6 dm.

CONSTRUCTION:-

a) Calculate R.F.= $\frac{\text{DIMENSION OF DRAWING}}{\text{DIMENSION OF OBJECT}}$

R.F.= 1cm/ 1m = 1/100

Length of scale = R.F. X max. distance

= 1/100 X 600 cm

= 6 cms

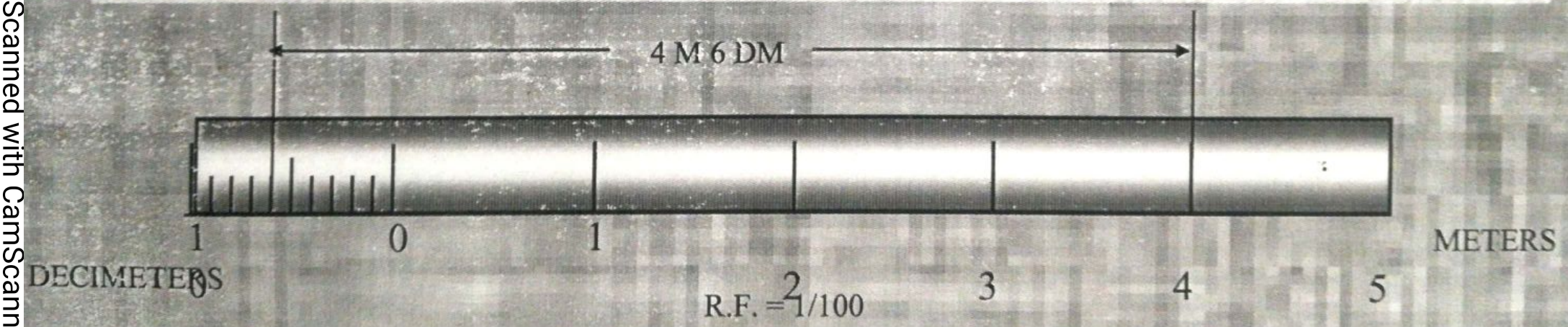
b) Draw a line 6 cm long and divide it in 6 equal parts. Each part will represent larger division unit.

c) Sub divide the first part which will represent second unit or fraction of first unit.

d) Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left-hand side of Zero. Take height of scale 5 to 10 mm for getting a look of scale.

e) After construction of scale mention it's RF and name of scale as shown.

f) Show the distance 4 m 6 dm on it as shown.



PLANE SCALE SHOWING METERS AND DECIMETERS.

PROBLEM NO.2:- In a map a 36 km distance is shown by a line 45 cms long. Calculate the R.F. and construct a plain scale to read kilometers and hectometers, for max. 12 km. Show a distance of 8.3 km on it.

PLAIN SCALE

CONSTRUCTION:-

a) Calculate R.F.

R.F.= 45 cm/ 36 km = 45/ 36 . 1000 . 100 = 1/ 80,000

Length of scale = R.F. $\times$ max. distance

= 1/ 80000 $\times$ 12 km

= 15 cm

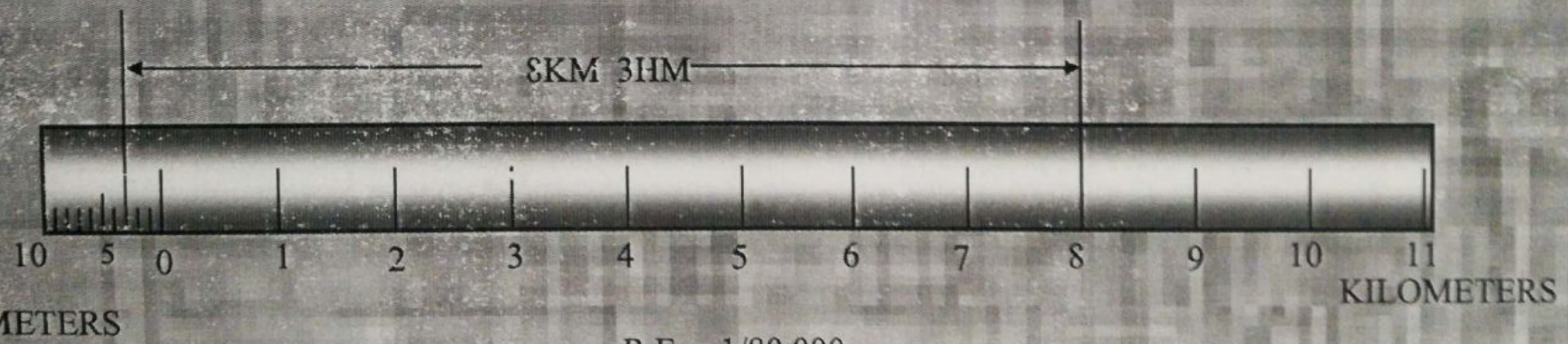
b) Draw a line 15 cm long and divide it in 12 equal parts. Each part will represent larger division unit.

c) Sub divide the first part which will represent second unit or fraction of first unit.

d) Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left-hand side of Zero. Take height of scale 5 to 10 mm for getting a look of scale.

e) After construction of scale mention it's RF and name of scale as shown.

f) Show the distance 8.3 km on it as shown.



R.F. = 1/80,000

PLANE SCALE SHOWING KILOMETERS AND HECTOMETERS

PROBLEM NO.3:- The distance between two stations is 210 km. A passenger train covers this distance in 7 hours. Construct a plain scale to measure time up to a single minute. RF is 1/200,000 Indicate the distance traveled by train in 29 minutes.

PLAIN SCALE

CONSTRUCTION:-

a) 210 km in 7 hours. Means speed of the train is 30 km per hour (60 minutes)

Length of scale = R.F. $\times$ max. distance per hour
= 1/ 2,00,000 $\times$ 30km
= 15 cm

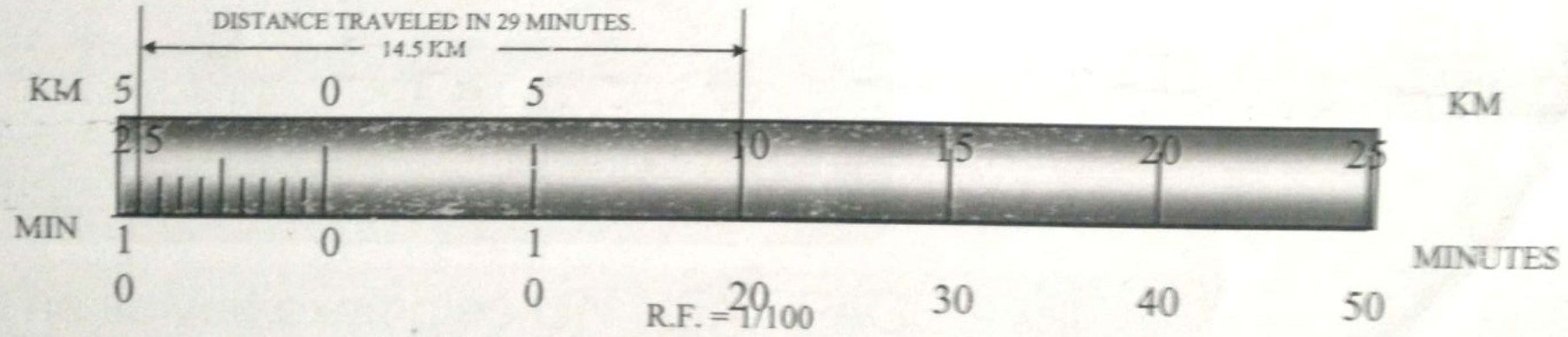
b) 15 cm length will represent 30 km and 1 hour i.e. 60 minutes.
Draw a line 15 cm long and divide it in 6 equal parts. Each part will represent 5 km and 10 minutes.

c) Sub divide the first part in 10 equal parts,which will represent second unit or fraction of first unit.
Each smaller part will represent distance traveled in one minute.

d) Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left-hand side of Zero. Take height of scale 5 to 10 mm for getting a proper look of scale.

e) Show km on upper side and time in minutes on lower side of the scale as shown.
After construction of scale mention it's RF and name of scale as shown.

f) Show the distance traveled in 29 minutes, which is 14.5 km, on it as shown.



PLANE SCALE SHOWING METERS AND DECIMETERS.

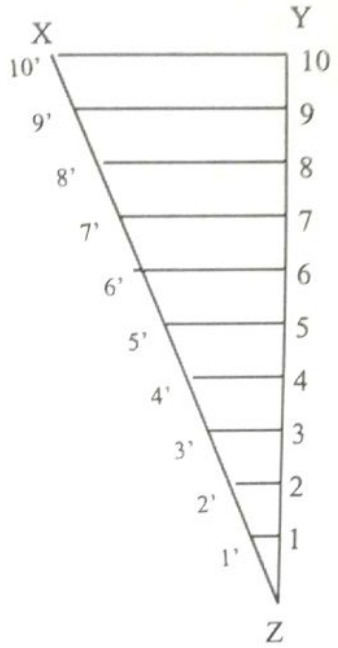
We have seen that the plain scales give only two dimensions, such as a unit and it's subunit or it's fraction.

DIAGONAL SCALE

The diagonal scales give us three successive dimensions that is a unit, a subunit and a subdivision of a subunit.

The principle of construction of a diagonal scale is as follows.
Let the XY in figure be a subunit.
From Y draw a perpendicular YZ to a suitable height.
Join XZ. Divide YZ in to 10 equal parts.
Draw parallel lines to XY from all these divisions and number them as shown.
From geometry we know that similar triangles have their like sides proportional.

Consider two similar triangles XYZ and 7' 7Z,
we have 7Z / YZ = 7'7 / XY (each part being one unit)
Means 7' 7 = 7 / 10. x X Y = 0.7 XY
∴
Similarly
1' – 1 = 0.1 XY
2' – 2 = 0.2 XY
Thus, it is very clear that, the sides of small triangles, which are parallel to divided lines, become progressively shorter in length by 0.1 XY.



The solved examples ON NEXT PAGES will make the principles of diagonal scales clear.

DIAGONAL SCALE

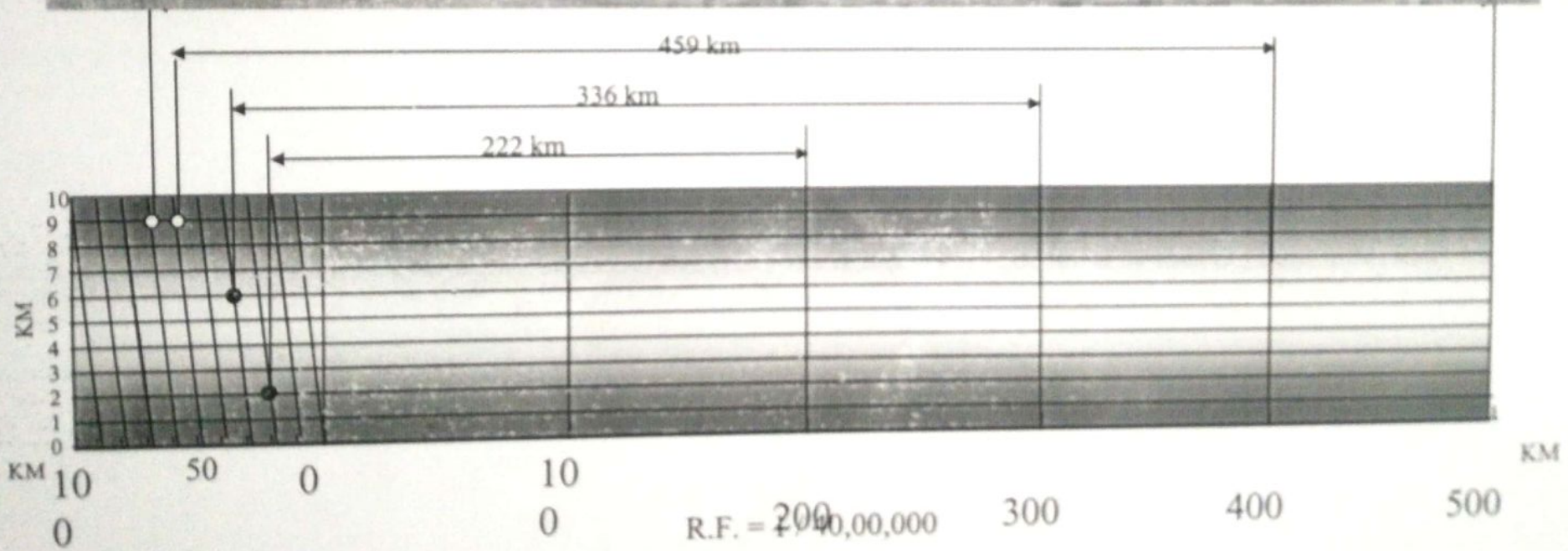
PROBLEM NO. 4 : The distance between Delhi and Agra is 200 km. In a railway map it is represented by a line 5 cm long. Find it's R.F. Draw a diagonal scale to show single km. And maximum 600 km. Indicate on it following distances. 1) 222 km 2) 336 km 3) 459 km 4) 569 km

SOLUTION STEPS:

RF = 5 cm / 200 km = 1 / 40, 00, 000

Length of scale = 1 / 40, 00, 000 X 600 X 10^5 = 15

Draw a line 15 cm long. It will represent 600 km. Divide it in six equal parts. (each will represent 100 km.) Divide first division in ten equal parts. Each will represent 10 km. Draw a line upward from left end and mark 10 parts on it of any distance. Name those parts 0 to 10 as shown. Join 9th sub-division of horizontal scale with 10th division of the vertical divisions. Then draw parallel lines to this line from remaining sub divisions and complete diagonal scale.



DIAGONAL SCALE SHOWING KILOMETERS.

PROBLEM NO.5: A rectangular plot of land measuring 1.28 hectors is represented on a map by a similar rectangle of 8 sq. cm. Calculate RF of the scale. Draw a diagonal scale to read single meter. Show a distance of 438 m on it.

SOLUTION :

1 hector = 10, 000 sq. meters

1.28 hectors = 1.28 X 10, 000 sq. meters

$= 1.28 \times 10^4 \times 10^4$ sq. cm

8 sq. cm area on map represents

$= 1.28 \times 10^4 \times 10^4$ sq. cm on land

1 cm sq. on map represents

$= 1.28 \times 10^4 \times 10^4 / 8$ sq cm on land

1 cm on map represent

$$= \sqrt{1.28 \times 10^4 \times 10^4 / 8} \text{ cm}$$

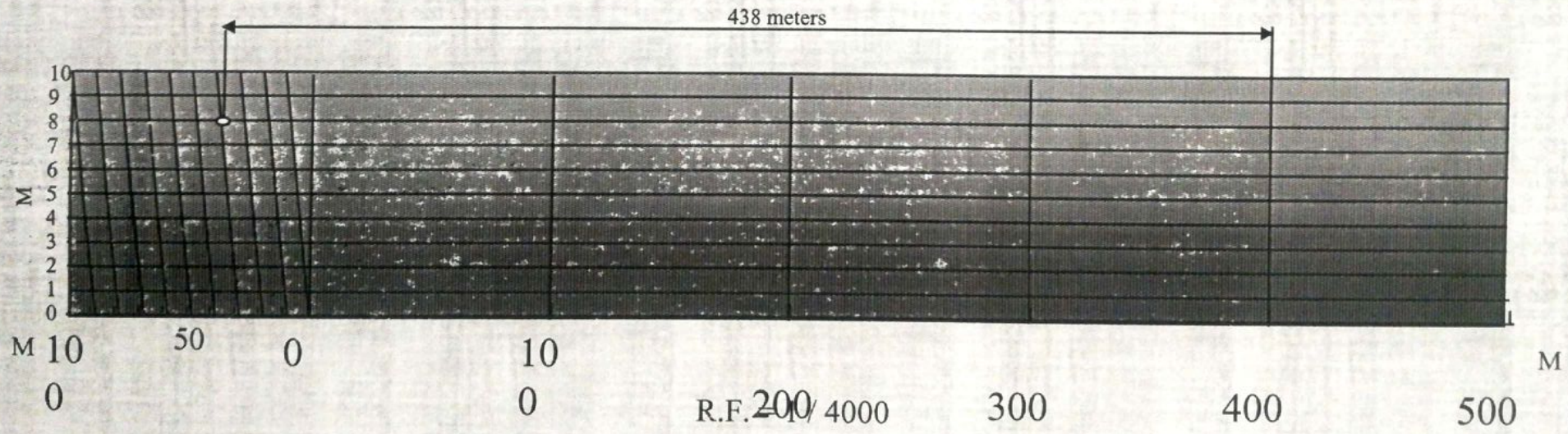
= 4, 000 cm

1 cm on drawing represent 4, 000 cm, Means RF = 1 / 4000

Assuming length of scale 15 cm, it will represent 600 m.

DIAGONAL SCALE

Draw a line 15 cm long.
It will represent 600 m.Divide it in six equal parts.
(each will represent 100 m.)
Divide first division in ten equal parts.Each will represent 10 m.
Draw a line upward from left end and mark 10 parts on it of any distance.
Name those parts 0 to 10 as shown.Join 9th sub-division of horizontal scale with 10th division of the vertical divisions.
Then draw parallel lines to this line from remaining sub divisions and complete diagonal scale.



DIAGONAL SCALE SHOWING METERS.

PROBLEM NO.6: Draw a diagonal scale of R.F. 1 : 2.5, showing centimeters and millimeters and long enough to measure up to 20 centimeters.

DIAGONAL SCALE

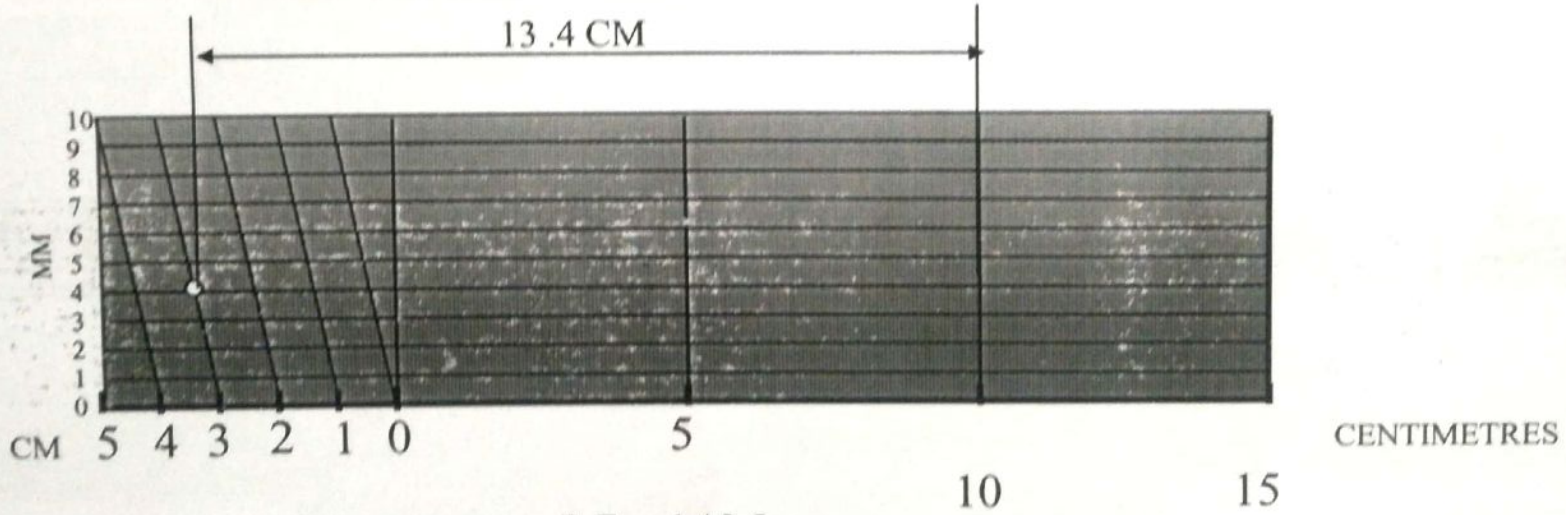
SOLUTION STEPS:

R.F. = 1 / 2.5

Length of scale = 1 / 2.5 X 20 cm.

= 8 cm.

1. Draw a line 8 cm long and divide it in to 4 equal parts. (Each part will represent a length of 5 cm.)
2. Divide the first part into 5 equal divisions. (Each will show 1 cm.)
3. At the left hand end of the line, draw a vertical line and on it step-off 10 equal divisions of any length.
4. Complete the scale as explained in previous problems. Show the distance 13.4 cm on it.



R.F. = 1 / 2.5

DIAGONAL SCALE SHOWING CENTIMETERS.

COMMON DEFINATION OF ELLIPSE, PARABOLA & HYPERBOLA:

These are the loci of points moving in a plane such that the ratio of it's distances from a *fixed point* And a *fixed line* always remains constant.

The Ratio is called ECCENTRICITY. (E)

A) For Ellipse $E<1$

B) For Parabola $E=1$

C) For Hyperbola $E>1$

Refer Problem nos. 6. 9 & 12

SECOND DEFINATION OF AN ELLIPSE:-

It is a locus of a point moving in a plane such that the SUM of it's distances from TWO fixed points always remains constant.

{And this *sum equals* to the length of *major axis*.}

These TWO fixed points are FOCUS 1 & FOCUS 2

Refer Problem no.4

Ellipse by Arcs of Circles Method.

ELLIPSE

BY CONCENTRIC CIRCLE METHOD

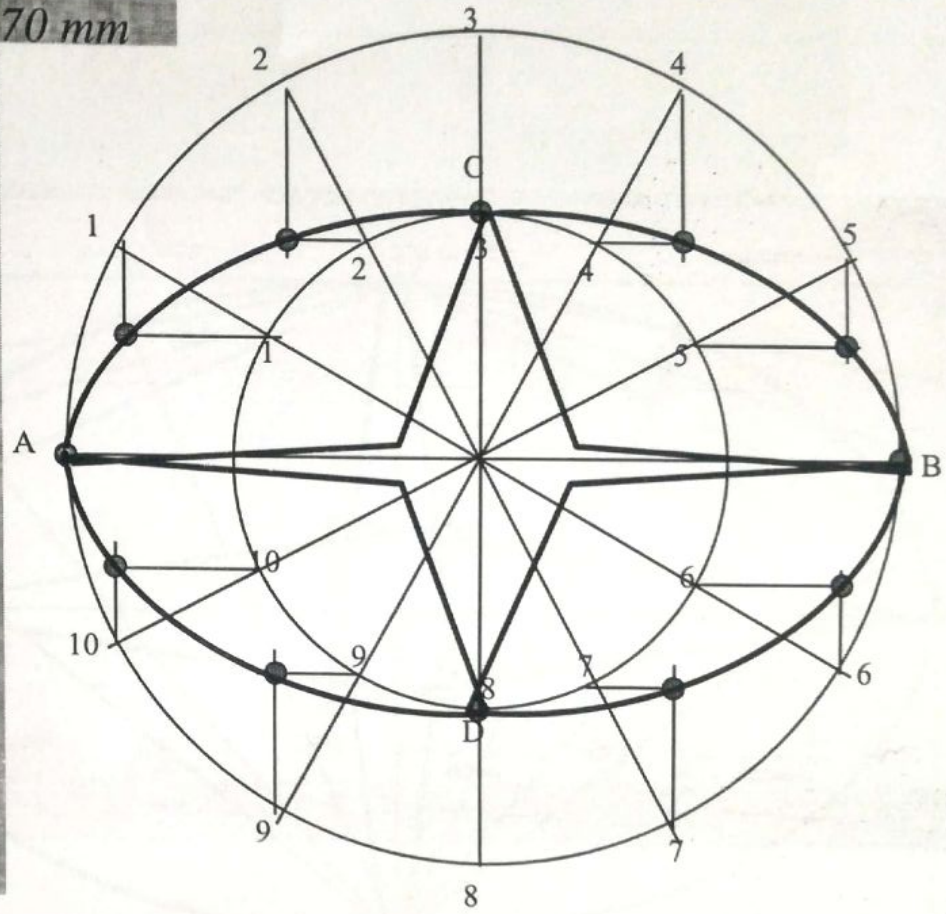
Problem 1 :-

Draw ellipse by concentric circle method

Take major axis 100 mm and minor axis 70 mm long.

Steps:

1. Draw both axes as perpendicular bisectors of each other & name their ends as shown.
2. Taking their intersecting point as a center, draw two concentric circles considering both as respective diameters.
3. Divide both circles in 12 equal parts & name as shown.
4. From all points of outer circle draw vertical lines downwards and upwards respectively.
5. From all points of inner circle draw horizontal lines to intersect those vertical lines.
6. Mark all intersecting points properly as those are the points on ellipse.
7. Join all these points along with the ends of both axes in smooth possible curve. It is required ellipse.



ELLIPSE

BY RECTANGLE METHOD

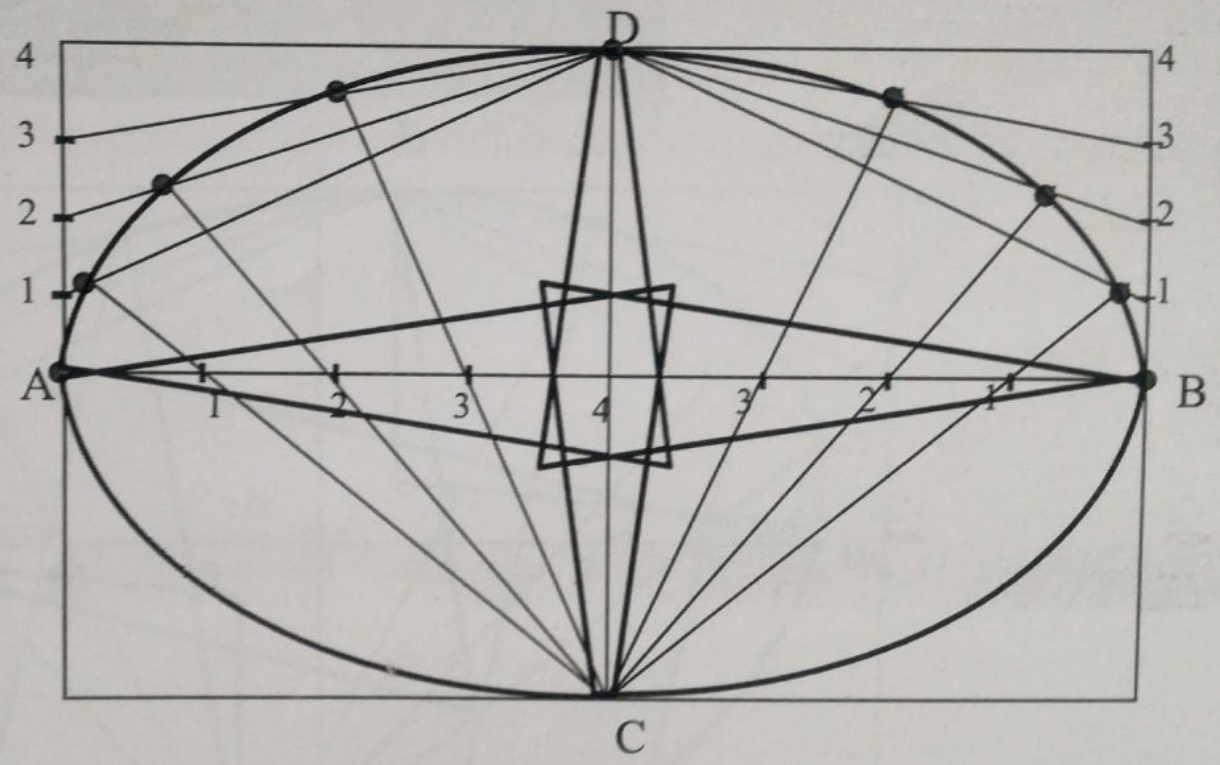
Steps:

1. Draw a rectangle taking major and minor axes as sides.
2. In this rectangle draw both axes as perpendicular bisectors of each other..
3. For construction, select upper left part of rectangle. Divide vertical small side and horizontal long side into same number of equal parts.(here divided in four parts)
4. Name those as shown..
5. Now join all vertical points 1,2,3,4, to the upper end of minor axis. And all horizontal points i.e.1,2,3,4 to the lower end of minor axis.
6. Then extend C-1 line upto D-1 and mark that point. Similarly extend C-2, C-3, C-4 lines up to D-2, D-3, & D-4 lines.
7. Mark all these points properly and join all along with ends A and D in smooth possible curve. Do similar construction in right side part,along with lower half of the rectangle.Join all points in smooth curve.

It is required ellipse.

Problem 2

Draw ellipse by Rectangle *method.*
Take major axis 100 mm and minor axis 70 mm long.



ELLIPSE

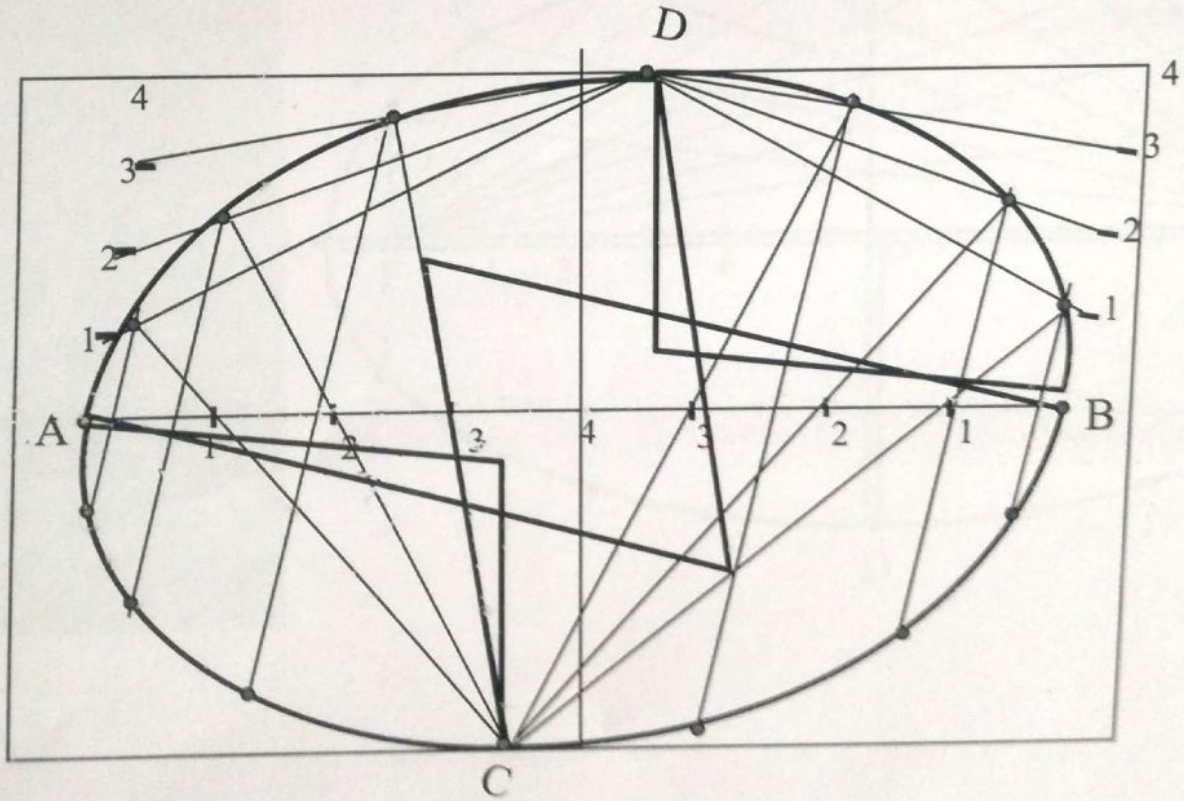
BY OBLONG METHOD

Problem 3:-

Draw ellipse by Oblong method.

Draw a parallelogram of 100 mm and 70 mm long sides with included angle of 75^0. Inscribe

STEPS ARE SIMILAR TO
THE PREVIOUS CASE
(RECTANGLE METHOD)
ONLY IN PLACE OF RECTANGLE,
HERE IS A PARALLELOGRAM.



PROBLEM 4.
MAJOR AXIS AB & MINOR AXIS CD ARE 100 AMD 70MM LONG RESPECTIVELY .DRAW ELLIPSE BY ARCS OF CIRLES METHOD.

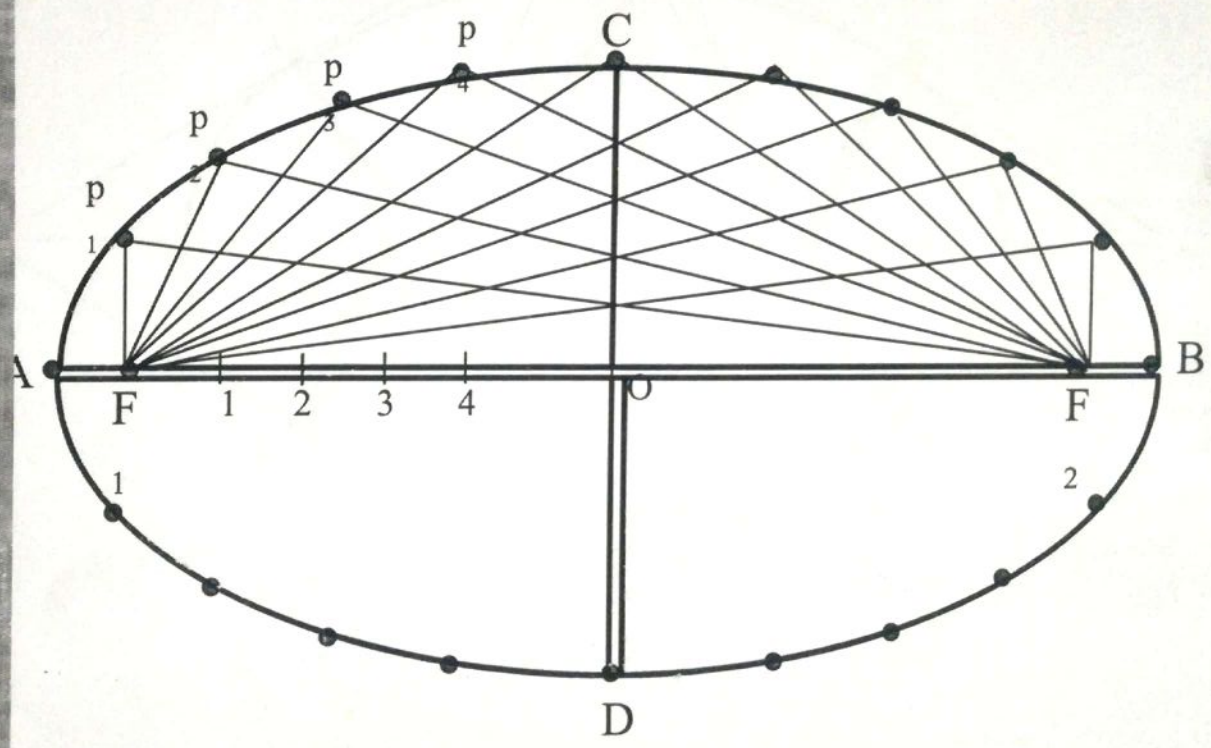
ELLIPSE

BY ARCS OF CIRCLE METHOD

As per the definition Ellipse is locus of point P moving in a plane such that the SUM of it's distances from two fixed points (F_1 & F_2) remains constant and equals to the length of major axis AB.(Note A .1+ B .1=A . 2 + B. 2 = AB)

STEPS:

1. Draw both axes as usual.Name the ends & intersecting point
2. Taking AO distance I.e.half major axis, from C, mark F_1 & F_2 On AB . (focus 1 and 2.)
3. On line F_1- O taking any distance, mark points 1,2,3, & 4
4. Taking F_1 center, with distance A-1 draw an arc above AB and taking F_2 center, with B-1 distance cut this arc. Name the point p_1
5. Repeat this step with same centers but taking now A-2 & B-2 distances for drawing arcs. Name the point p_2
6. Similarly get all other P points. With same steps positions of P can be located below AB.
7. Join all points by smooth curve to get an ellipse/



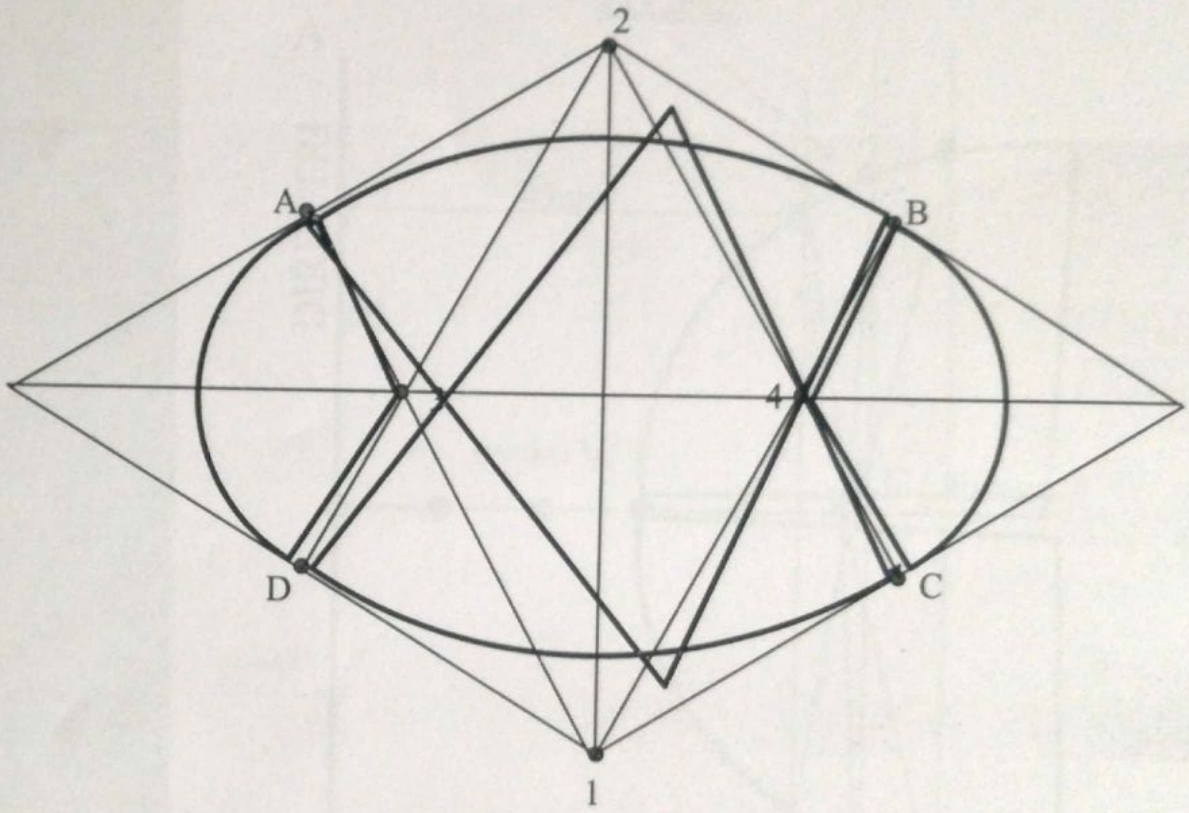
ELLIPSE

BY RHOMBUS METHOD

PROBLEM 5.
DRAW RHOMBUS OF 100 MM & 70 MM LONG DIAGONALS AND INSCRIBE AN ELLIPSE IN IT.

STEPS:

1. Draw rhombus of given dimensions.
2. Mark mid points of all sides & name Those A,B,C,& D
3. Join these points to the ends of smaller diagonals.
4. Mark points 1,2,3,4 as four centers.
5. Taking 1 as center and 1-A radius draw an arc AB.
6. Take 2 as center draw an arc CD.
7. Similarly taking 3 & 4 as centers and 3-D radius draw arcs DA & BC.



ELLIPSE

DIRECTRIX-FOCUS METHOD

PROBLEM 6:- POINT F IS 50 MM FROM A LINE AB.A POINT P IS MOVING IN A PLANE SUCH THAT THE *RATIO* OF IT'S DISTANCES FROM F AND LINE AB REMAINS CONSTANT AND EQUALS TO 2/3 DRAW LOCUS OF POINT P. { ECCENTRICITY = 2/3 }

STEPS:

1 .Draw a vertical line AB and point F 50 mm from it.

2 .Divide 50 mm distance in 5 parts.

3 .Name 2nd part from F as V. It is 20mm and 30mm from F and AB line resp. It is first point giving ratio of it's distances from F and AB 2/3 i.e 20/30

4 Form more points giving same ratio such as 30/45, 40/60, 50/75 etc.

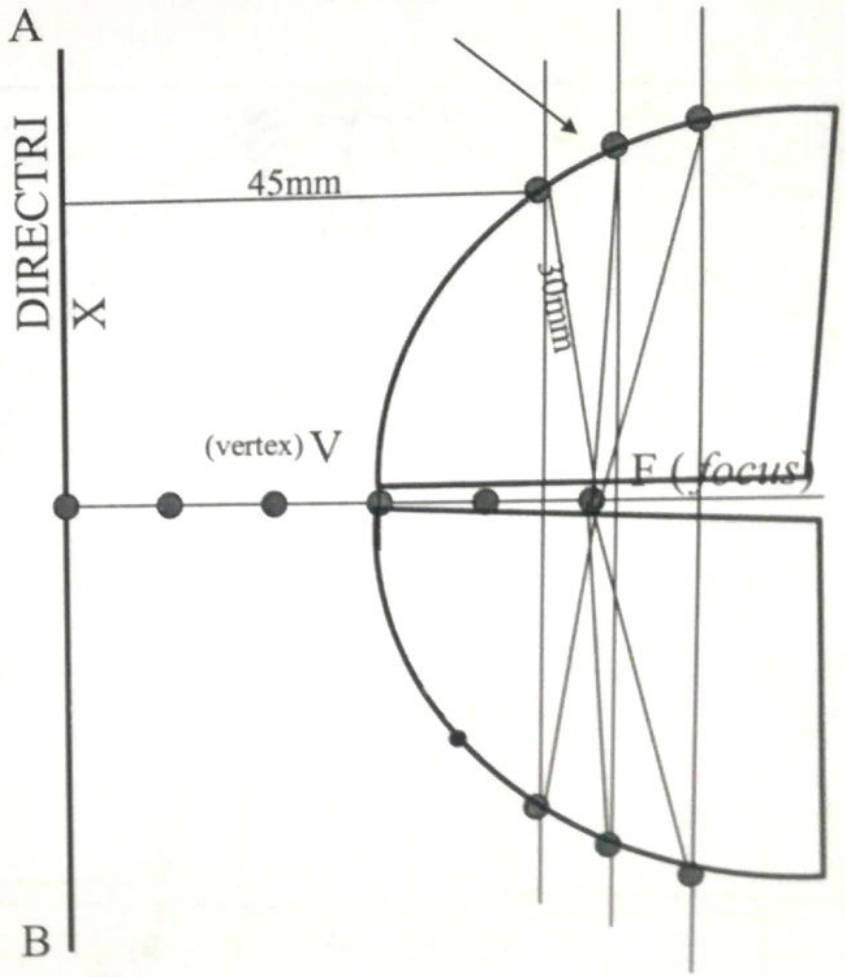
5.Taking 45,60 and 75mm distances from line AB, draw three vertical lines to the right side of it.

6. Now with 30, 40 and 50mm distances in compass cut these lines above and below, with F as center.

7. Join these points through V in smooth curve.

This is required locus of P.It is an ELLIPSE.

ELLIPSE

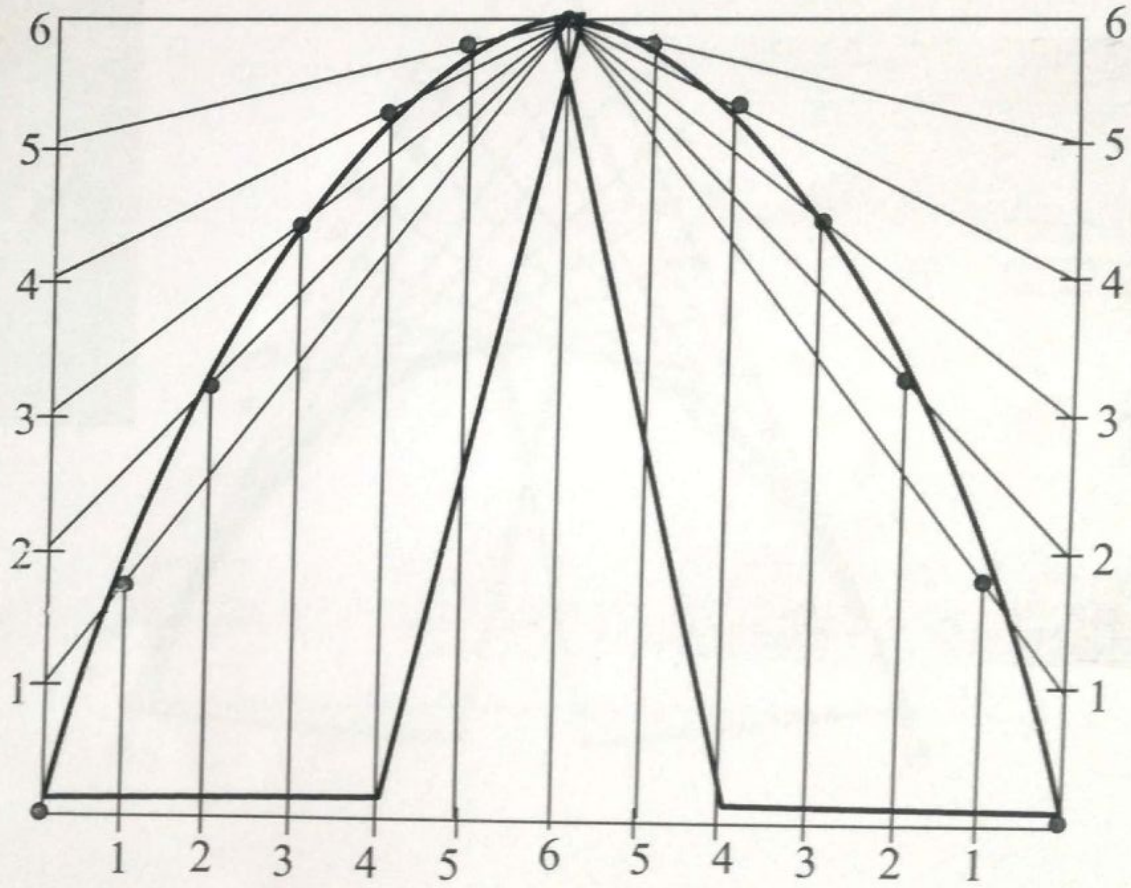


PARABOLA
RECTANGLE METHOD

PROBLEM 7: A BALL THROWN IN AIR ATTAINS 100 M HIEGHT AND COVERS HORIZONTAL DISTANCE 150 M ON GROUND. Draw the path of the ball (projectile)-

STEPS:

1. Draw rectangle of above size and divide it in two equal vertical parts
2. Consider left part for construction. Divide height and length in equal number of parts and name those 1,2,3,4.5& 6
3. Join vertical 1,2,3,4,5 & 6 to the top center of rectangle
4. Similarly draw upward vertical lines from horizontal1,2,3,4,5 And wherever these lines intersect previously drawn inclined lines in sequence Mark those points and further join in smooth possible curve.
5. Repeat the construction on right side rectangle also.Join all in sequence. This locus is Parabola.

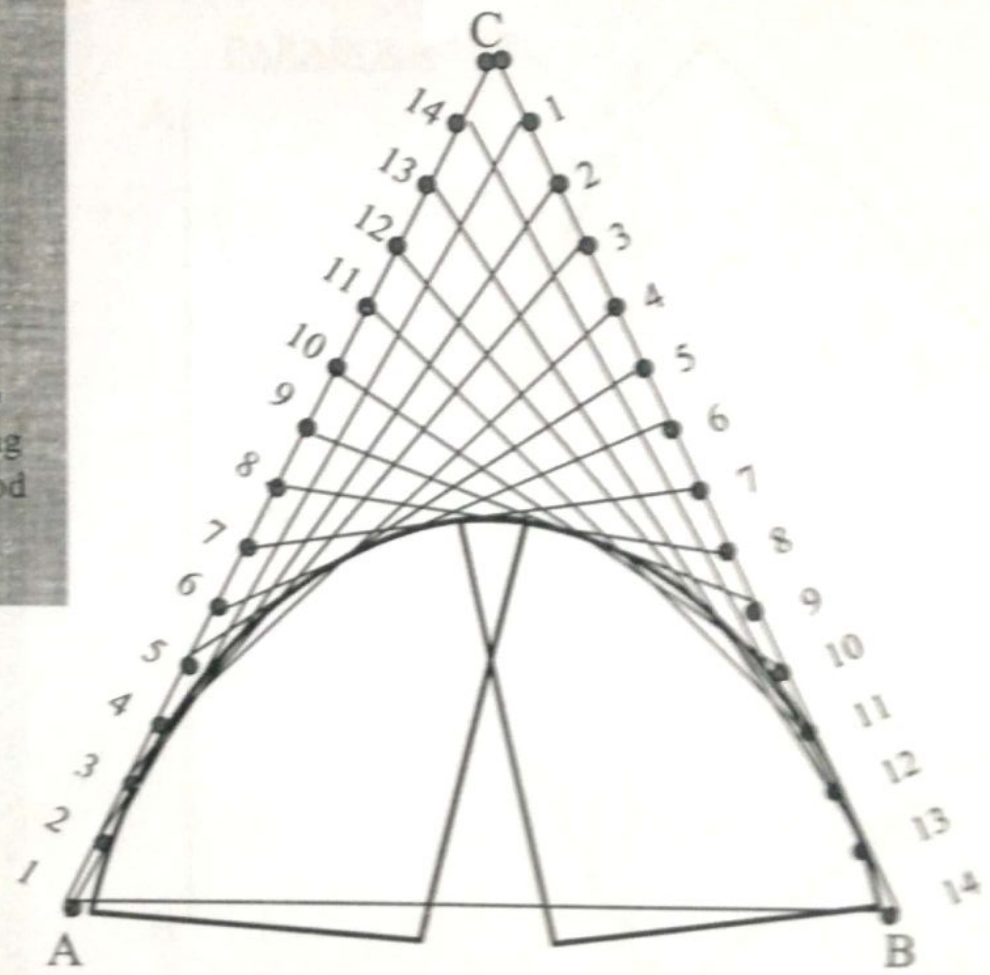


PARABOLA
METHOD OF TANGENTS

Problem no.8: Draw an isosceles triangle of 100 mm long base and 110 mm long altitude. Inscribe a parabola in it by method of tangents.

Solution Steps:

1. Construct triangle as per the given dimensions.
2. Divide it's both sides in to same no of equal parts.
3. Name the parts in ascending and descending manner, as shown.
4. Join 1-1, 2-2, 3-3 and so on.
5. Draw the curve as shown i.e tangent to all these lines. The above all lines being tangents to the curve, it is called method of tangents.



PARABOLA

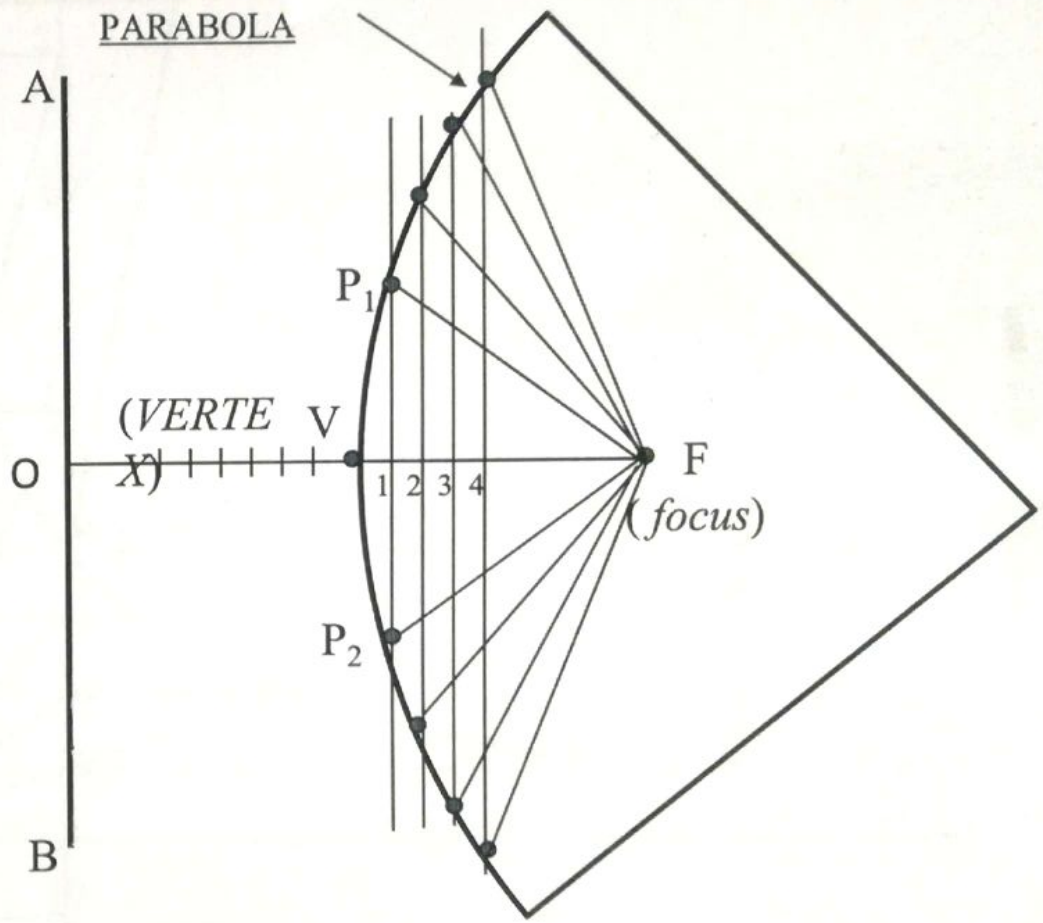
DIRECTRIX-FOCUS METHOD

PROBLEM 9: Point F is 50 mm from a vertical straight line AB. Draw locus of point P, moving in a plane such that it always remains equidistant from point F and line AB.

SOLUTION STEPS:

1. Locate center of line, perpendicular to AB from point F. This will be initial point P and also the vertex.
2. Mark 5 mm distance to its right side, name those points 1,2,3,4 and from those draw lines parallel to AB.
3. Mark 5 mm distance to its left of P and name it 1.
4. Take O-1 distance as radius and F as center draw an arc cutting first parallel line to AB. Name upper point P_1 and lower point P_2. (FP_1=O1)
5. Similarly repeat this process by taking again 5mm to right and left and locate P_3P_4.
6. Join all these points in smooth curve.

It will be the locus of P equidistance from line AB and fixed point F.

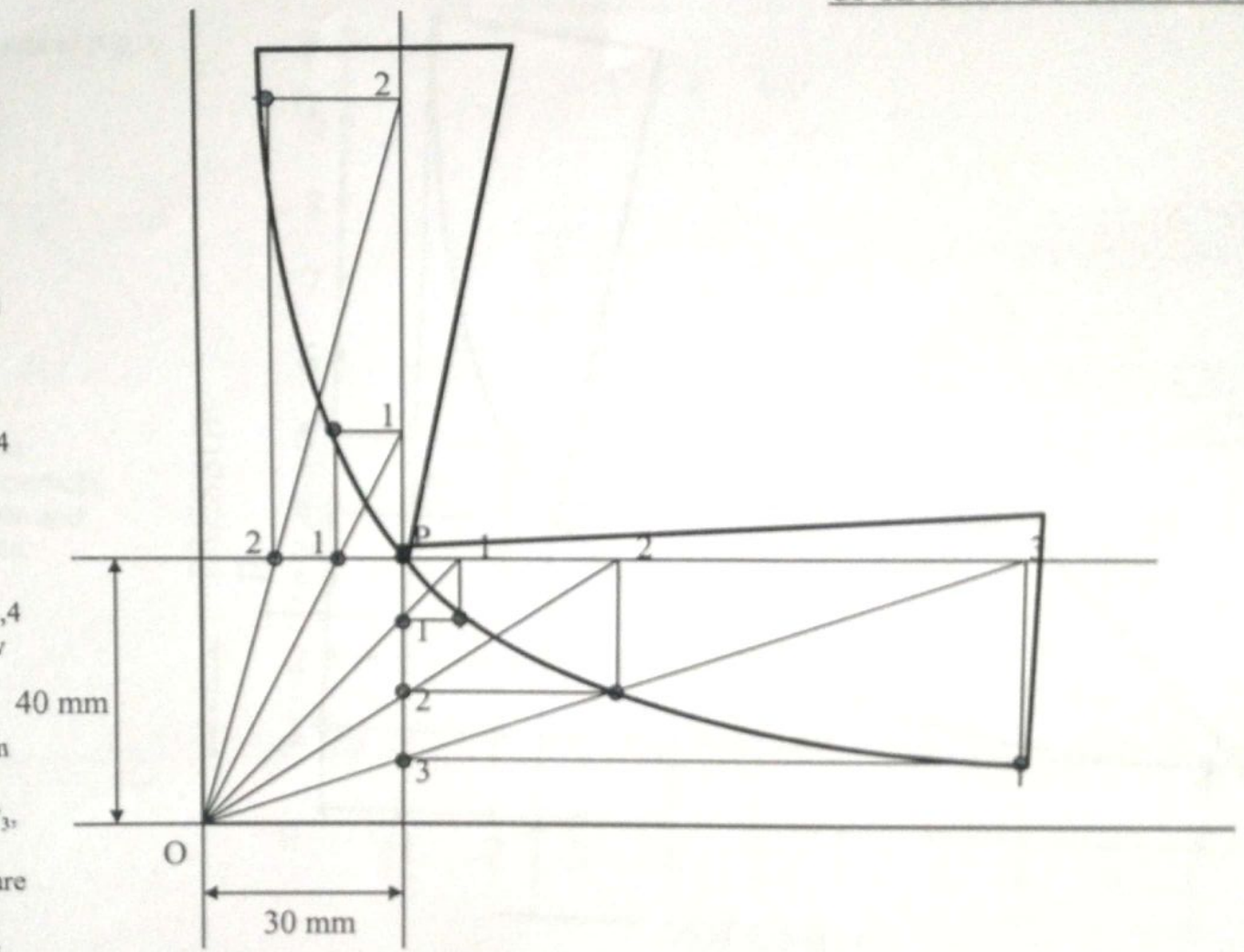


HYPERBOLA
THROUGH A POINT OF KNOWN CO-ORDINATES

Problem No.10: Point P is 40 mm and 30 mm from horizontal and vertical axes respectively.Draw Hyperbola through it.

Solution Steps:

1) Extend horizontal line from P to right side.
2) Extend vertical line from P upward.
3) On horizontal line from P, mark some points taking any distance and name them after P-1, 2,3,4 etc.
4) Join 1-2-3-4 points to pole O. Let them cut part [P-B] also at 1,2,3,4 points.
5) From horizontal 1,2,3,4 draw vertical lines downwards and
6) From vertical 1,2,3,4 points [from P-B] draw horizontal lines.
7) Line from 1 horizontal and line from 1 vertical will meet at P_1.Similarly mark P_2, P_3, P_4 points.
8) Repeat the procedure by marking four points on upward vertical line from P and joining all those to pole O. Name this points P_6, P_7, P_8 etc. and join them by smooth curve.



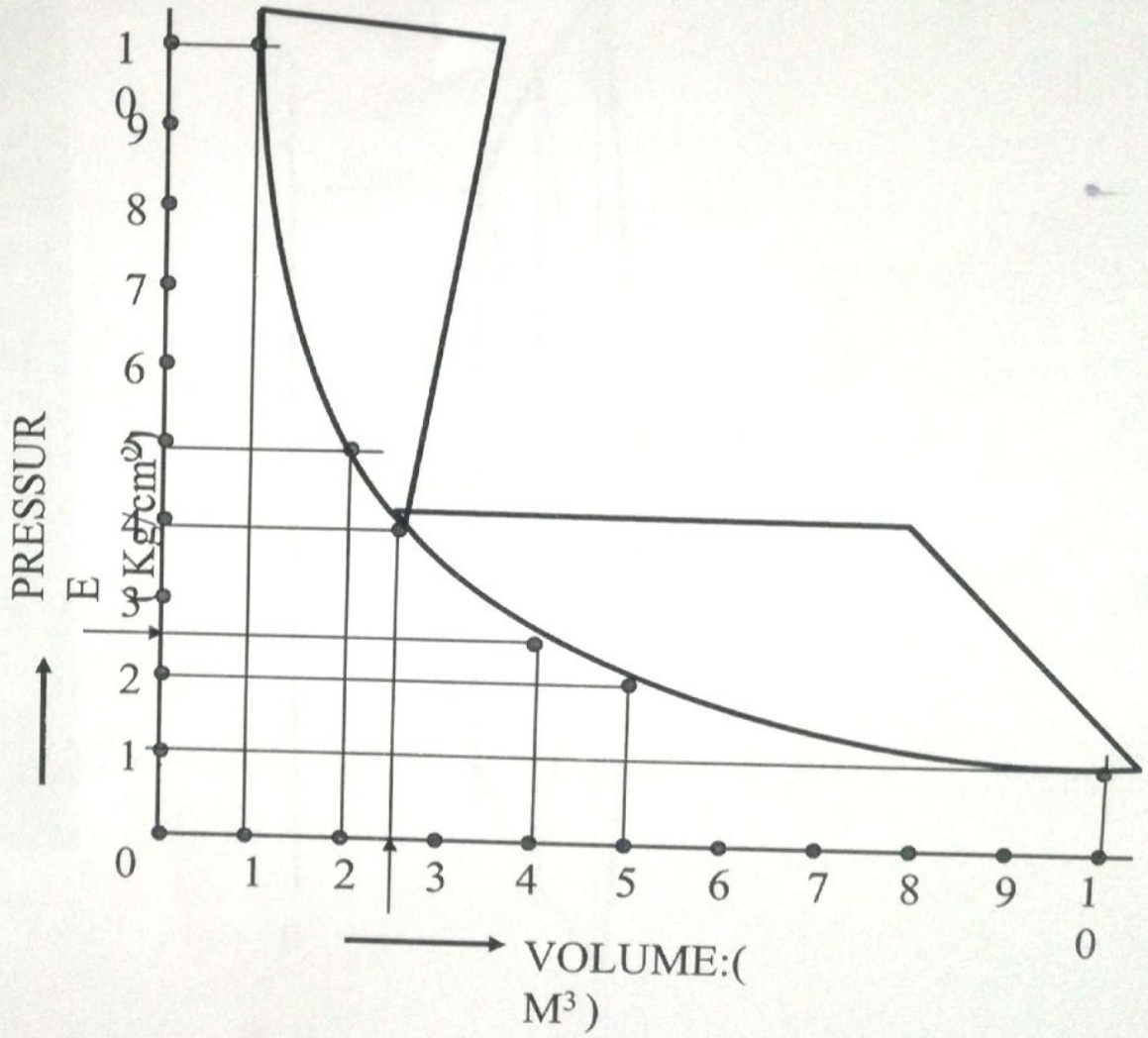
Problem no.11: A sample of gas is expanded in a cylinder from 10 unit pressure to 1 unit pressure.Expansion follows law PV=Constant.If initial volume being 1 unit, draw the curve of expansion. Also Name the curve.

HYPERBOLA
P-V DIAGRAM

Form a table giving few more values of P & V

P × V	= C
10 × 1	= 10
5 × 2	= 10
4 × 2.5	= 10
2.5 × 4	= 10
2 × 5	= 10
1 × 10	= 10

Now draw a Graph of
Pressure against Volume.
It is a PV Diagram and it is Hyperbola.
Take pressure on vertical axis and
Volume on horizontal axis.



HYPERBOLA
DIRECTRIX
FOCUS METHOD

PROBLEM 12:- POINT F IS 50 MM FROM A LINE AB.A POINT P IS MOVING IN A PLANE

STEPS:

1 .Draw a vertical line AB and point F 50 mm from it.

2 .Divide 50 mm distance in 5 parts.

3 .Name 2nd part from F as V. It is 20mm and 30mm from F and AB line resp. It is first point giving ratio of it's distances from F and AB 2/3 i.e 20/30

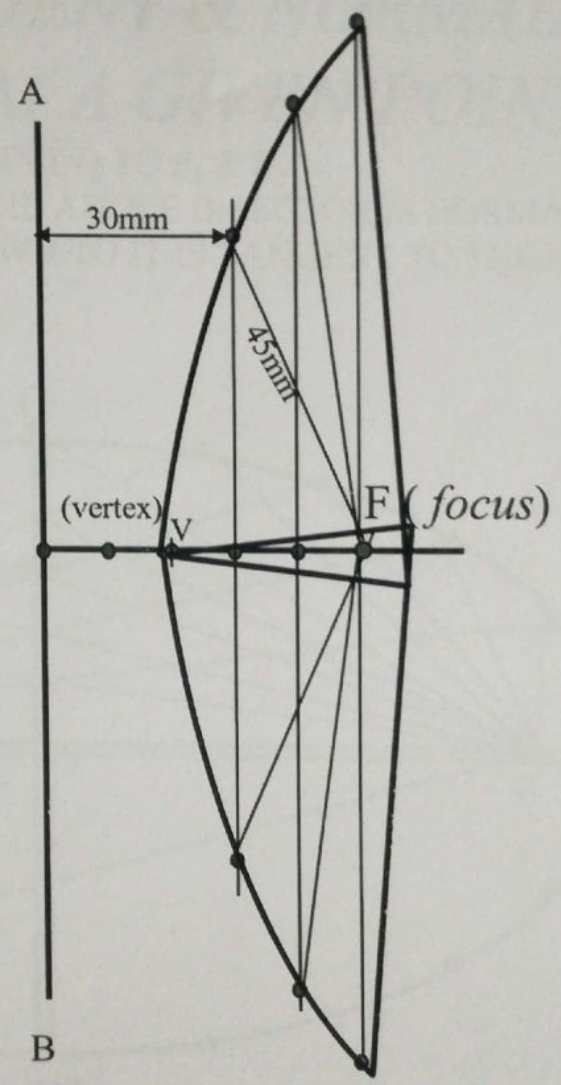
4 Form more points giving same ratio such as 30/45, 40/60, 50/75 etc.

5.Taking 45.60 and 75mm distances from line AB, draw three vertical lines to the right side of it.

6. Now with 30, 40 and 50mm distances in compass cut these lines above and below, with F as center.

7. Join these points through V in smooth curve.

This is required locus of P.It is an ELLIPSE.



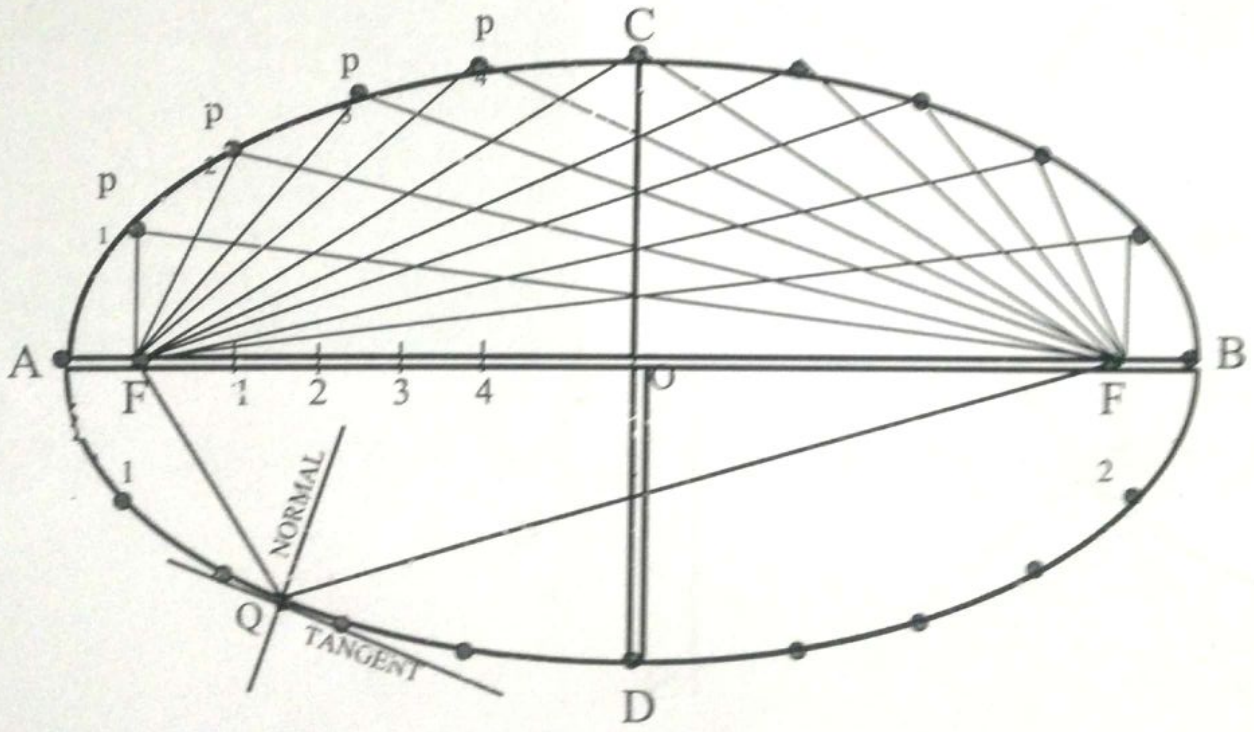
Problem 13:

ELLIPSE

TANGENT & NORMAL

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

1. JOIN POINT Q TO F_1 & F_2
2. BISECT ANGLE $F_1Q\,F_2$ THE ANGLE BISECTOR IS NORMAL
3. A PERPENDICULAR LINE DRAWN TO IT IS TANGENT TO THE CURVE.



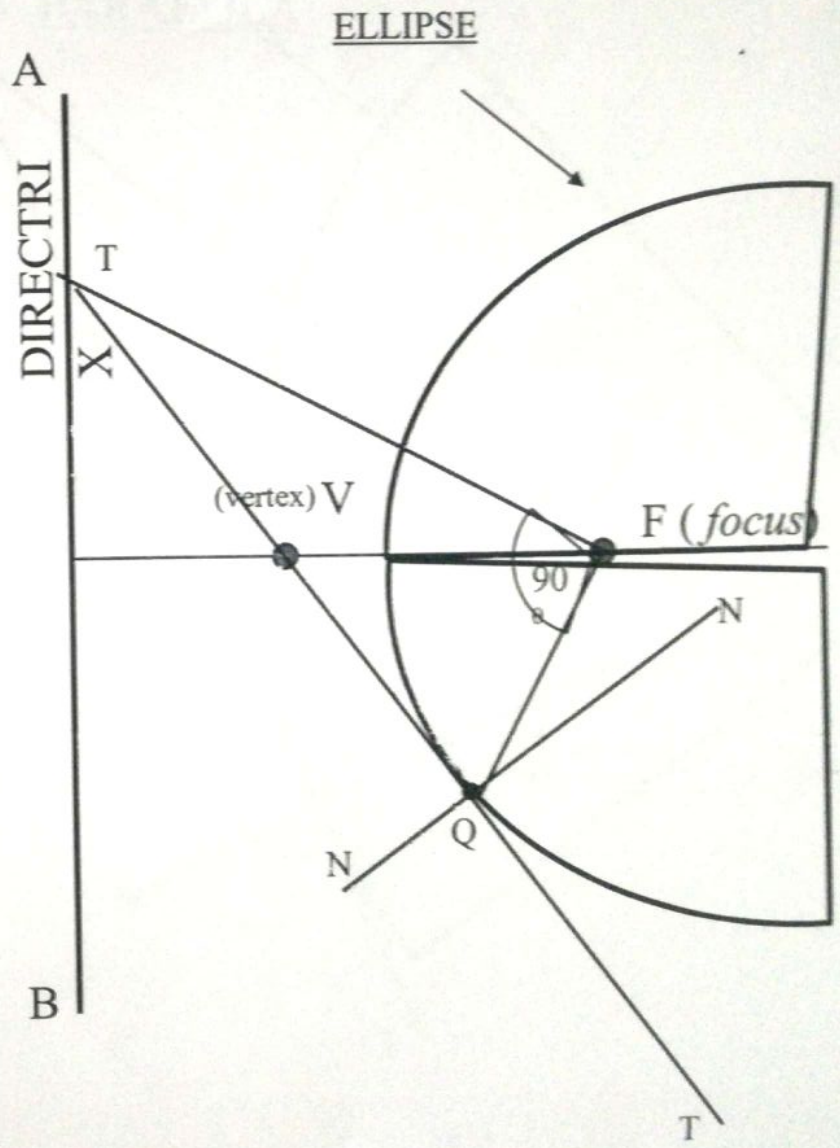
ELLIPSE

TANGENT & NORMAL

Problem 14:

TO DRAW TANGENT & NORMAL
TO THE CURVE
FROM A GIVEN POINT (Q)

1.JOIN POINT Q TO F.
2.CONSTRUCT 900 ANGLE WITH
THIS LINE AT POINT F
3.EXTEND THE LINE TO MEET DIRECTRIX
AT T
4. JOIN THIS POINT TO Q AND EXTEND. THIS IS
TANGENT TO ELLIPSE FROM Q
5.TO THIS TANGENT DRAW PERPENDICULAR
LINE FROM Q. IT IS NORMAL TO CURVE.

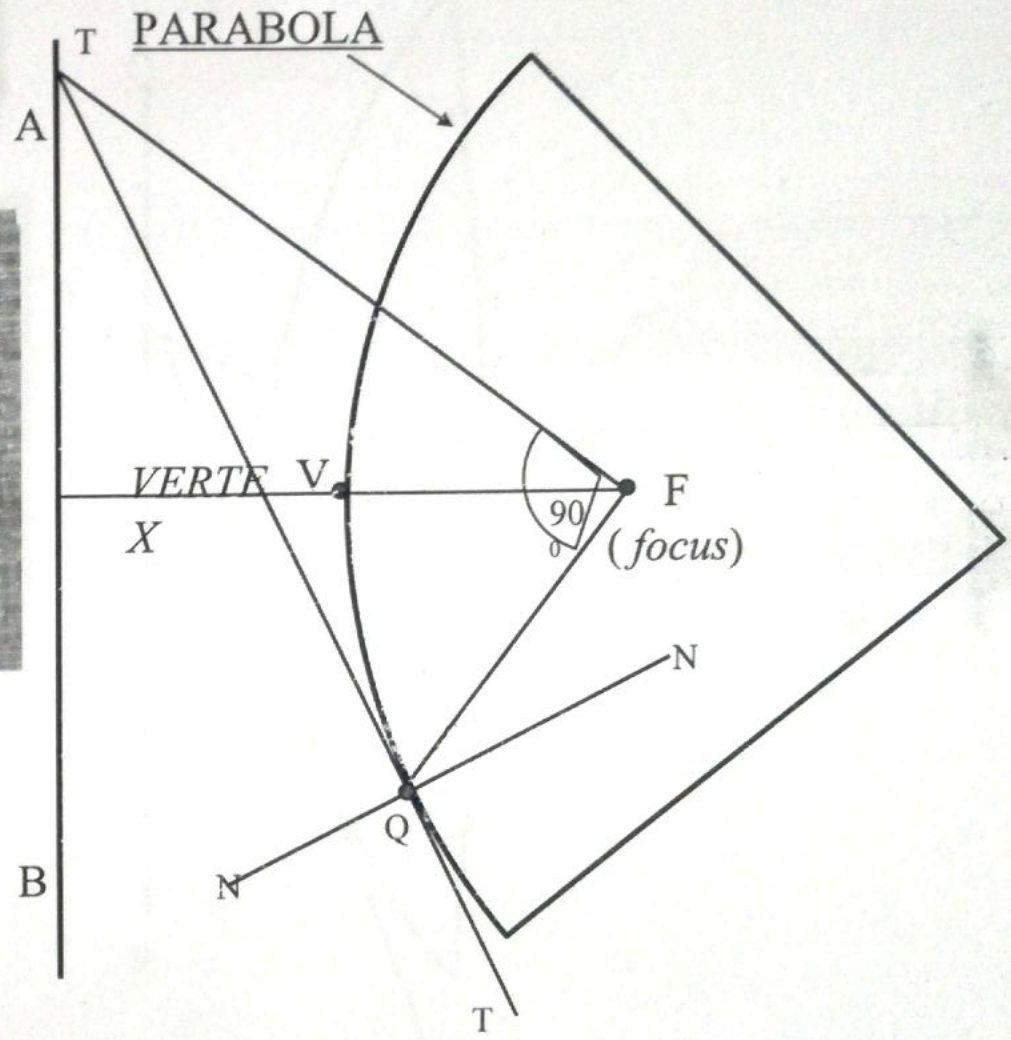


Problem 15:

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

1. JOIN POINT Q TO F.
2. CONSTRUCT 90^0 ANGLE WITH THIS LINE AT POINT F
3. EXTEND THE LINE TO MEET DIRECTRIX AT T
4. JOIN THIS POINT TO Q AND EXTEND. THIS IS TANGENT TO THE CURVE FROM Q
5. TO THIS TANGENT DRAW PERPENDICULAR LINE FROM Q. IT IS NORMAL TO CURVE.

PARABOLA TANGENT & NORMAL

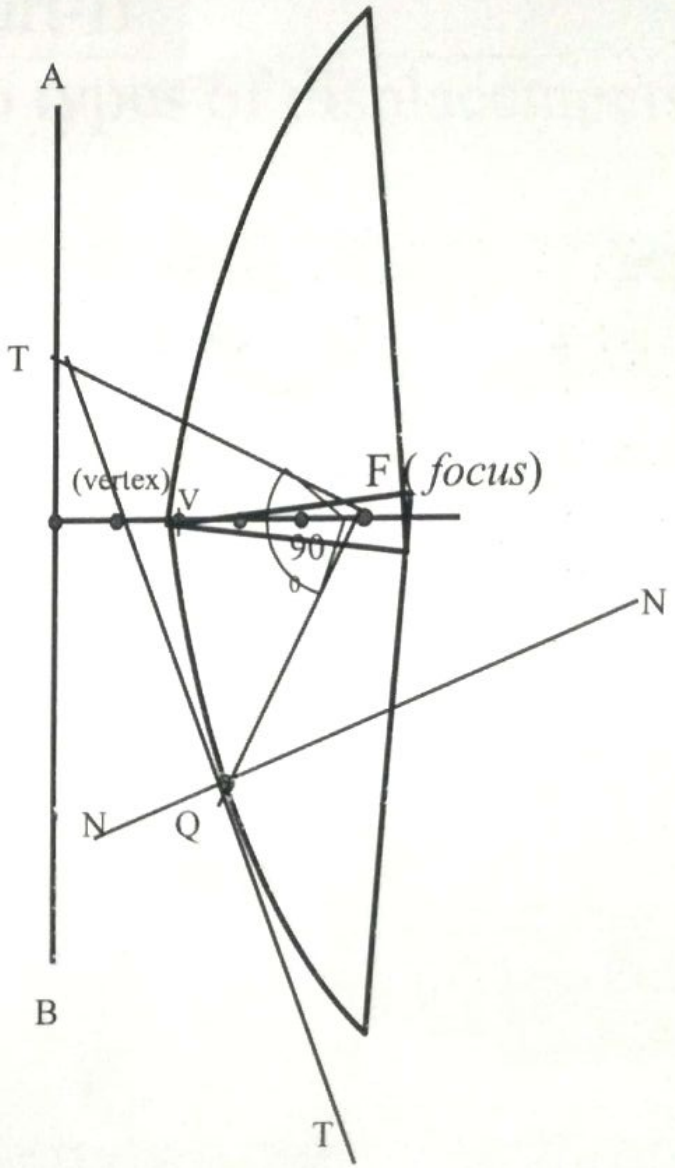


Problem 16

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

1. JOIN POINT Q TO F.
2. CONSTRUCT 90^0 ANGLE WITH THIS LINE AT POINT F
3. EXTEND THE LINE TO MEET DIRECTRIX AT T
4. JOIN THIS POINT TO Q AND EXTEND. THIS IS TANGENT TO CURVE FROM Q
5. TO THIS TANGENT DRAW PERPENDICULAR LINE FROM Q. IT IS NORMAL TO CURVE.

HYPERBOLA
TANGENT & NORMAL



ENGINEERING CURVES

Part-II

(Point undergoing two types of displacements)

INVOLUTE

1. Involute of a circle
   a)String Length = πD
   b)String Length > πD
   c)String Length < πD
2. Pole having Composite shape.
3. Rod Rolling over a Semicircular Pole.

CYCLOID

1. General Cycloid
2. Trochoid (superior)
3. Trochoid (Inferior)
4. Epi-Cycloid
5. Hypo-Cycloid

SPIRAL

1. Spiral of One Convolution.
2. Spiral of Two Convolutions

HELIX

1. On Cylinder
2. On a Cone

AND Methods of Drawing Tangents & Normal To These Curves.

DEFINITIONS

CYCLOID:

IT IS A LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS ON A STRAIGHT LINE PATH.

SUPERIORTROCHOID:
IF THE POINT IN THE DEFINATION OF CYCLOID IS OUTSIDE THE CIRCLE

INFERIOR TROCHOID.:
IF IT IS INSIDE THE CIRCLE

EPI-CYCLOID
IF THE CIRCLE IS ROLLING ON ANOTHER CIRCLE FROM OUTSIDE

HYPO-CYCLOID.
IF THE CIRCLE IS ROLLING FROM INSIDE THE OTHER CIRCLE,

INVOLUTE:

IT IS A LOCUS OF A FREE END OF A STRING WHEN IT IS WOUND ROUND A CIRCULAR POLE

SPIRAL:

IT IS A CURVE GENERATED BY A POINT WHICH REVOLVES AROUND A FIXED POINT AND AT THE SAME MOVES TOWARDS IT.

HELIX:

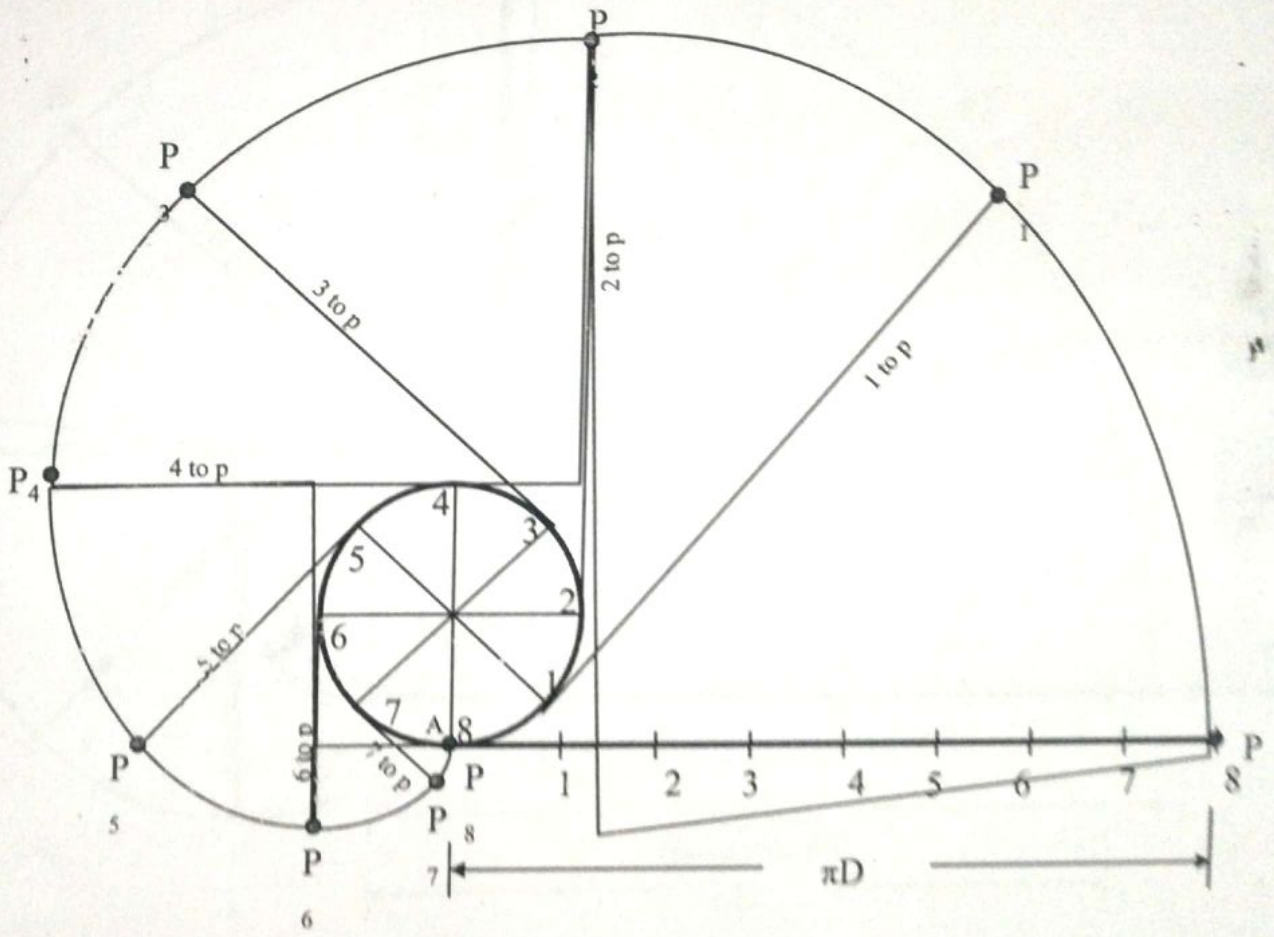
IT IS A CURVE GENERATED BY A POINT WHICH MOVES AROUND THE SURFACE OF A RIGHT CIRCULAR CYLINDER / CONE AND AT THE SAME TIME ADVANCES IN AXIAL DIRECTION

INVOLUTE OF A CIRCLE

Problem no 17: Draw Involutes of a circle. String length is equal to the circumference of circle

Solution Steps:

1) Point or end P of string AP is exactly πD distance away from A. Means if this string is wound round the circle, it will completely cover given circle. B will meet A after winding.
2) Divide πD (AP) distance into 8 number of equal parts.
3) Divide circle also into 8 number of equal parts.
4) Name after A, 1, 2, 3, 4, etc. up to 8 on πD line AP as well as on circle (in anticlockwise direction).
5) To radius C-1, C-2, C-3 up to C-8 draw tangents (from 1,2,3,4,etc to circle).
6) Take distance 1 to P in compass and mark it on tangent from point 1 on circle (means one division less than distance AP).
7) Name this point P1.
8) Take 2-B distance in compass and mark it on the tangent from point 2. Name it point P2.
9) Similarly take 3 to P, 4 to P, 5 to P up to 7 to P distance in compass and mark on respective tangents and locate P3, P4, P5 up to P8 (i.e. A) points and join them in smooth curve it is an INVOLUTE of a given circle.



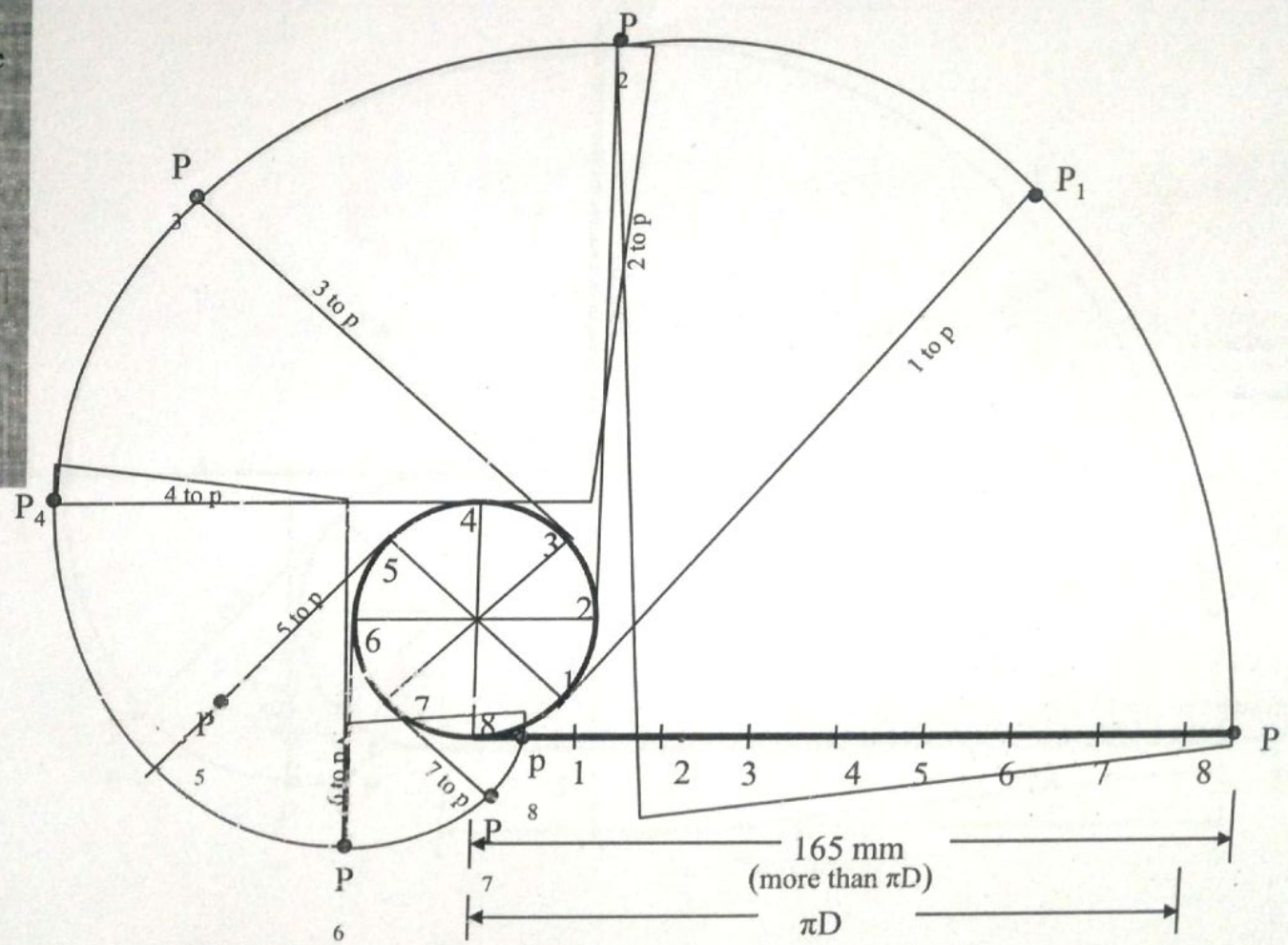
Problem 18: Draw Involutes of a circle.
String length is MORE than the circumference of circle.

INVOLUTE OF A CIRCLE

String length MORE than πD

Solution Steps:
In this case string length is more than Π D.

But remember!
Whatever may be the length of string, mark Π D distance horizontal i.e.along the string and divide it in 8 number of equal parts, and not any other distance. Rest all steps are same as previous INVOLUTE. Drew the curve completely.



INVOLUTE OF A CIRCLE

String length LESS than πD

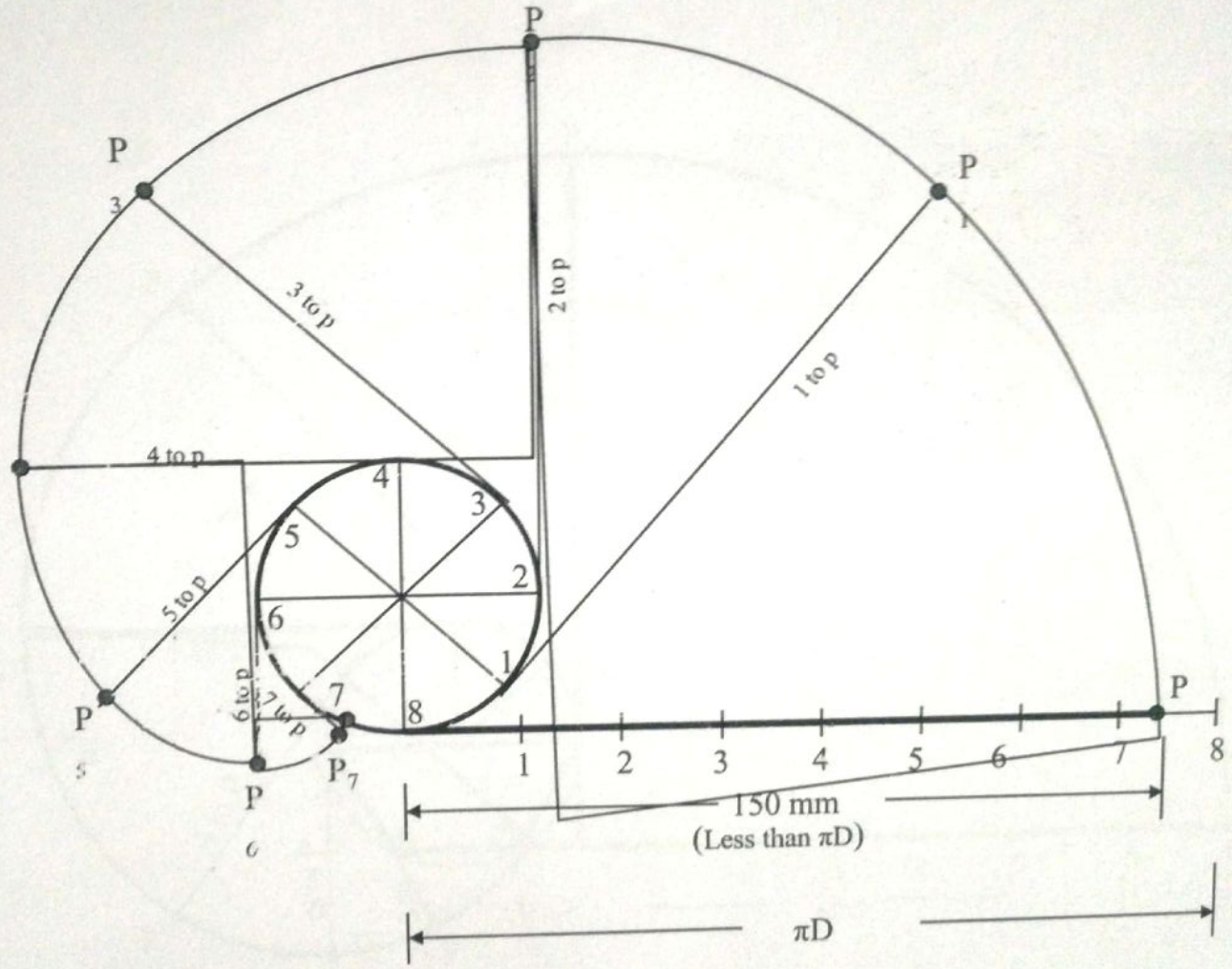
Problem 19: Draw Involutes of a circle. String length is LESS than the circumference of circle.

Solution Steps:

In this case string length is less than Π D.

But remember!

Whatever may be the length of string, mark Π D distance horizontal i.e.along the string and divide it in 8 number of equal parts, and not any other distance. Rest all steps are same as previous INVOLUTE. Draw the curve completely.



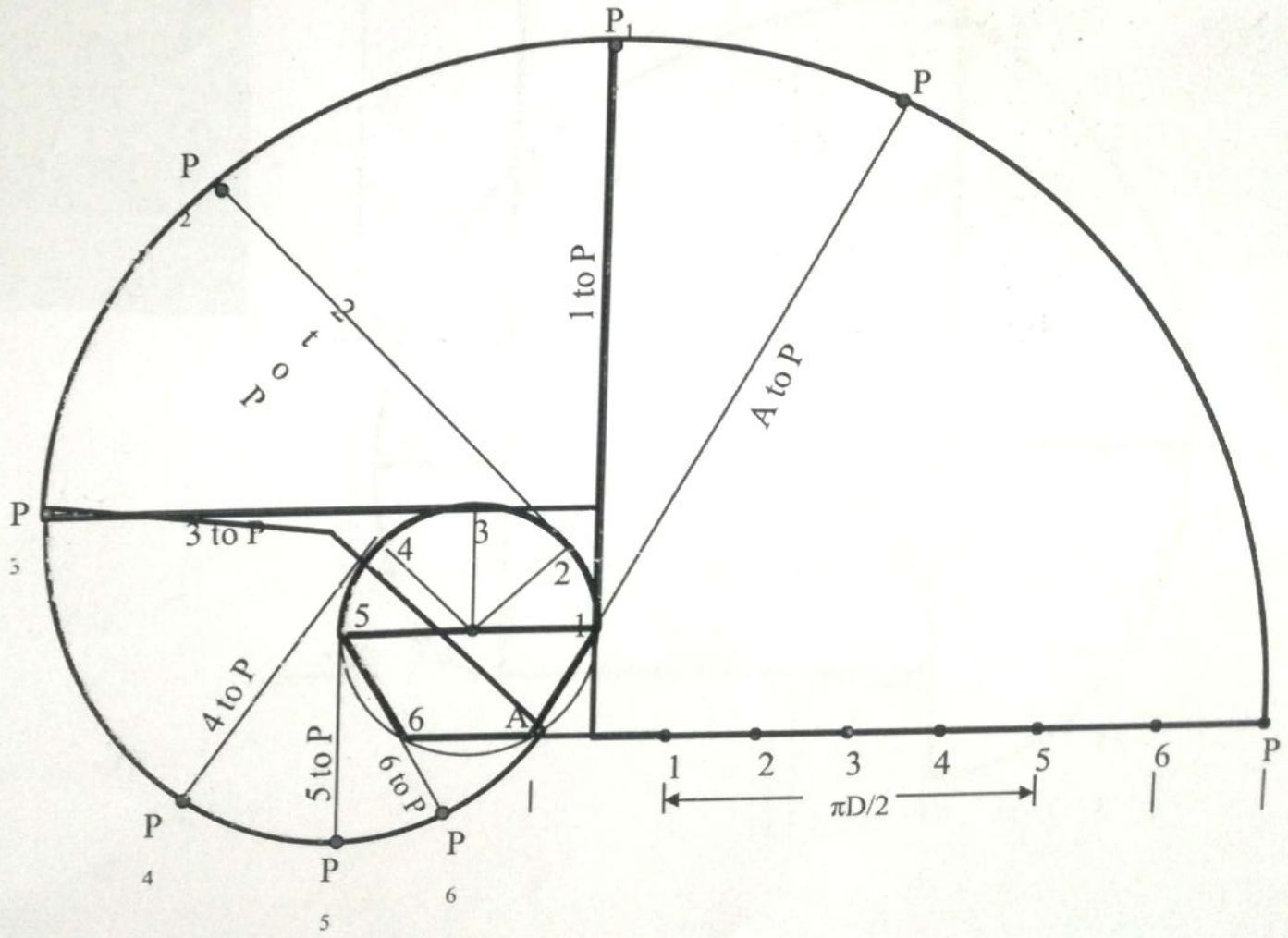
PROBLEM 20 : A POLE IS OF A SHAPE OF HALF HEXABON AND SEMICIRCLE. ASTRING IS TO BE WOUND HAVING LENGTH EQUAL TO THE POLE PERIMETER DRAW PATH OF FREE END *P* OF STRING WHEN WOUND COMPLETELY.

(Take hex 30 mm sides and semicircle of 60 mm diameter.)

INVOLUTE OF COMPOSIT SHAPED POLE

SOLUTION STEPS:

Draw pole shape as per dimensions.
Divide semicircle in 4 parts and name those along with corners of hexagon.
Calculate perimeter length.
Show it as string AP.
On this line mark 30mm from A
Mark and name it 1
Mark πD/2 distance on it from 1
And dividing it in 4 parts name 2,3,4,5.
Mark point 6 on line 30 mm from 5
Now draw tangents from all points of pole and proper lengths as done in all previous involute's problems and complete the curve.

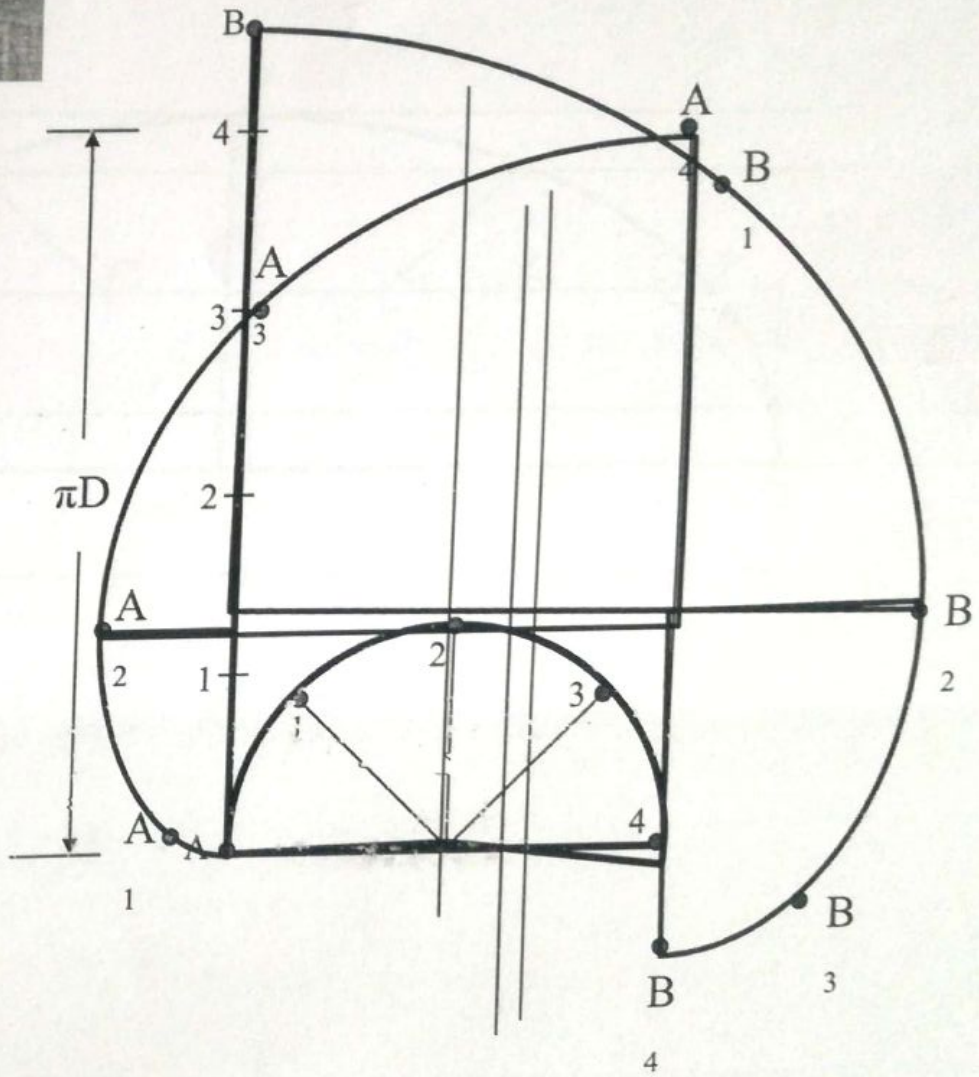


PROBLEM 21 : Rod AB 85 mm long rolls over a semicircular pole without slipping from it's initially vertical position till it becomes up-side-down vertical.
Draw locus of both ends A & B.

Solution Steps?

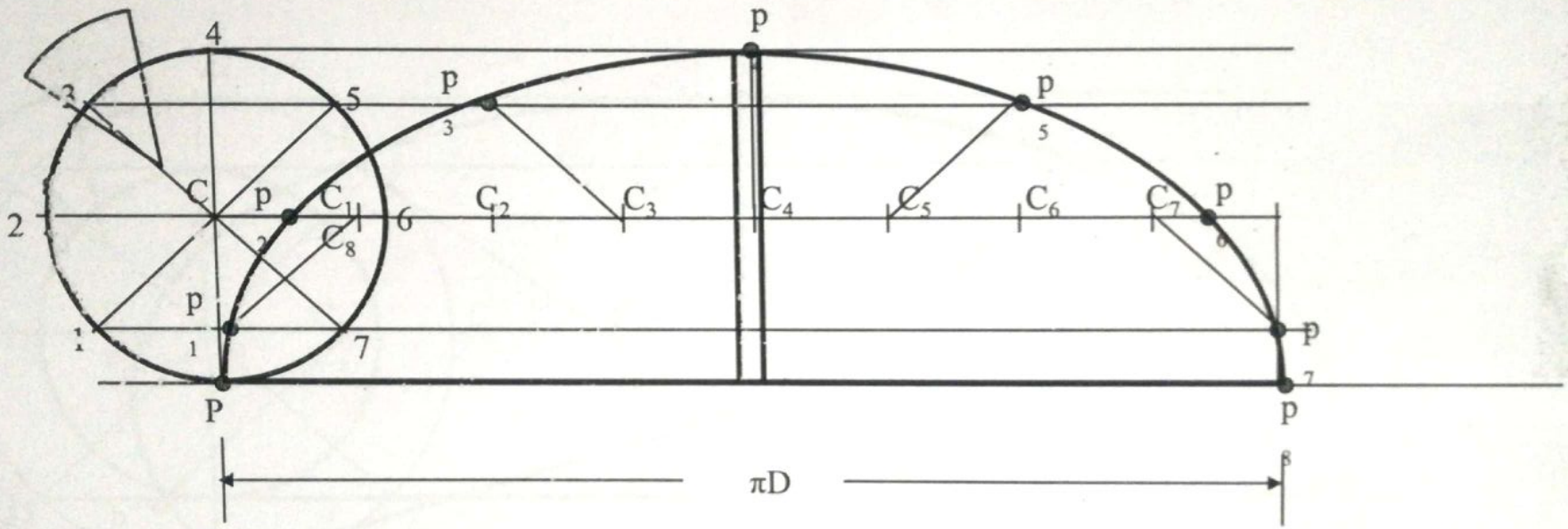
If you have studied previous problems properly, you can surely solve this also. Simply remember that this being a rod, it will roll over the surface of pole. Means when one end is approaching, other end will move away from poll.

OBSERVE ILLUSTRATION CAREFULLY!



PROBLEM 22: DRAW LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS ON STRAIGHT LINE PATH. Take Circle diameter as 50 mm

CYCLOID

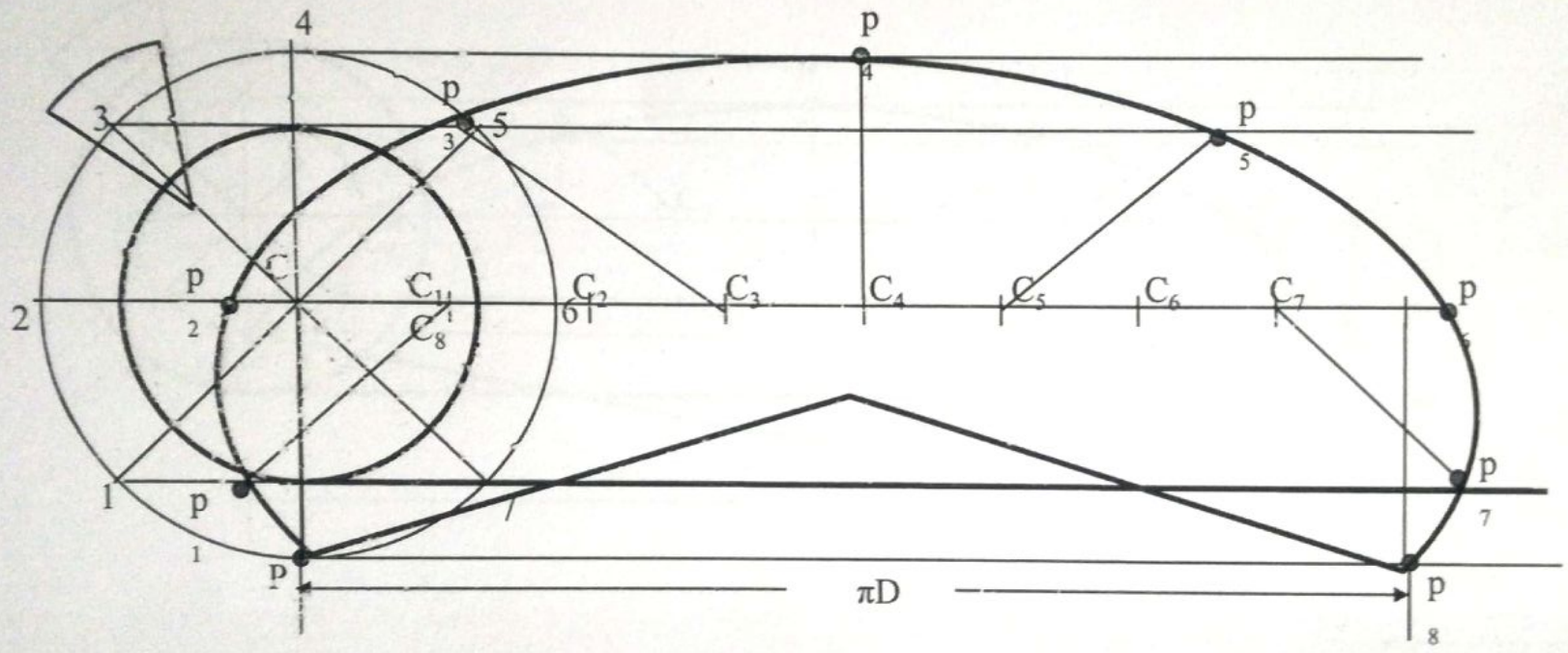


Solution Steps:

1) From center C draw a horizontal line equal to πD distance.
2) Divide πD distance into 8 number of equal parts and name them C1, C2, C3__ etc.
3) Divide the circle also into 8 number of equal parts and in clock wise direction, after P name 1, 2, 3 up to 8.
4) From all these points on circle draw horizontal lines. (parallel to locus of C)
5) With a fixed distance C-P in compass, C1 as center, mark a point on horizontal line from 1. Name it P.
6) Repeat this procedure from C2, C3, C4 upto C8 as centers. Mark points P2, P3, P4, P5 up to P8 on the horizontal lines drawn from 2, 3, 4, 5, 6, 7 respectively.
7) Join all these points by curve. It is Cycloid.

PROBLEM 23: DRAW LOCUS OF A POINT , 5 MM AWAY FROM THE PERIPHERY OF A CIRCLE WHICH ROLLS ON STRAIGHT LINE PATH. Take Circle diameter as 50 mm

SUPERIOR TROCHOID

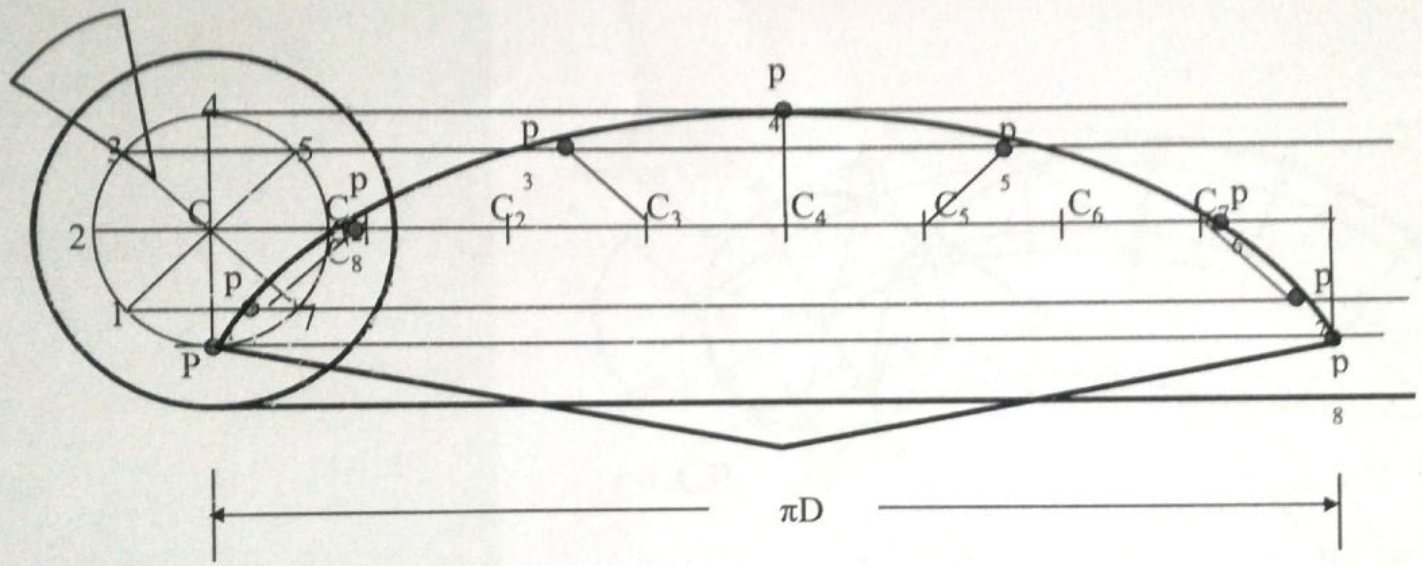


Solution Steps:

1) Draw circle of given diameter and draw a horizontal line from it's center C of length Π D and divide it in 8 number of equal parts and name them C1, C2, C3, up to C8.
2) Draw circle by CP radius, as in this case CP is larger than radius of circle.
3) Now repeat steps as per the previous problem of cycloid, by dividing this new circle into 8 number of equal parts and drawing lines from all these points parallel to locus of C and taking CP radius wit different positions of C as centers, cut these lines and get different positions of P and join
4) This curve is called Superior Trochoid.

PROBLEM 24: DRAW LOCUS OF A POINT , 5 MM INSIDE THE PERIPHERY OF A CIRCLE WHICH ROLLS ON STRAIGHT LINE PATH. Take Circle diameter as 50 mm

INFERIOR TROCHOID



Solution Steps:

1) Draw circle of given diameter and draw a horizontal line from it's center C of length Π D and divide it in 8 number of equal parts and name them C1, C2, C3, up to C8.
2) Draw circle by CP radius, as in this case CP is SHORTER than radius of circle.
3) Now repeat steps as per the previous problem of cycloid, by dividing this new circle into 8 number of equal parts and drawing lines from all these points parallel to locus of C and taking CP radius with different positions of C as centers, cut these lines and get different positions of P and join those in curvature.
4) This curve is called Inferior Trochoid.

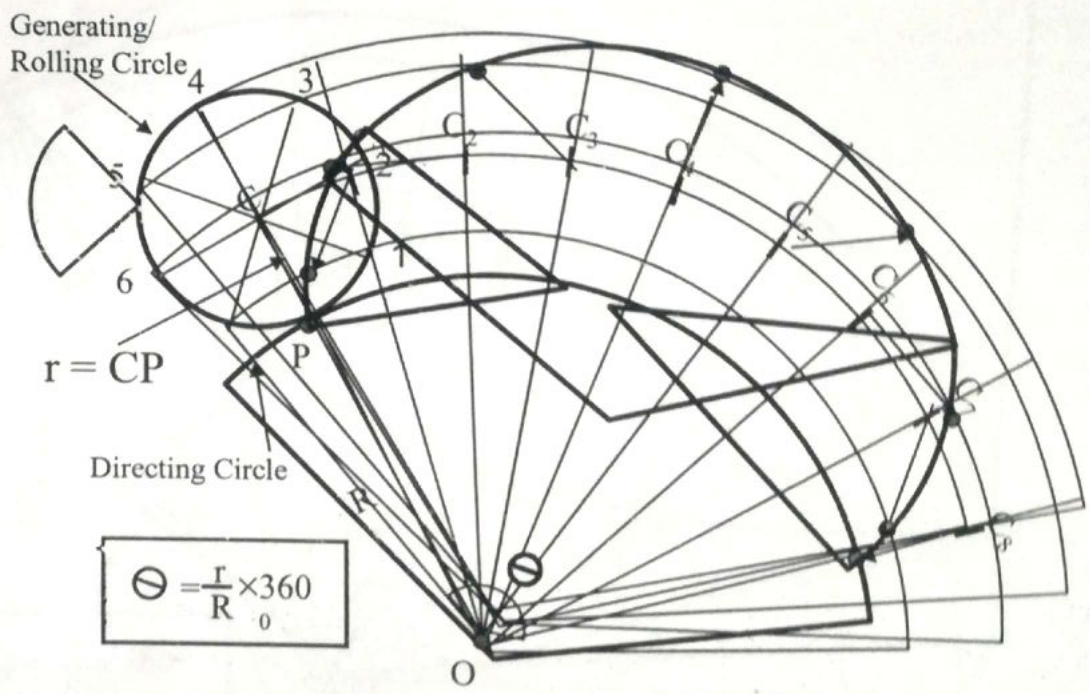
PROBLEM 25: DRAW LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS ON A CURVED PATH. Take diameter of rolling Circle 50 mm And radius of directing circle i.e. curved path, 75 mm.

EPI CYCLOID

Solution Steps:

1) When smaller circle will roll on larger circle for one revolution it will cover Π D distance on arc and it will be decided by included arc angle θ.
2) Calculate θ by formula θ = (r/R) x 3600.
3) Construct angle θ with radius OC and draw an arc by taking O as center OC as radius and form sector of angle θ.
4) Divide this sector into 8 number of equal angular parts. And from C onward name them C1, C2, C3 up to C8.
5) Divide smaller circle (Generating circle) also in 8 number of equal parts. And next to P in clockwise direction name those 1, 2, 3, up to 8.
6) With O as center, O-1 as radius draw an arc in the sector. Take O-2, O-3, O-4, O-5 up to O-8 distances with center O, draw all concentric arcs in sector. Take fixed distance C-P in compass, C1 center, cut arc of 1 at P1.

Repeat procedure and locate P2, P3, P4, P5 unto P8 (as in cycloid) and join them by smooth curve. This is EPI – CYCLOID.



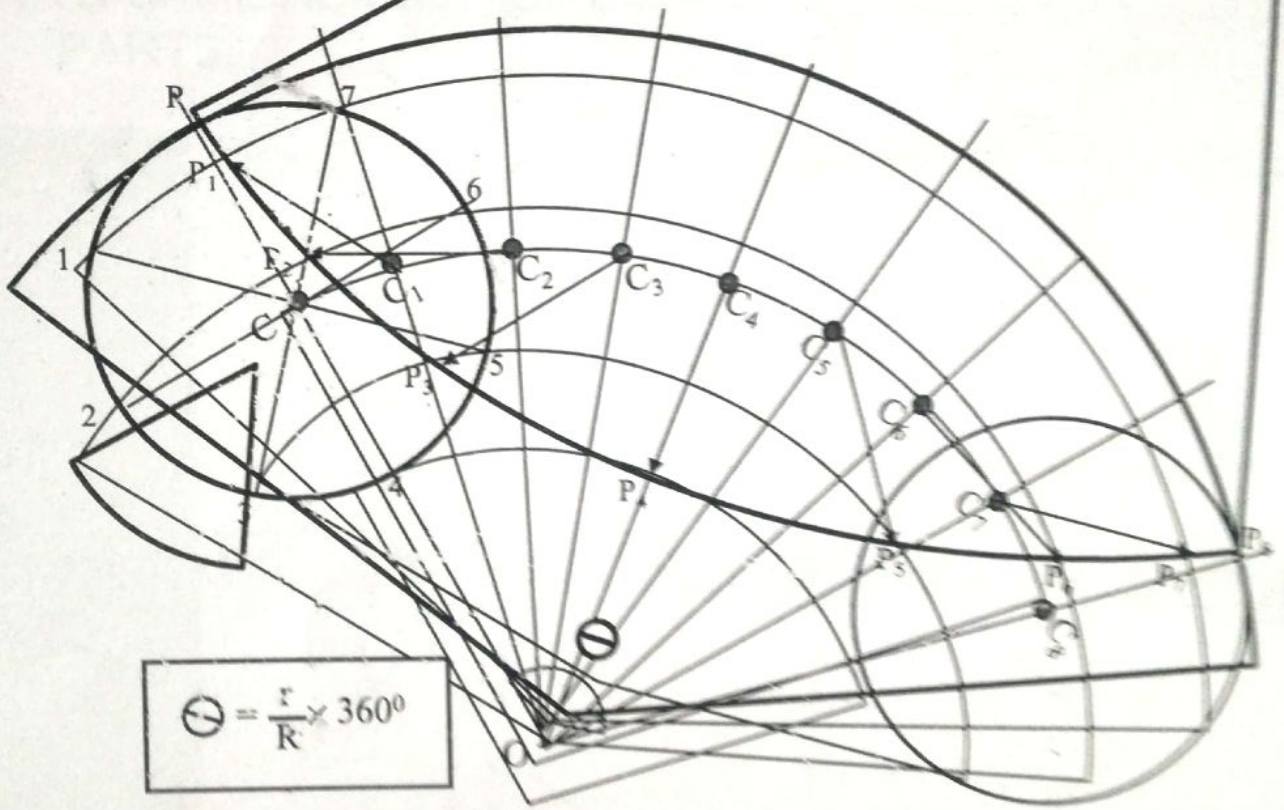
$$\Theta = \frac{r}{R} \times 360^{0}$$

PROBLEM 26: DRAW LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS FROM THE INSIDE OF A CURVED PATH. Take diameter of rolling circle 50 mm and radius of directing circle (curved path) 75 mm.

HYPO CYCLOID

Solution Steps:

1) Smaller circle is rolling here, inside the larger circle. It has to rotate anticlockwise to move ahead.
2) Same steps should be taken as in case of EPI – CYCLOID. Only change is in numbering direction of 8 number of equal parts on the smaller circle
3) From next to P in anticlockwise direction, name 1,2,3,4,5,6,7,8.
4) Further all steps are that of epi – cycloid. This is called HYPO – CYCLOID.



$$\theta = \frac{r}{R} \times 360^0$$

OC = R (Radius of Directing Circle)
CP = r (Radius of Generating Circle)

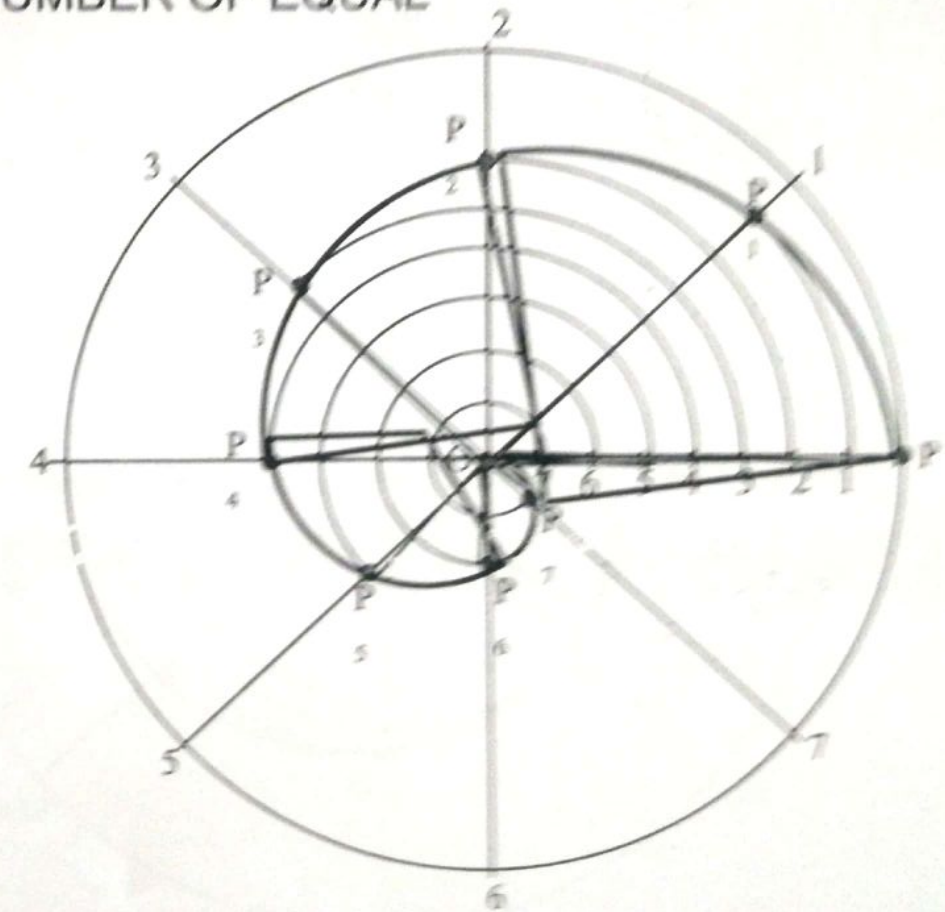
Problem 27: Draw a spiral of one convolution. Take distance PO 40 mm.

SPIRAL

IMPORTANT APPROACH FOR CONSTRUCTION!
FIND TOTAL ANGULAR AND TOTAL LINEAR DISPLACEMENT
AND DIVIDE BOTH IN TO SAME NUMBER OF EQUAL PARTS.

Solution Steps

1. With PO radius draw a circle and divide it in EIGHT parts. Name those 1,2,3,4, etc. up to 8
2. Similarly divided line PO also in EIGHT parts and name those 1,2,3,-- as shown.
3. Take o-1 distance from op line and draw an arc up to O1 radius vector. Name the point P_1
4. Similarly mark points P_2, P_3,



Problem 28

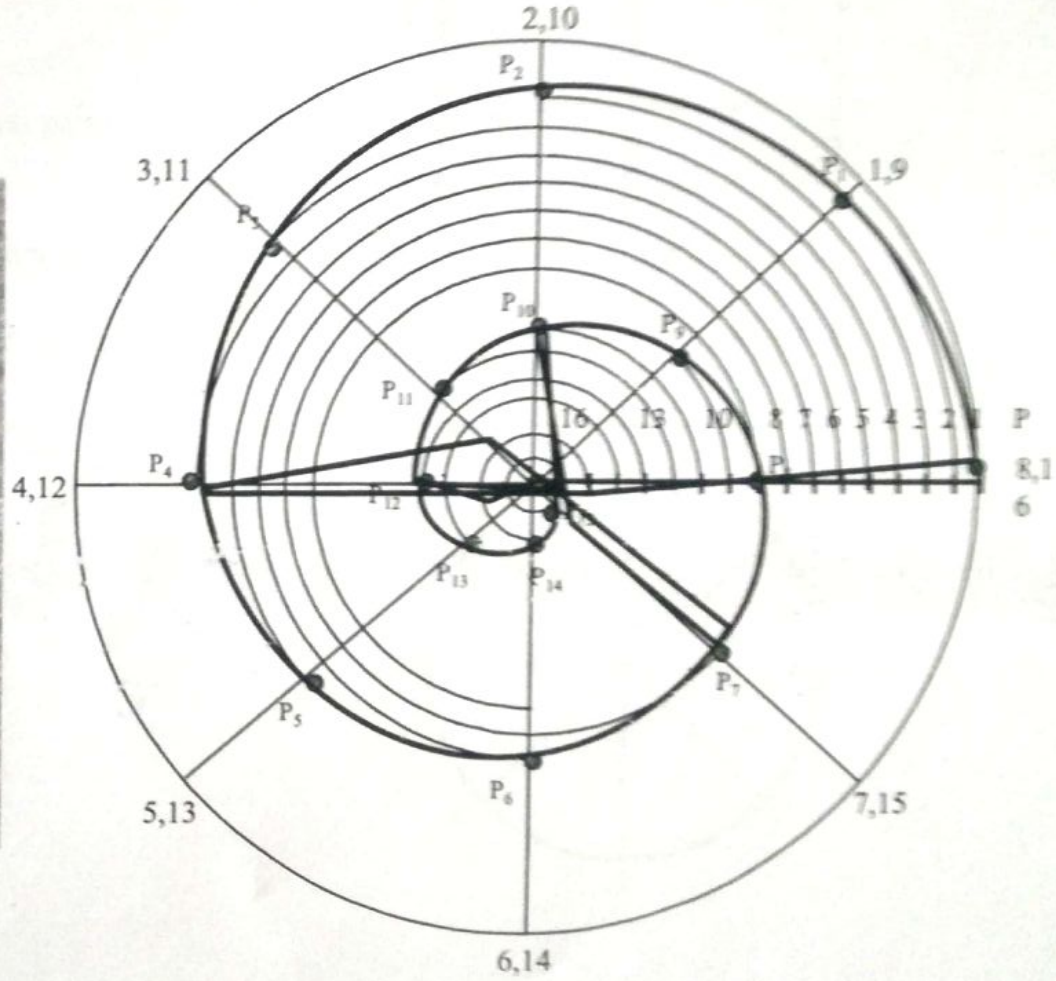
Point P is 80 mm from point O. It starts moving towards O and reaches it in two revolutions around it Draw locus of point P (To draw a Spiral of TWO convolutions).

SPIRAL of two convolutions

IMPORTANT APPROACH FOR CONSTRUCTION!
FIND TOTAL ANGULAR AND TOTAL LINEAR DISPLACEMENT AND DIVIDE BOTH IN TO SAME NUMBER OF EQUAL PARTS.

SOLUTION STEPS:
Total angular displacement here is two revolutions And
Total Linear displacement here is distance PO.
Just divide both in same parts i.e. Circle in EIGHT parts.
(means total angular displacement in SIXTEEN parts)
Divide PO also in SIXTEEN parts.

Rest steps are similar to the previous

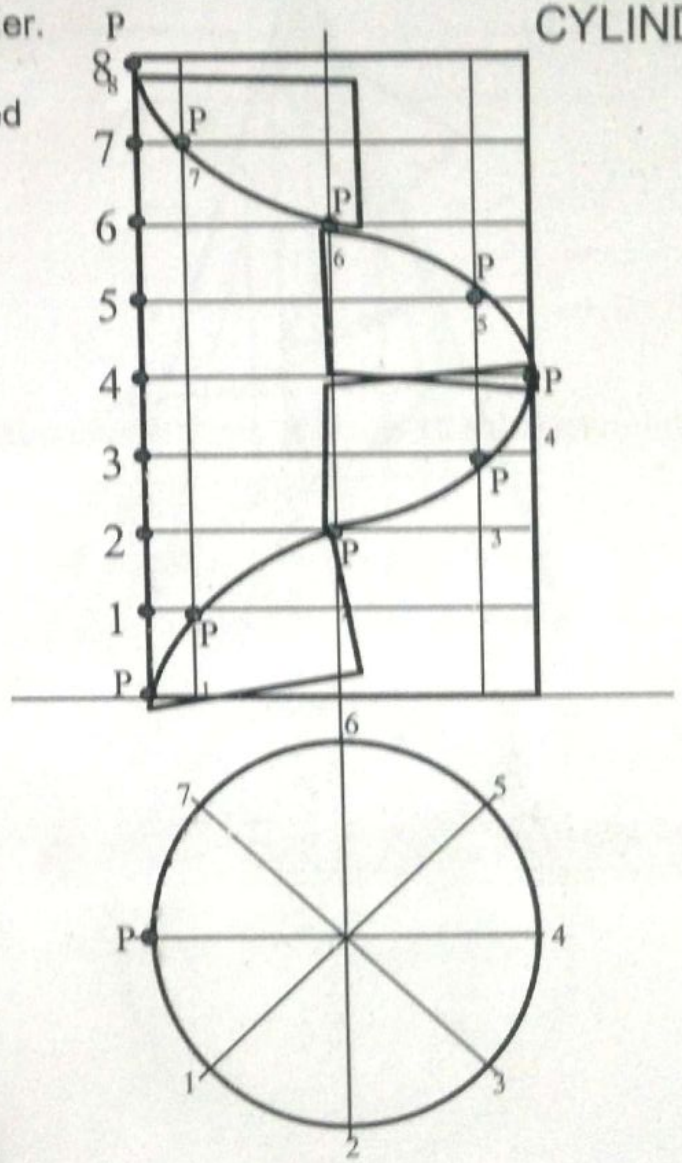


HELIX
(UPON A CYLINDER)

PROBLEM: Draw a helix of one convolution, upon a cylinder. Given 80 mm pitch and 50 mm diameter of a cylinder. (The axial advance during one complete revolution is called The *pitch* of the helix)

SOLUTION:

Draw projections of a cylinder.
Divide circle and axis in to same no. of equal parts. (8)
Name those as shown.
Mark initial position of point 'P'
Mark various positions of *P* as shown in animation.
Join all points by smooth possible curve.
Make upper half dotted, as it is going behind the solid and hence will not be seen from front side.



HELIX (UPON A CONE)

PROBLEM: Draw a helix of one convolution, upon a cone, diameter of base 70 mm, axis 90 mm and 90 mm pitch. (The axial advance during one complete revolution is called The *pitch* of the helix)

SOLUTION:

Draw projections of a cone

Divide circle and axis in to same no. of equal parts. (8)

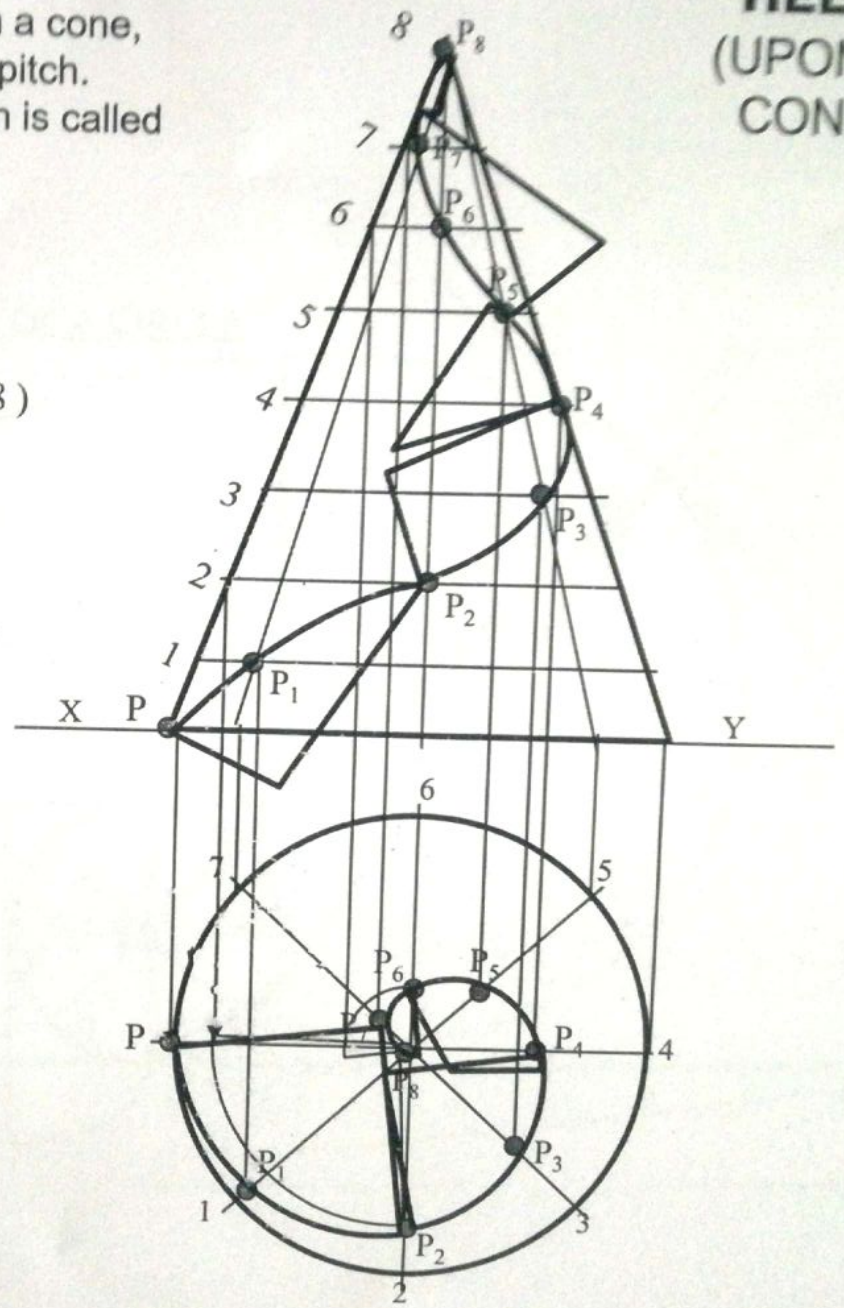
Name those as shown.

Mark initial position of point 'P'

Mark various positions of *P* as shown in animation.

Join all points by smooth possible curve.

Make upper half dotted, as it is going behind the solid and hence will not be seen from front side.



Involute Method of Drawing Tangent & Normal

STEPS:
DRAW INVOLUTE AS USUAL.

MARK POINT Q ON IT AS DIRECTED.

JOIN Q TO THE CENTER OF CIRCLE C. CONSIDERING CQ DIAMETER, DRAW A SEMICIRCLE AS SHOWN.

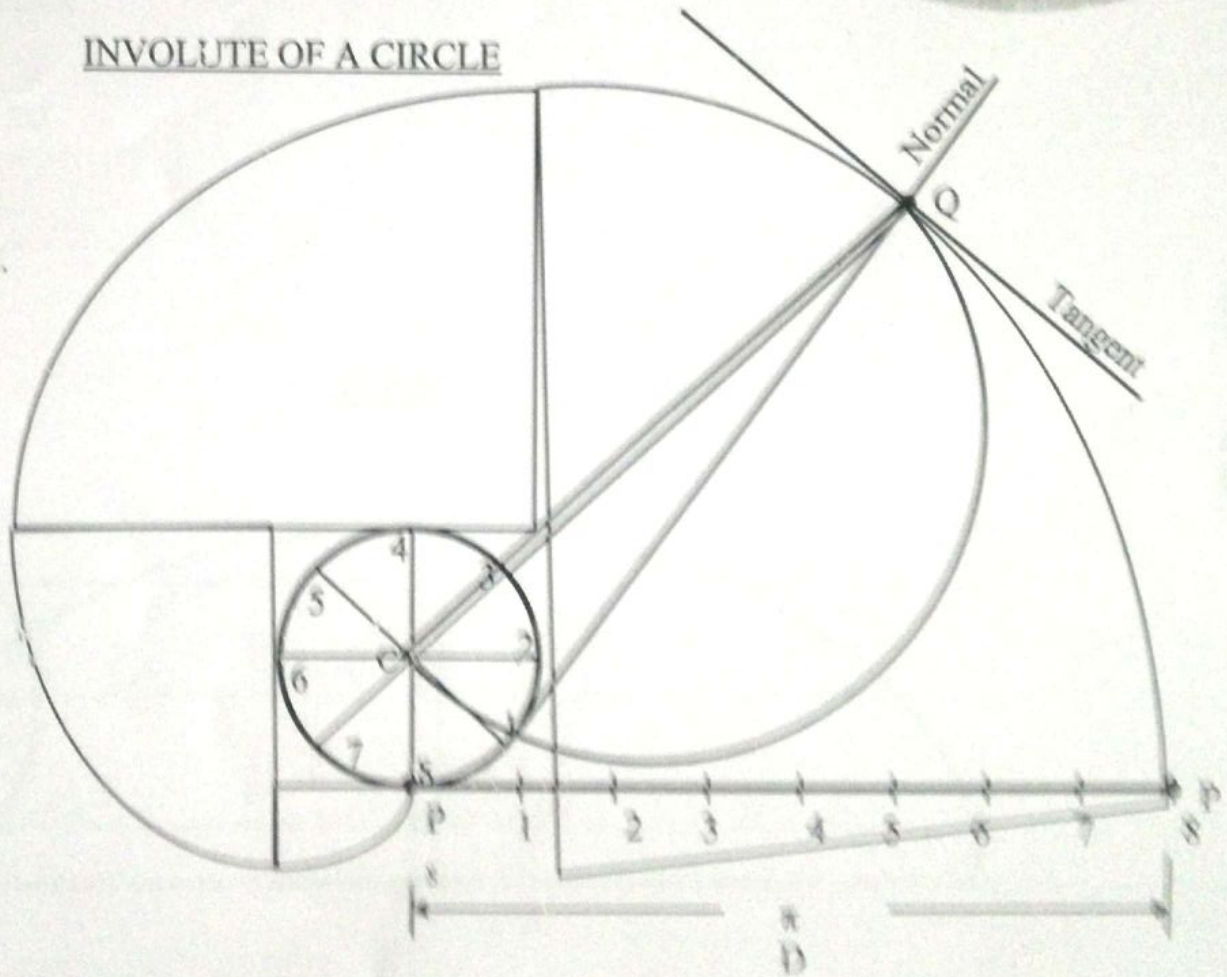
MARK POINT OF INTERSECTION OF THIS SEMICIRCLE AND POLE CIRCLE AND JOIN IT TO Q.

THIS WILL BE NORMAL TO INVOLUTE.

DRAW A LINE AT RIGHT ANGLE TO THIS LINE FROM Q.

IT WILL BE TANGENT TO INVOLUTE.

INVOLUTE OF A CIRCLE



CYCLOID
Method of Drawing Tangent & Normal

STEPS:
DRAW CYCLOID AS USUAL.
MARK POINT Q ON IT AS DIRECTED.

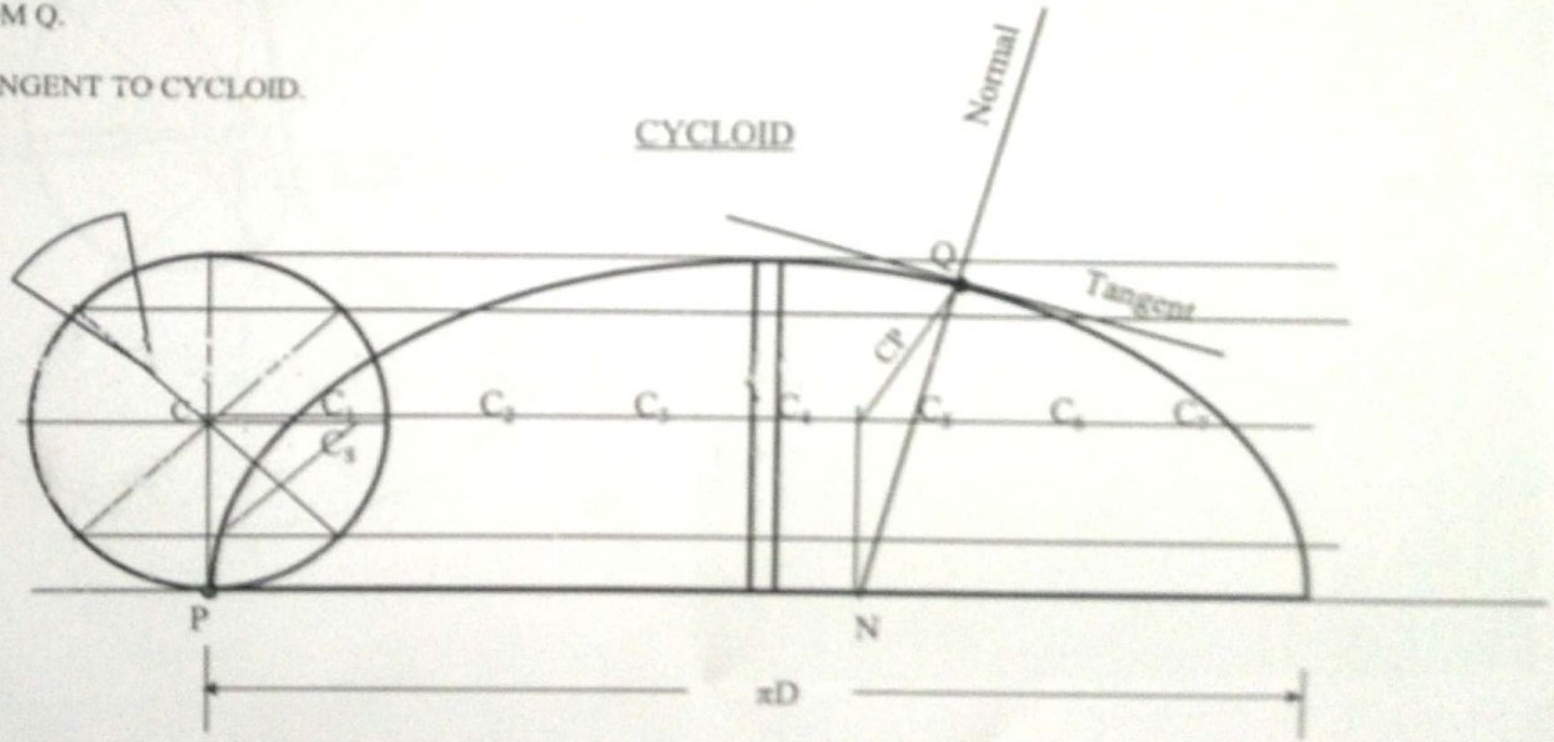
WITH CP DISTANCE, FROM Q. CUT THE POINT ON LOCUS OF C AND JOIN IT TO Q.

FROM THIS POINT DROP A PERPENDICULAR ON GROUND LINE AND NAME IT N

JOIN N WITH Q.THIS WILL BE NORMAL TO CYCLOID.

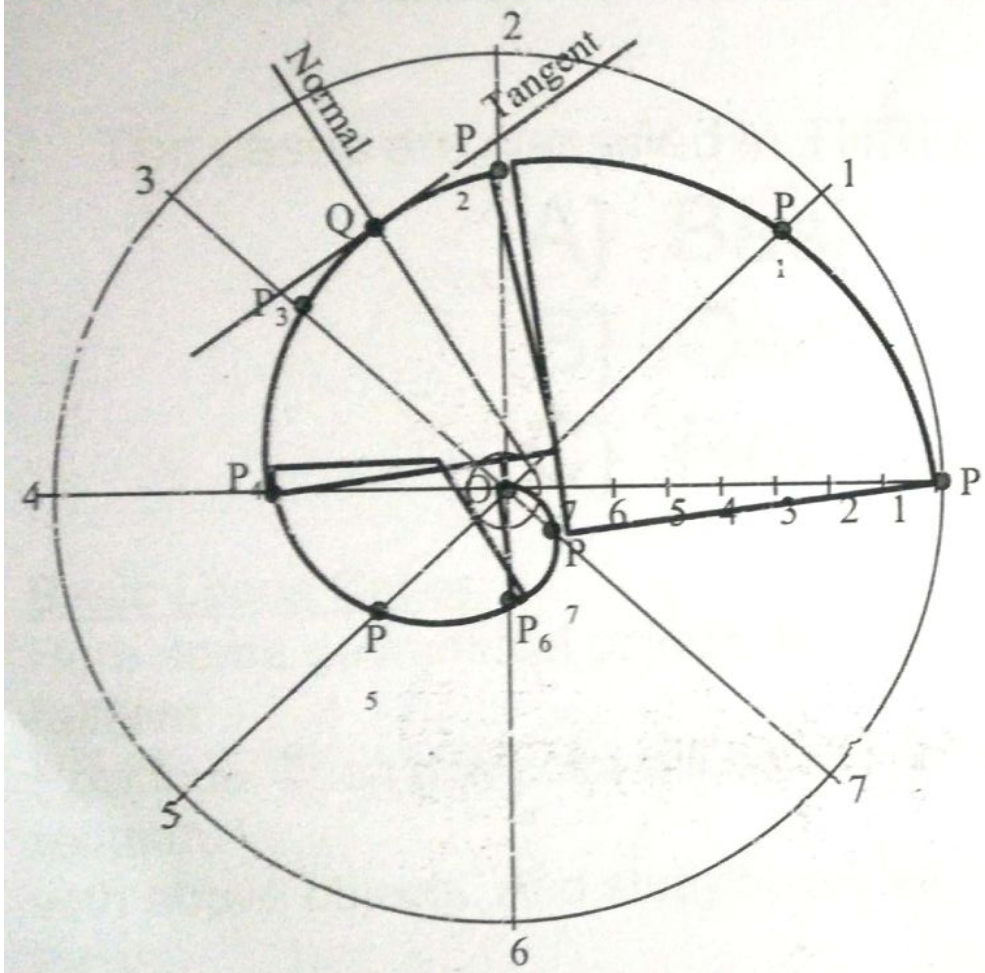
DRAW A LINE AT RIGHT ANGLE TO THIS LINE FROM Q.

IT WILL BE TANGENT TO CYCLOID.



Spiral. Method of Drawing Tangent & Normal

SPIRAL (ONE CONVOLUSION.)



Constant of the Curve = $\dfrac{\text{Difference in length of any radius vectors}}{\text{Angle between the corresponding radius vector in radian}}$

$= \dfrac{OP - OP_2}{\pi/2} = \dfrac{OP - OP_2}{1.57}$

$= 3.185$ m m

STEPS:

*DRAW SPIRAL AS USUAL.
DRAW A SMALL CIRCLE OF RADIUS EQUAL TO THE CONSTANT OF CURVE CALCULATED ABOVE.

*LOCATE POINT Q AS DISCRIBED IN PROBLEM AND THROUGH IT DRAW A TANGENTTO THIS SMALLER CIRCLE THIS IS A NORMAL TO THE SPIRAL.

*DRAW A LINE AT RIGHT ANGLE

*TO THIS LINE FROM Q.
IT WILL BE TANGENT TO CYCLOID.

LOCUS

It is a path traced out by a point moving in a plane,
in a particular manner, for one cycle of operation.

The cases are classified in THREE categories for easy understanding.

A} Basic Locus Cases.

B} Oscillating Link……

C} Rotating Link……..

Basic Locus Cases:

Here some geometrical objects like point, line, circle will be described with there relative
Positions. Then one point will be allowed to move in a plane maintaining specific relation
with above objects. And studying situation carefully you will be asked to draw it's locus.

Oscillating & Rotating Link:

Here a link oscillating from one end or rotating around it's center will be described.
Th **STUDY TEN CASES GIVEN ON NEXT PAGES** ow
studying

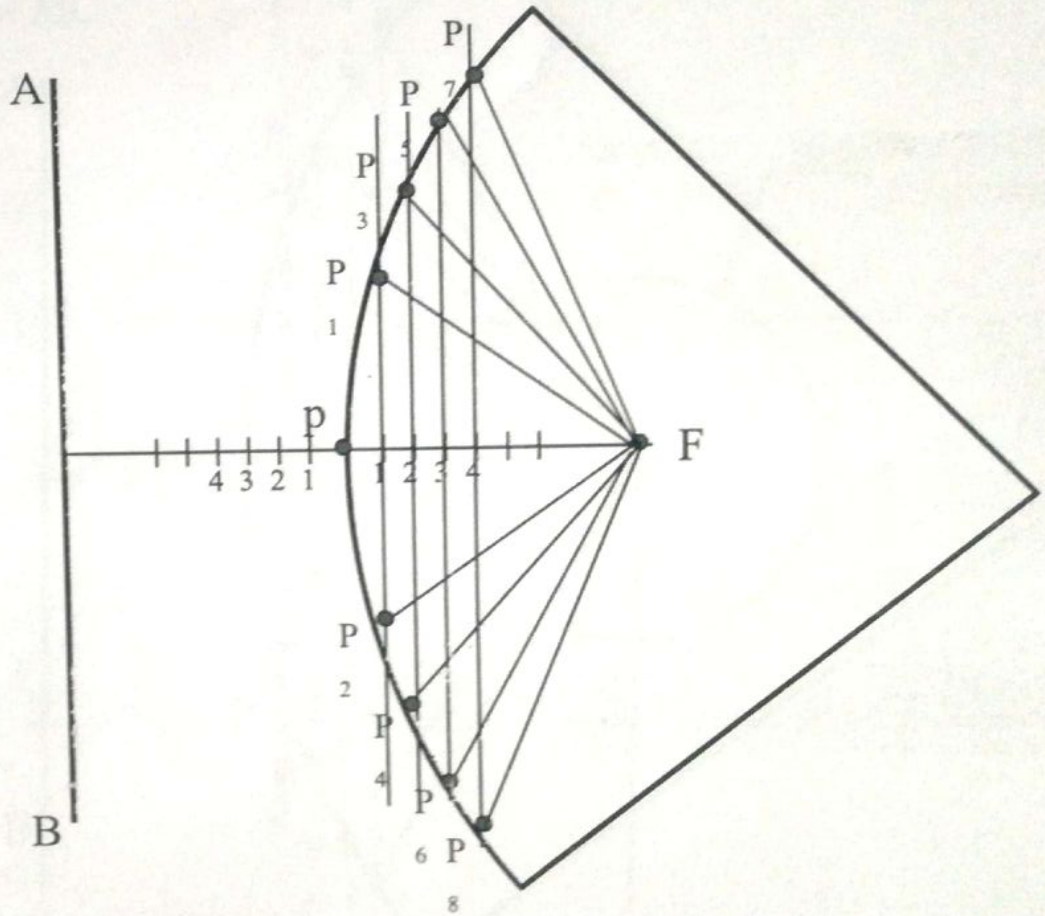
Basic Locus Cases:

PROBLEM 1.: Point F is 50 mm from a vertical straight line AB. Draw locus of point P, moving in a plane such that it always remains equidistant from point F and line AB.

SOLUTION STEPS:

1. Locate center of line, perpendicular to AB from point F. This will be initial point P.
2. Mark 5 mm distance to its right side, name those points 1,2,3,4 and from those draw lines parallel to AB.
3. Mark 5 mm distance to its left of P and name it 1.
4. Take F-1 distance as radius and F as center draw an arc cutting first parallel line to AB. Name upper point P_1 and lower point P_2.
5. Similarly repeat this process by taking again 5mm to right and left and locate P_3P_4.
6. Join all these points in smooth curve.

it will be the locus of P equidistance from line AB and fixed point F.



GROUP (B)

PROBLEMS INVOLVING TRACES OF THE LINE

TRACES OF THE LINE

V.T. :- It is a point on Vp

Hence it is called Fv of a point in Vp.

Hence it is Fv comes on XY line (Here onward named as V)

H.T. :- It is a point on Hp.

Hence it is called Fh of a point in Hp.

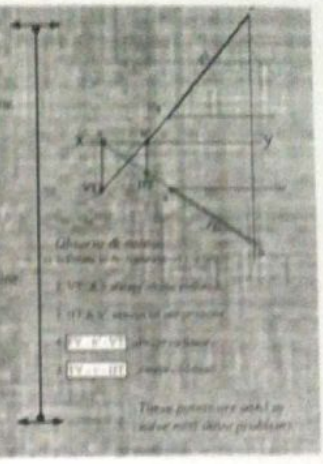
Hence it is Fh comes on XY line (Here onward named as 'h').

STEPS TO FOLLOW (WHEN PROJECTIONS ARE GIVEN)

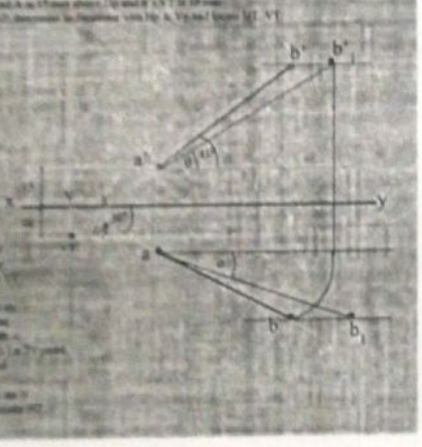
1. Begin with FV. Extend FV up to XY line.
2. Name this point 'h'
   (as it is a Fv of a point in Hp)
3. Draw one projector from h'.
4. Now extend Fh on that projector.
   This point is HT

STEPS TO FOLLOW (WHEN PROJECTIONS ARE GIVEN)

1. Begin with FV. Extend FV up to XY line
2. Name this point V
   (as it is a Fv of a point in Vp)
3. Draw one projector from v.
4. Now extend Fv on that projector.
   This point is VT



These points are used as value with other problems

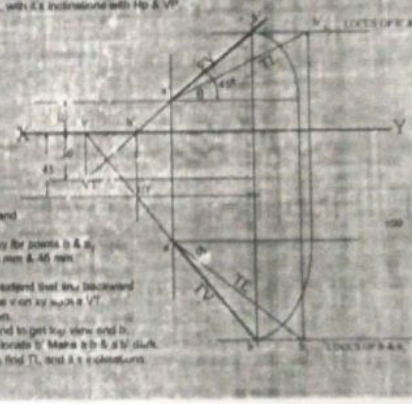


PROBLEM 7 :-

One end of line AB is 10mm above Hp and other end is 100 mm in front of Vp.

If's Fv is 45° inclined to xy while it's HT & VT are 45mm and 30 mm below xy respectively.

Draw projections and find TL with it's inclinations with Hp & VP.



SOLUTION STEPS:-

Draw xy line, one projector and locate a' 10 mm above xy.

Draw locus 100 mm below xy for points b & b_1.

Draw locus for VT and HT, 30 mm & 45 mm below xy respectively.

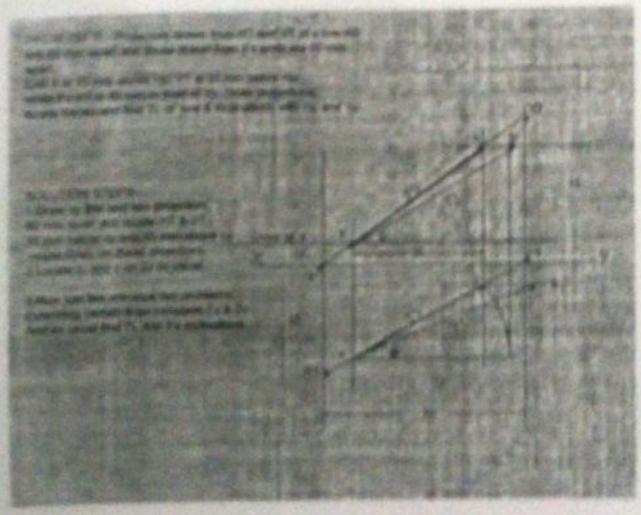
Take 45° angle from a' and extend that line backward to locate v on VT, & Locate v on xy such a VT.

Locate HT below h' as shown.

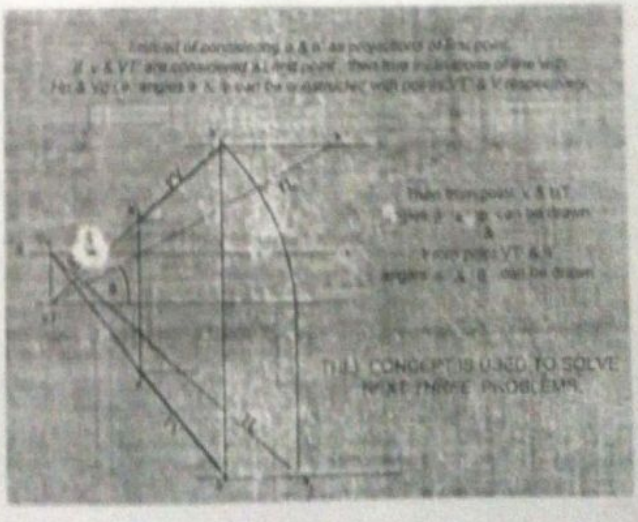
Then join v to HT – and extend to get top view and h.

Draw projector upward and locate b' Make a b & a b' dark.

Now as usual rotating views find TL and it's inclinations.



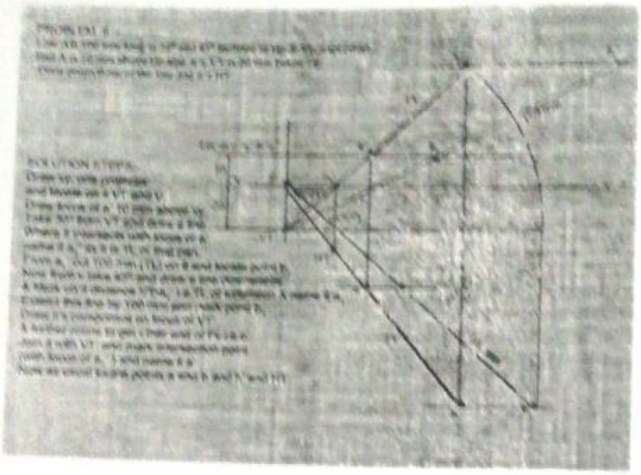
Instead of considering a & a' as projections of the point, if v & VT are considering a Line and point. Then line inclinations of line with Hp & Vp i.e. angles θ & ϕ will be measuring with points VT & V respectively.

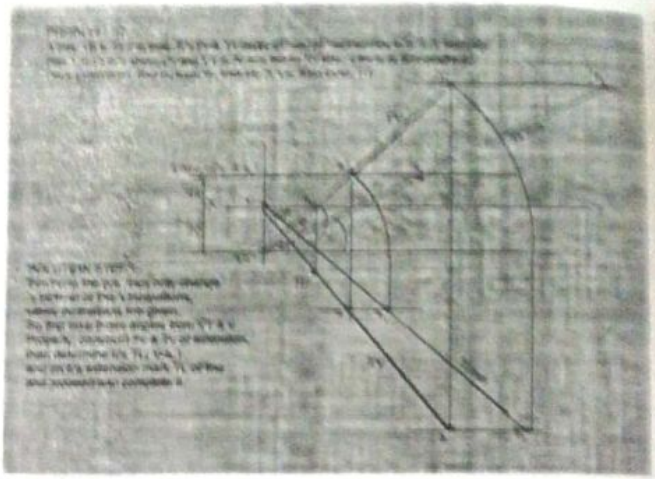


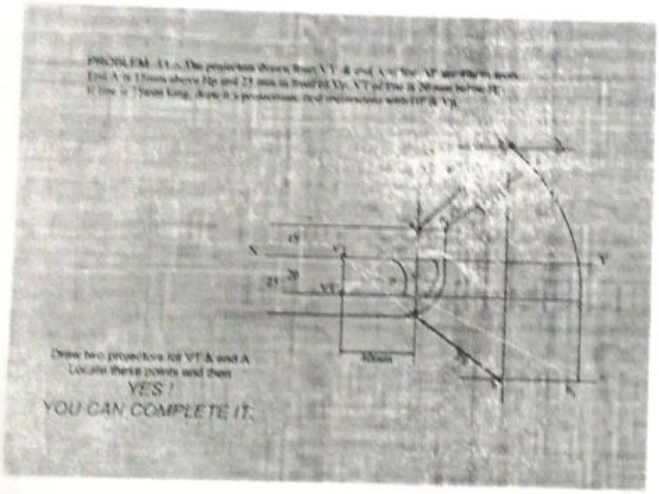
Then from point v & HT angle θ & ϕ can be drawn

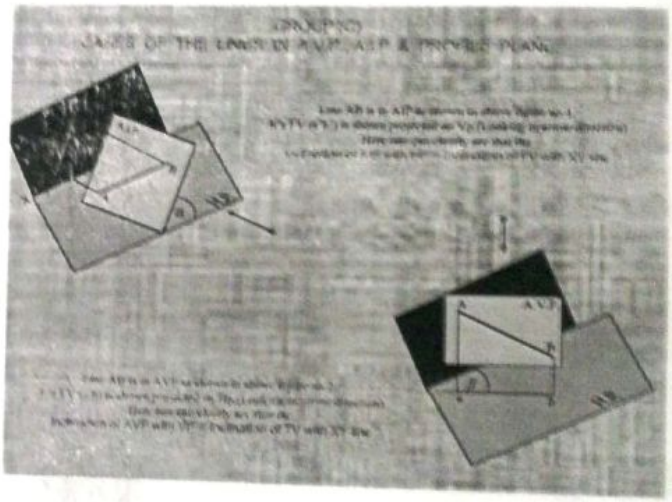
& from point VT & V angles θ & ϕ can be drawn

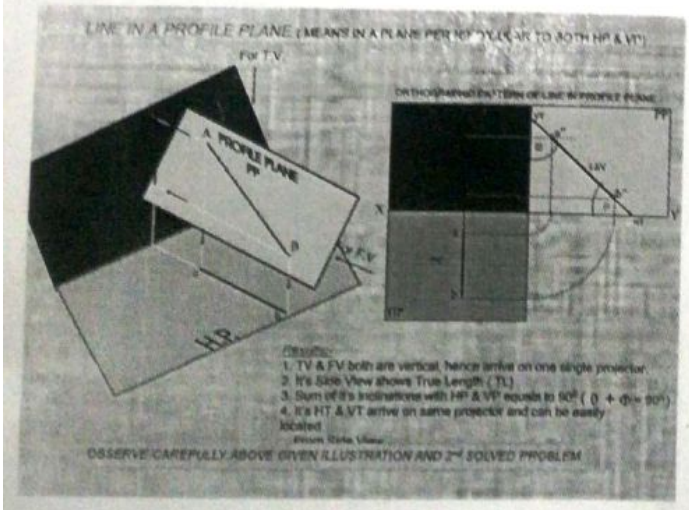
THIS CONCEPT IS USED TO SOLVE NEXT THREE PROBLEMS.

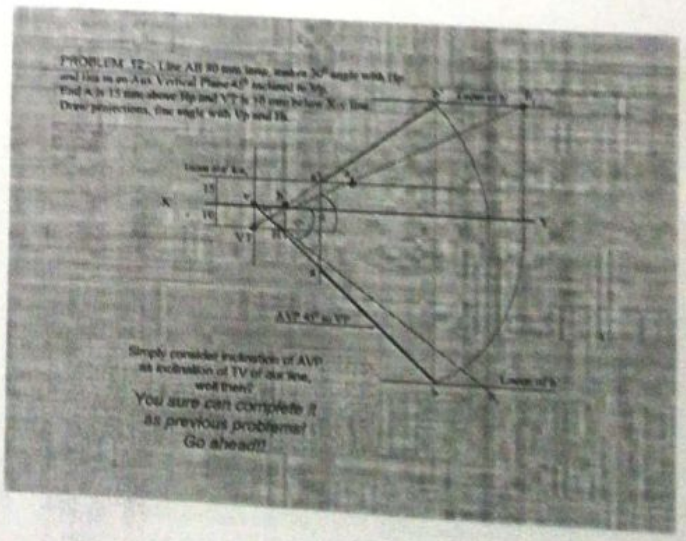












ENGINEERING APPLICATIONS OF THE PRINCIPLES OF PROJECTIONS OF SOLIDES.

1. SECTIONS OF SOLIDS.
2. DEVELOPMENT.
3. INTERSECTIONS.

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NEXT SIX PAGES.

SECTIONING A SOLID.

An object (here a solid) is cut by some imaginary cutting plane to understand internal details of that object.

The plane of cutting is called SECTION PLANE.

Two methods which a section plane are mentioned.

A) Section Plane perpendicular to Vp and inclined to Hp.
(This is a definition of an Axis Inclined Plane i.e. A.I.P.)
NOTE:- This section plane appears as a straight line in FV.

B) Section Plane perpendicular to Hp and inclined to Vp.
(This is a definition of an Axis Vertical Plane i.e. A.V.P.)
NOTE:- This section plane appears as a straight line in TV.

Remember:-
1. After launching a section plane either in FV or TV, the part towards observer is assumed to be removed.
2. As far as possible the smaller part is assumed to be removed.

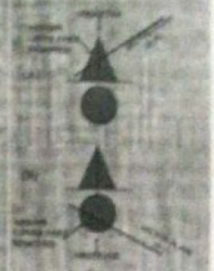
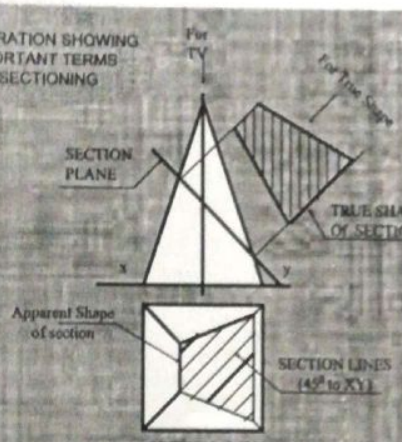


ILLUSTRATION SHOWING IMPORTANT TERMS IN SECTIONING



SECTIONAL T.V.

Typical Section Planes & Typical Shapes Of Sections.

DEVELOPMENT OF SURFACES OF SOLIDS.

MEANING:-
ASSUME OBJECT HOLLOW AND MADE-UP OF THIN SHEET, CUT OPEN IT FROM ONE SIDE AND UNFOLD THE SHEET COMPLETELY. THEN THE SHAPE OF THAT UNFOLDED SHEET IS CALLED DEVELOPMENT OF LATERAL SURFACES OF THAT OBJECT OR SOLID.

LATERAL SURFACE IS THE SURFACE EXCLUDING SOLID'S TOP & BASE.

ENGINEERING APPLICATION:
THERE ARE SO MANY PRODUCTS OR OBJECTS WHICH ARE DESIGNED AND MANUFACTURED BY CONVENTIONAL MANUFACTURING PROCESSES. BECAUSE OF THEIR SHAPES AND SIZES THOSE ARE FABRICATED IN SHEET METAL INDUSTRY BY USING DEVELOPMENT TECHNIQUE. THERE IS A VAST RANGE OF SUCH OBJECTS.

EXAMPLES:-
Boiler Shells & chimneys, Funnels, Vessels, Stoves, Tanks, Buckets & Containers, Roofing Mappers, Large Pipe sections, Body & Parts of automobiles, Ships, Aeroplanes and many more.

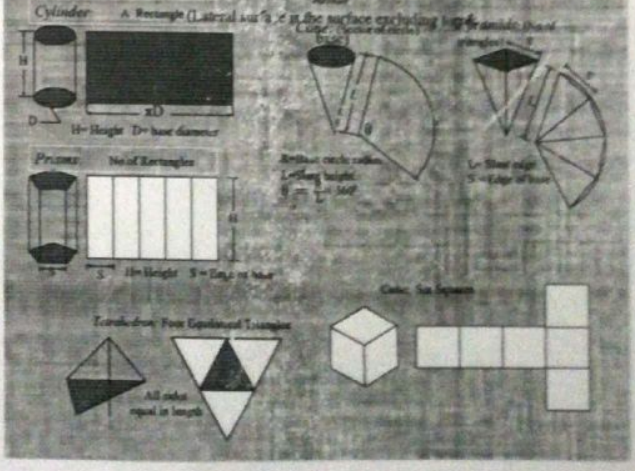
WHAT IS OUR OBJECTIVE IN THIS TOPIC. → To learn methods of development of surfaces of different solids, their sections and fractures.

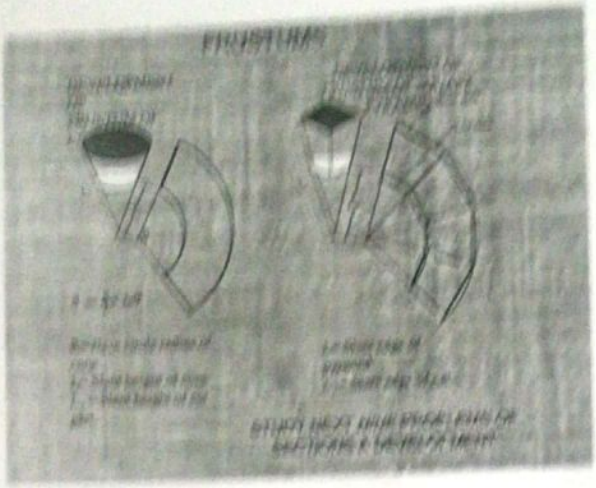
But before going ahead, note following Important points.

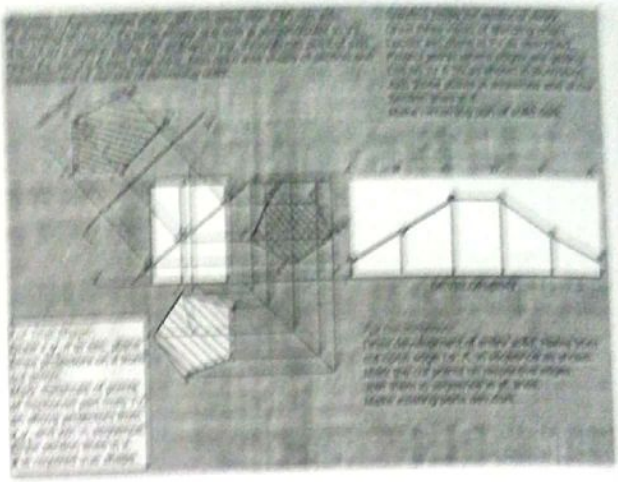
1. Development is different drawing than PROJECTIONS.
2. It is a shape showing AREA, means it's a 2-D plane drawing.
3. Hence all dimensions of it must be TRUE dimensions.
4. As it is representing shape of an un-folded sheet, no edges can remain hidden. And hence DOTTED LINES are never shown on development.

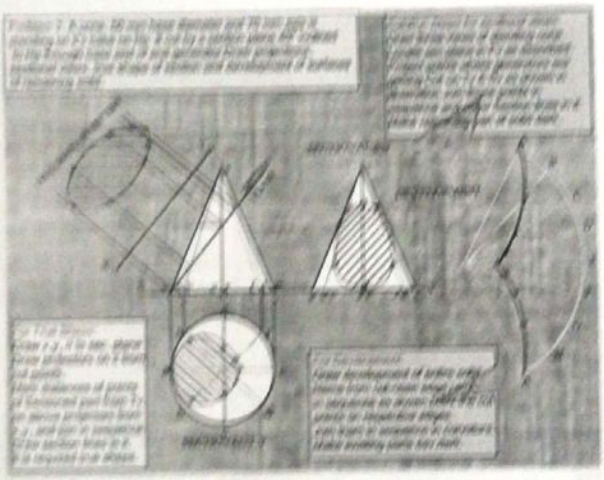
Study illustrations given on next page carefully.

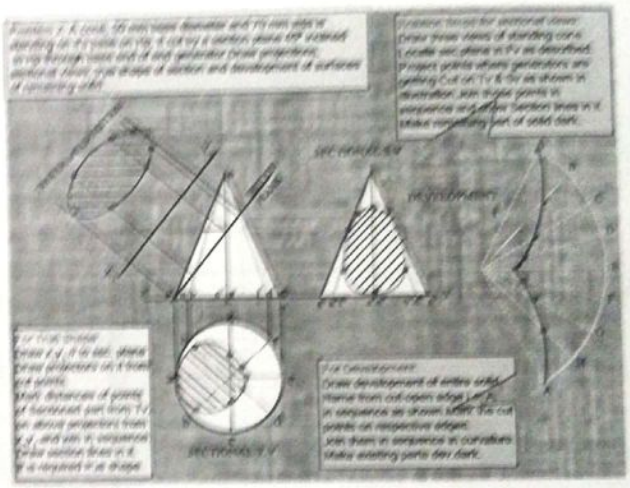
Develop lateral surfaces of different solids

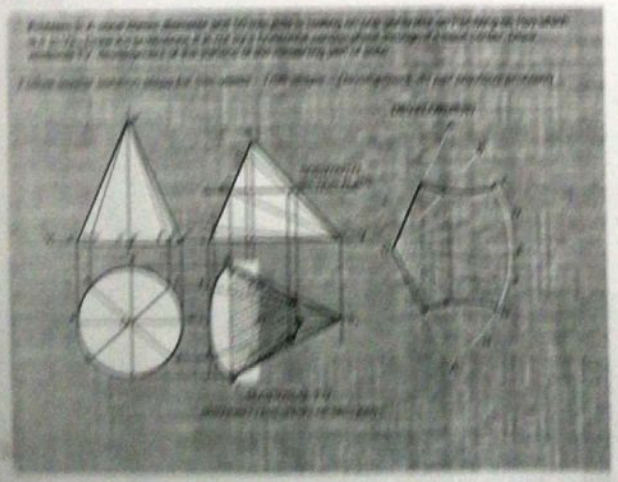


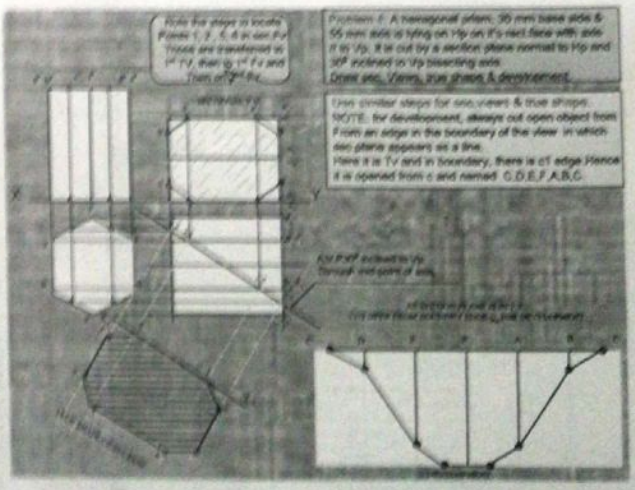












ORTHOGRAPHIC PROJECTIONS
{ MACHINE ELEMENTS }

OBJECT IS OBSERVED IN THREE DIRECTIONS.
THE DIRECTIONS SHOULD BE NORMAL
TO THE RESPECTIVE PLANES.
AND NOW PROJECT THREE DIFFERENT VIEWS ON THOSE PLANES.
THESE VEWS ARE FRONT VIEW , TOP VIEW AND SIDE VIEW.

FRONT VIEW IS A VIEW PROJECTED ON VERTICAL PLANE (VP)
TOP VIEW IS A VIEW PROJECTED ON HORIZONTAL PLANE (HP)
SIDE VIEW IS A VIEW PROJECTED ON PROFILE PLANE (PP)

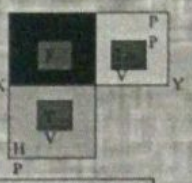
FIRST STUDY THE CONCEPT OF 1ST AND 3RD ANGLE
PROJECTION METHODS.

AND THEN STUDY NEXT 26 ILLUSTRATED CASES CAREFULLY.
TRY TO RECOGNIZE SURFACES
PERPENDICULAR TO THE ARROW DIRECTIONS

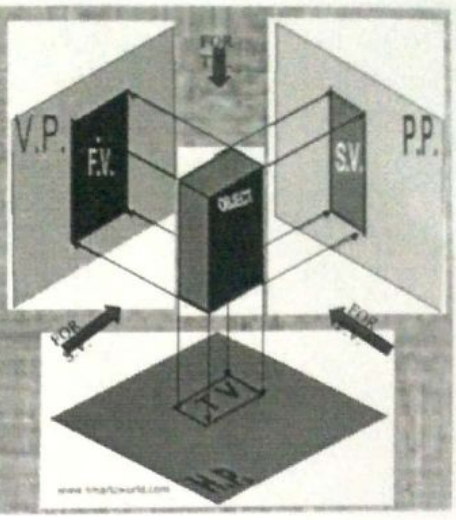
FIRST ANGLE PROJECTION

IN THIS METHOD,
THE OBJECT IS ASSUMED TO BE
SITUATED IN FIRST QUADRANT
MEANS
ABOVE HP & INFRONT OF VP.

OBJECT IS INBETWEEN
OBSERVER & PLANE.



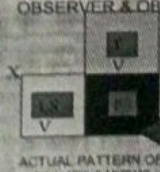
ACTUAL PATTERN OF
PLANES & VIEWS
IN
FIRST ANGLE METHOD
OF PROJECTIONS



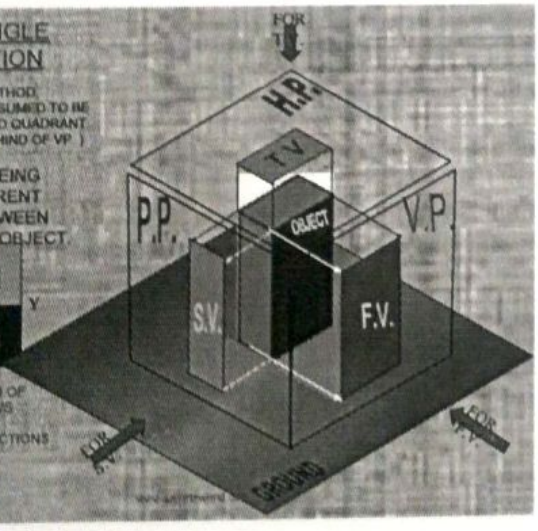
THIRD ANGLE PROJECTION

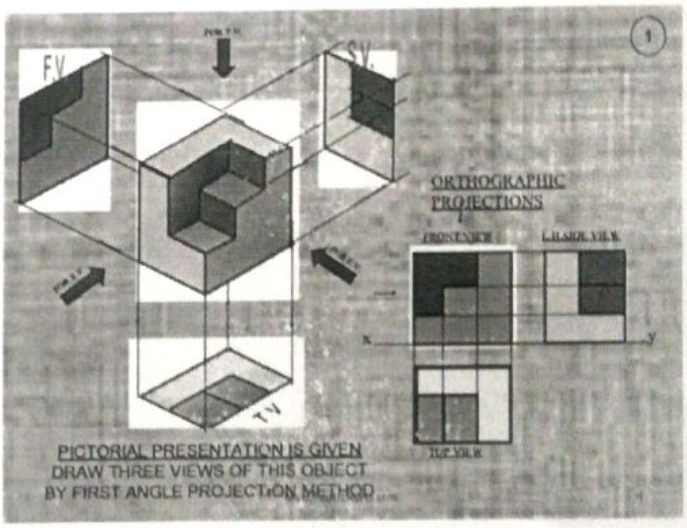
IN THIS METHOD,
THE OBJECT IS ASSUMED TO BE
SITUATED IN THIRD QUADRANT
(BELOW HP & BEHIND OF VP)

PLANES BEING
TRANSPERENT
AND INBETWEEN
OBSERVER & OBJECT.

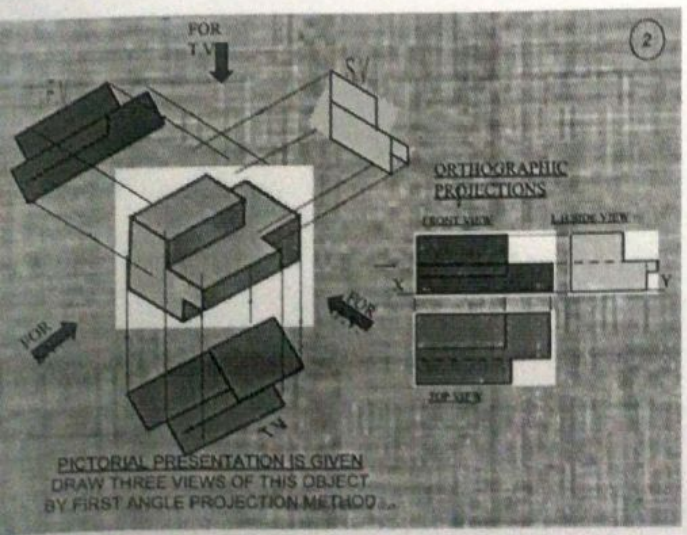


ACTUAL PATTERN OF
PLANES & VIEWS
OF
THIRD ANGLE PROJECTIONS

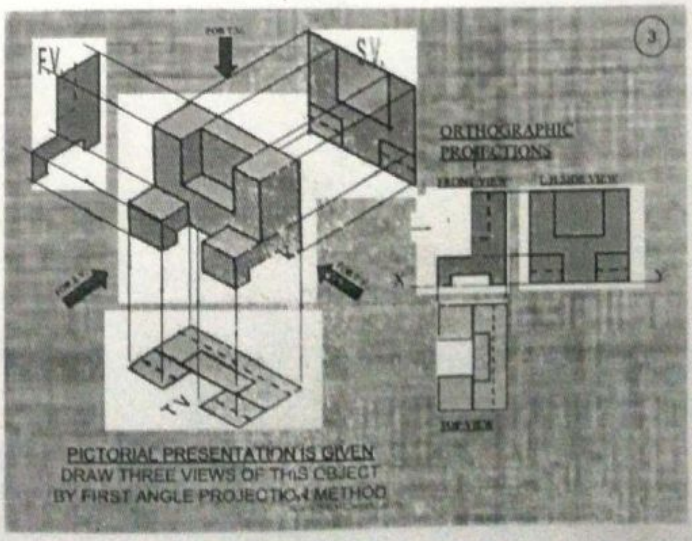




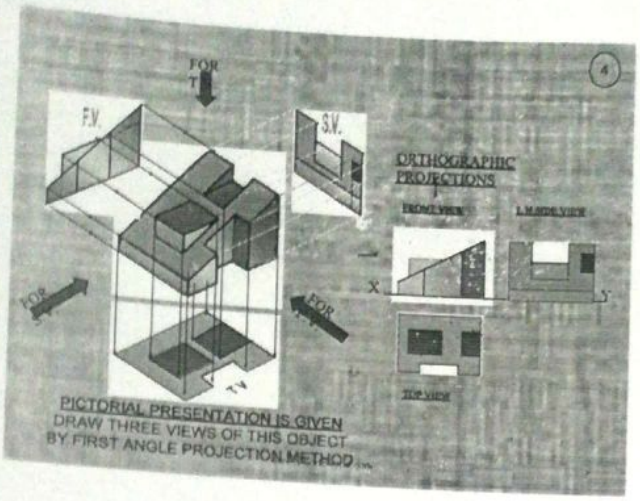
PICTORIAL PRESENTATION IS GIVEN
DRAW THREE VIEWS OF THIS OBJECT
BY FIRST ANGLE PROJECTION METHOD

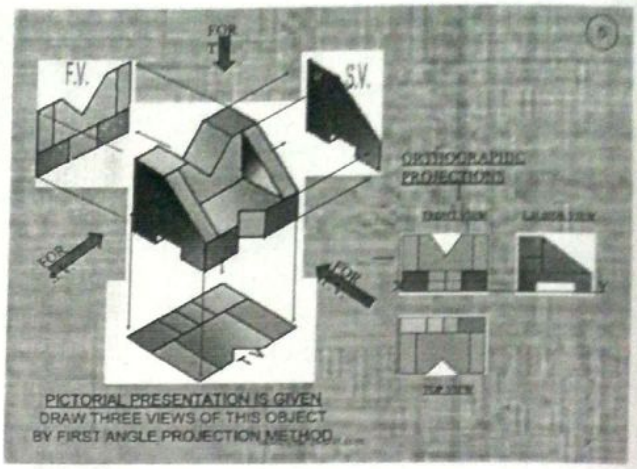


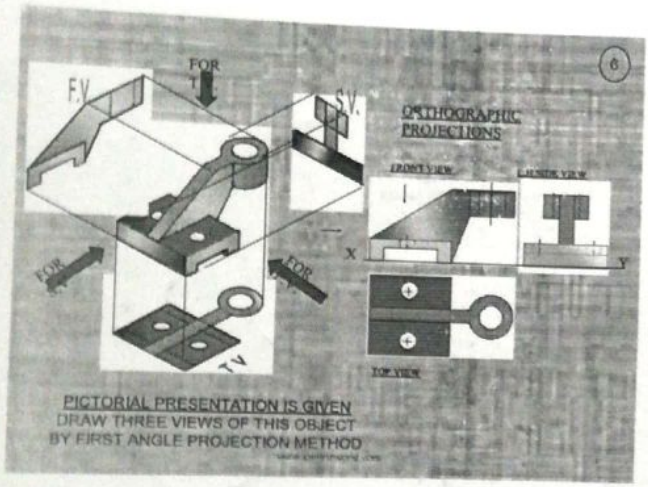
PICTORIAL PRESENTATION IS GIVEN
DRAW THREE VIEWS OF THIS OBJECT
BY FIRST ANGLE PROJECTION METHOD



PICTORIAL PRESENTATION IS GIVEN
DRAW THREE VIEWS OF THIS OBJECT
BY FIRST ANGLE PROJECTION METHOD







ORTHOGRAPHIC PROJECTIONS
OF POINTS, LINES, PLANES, AND SOLIDS.

TO DRAW PROJECTIONS OF ANY OBJECT,
ONE MUST HAVE FOLLOWING INFORMATION

A) OBJECT
(WITH IT'S DESCRIPTION, WELL DEFINED.)

B) OBSERVER
(ALWAYS OBSERVING PERPENDICULAR TO RESP. REF.PLANE).

C) LOCATION OF OBJECT,
(MEANS IT'S POSITION WITH REFFERENCE TO H.P. & V.P.)

TERMS 'ABOVE' & 'BELOW' WITH RESPECTIVE TO H.P.
AND TERMS 'INFRONT' & 'BEHIND' WITH RESPECTIVE TO V.P
FORM 4 QUADRANTS.
OBJECTS CAN BE PLACED IN ANY ONE OF THESE 4 QUADRANTS.

IT IS INTERESTING TO LEARN THE EFFECT ON THE POSITIONS OF VIEWS (F.V. TV)

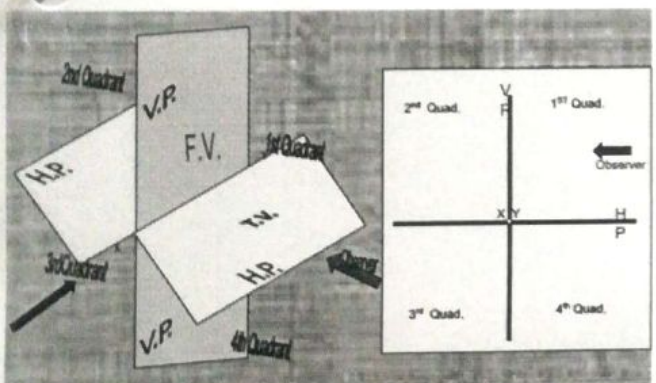
STUDY ILLUSTRATIONS GIVEN ON NEXT PAGES AND NOTE THE RESULTS TO MAKE IT EASY HERE A POINT 'A' IS TAKEN AS AN OBJECT, BECAUSE IT'S ALL VIEWS ARE JUST POINTS

NOTATIONS

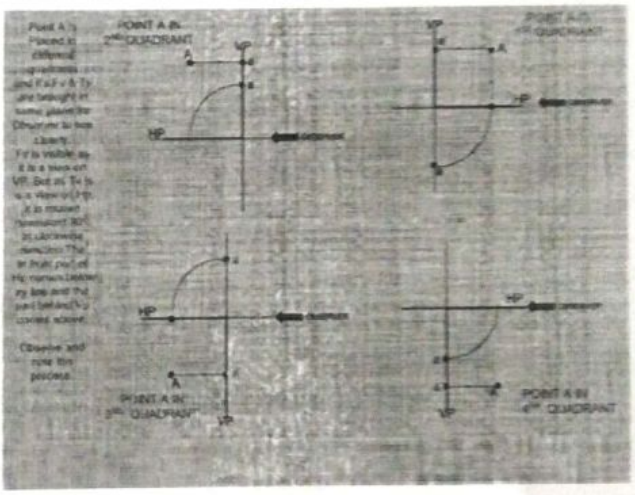
FOLLOWING NOTATIONS SHOULD BE FOLLOWED WHILE MAKING DIFFERENT VIEWS IN ORTHOGRAPHIC PROJECTIONS.

OBJECT	POINT A	LINE AB
IT'S TOP VIEW	a	ab
IT'S FRONT VIEW	a'	a'b'
IT'S SIDE VIEW	a''	a''b''

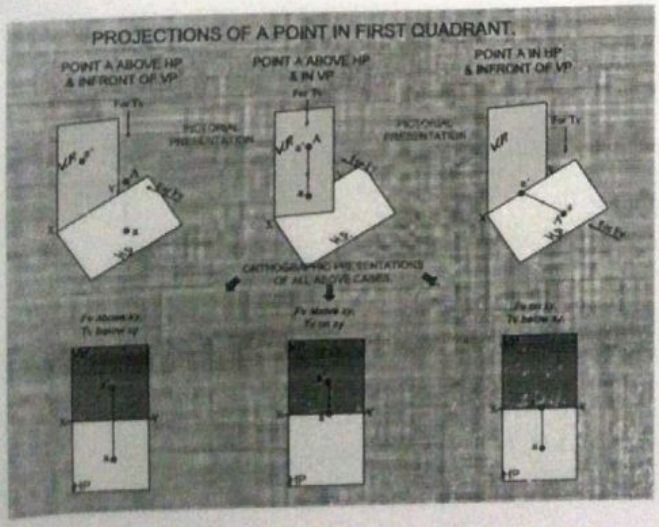
SAME SYSTEM OF NOTATIONS SHOULD BE FOLLOWED INCASE NUMBERS, LIKE 1, 2, 3 ... ARE USED



THIS QUADRANT PATTERN,
IF OBSERVED ALONG X-Y LINE (IN RED ARROW DIRECTION)
WILL EXACTLY APPEAR AS SHOWN ON RIGHT SIDE AND HENCE,
IT IS FURTHER USED TO UNDERSTAND ILLUSTRATION PROPERLLY.



PROJECTIONS OF A POINT IN FIRST QUADRANT.

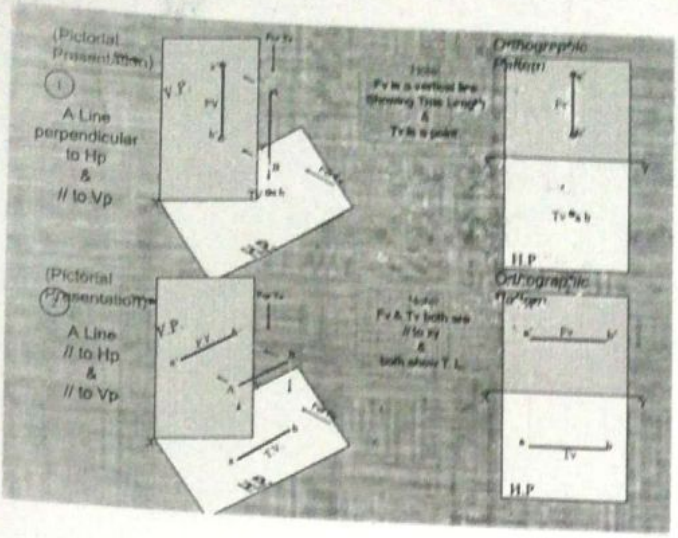


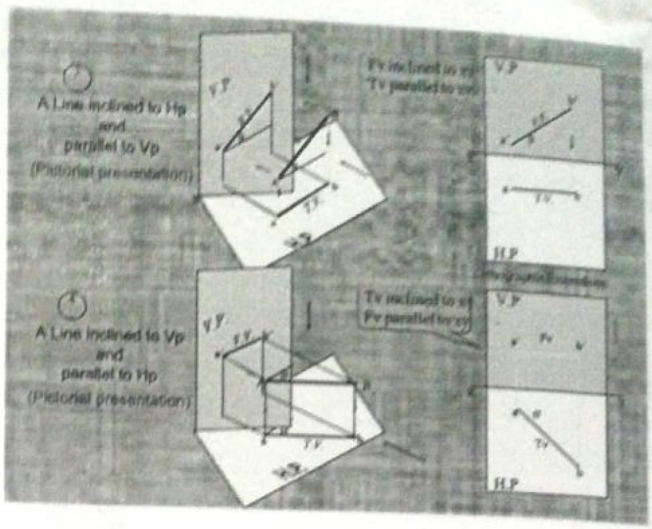
PROJECTIONS OF STRAIGHT LINES

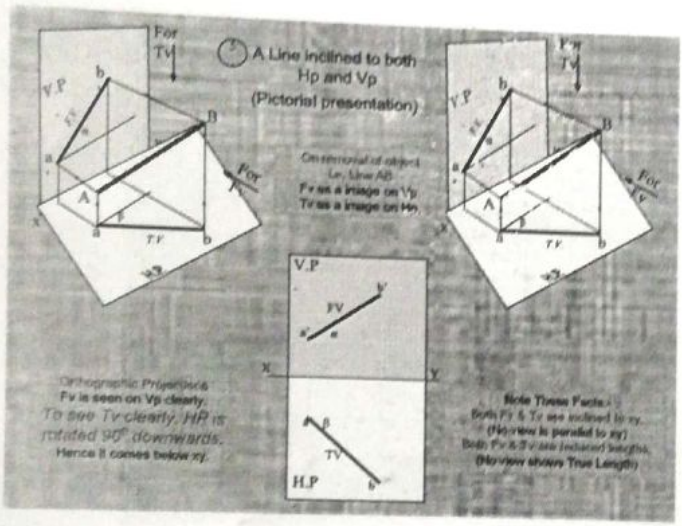
SIMPLE CASES OF A LINE

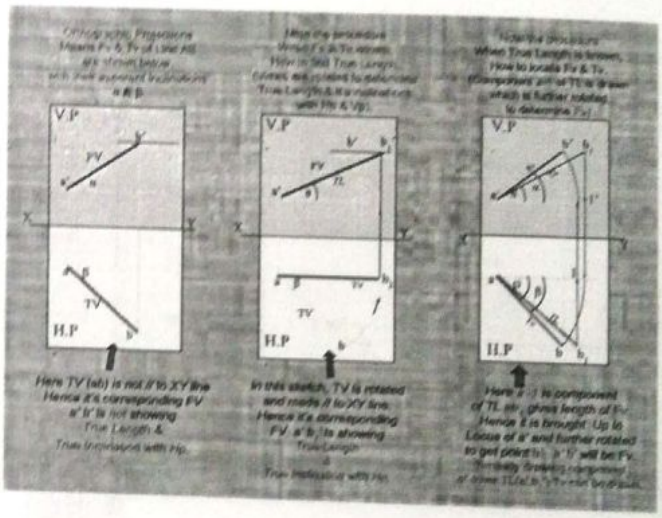
1. A VERTICAL LINE (LINE PERPENDICULAR TO HP & TO VP)
2. LINE PARALLEL TO BOTH HP & VP.
3. LINE INCLINED TO HP & PARALLEL TO VP.
4. LINE INCLINED TO VP & PARALLEL TO HP.

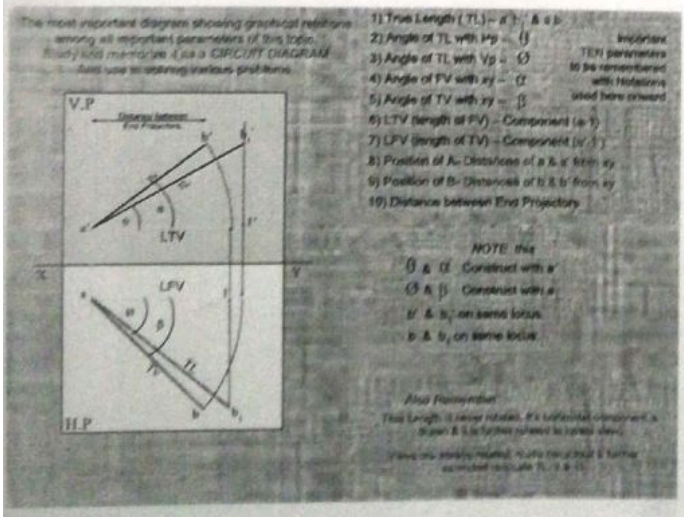
5 STUDY INCLINED VIEWS GIVEN ON NEXT PAGE SHOWING CLEARLY THE NATURE OF FV & TV OF LINES LISTED ABOVE AND NOTE RESULTS.

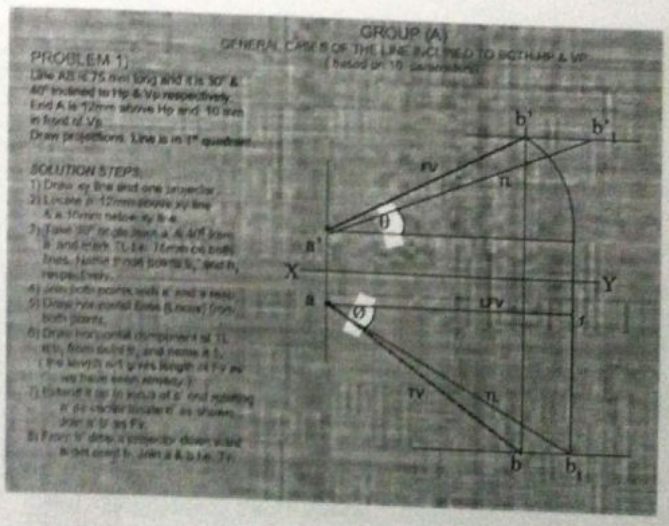


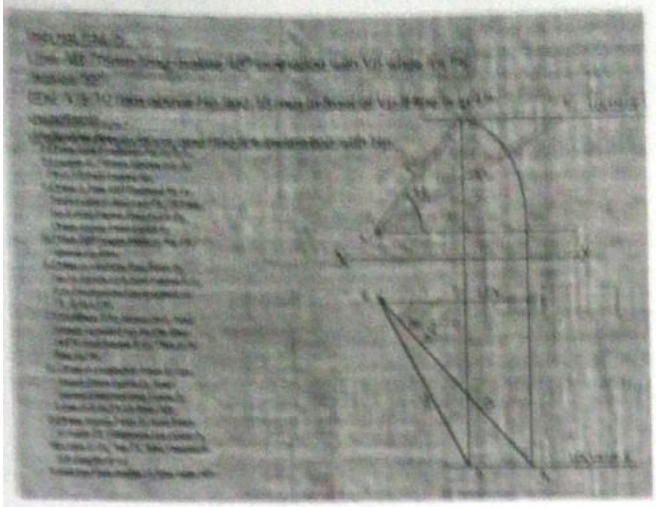


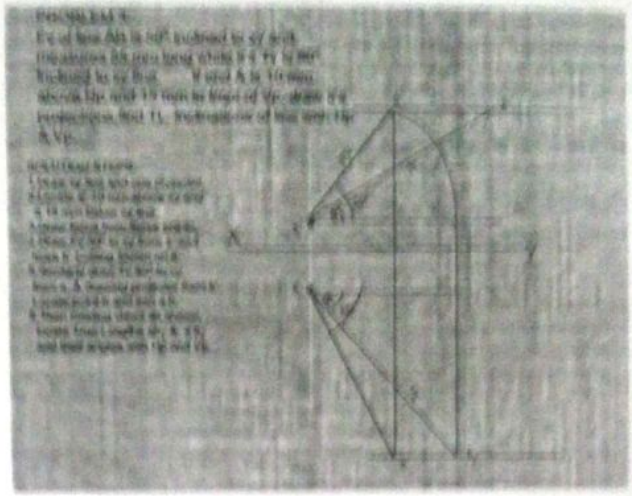


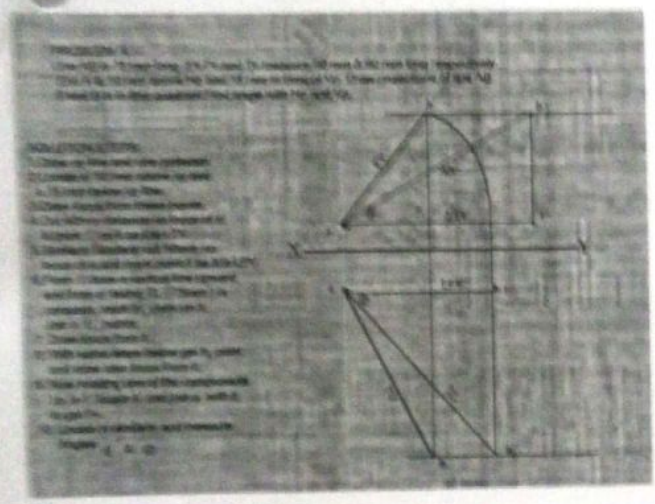


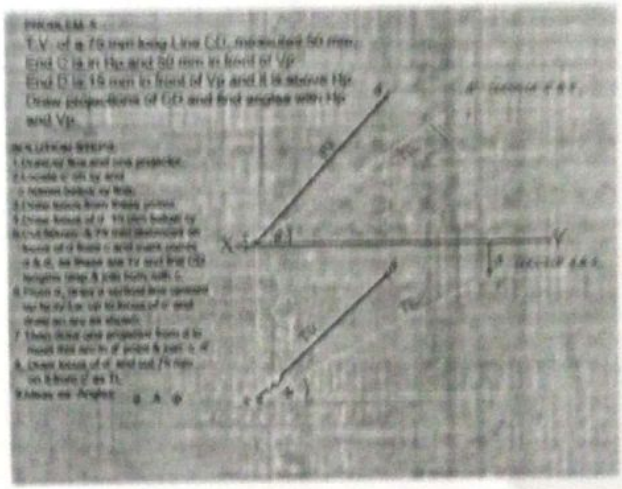












PROJECTIONS OF PLANES

What is exactly asked in the problem?

To draw their projections mean FV & TV

What will be given in the problem?

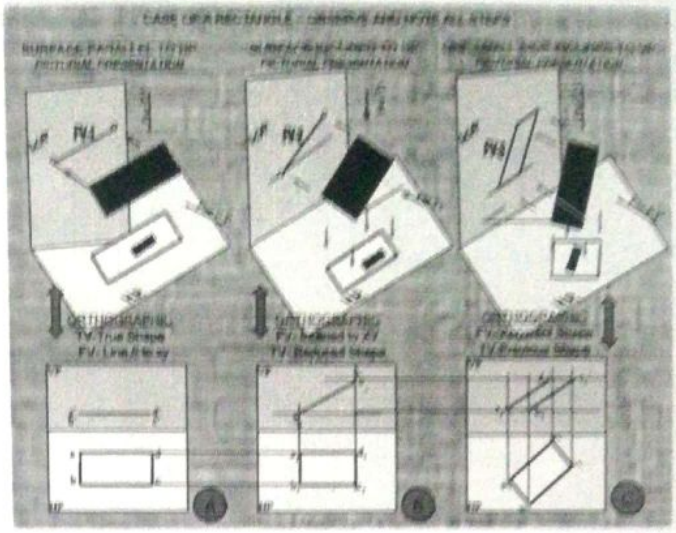
Description of the plane figure

It's position with HP and VP

In which manner its position with HP & VP will be described?

1. Inclination of it's SURFACE with one of the reference planes will be given.
2. Inclination of one of it's EDGES with other reference plane will be given.
   (Hence this will be a case of an object inclined to both reference Planes.)

Study the illustration showing surface & side inclination given on next page.



PROCEDURE OF SOLVING THE PROBLEM

IN THREE STEPS EACH PROBLEM CAN BE SOLVED:(As Shown In Previous Illustration)

STEP 1. Assume suitable conditions & draw Fv & Tv of initial position.

STEP 2. Now consider surface inclination & draw 2nd Fv & Tv.

STEP 3. After this,consider side/edge inclination and draw 3rd (final) Fv & Tv.

ASSUMPTIONS FOR INITIAL POSITION:

(Initial Position means assuming surface // to HP or VP)

1. If in problem surface is inclined to HP – assume it // HP
   Or If surface is inclined to VP – assume it // to VP
2. Now if surface is assumed // to HP- It's TV will show True Shape.
   And If surface is assumed // to VP – It's FV will show True Shape.
3. Hence begin with drawing TV or FV as True Shape.
4. While drawing this True Shape –
   keep one side/edge (which is making inclination) perpendicular to xy line
   (similar to pair no. A on previous page illustration).

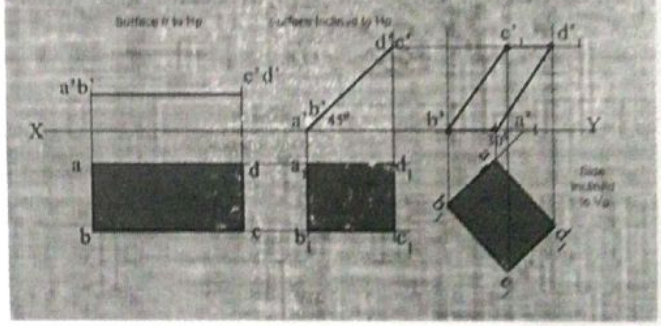
Now Complete STEP 2. By making surface inclined to the resp plane & project it's other view.

Now Complete STEP 3. By making side inclined to the resp plane & project it's other view.
(Ref. 3rd pair C on previous page illustration)

APPLY SAME STEPS TO SOLVE NEXT *ELEVEN* PROBLEMS

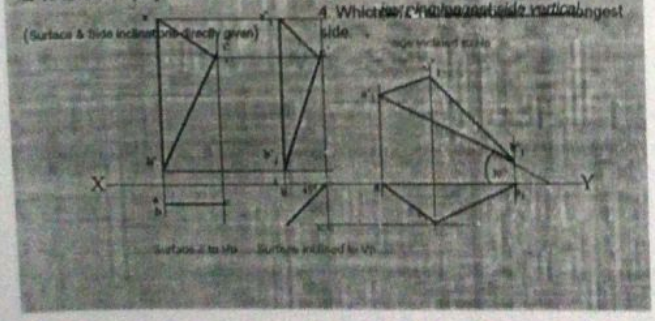
Problem 1:
Rectangle 30mm and 50mm sides is resting on HP on one small side which is 30° inclined to VP,while the surface of the plane makes 45° inclination with HP. Draw it's projections.

Read problem and answer following questions
1. Surface inclined to which plane? ——— HP
2. Assumption for initial position? ——// to HP
3. So which view will show True shape? —— TV
4. Which side will be vertical? —One small side
Hence begin with TV, draw rectangle below X-Y drawing one small side vertical.



Problem 2:
A 30° – 60° set square of longest side 100 mm long, is in VP and 30° inclined to HP while it's surface is 45° inclined to VP.Draw it's projections

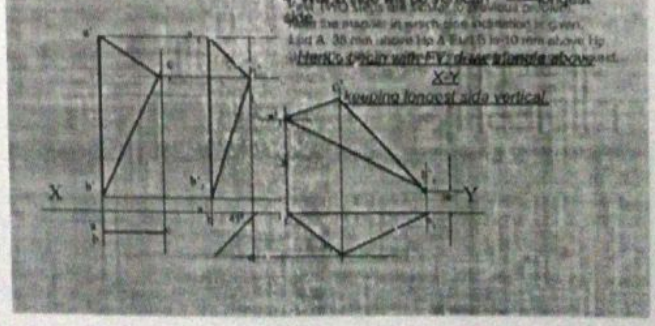
Read problem and answer following questions
1. Surface inclined to which plane? ——— VP
2. Assumption for initial position? ——// to VP
3. Hence begin with FV, draw triangle above X-Y
4. Which side will be vertical? ——longest side

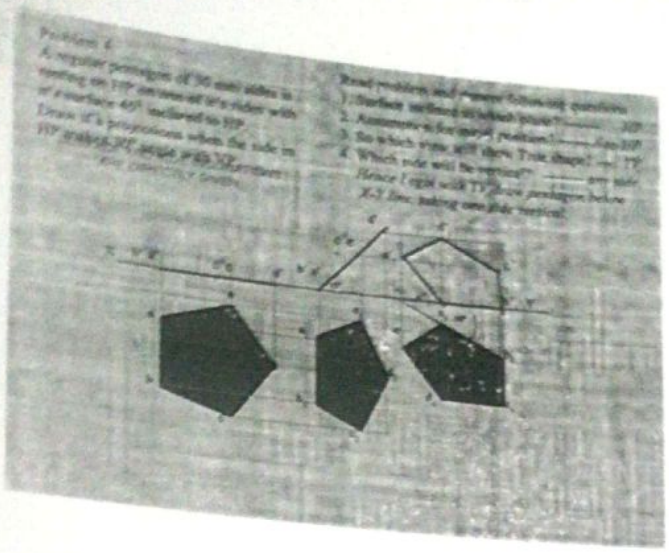


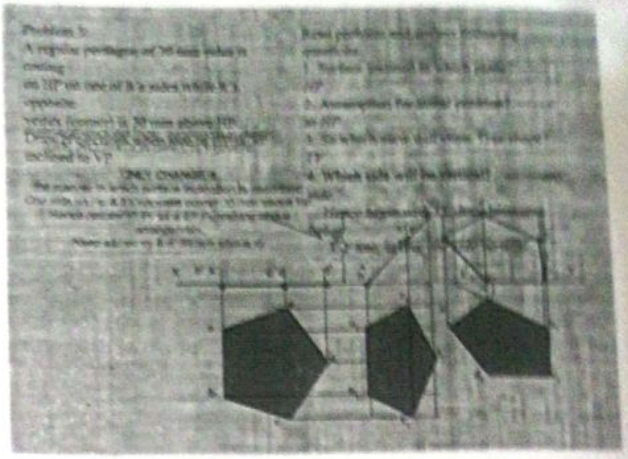
Problem 3:
A 30° – 60° set square of longest side 100 mm long is in VP and it's surface 45° inclined to VP. One end of longest side is 10 mm and other end is 35 mm above HP. Draw it's projections.

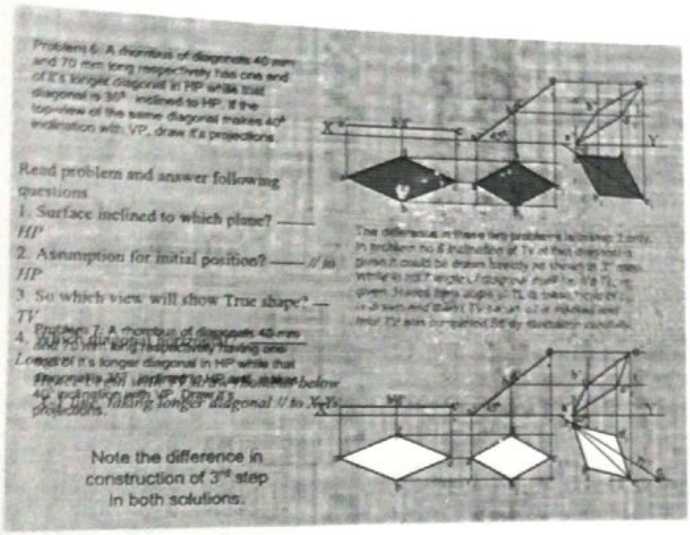
(Surface inclination directly given, Side inclination indirectly given)

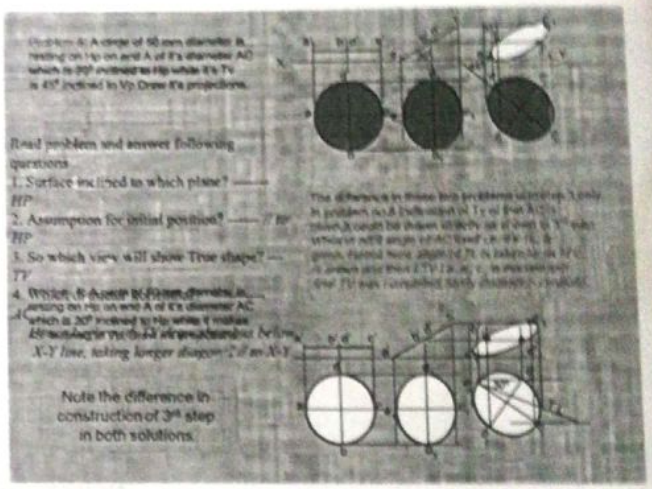
Read problem and answer following questions
1. Surface inclined to which plane? ——— VP.
2. Assumption for initial position? ——// to VP
3. So which view will show True shape? —— FV.
4. Which side will be vertical? ——longest side
Hence begin with FV, draw triangle above X-Y keeping longest side vertical.

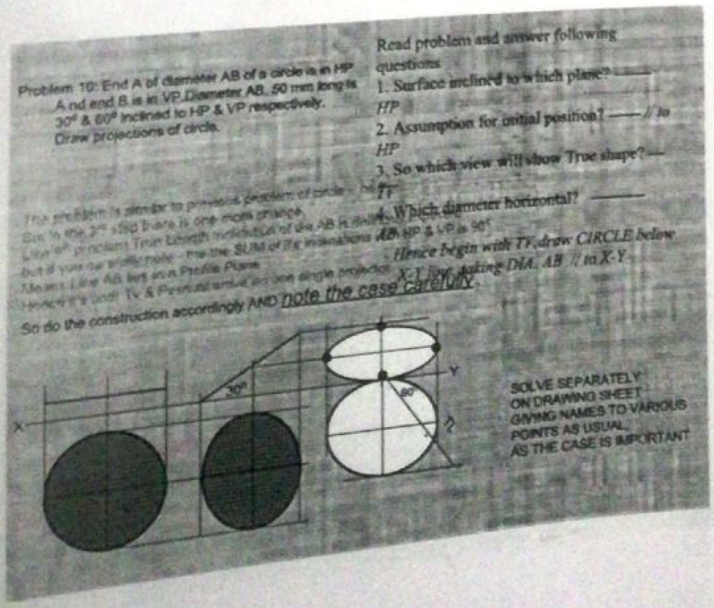


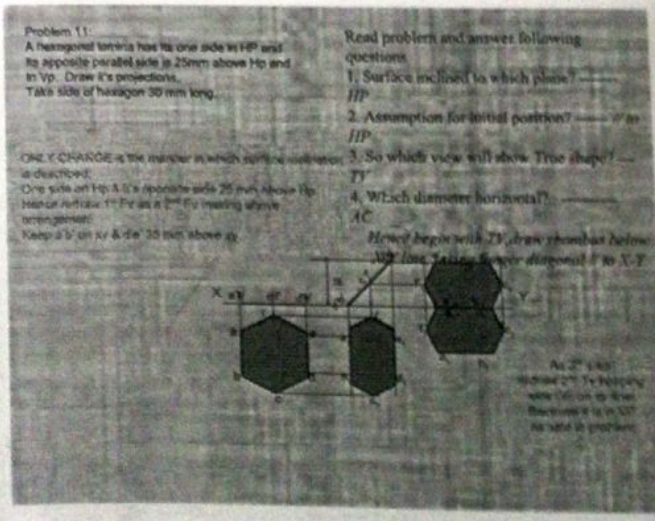








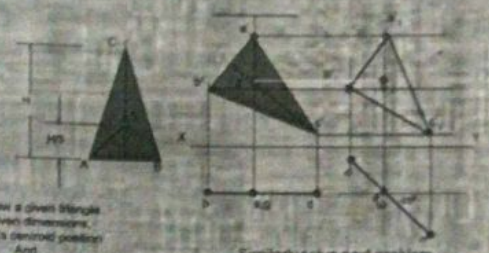




FREELY SUSPENDED CASES

Problem 12:
An isosceles triangle of 40 mm long base side, 60 mm long altitude is freely suspended from one corner of base side. It's plane is 45° inclined to Vp. Draw it's projections.

IMPORTANT



First draw a given triangle
With given dimensions.
Locate it's desired position
And
join it with point of suspension.

Similarly solve next problem
of Semi-circle

To determine true shape of plane figure when it's projections are given
BY USING AUXILIARY PLANE METHOD

WHAT WILL BE THE PROBLEM?
Description of final Fv & Tv will be given
You are supposed to determine true shape of that plane

Follow the below given steps:

1. Draw the given Fv & Tv as per the given information in problem.
2. Then among all lines of Fv & Tv select a line showing True Length (T.L.)
   (It's other view must be // to xy)
3. Draw x_1y_1 perpendicular to this line showing T.L.
4. Project view on x_1y_1 (It must be a line view)
5. Draw x_2y_2 // to the line view & project new view on it.
   It will be the required answer i.e. True Shape.

The facts you must follow
If you carefully study and observe the solutions of all previous problems
You will find
IF ONE VIEW IS A LINE VIEW & THAT TOO PARALLEL TO XY LINE,
THEN AND THEN IT'S OTHER VIEW WILL SHOW TRUE SHAPE

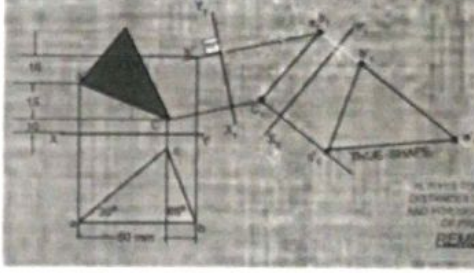
NOW FINAL VIEWS ARE ALWAYS SOME SHAPE NOT LINE VIEWS
BY APPLYING ABOVE METHODS
WE FIRST CONVERT ONE VIEW IN INCLINED LINE VIEW (By using x_1y_1) and then
THEN BY MAKING IT // TO X_2-Y2 WE GET TRUE SHAPE

Study Next
Four Cases

Problem 14. Tv is a triangle abc. Ab is 50 mm long, angle cab is 30° and angle cba is 60°. a'b'c' is a Fv. a' is 25 mm, b' is 40 mm and c' is 10 mm etc. a is the nearest point. Draw projections of that figure and find it's true shape.

As per the procedure

1. First draw Fv & Tv as per the data.
2. In Tv line ab is // to xy hence it's other view a'b' is TL. So draw x_1y_1 perpendicular to it.
3. Project view on x_1y_1.
   a) First draw projectors from a'b' & c' on x_1y_1
   b) from xy take distances of a,b & c to Tv1 make on these projectors from x_1y_1. Name points a'b1 & c1.
   c) This line view is an Aux.Tv. Draw x_2y_2 // to this line view and project Aux. Fv on it.
   Ie that from x_1y_1 take distances of a'b' & c' and mark them on new projectors.
4. Name points a", b", & c", and join them. This will be the required true shape.



TRUE SHAPE

ALWAYS FOR NEW Fv TAKE DISTANCES OF PREVIOUS Fv AND FOR NEW Tv TAKE DISTANCES OF PREVIOUS Tv

REMEMBER!!

Problem 15: Fv & Tv of a triangular plate are shown. Determine it's true shape.

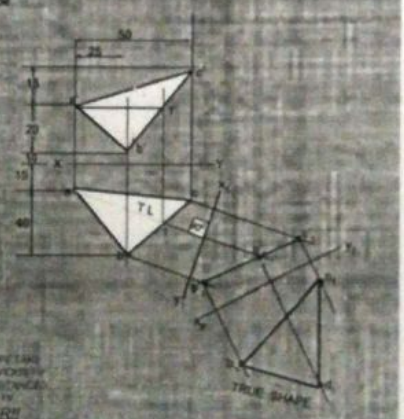
USE SAME PROCEDURE STEPS OF PREVIOUS PROBLEM
BUT THERE IS ONE DIFFICULTY

NO LINE IS // TO XY IN ANY VIEW MEANS NO TL IS AVAILABLE.

IN SUCH CASES DRAW ONE LINE // TO XY IN ANY VIEW & IT'S OTHER VIEW CAN BE CONSIDERED AS TL FOR THE PURPOSE.

HERE a' 1' line in Fv is drawn // to xy HENCE it's Tv a-1 becomes TL.

THEN FOLLOW SAME STEPS AND DETERMINE TRUE SHAPE.
(STUDY THE ILLUSTRATION)



TRUE SHAPE

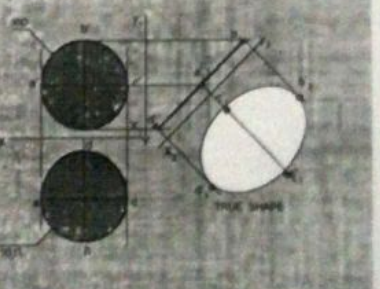
ALWAYS FOR NEW Fv TAKE DISTANCES OF PREVIOUS Fv AND FOR NEW Tv TAKE DISTANCES OF PREVIOUS Tv

REMEMBER!!

PROBLEM 16. Fv & Tv both are circle each of 50 mm diameter. Determine true shape of an inclined plane.

ADOPT SAME PROCEDURE.
a c is considered as line // to xy
Then a'c' becomes TL for the purpose.
Using steps properly true shape can be easily determined.

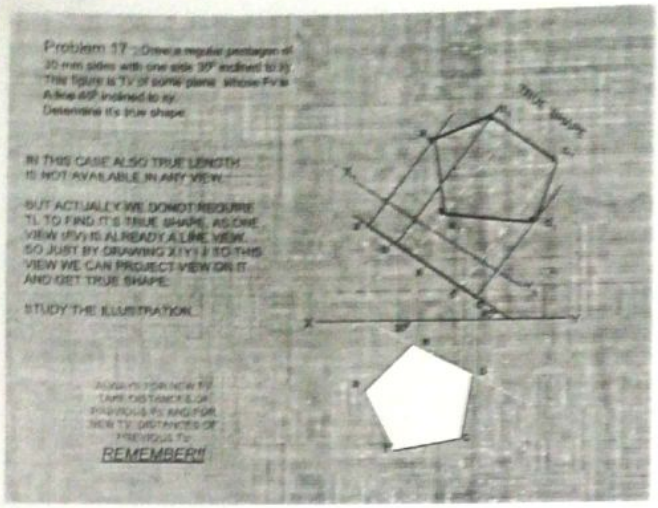
Study the illustration

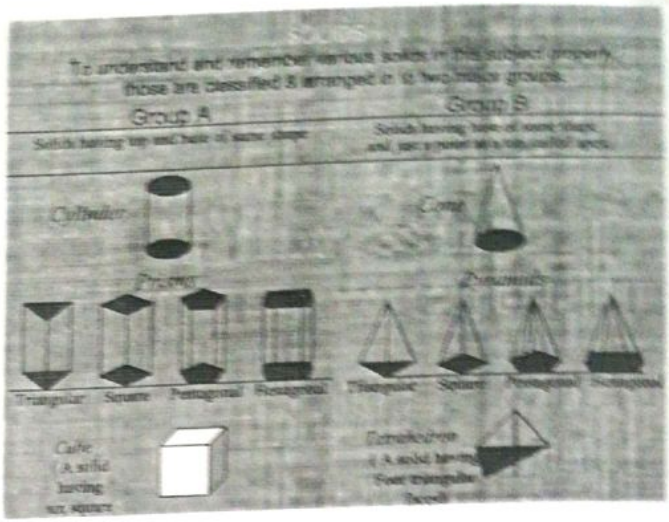


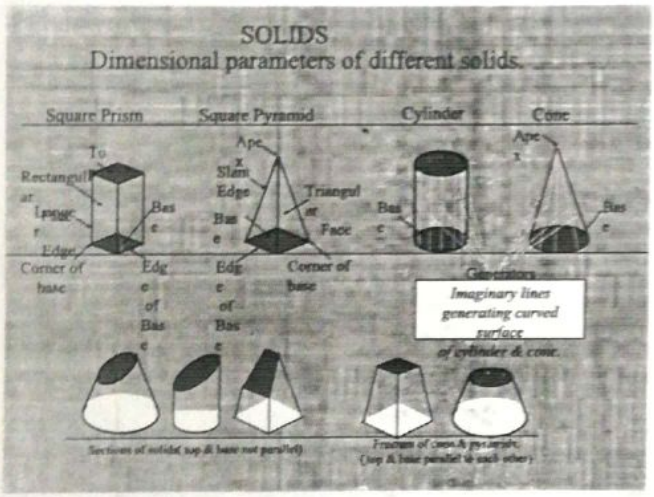
TRUE SHAPE

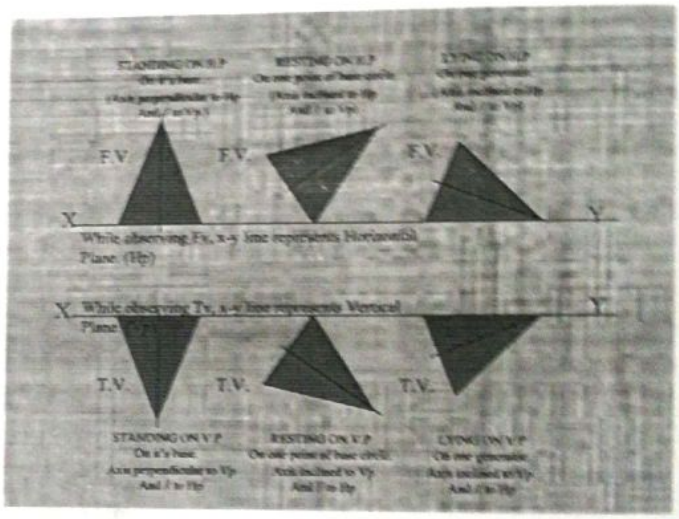
ALWAYS FOR NEW Fv TAKE DISTANCES OF PREVIOUS Fv AND FOR NEW Tv TAKE DISTANCES OF PREVIOUS Tv

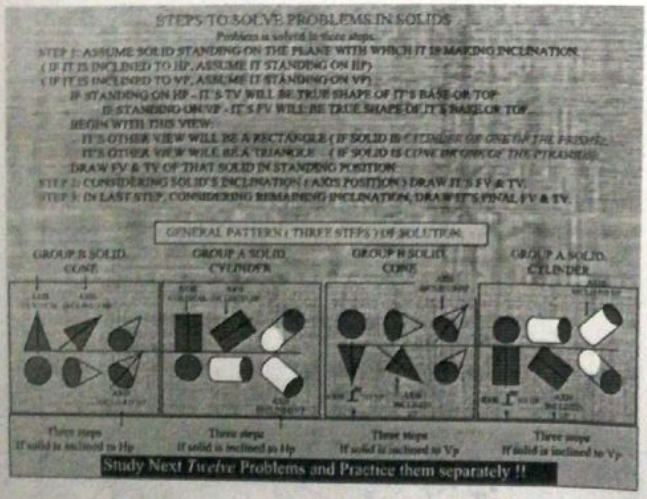
REMEMBER!!

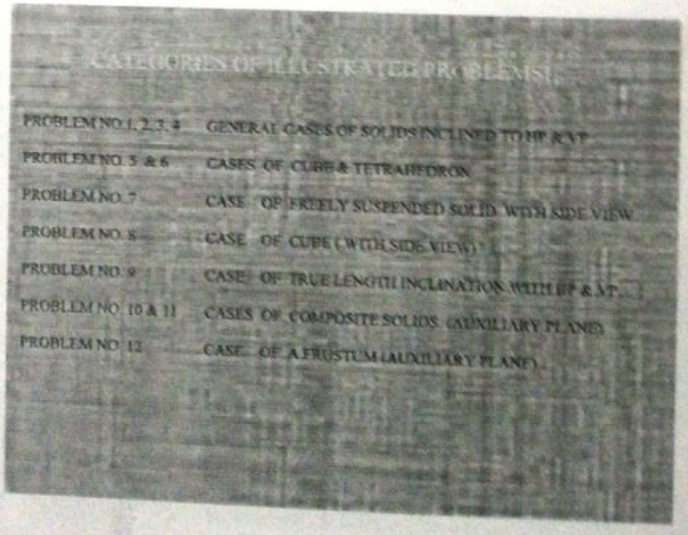




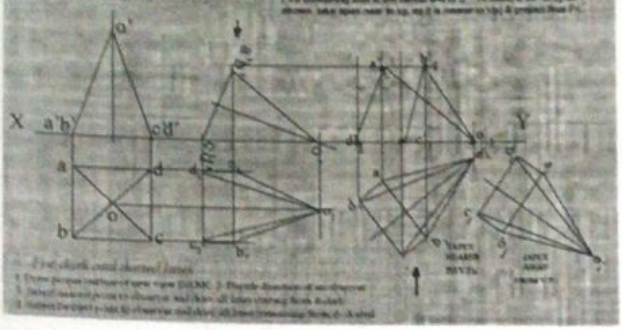




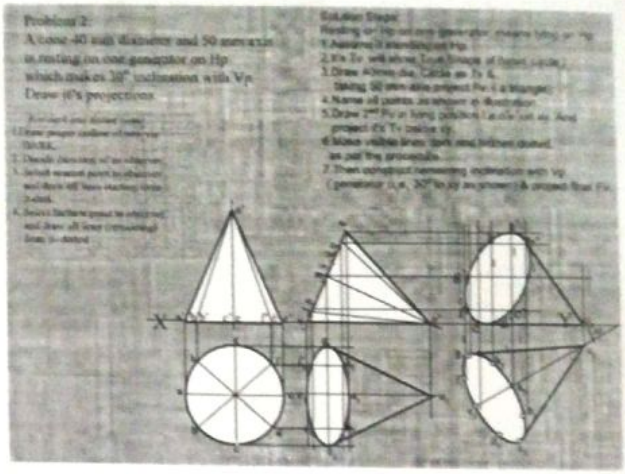




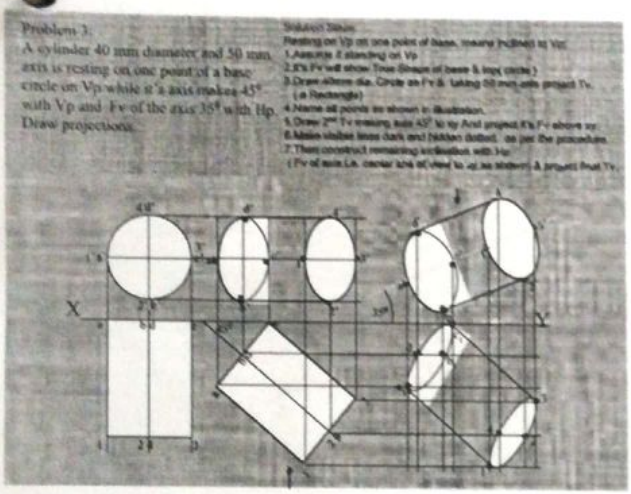
Problem 1. A square pyramid, 4 mm base sides and axis 60 mm long, has a triangular face on the ground and the vertical plan containing the axis makes a angle of 45° with the VP. Draw 8 projections. Take apex heavier i Vp.

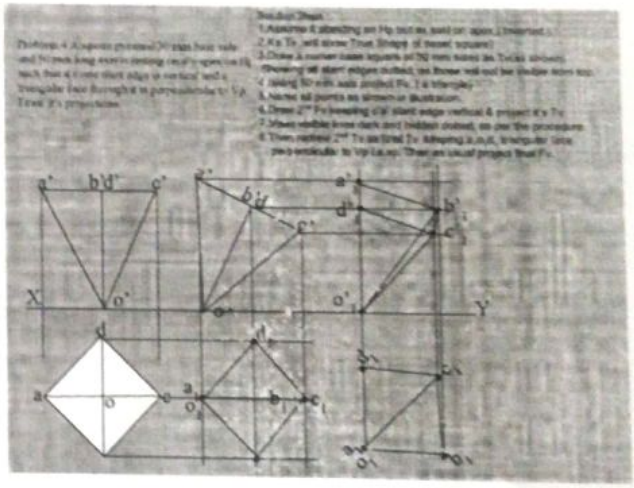


Problem 2:
A cone 40 mm diameter and 50 mm axis is resting on one generator on Hp which makes 30° inclination with Vp. Draw 6's projections

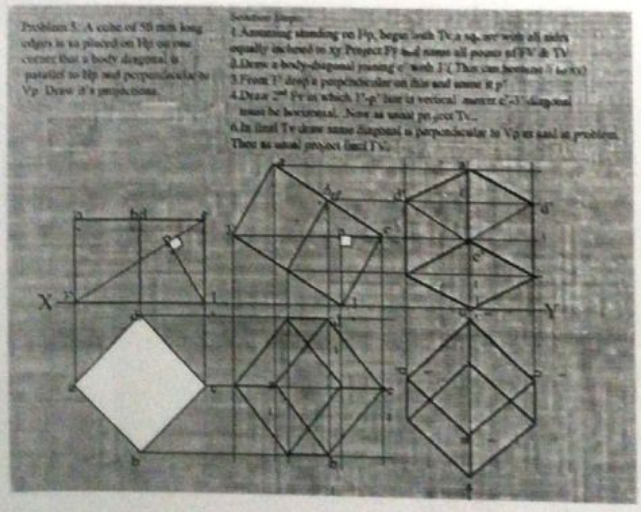


Problem 3.
A cylinder 40 mm diameter and 50 mm axis is resting on one point of a base circle on Vp while it's axis makes 45° with Vp and Fv of the axis 35° with Hp. Draw projections.

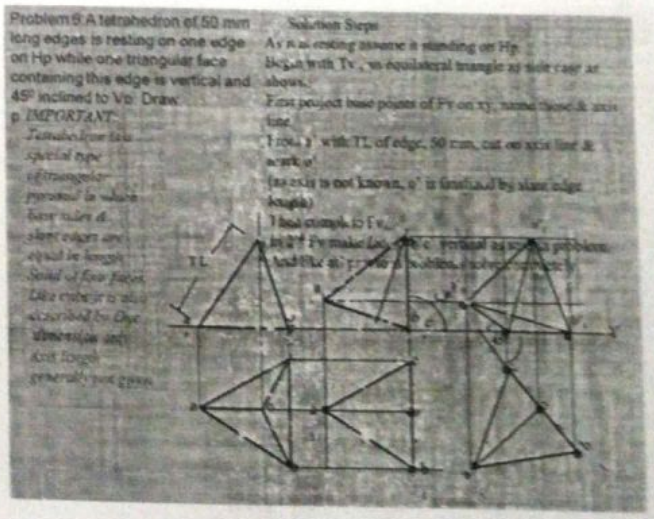


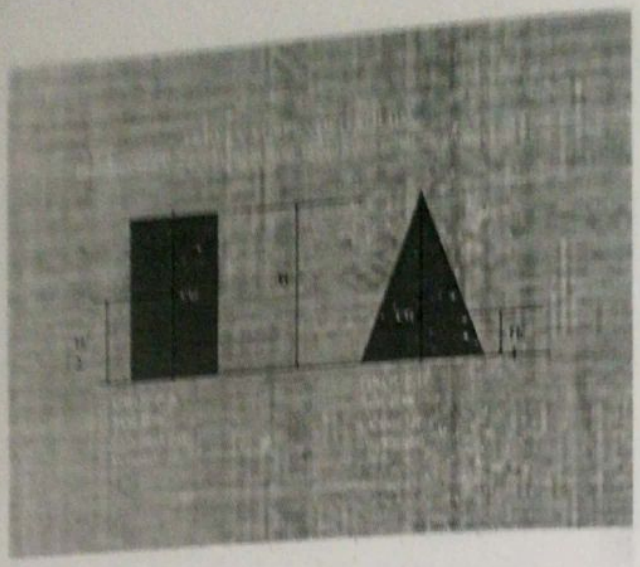


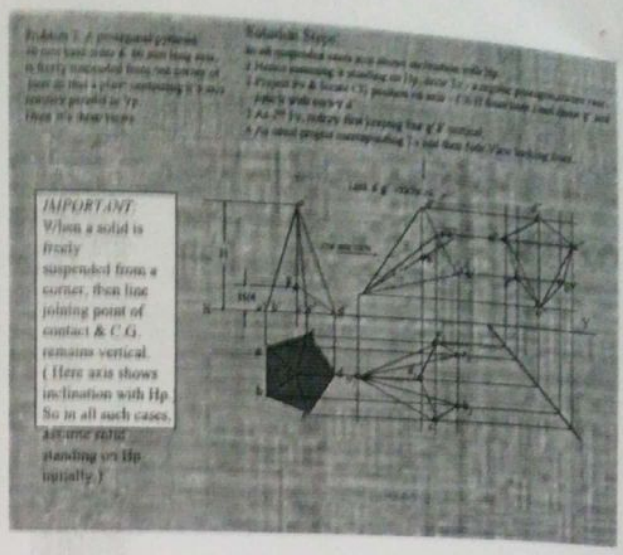
Problem 5. A cube of 50 mm long edges is so placed on Hp on one corner that a body diagonal is parallel to Hp and perpendicular to Vp. Draw it's projections.

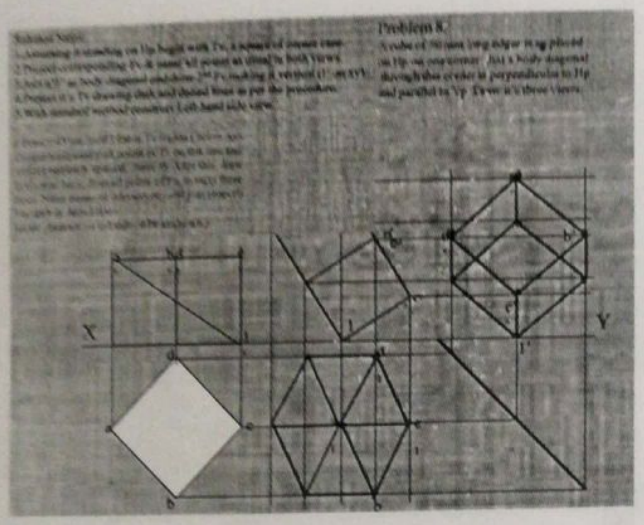


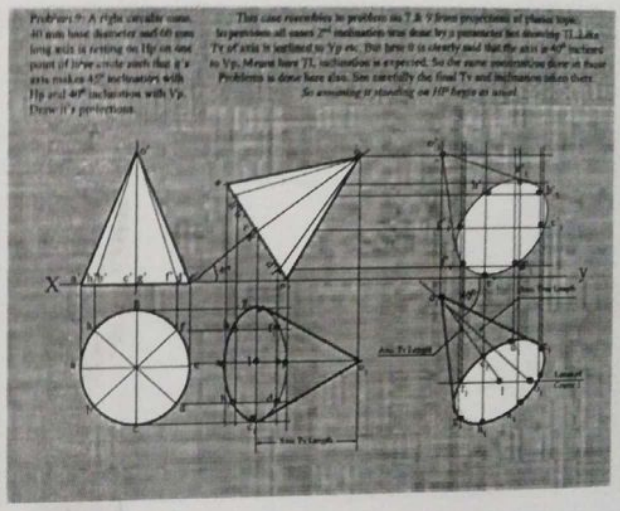
Problem 6 A tetrahedron of 50 mm long edges is resting on one edge on Hp while one triangular face containing this edge is vertical and 45° inclined to Vp. Draw.

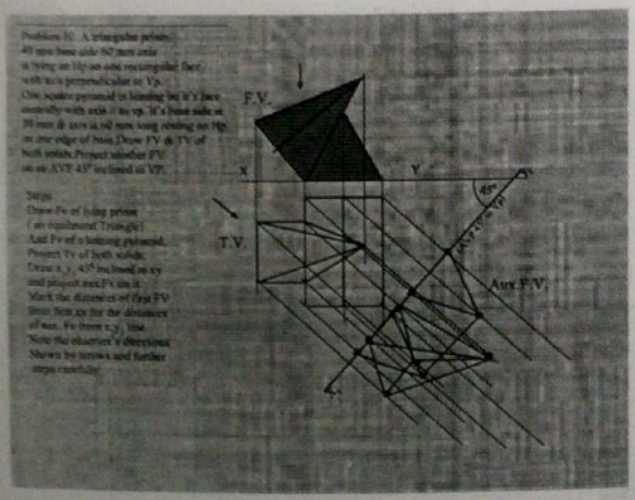


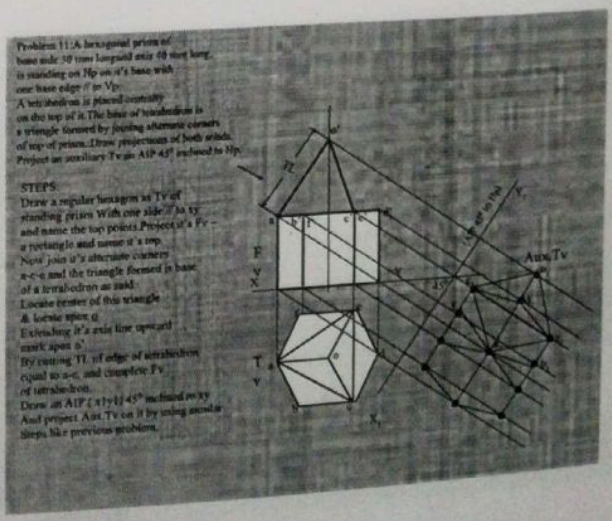


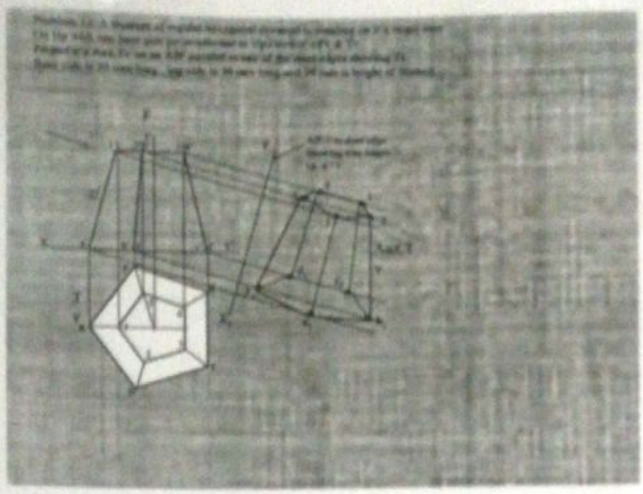


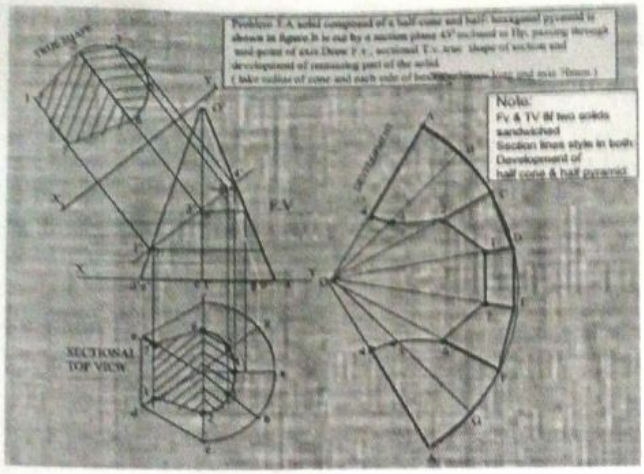


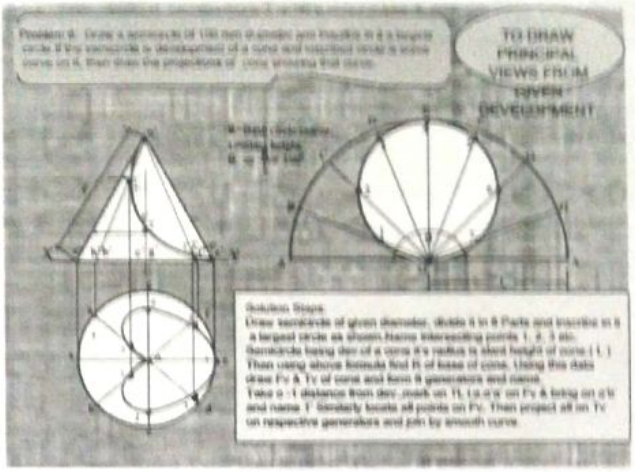


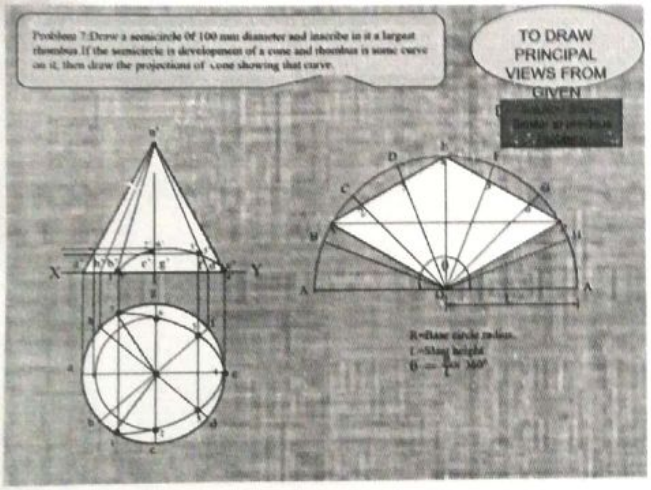


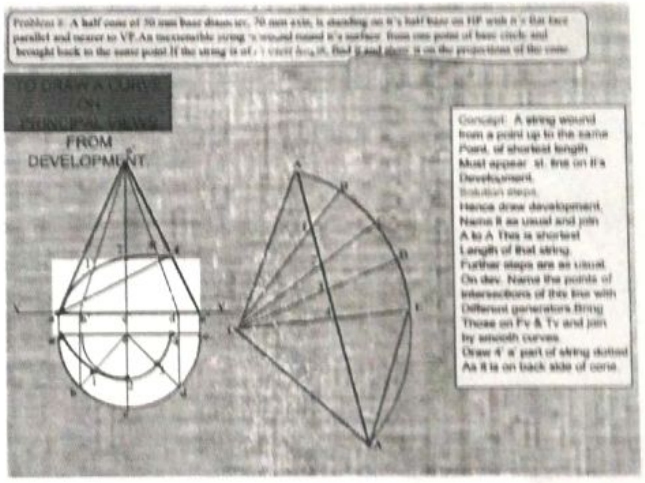


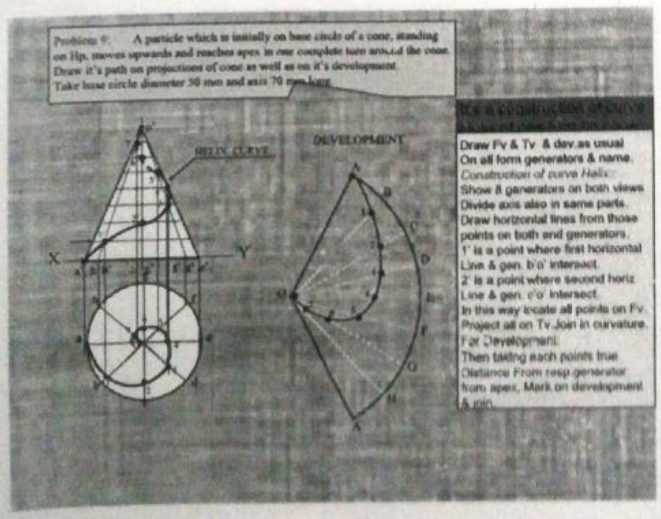


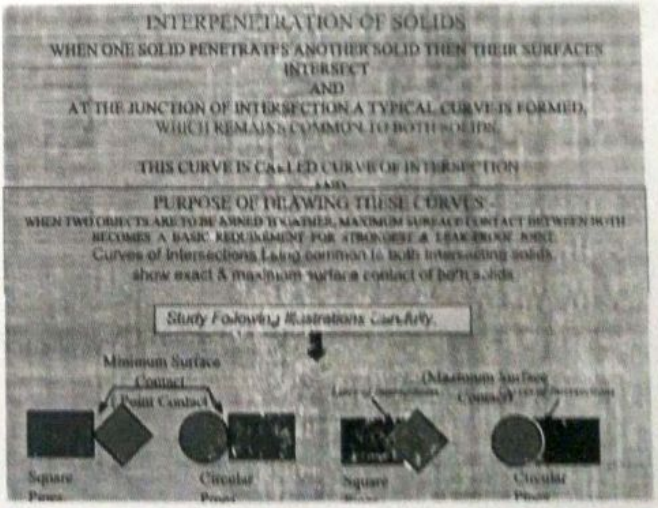












FOLLOWING CASES ARE SOLVED.
REFFER ILLUSTRATIONS AND NOTE THE COMMON CONSTRUCTION

1.CYLINDER TO CYLINDER.

2.SQ.PRISM TO CYLINDER

3.CONE TO CYLINDER

4.TRIANGULAR PRISM TO CYLINDER

5.SQ.PRISM TO SQ.PRISM

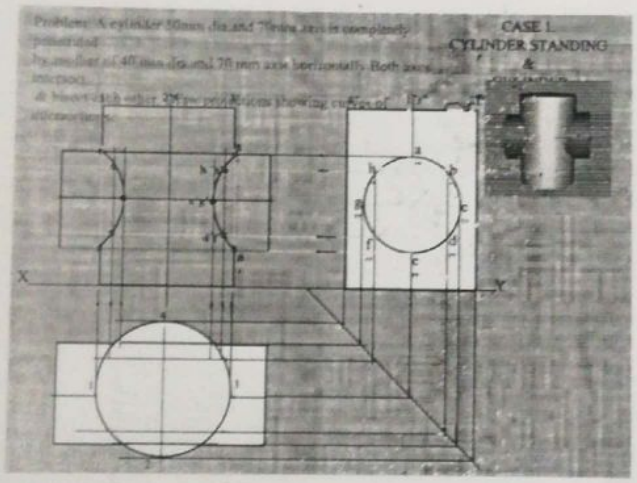
6.SQ.PRISM TO SQ.PRISM (SKEW POSITION)

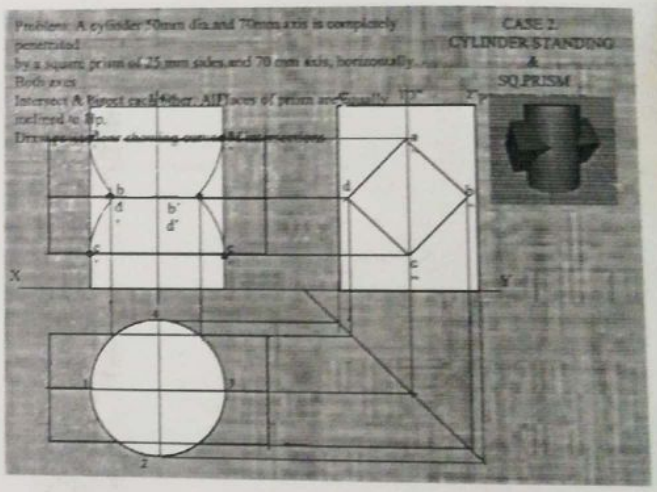
7.SQARE PRISM TO CONE (from top)

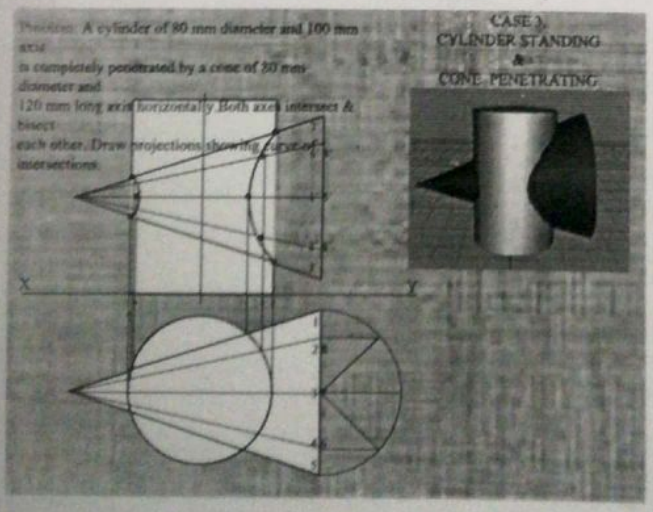
8.CYLINDER TO CONE

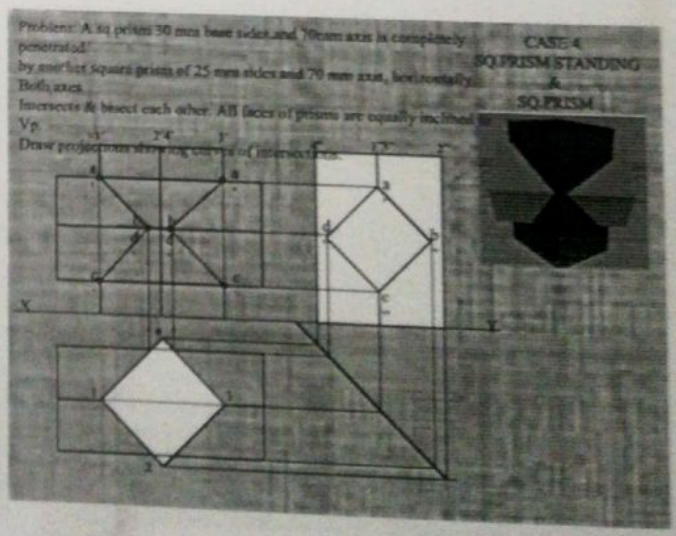
COMMON SOLUTION STEPS
One solid will be standing on HP.
Other will penetrate horizontally.
Draw three views of standing solid.
Name views as per the illustration.
Beginning with side view draw three views of penetrating solids also.
On it's S.V. mark number of points.
And name them(capital letters or nos.)
The points which are on visible generators or edges of standing solid (in S.V.) can be marked on respective generators in Fv and Tv. And other points from S.V. should be brought in Tv first and then projecting upward To Fv.
Dark and dotted line's decision should be taken by observing side view. Seen it's right side it shown by arrow. Accordingly these should be joined by curvature or straight lines.

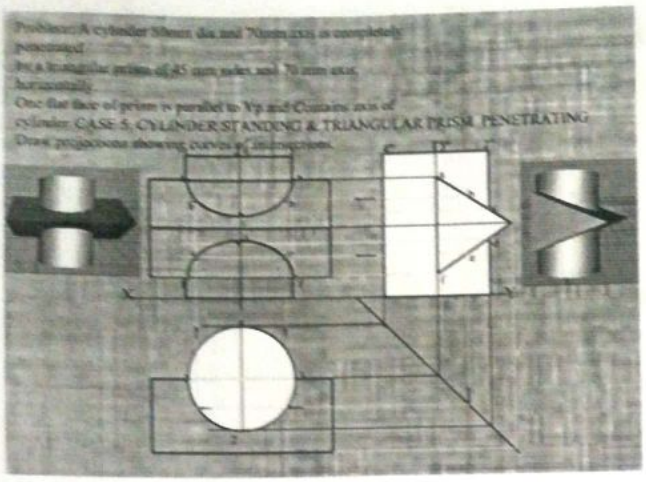
Indent arrow in projecting solids help more in understanding. Thickness or line of intersection has not to be marked.

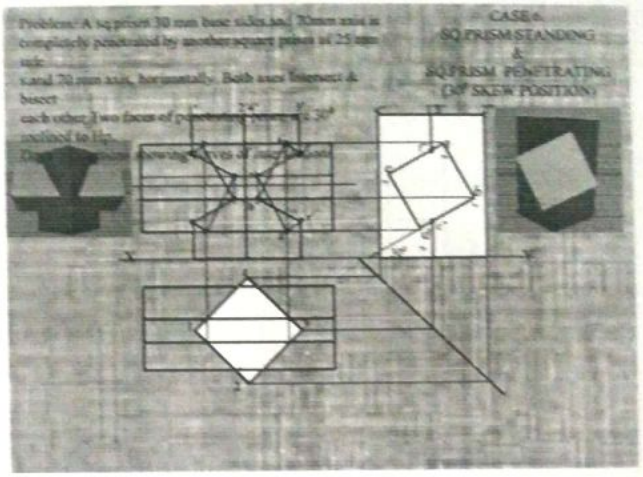


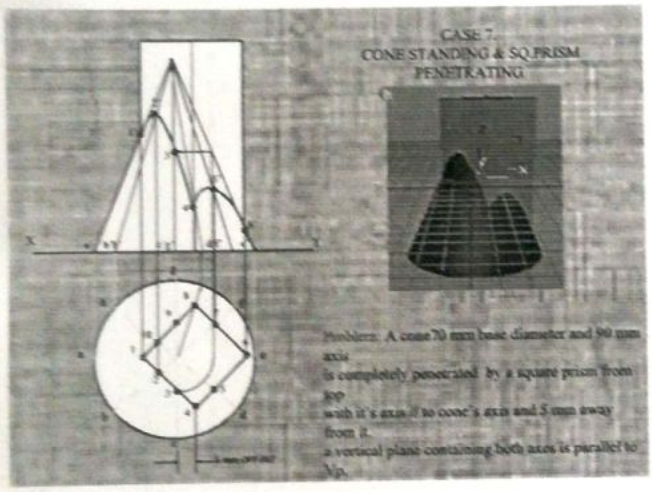


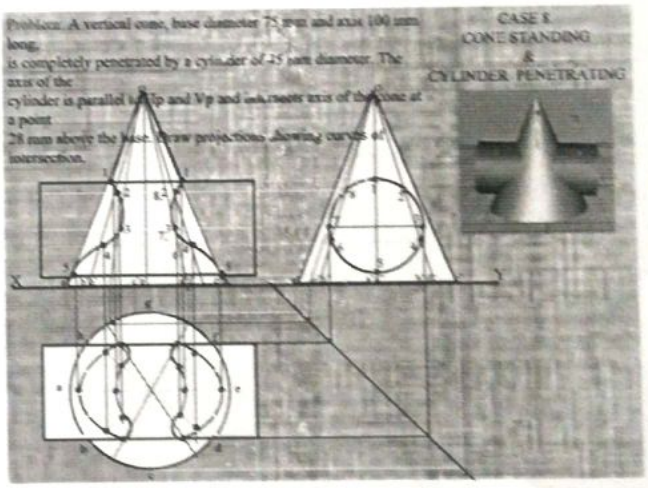


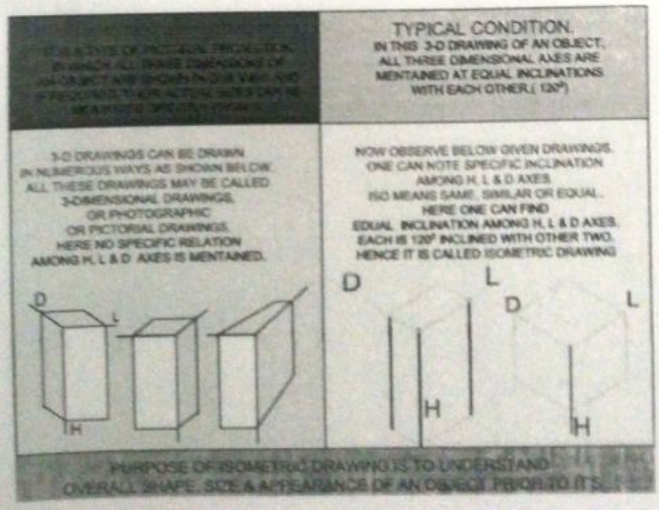


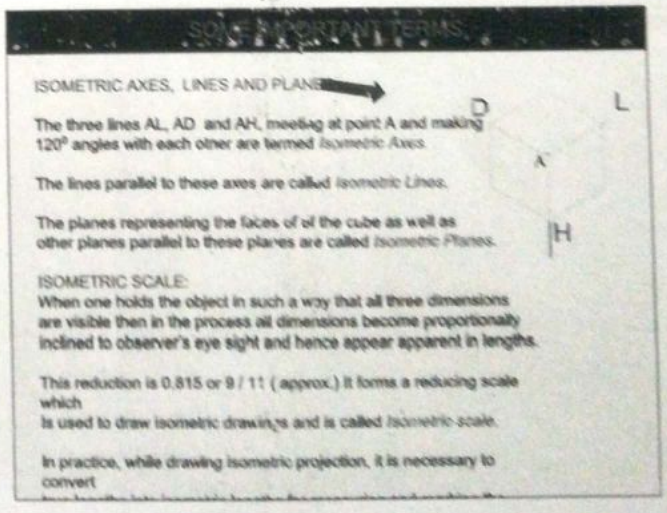


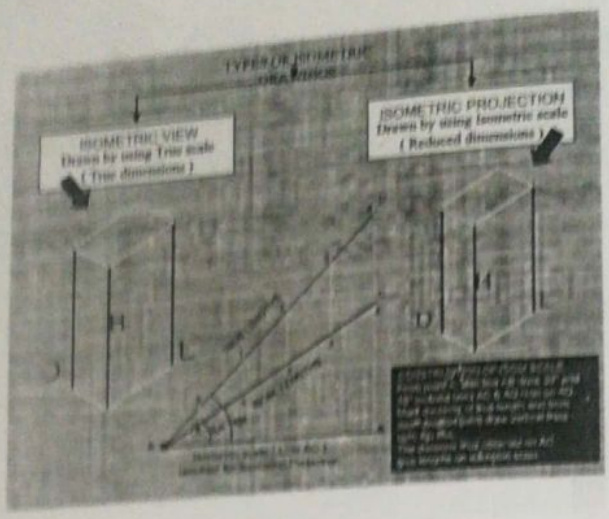


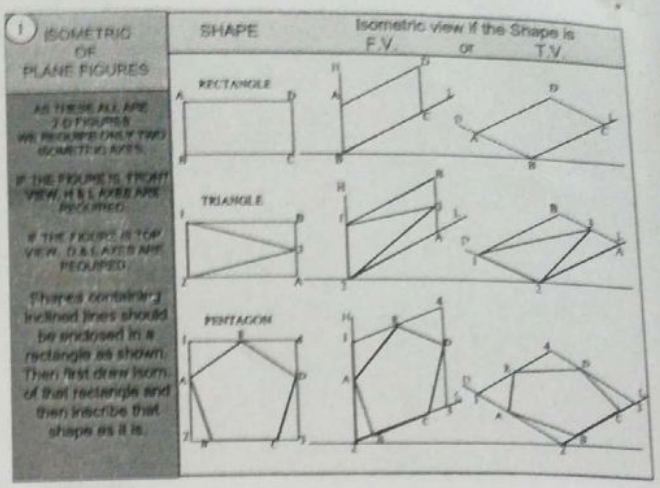


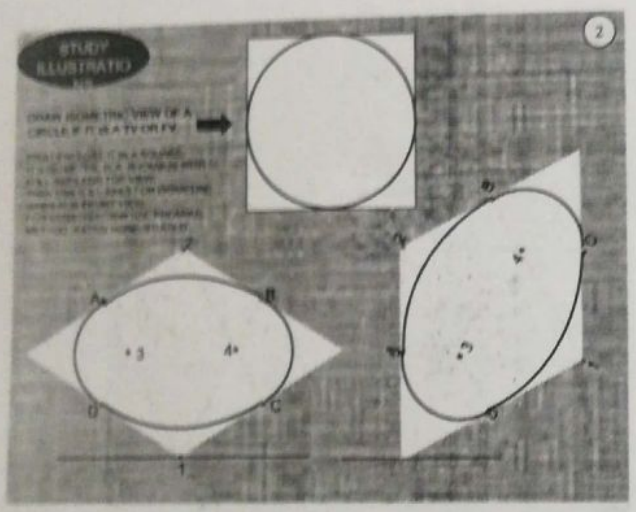


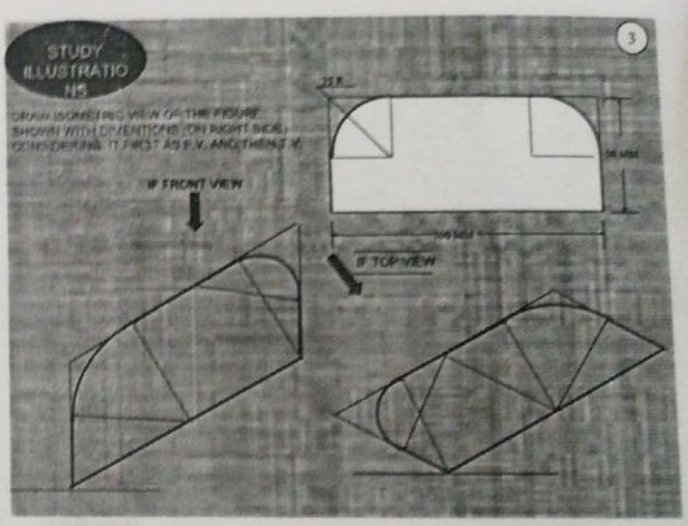


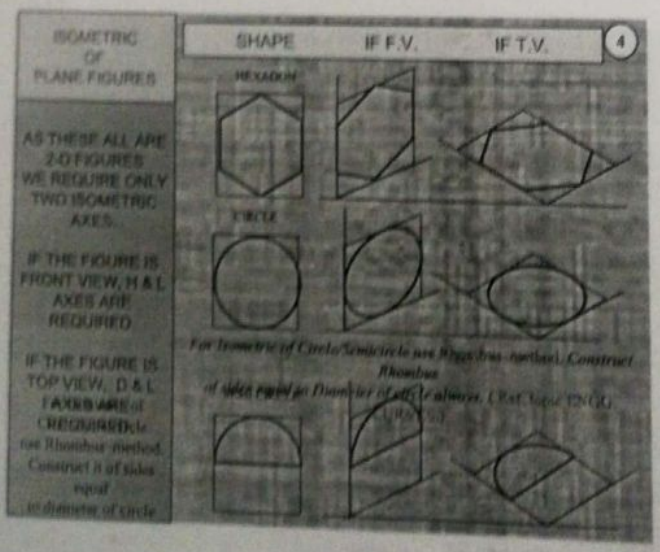


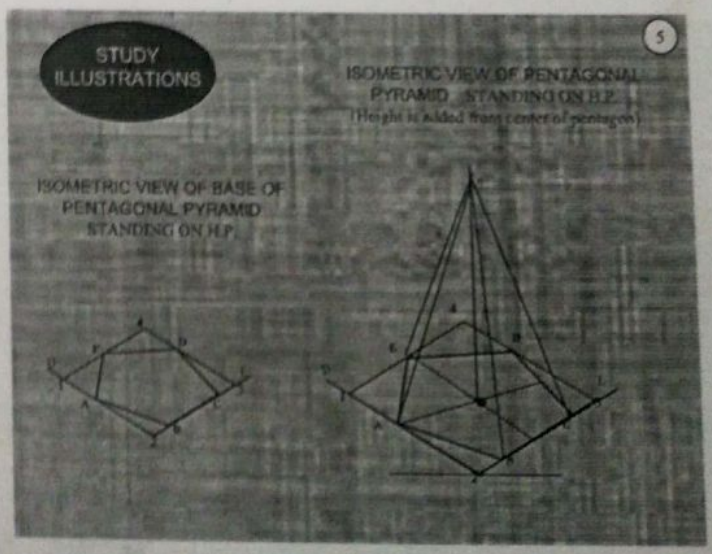


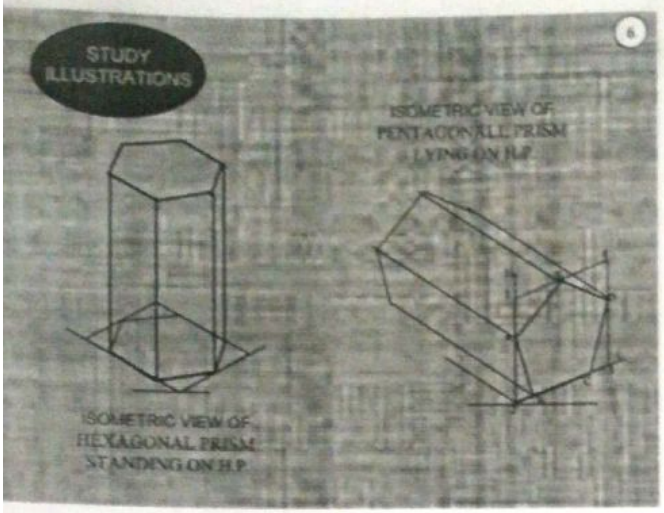


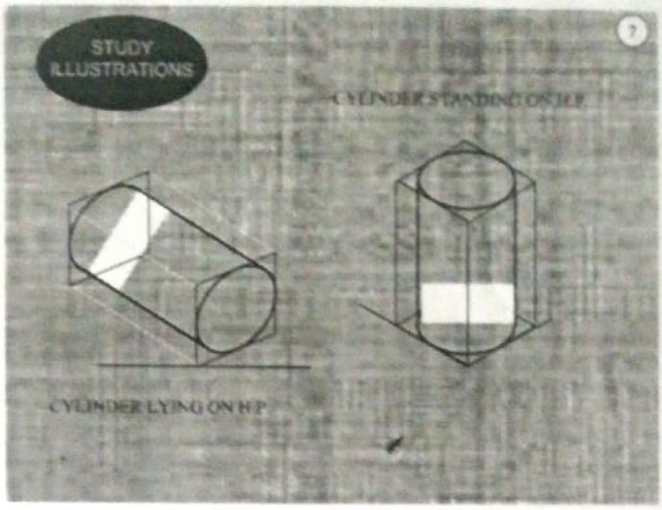


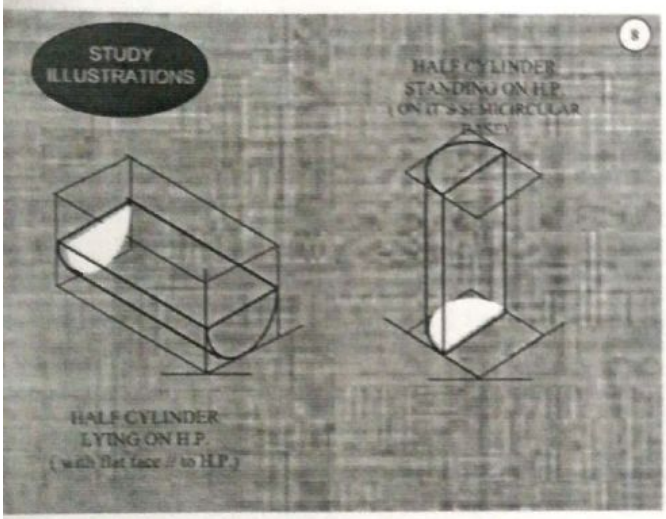


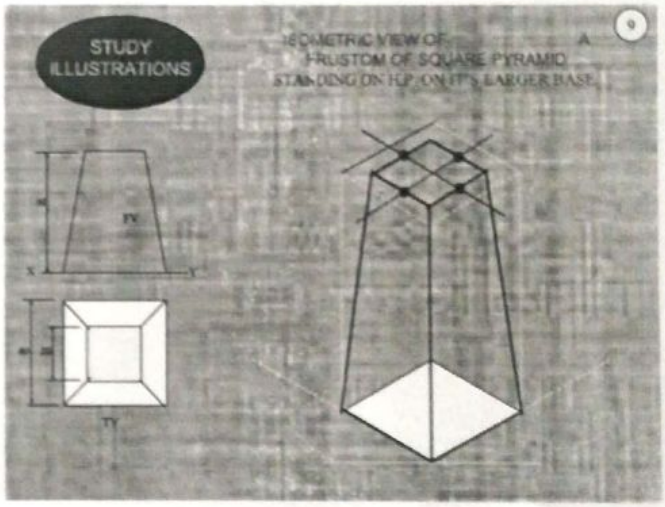


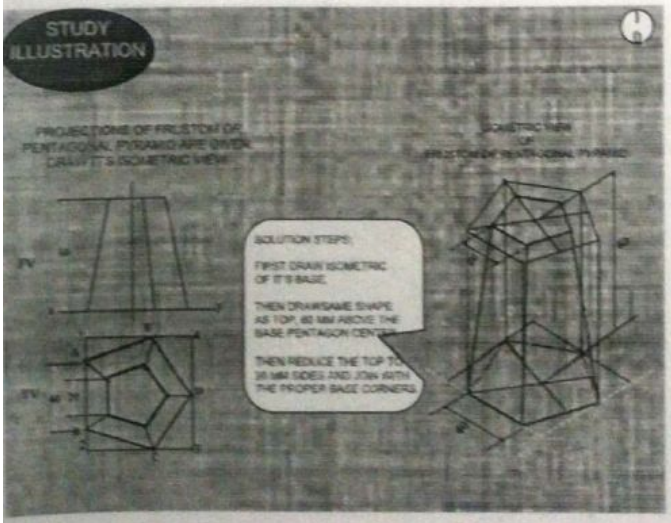


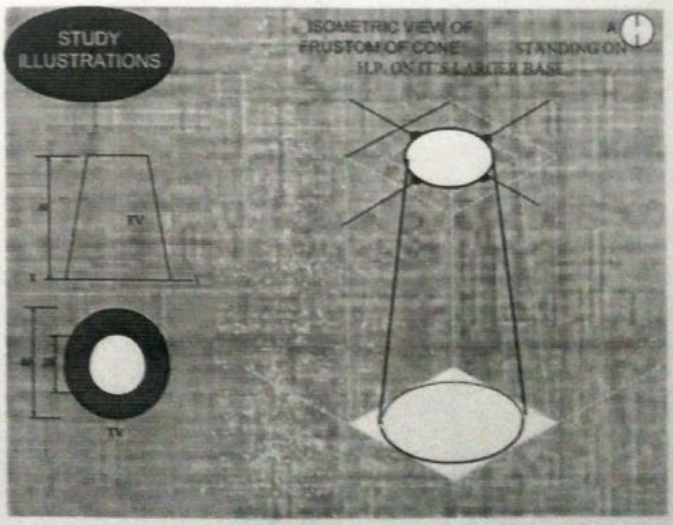


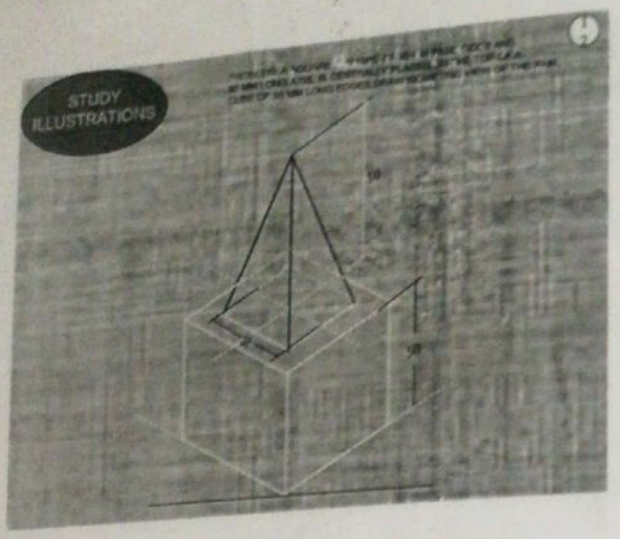


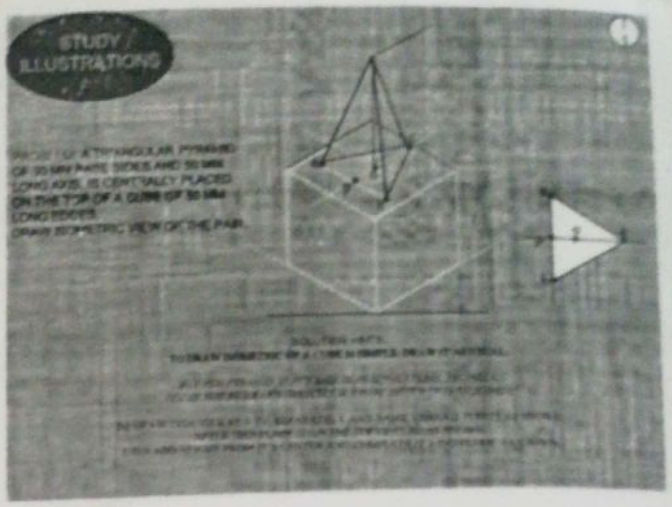


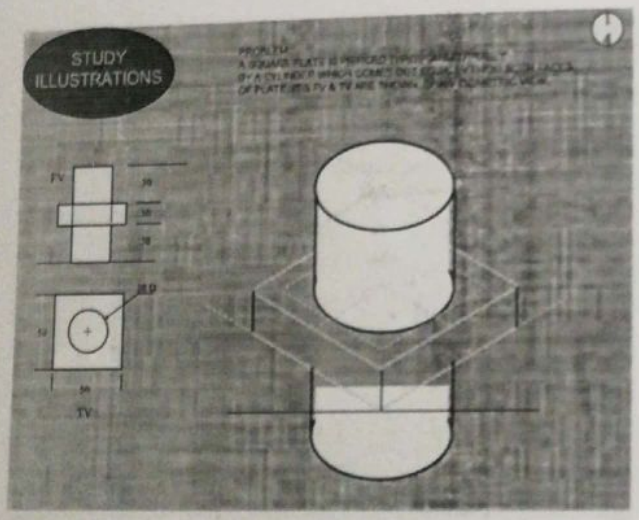


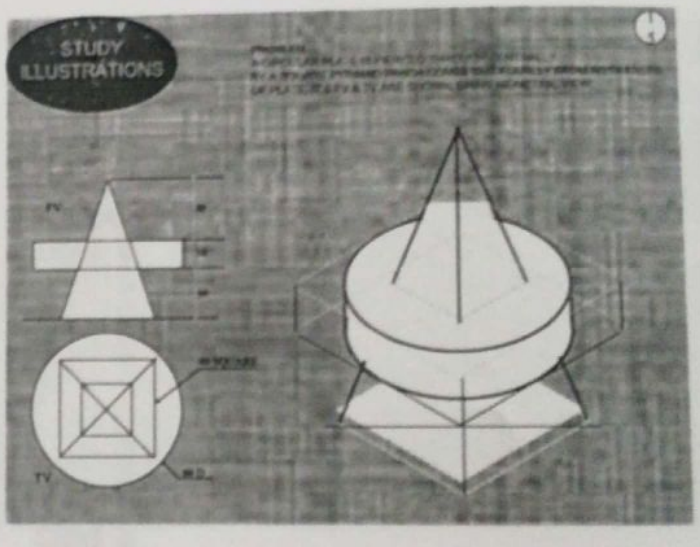


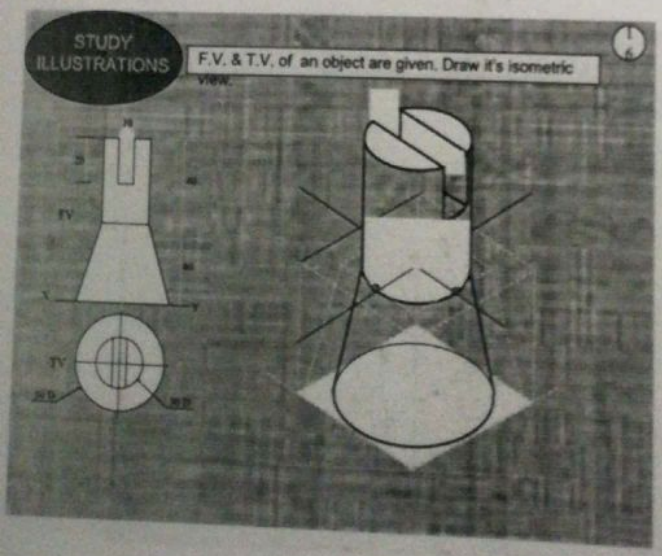


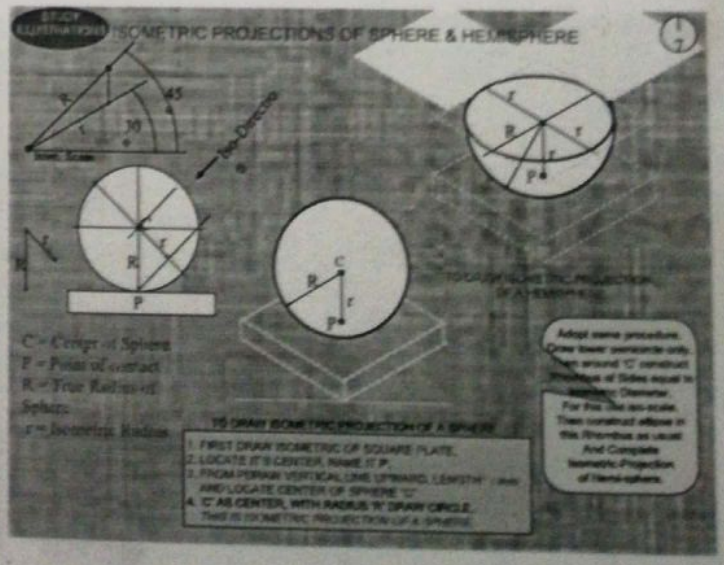


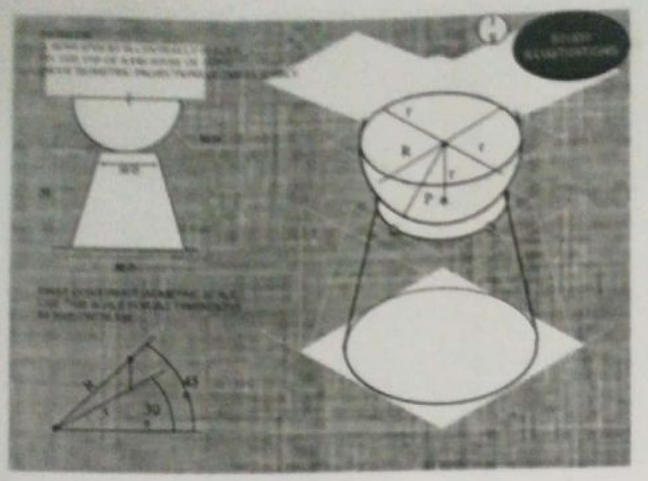


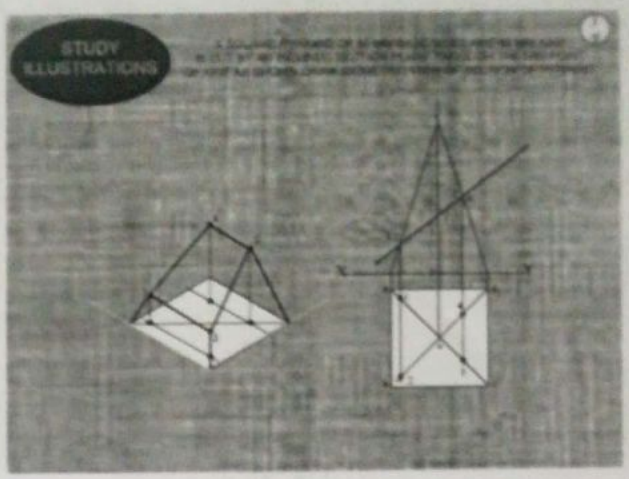


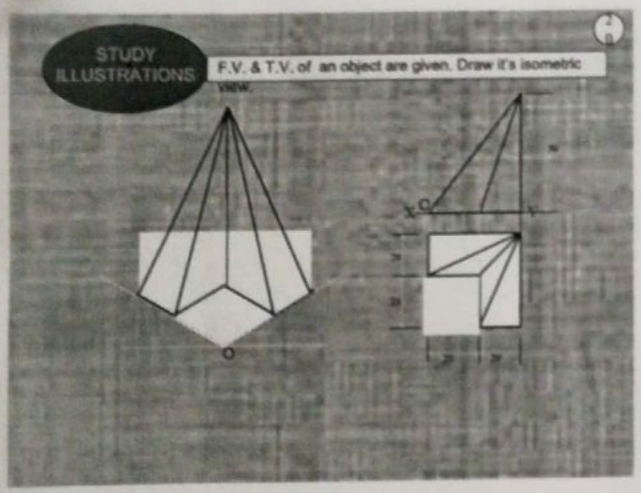


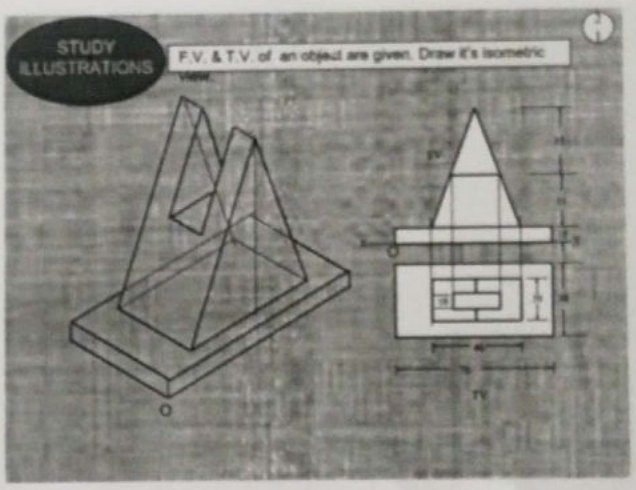


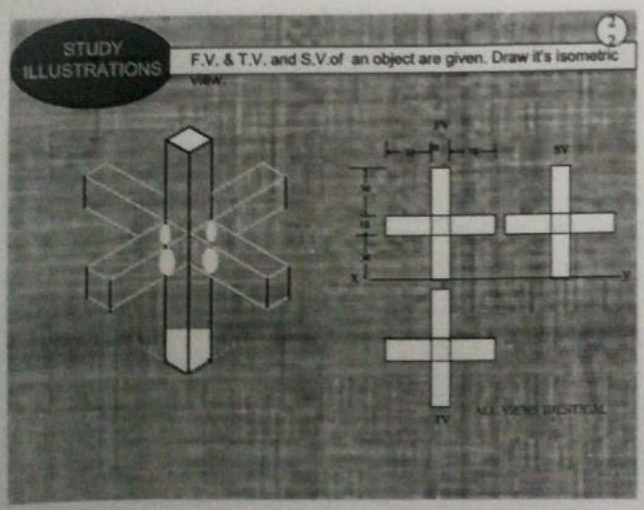


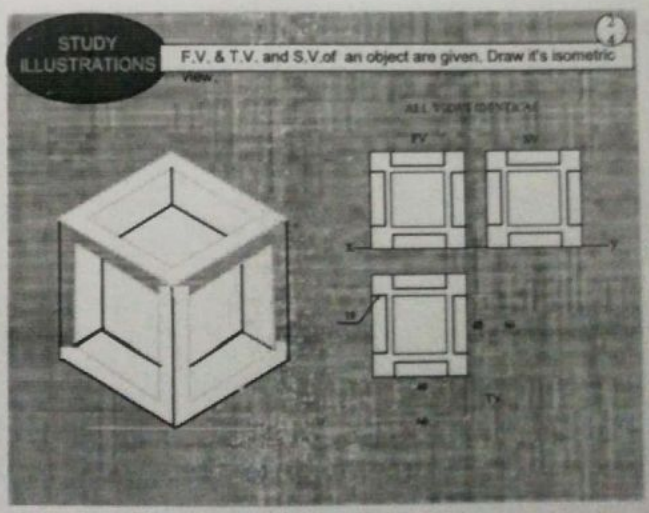


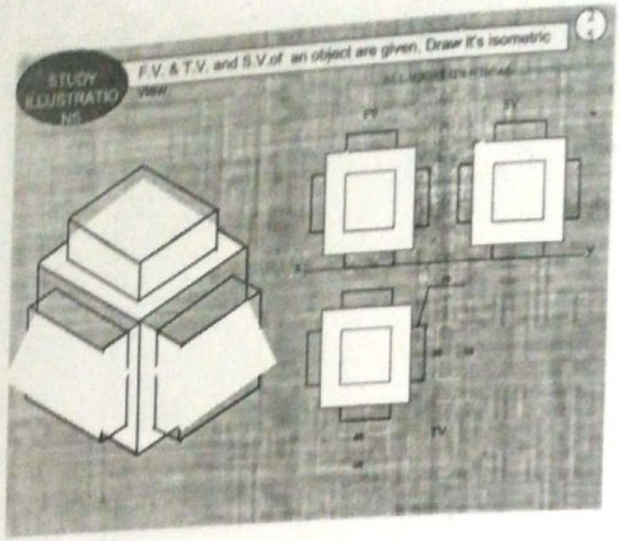


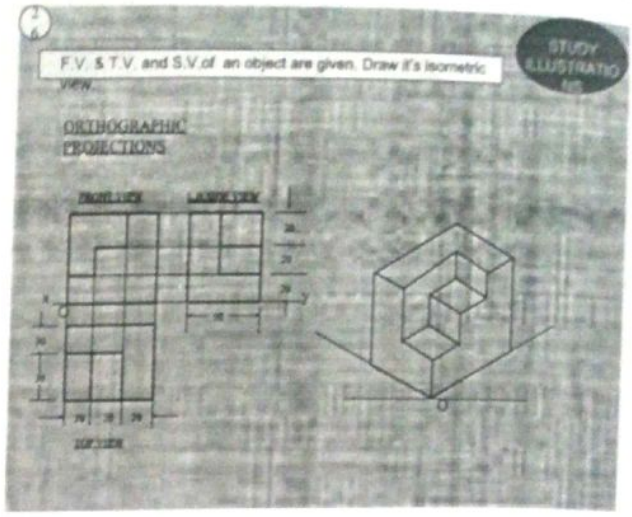


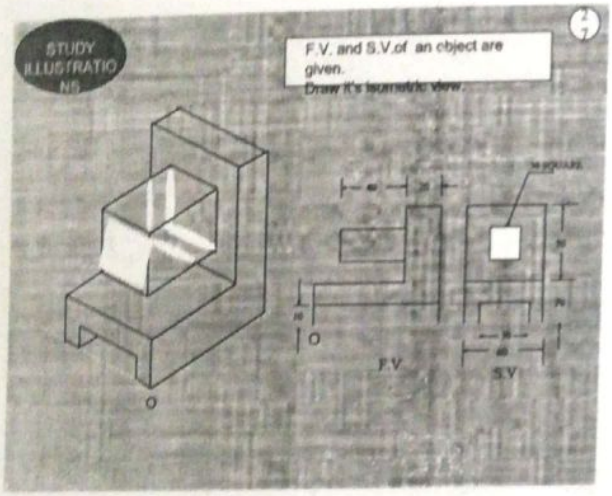


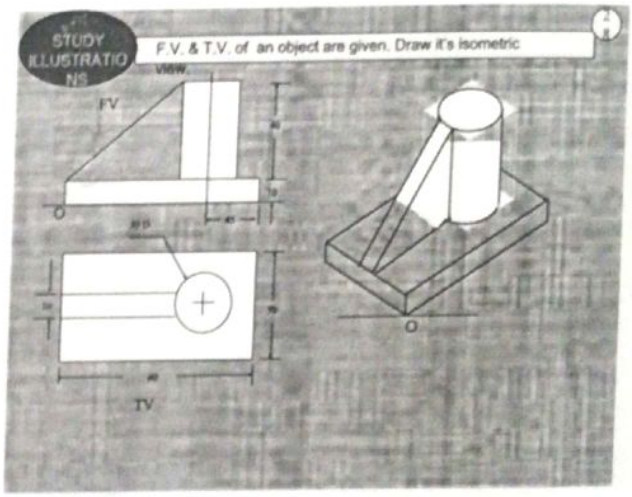


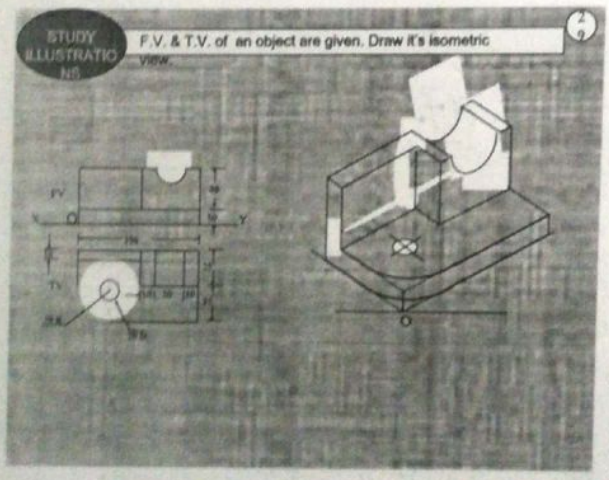


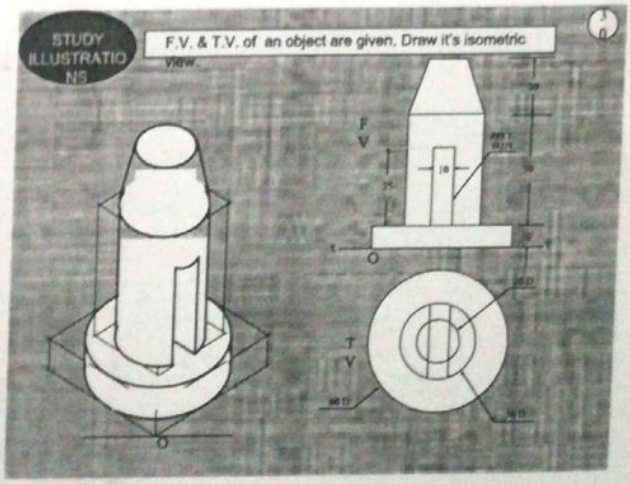


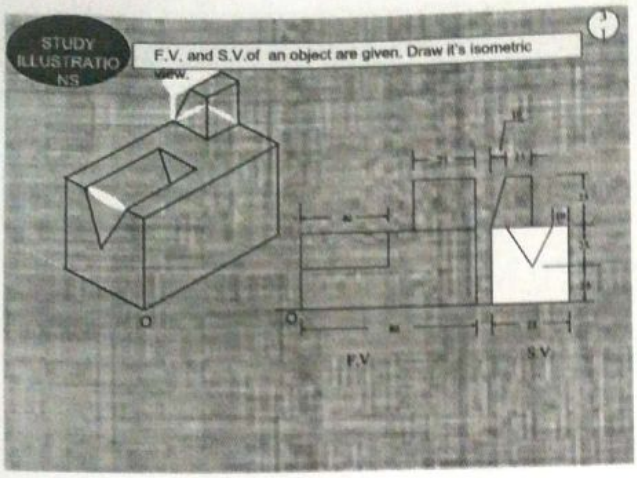


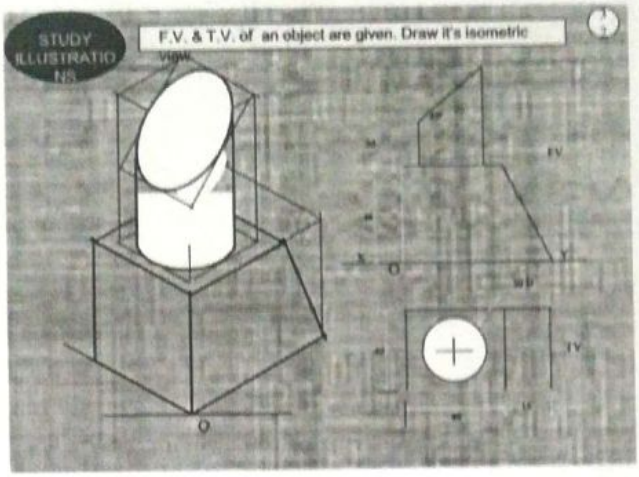


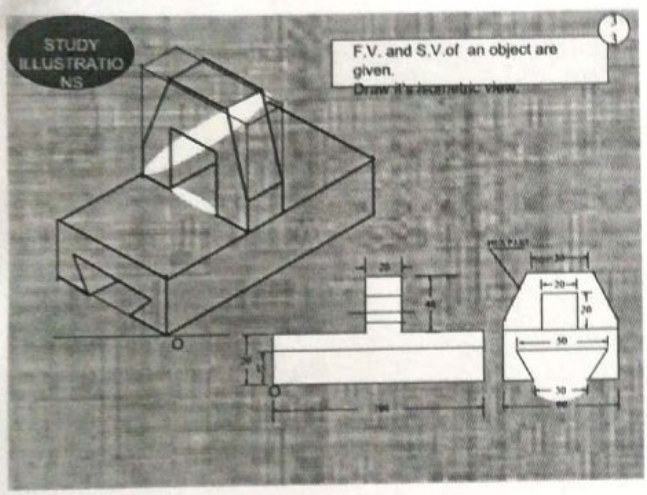


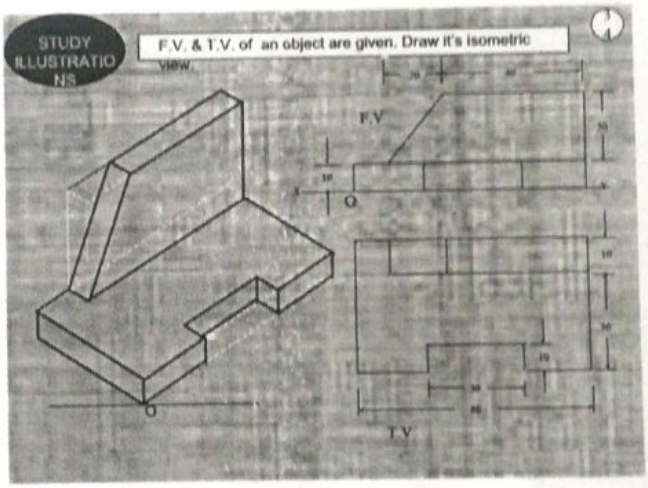


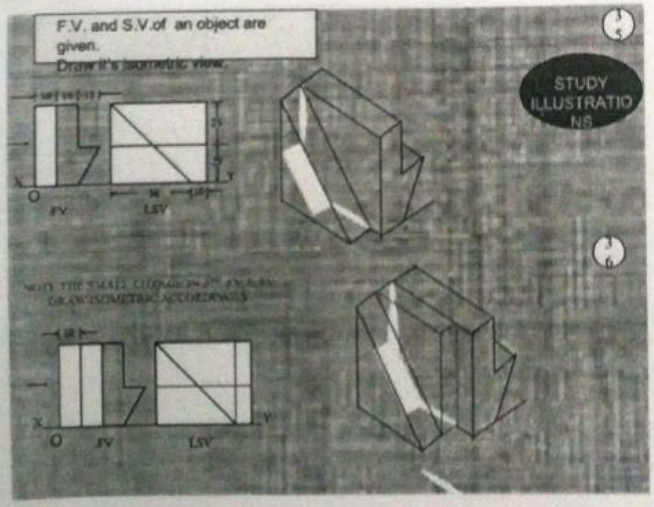


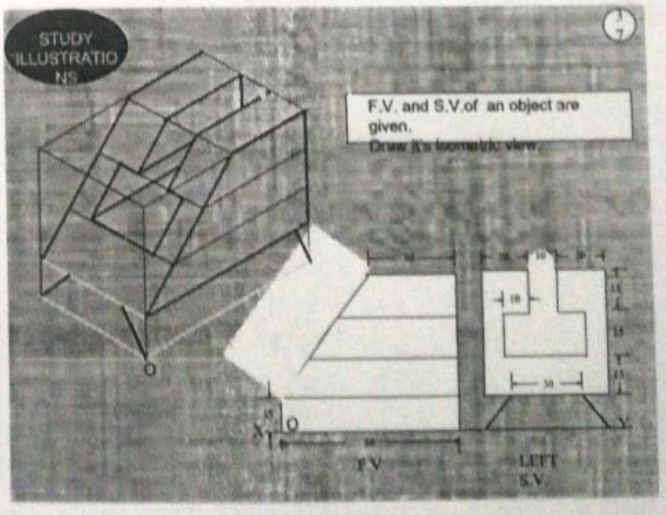


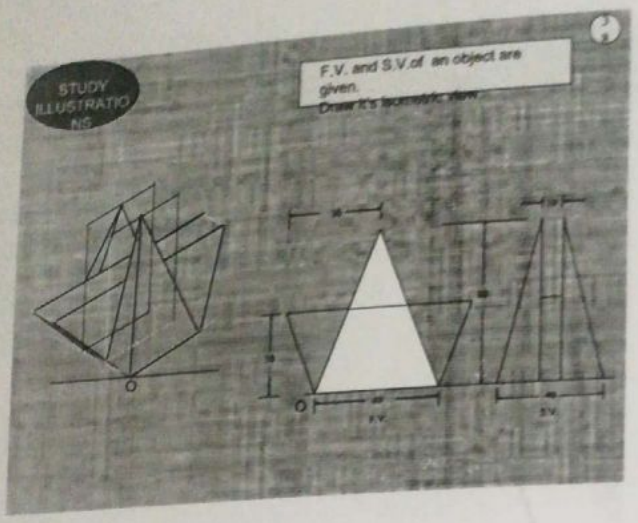












EXERCISES

PROJECTIONS OF STRAIGHT LINES

1. A line AB is in first quadrant. Its ends A and B are 25mm and 40mm above VP respectively. The distance between the end projections is 75mm. The line is inclined at 30° to VP and its VT is 15mm above HP. Draw the projections of AB and determine its true length and HT and inclination with HP.

2. A line AB measures 150mm. The projections through its VT and end A are 40mm apart. The point A is 25mm above HP and 25mm in front of VP. The VT is 15mm above HP. Draw the projections of line and determine its HT and inclinations with HP and VP.

3. Draw the three views of line AB, 80mm long, which is lying in profile plane and inclined at 35° to HP. Its end A is in HP and 20mm in front of VP, while other end B is in first quadrant. Determine also its views.

4. A line AB 75 mm long, has its one end A in VP and other end is 15mm above HP and 50mm in front of VP. Draw the projections of line when sum of inclinations with HP and VP is 90°. Determine the true angles of inclination and show traces.

5. A line AB is 75mm long and lies in an auxiliary horizontal plane (AHP) which makes an angle of 45° with the HP. The front view of the line measures 50mm. The end A is in VP and 20mm above HP. Draw the projections of the line AB and find its inclination with HP and VP.

APPLICATIONS OF LINES

Room , compound wall cases

7) A room measures 8m x 5m x4m high. An electric point hang in the center of ceiling and 1m below it. A thin straight wire connects the point to the switch in one of the corners of the room and 2m above the floor. Draw the projections of the and its length and slope angle with the floor.

8) A room is of size 6m\5m\3.5m high. Determine graphically the real distance between the top corner and its diagonally appoite bottom corners, consider appropriate scale

9) Two pegs A and B are fixed in each of the two adjacent side walls of the rectangular room 3m x 4m sides. Peg A is 1.5m above the floor, 1.2m from the longer side wall and is protruding 0.3m from the wall. Peg B is 2m above the floor, 1m from other side wall and protruding 0.2m from the wall. Find the distance between the ends of the two pegs. Also find the height of the roof if the shortest distance between peg A and and center of the ceiling is 5m.

10) Two fan motors hang from the ceiling of a hall 12m x 5m x 8m high at heights of 4m and 6m respectively. Determine graphically the distance between the motors. Also find the distance of each motor from the top corner joining end and front wall.

11) Two mangos on a two tree are 2m and 3m above the ground level and 1.5m and 2.5m from a 0.25m thick wall but on apposite sides of it. Distances being measured from the center line of the wall. The distance between the apples, measured along ground and parallel to the wall is 3m. Determine the real distance between the ranges.

POLES,ROADS, PIPE LINES,, NORTH-EAST-SOUTH WEST,SLOPE AND GRADIENT CASES.

12)Three vertical poles AB, CD and EF are lying along the corners of equilateral triangle lying on the ground of 100mm sides. Their lengths are 5m, 8m and 10m respectively. Draw their projections and find real distance between their top ends.

13) A straight road going up hill from a point A due east to another point B is 4km long and has a slop of 25°. Another straight road from B due 30° east of north to a point C is also 4 kms long but going downward and has slope of 15°. Find the length and slope of the straight road connecting A and C.

14) An electric transmission line laid along an uphill from the hydroelectric power station due west to a substation is 2km long and has a slop of 30°. Another line from the substation running W 45° N to village, is 4km long and laid on the ground level. Determine the length and slope of the proposed telephone line joining the the powers station and village.

15) Two wire ropes are attached to the top corner of a 15m high building. The other end of one wire rope is attached to the top of the vertical pole 5m high and the rope makes an angle of depression of 45°. The rope makes 30° angle of depression and is attached to the top of a 2m high pole. The pole in the top view are 2m apart. Draw the projections of the wire ropes.

16) Two hill tops A and B are 90m and 60m above the ground level respectively. They are observed from the point C, 20m above the ground. From C angles and elevations for A and B are 45° and 30° respectively. From B angle of elevation of A is 45°. Determine the real distances between A, B and C.

PROJECTIONS OF PLANES:-

1. A thin regular pentagon of 30mm sides has one side ⊥ to Hp and 30° inclined to Vp while its surface is 45° inclined to Hp. Draw its projections.

2. A circle of 50mm diameter has end A of diameter AB in Hp and AB diameter 300 inclined to Hp. Draw its projections if

a) the TV of same diameter is 45° inclined to Vp. OR. b) Diameter AB is in profile plane.

3. A thin triangle PQR has sides PQ = 60mm, QR = 80mm, and RP = 50mm, long respectively. Side PQ rest on ground and makes 30° with Vp. Point P is 30mm in front of Vp and R is 40mm above ground. Draw its projections.

4. An isosceles triangle having base 60mm long and altitude 40mm long appears as an equilateral triangle of 60mm sides with one side 30° inclined to XY in top view. Draw its projections.

5. A 30°-60° set-square of 40mm long shortest side in Hp appears as an isosceles triangle in its TV. Draw projections of it and find its inclination with Hp.

6. A rhombus of 60mm and 45mm long diagonals is so placed on Hp that its TV is seen as a square of 30mm long diagonals. Draw its FV.

7. Draw projections of a circle 80 mm diameter resting on Hp on a point A on the circumference with its surface 30° inclined to Hp and 45° to Vp.

8. A top view of plane figure whose surface is perpendicular to Vp and 60° inclined to Hp is regular hexagon of 30mm sides with one side 30° inclined to xy.Determine it's true shape.

9. Draw a rectangular abcd of side 50mm and 30mm with longer 35° with XY, representing TV of a quadrilateral plane ABCD. The point A and B are 25 and 50mm above Hp respectively. Draw a suitable Fv and determine its true shape.

10.Draw a pentagon abcde having side 50° to XY, with the side ab =30mm, bc =40mm, cd =50mm, de =25mm and angles abc 120°, cde 125°. A figure is a TV of a plane whose ends AB and E are 15, 25 and 35mm above Hp respectively. Complete the projections and determine the true shape of the plane figure.

PROJECTIONS OF SOLIDS

1. Draw the projections of a square prism of 25mm sides base and 50mm long axis. The prism is resting with one of its corners in VP and axis inclined at 30° to VP and parallel to HP.

2. A pentagonal pyramid, base 40mm side and height 75mm rests on one edge on its base on the ground so that the highest point in the base is 25mm above ground. Draw the projections when the axis is parallel to Vp. Draw an another top view on an AVP inclined at 30° to edge on which it is resting so that the base is visible.

3. A square pyramid of side 30mm and axis 60 mm long has one of its slant edges inclined at 45° to HP and a plane containing that slant edge and axis is inclined at 30° to VP. Draw the projections.

4. A hexagonal prism, base 30mm sides and axis 75mm long, has an edge of the base parallel to the HP and inclined at 45° to the VP. Its axis makes an angle of 60° with the HP. Draw its projections. Draw another top view on an auxiliary plane inclined at 50° to the HP.

5. Draw the three views of a cone having base 50 mm diameter and axis 60mm long. It is resting on a ground on a point of its base circle. The axis is inclined at 40° to ground and at 30° to VP.

6. Draw the projections of a square prism resting on an edge of base on HP. The axis makes an angle of 30° with VP and 45° with HP. Take edge of base 25mm and axis length as 125mm.

CASES OF COMPOSITE SOLIDS.

9. A cube of 40mm long edges is resting on the ground with its vertical faces equally inclined to the VP. A right circular cone base 25mm diameter and height 50mm is placed centrally on the top of the cube so that their axis are in a straight line. Draw the front and top views of the solids. Project another top view on an AIP making 45° with the HP

10. A square bar of 30mm base side and 100mm long is pushed through the center of a cylindrical block of 30mm thickness and 70mm diameter, so that the bar comes out equally through the block on either side. Draw the front view, top view and side view of the solid when the axis of the bar is inclined at 30° to HP and parallel to VP, the sides of a bar being 45° to VP.

11. A cube of 50mm long edges is resting on the ground with its vertical faces equally inclined to VP. A hexagonal pyramid, base 25mm side and axis 50mm long, is placed centrally on the top of the cube so that their axes are in a straight line and two edges of its base are parallel to VP. Draw the front view and the top view of the solids, project another top view on an AIP making an angle of 45° with the HP.

12. A circular block, 75mm diameter and 25mm thick is pierced centrally through its flat faces by a square prism of 35mm base sides and 125mm long axis, which comes out equally on both sides of the block. Draw the projections of the solids when the combined axis is parallel to HP and inclined at 30° to VP, and a face of the prism makes an angle of 30° with HP. Draw side view also.

SECTION & DEVELOPMENT

1) A square pyramid of 40mm base sides and 50mm long axis is resting on its base in HP. Edges of base are equally inclined to VP. It is cut by section plane perpendicular to VP and inclined at 550 to HP. The plane cuts the axis at 15mm above the base. Draw the projections of the solid and show its development.

2) A hexagonal pyramid, edge of base 30mm and axis 75mm, is resting on its edge on HP which is perpendicular to VP. The axis makes an angle of 300to HP, the solid is cut by a section plane perpendicular to both HP and VP, and passing through the mid point of the axis. Draw the projections showing the sectional view, true shape of section and development of surface of a cut pyramid containing apex.

3) A cone of base diameter 60mm and axis 80mm, long has one of its generators in VP and parallel to HP. It is cut by a section plane perpendicular HP and parallel to VP. Draw the sectional FV, true shape of section and develop the lateral surface of the cone containing the apex.

4) A cube of 50mm long side designed cut on ground on one of its edges so that the solid designed is vertical and an edge through that corner is parallel to VP. A horizontal section plane passing through midpoint of vertical solid diagonal cuts the cube. Draw the front view of the sectional top view and development of surface.

5) A vertical cylinder cut by a section plane perpendicular to VP and inclined to HP in such a way that the true shape of a section is an ellipse with 30mm and 80mm as its minor and major axes. The vertical generator on the cylinder is 80mm long after it is cut by a section plane. Draw the projections and show the true shape of the section. Also find the inclination of the section plane with HP. Draw the development of the lower half of the cylinder.

6) A cube of 75mm long edges has its vertical faces equally inclined to VP. It is cut by a section plane perpendicular to VP such that the true shape of section is regular hexagon. Determine the inclination of cutting plane with HP. Draw the sectional top view and true shape of section.

7) The pyramidal portion of a half pyramidal and half conical solid has a base of square sides, each 30mm long. The height of axis is 80mm. The solid rest on its base with the sides of the pyramid base perpendicular to VP. A plane parallel to VP cuts the solid at a distance of 10mm from the top view of the axis. Draw sectional front view and true shape of section. Also develop the lateral surface of the cut solid.

8) A hexagonal pyramid having edge to edge distance 40mm and height 60mm has its base in HP and an edge of base perpendicular to VP. It is cut by a section plane, perpendicular to VP and passing through a point on the axis 10mm from the base. Draw three views of solid when it is resting on its cut face in HP, making the largest part of the pyramid. Also draw the lateral surface development of the pyramid.

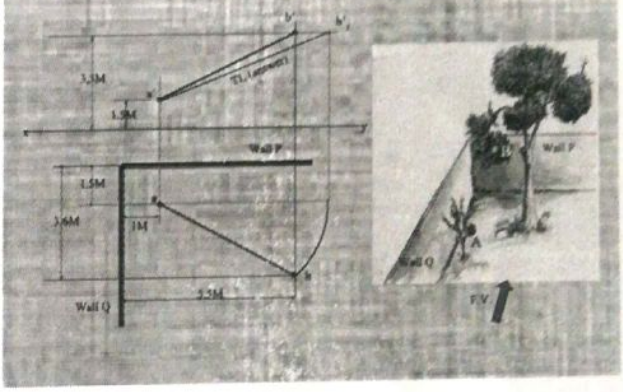
9) A cone diameter of base 50mm and axis 60mm long is resting on its base on ground. It is cut by a section plane perpendicular to VP in such a way that the true shape of a section is a parabola having base 40mm. Draw three views showing section, true shape of section and development of remaining surface of cone removing its apex.

10) A hexagonal pyramid, base 50mm side and axis 100mm long is lying on ground on one of its triangular faces with axis parallel to VP. A vertical section plane, the HT of which makes an angle of 300 with the reference line passes through center of base, the apex being retained. Draw the top view, sectional front view and the development of surface of the cut pyramid containing apex.

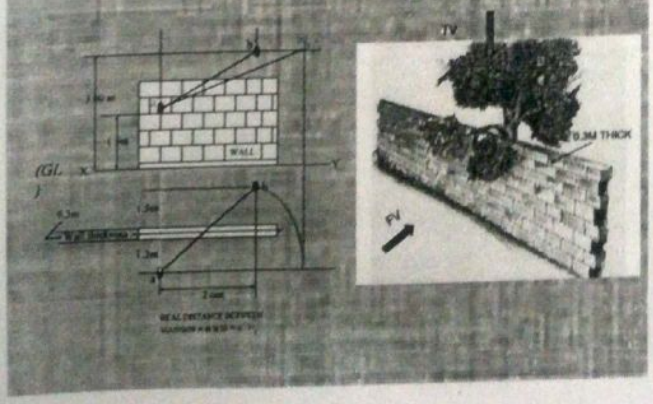
11) Hexagonal pyramid of 40mm base side and height 80mm is resting on its base on ground. It is cut by a section plane parallel to HP and passing through a point on the axis 25mm from the apex. Draw the projections of the cut pyramid. A particle P, initially at the mid point of edge of base, starts moving over the surface and reaches the mid point of opposite edge of the top face. Draw the development of the cut pyramid and show the shortest path of particle P. Also show the path in front and top views

12) A cube of 65 mm long edges has its vertical face equally inclined to the VP. It is cut by a section plane, perpendicular to VP, so that the true shape of the section is a regular hexagon. Determine the inclination of the cutting plane with the HP and draw the sectional top view and true shape of the section.

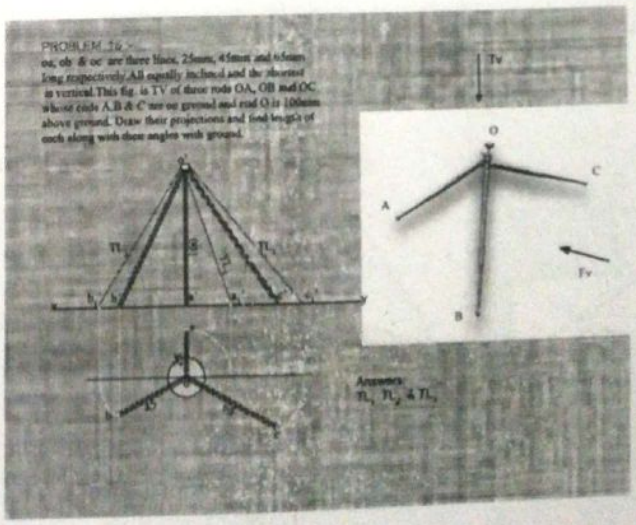
PROBLEM 14: Two objects, a flower (A) and an orange (B) are within a rectangular compound wall, whose P & Q are walls meeting at 90°. Flower A is 1.5M & 1 M from walls P & Q respectively. Orange B is 3.5M & 5.5M from walls P & Q respectively. Drawing projection, find distance between them if flower is 1.5 M and orange is 3.5 M above the ground. Consider suitable scale.

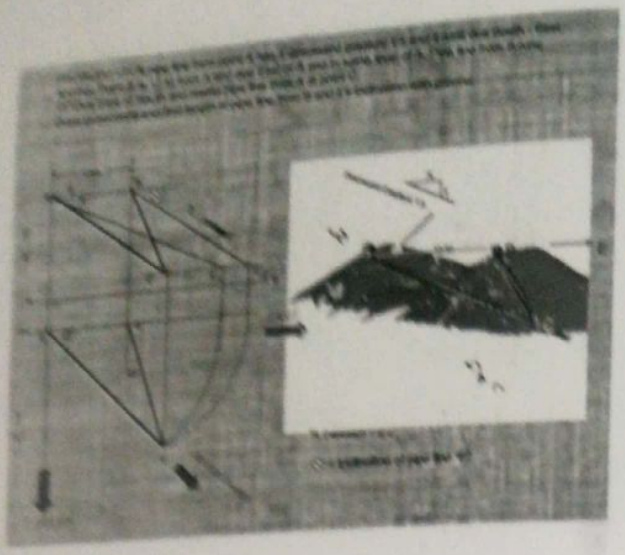


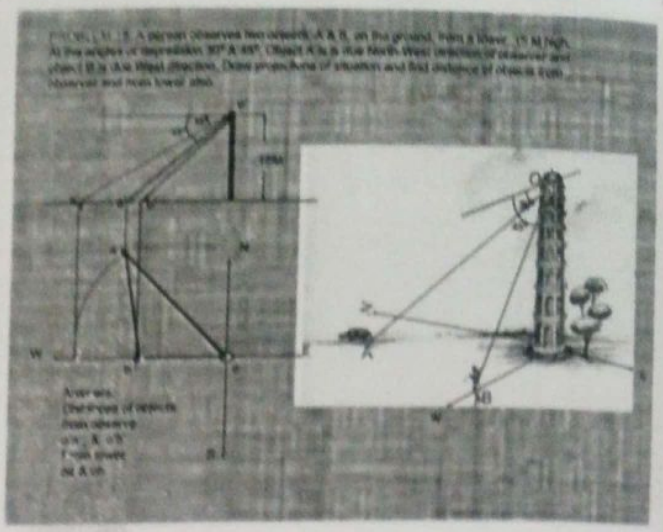
PROBLEM 15: Two mangos on a tree A & B are 1.5 m and 3.00 m above ground and those are 1.2 m & 1.5 m from a 0.3 m thick wall but on opposite sides of it. If the distance measured between them along the ground and parallel to walls 2.8 m. Then find real distance between them by drawing their projections.

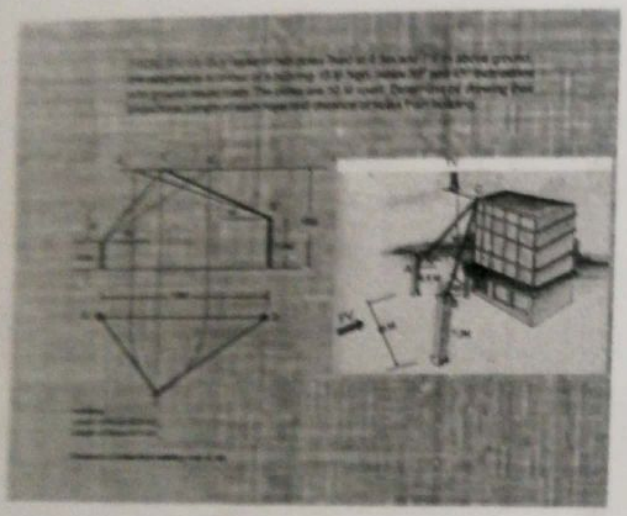


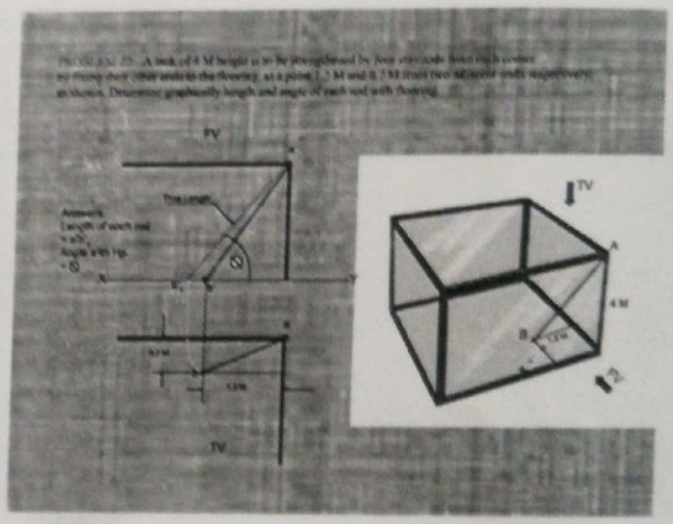
PROBLEM 16: oa, ob & oc are three lines, 25mm, 45mm and 65mm long respectively. All equally inclined and the shortest is vertical. This fig. is TV of three rods OA, OB and OC whose ends A,B & C are on ground and end O is 100mm above ground. Draw their projections and find lengths of each along with their angles with ground.

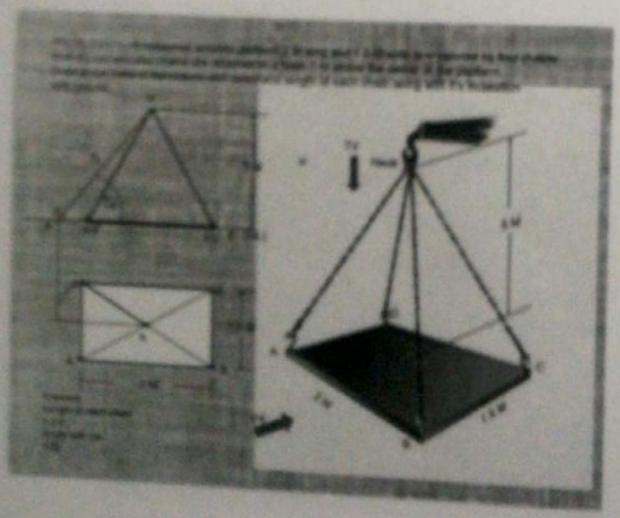


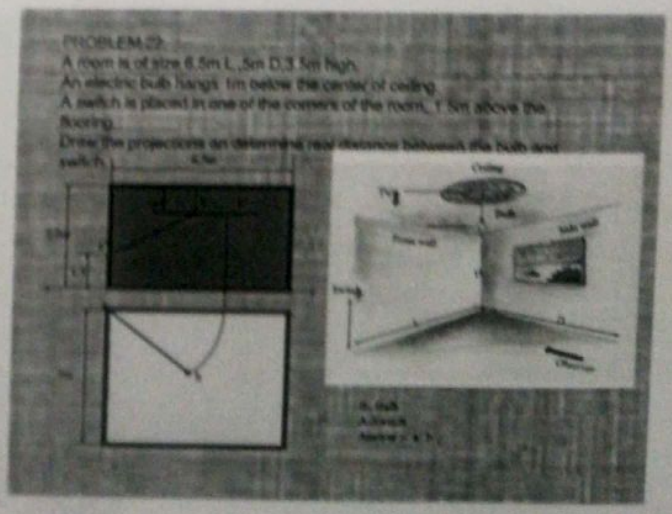


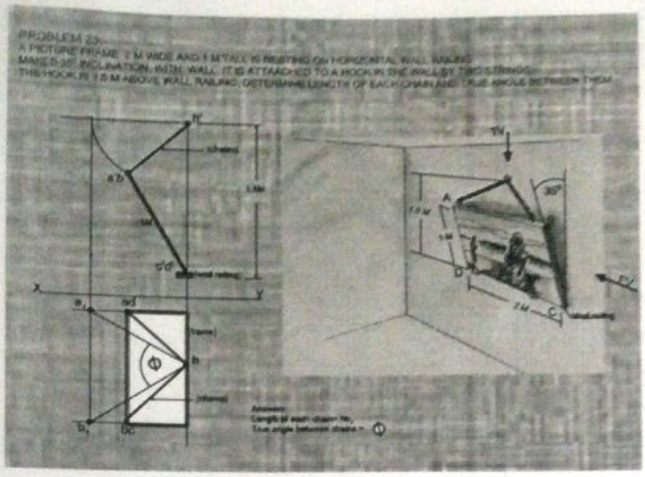












THANK YOU

By: B.Tech
(C.S.E) II - year

APPLICATIONS OF PRINCIPLES OF PROJECTIONS OF LINES
IN SOLVING CASES OF DIFFERENT PRACTICAL SITUATIONS

In these types of problems some situation in the field
or
some object will be described
It's relation with Ground (HP)
And
a Wall or some vertical object (VP) will be given

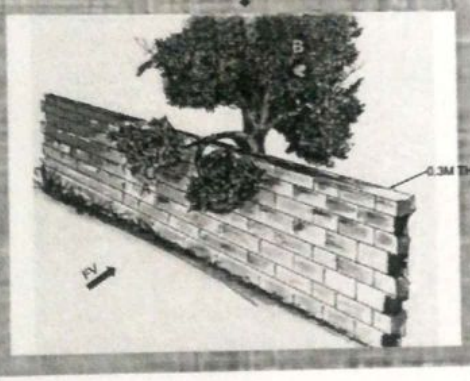
Indirectly information regarding Fv & Tv of some line or lines
inclined to both reference Planes will be given
and
you are supposed to draw it's projections
and
further to determine it's true Length and it's inclinations with

Here various problems along with
actual pictures of those situations are given
for you to understand those clearly.
Now looking for views in given ARROW directions,
YOU are supposed to draw projections & find answers.
Off course you must visualize the situation properly.

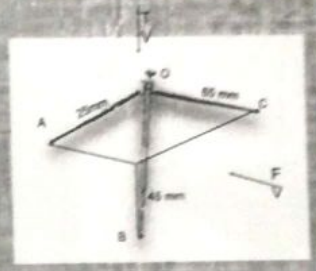
CHECK YOUR ANSWERS
WITH THE SOLUTIONS
GIVEN IN THE END.
ALL THE BEST!!

PROBLEM 14:- Two chords, a flower (X) and an orange (O), are which are perpendicular and whose P & Q are walls meeting at 90°. Flower X is 3.5 M from wall P & 1.5 M from wall Q. Orange O is 4.5 M from walls P & Q respectively. Drawing projection find distance between flower and orange. If flower is 5.5 M and orange is 3.5 M above the ground. Consider suitable scale.

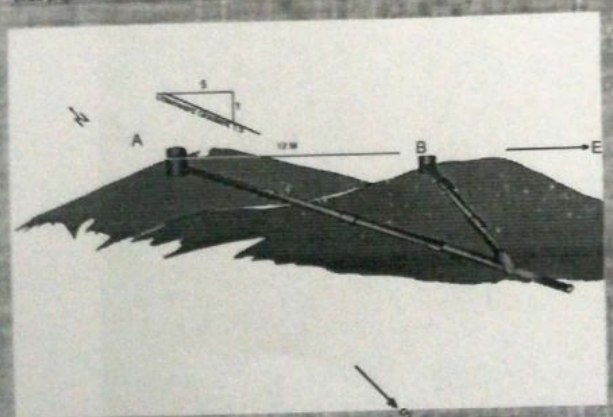
PROBLEM 15 :- Two mangos on a tree A & B are 1.5 m and 3.00 m above ground and those are 1.2 m & 1.5 m from a 0.3 m thick wall but on opposite sides of it. If the distance measured between them along the ground and parallel to wall is 2.5 m, Then find real distance between them by drawing their projections.



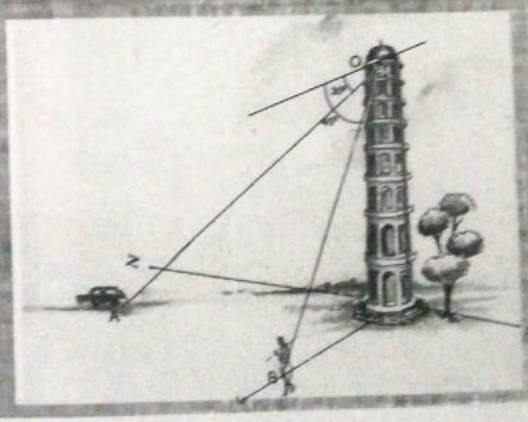
PROBLEM 16 :- Five rods AB, BC, BD, BE and BF, of equal length and of negligible thickness are joined together at a vertical axis BO. Rod BC is parallel to the ground and rod BD is 70 mm above ground. Draw their projections and find length of each along with their angles with ground.

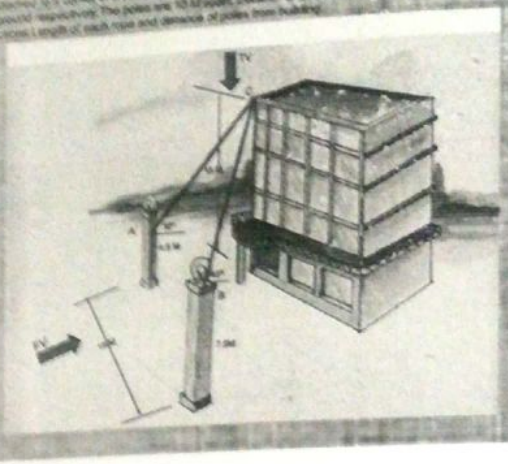


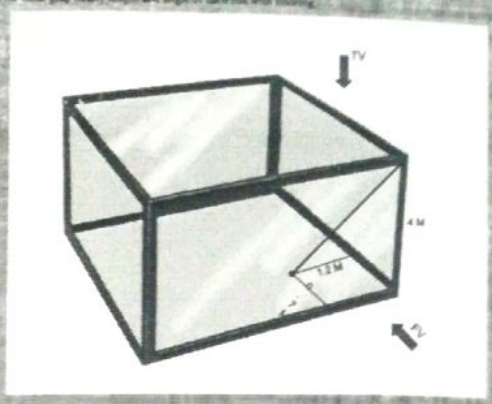
PROBLEM 17:- A pipe line from point A has a downward gradient 1:5 and it runs due East-South. Another Point B is 12 M from A and due East of A and in same level of A. Pipe line from B runs 20° Due East of South and meets pipe line from A at point C. Draw projections and find length of pipe line from B and it's inclination with ground.

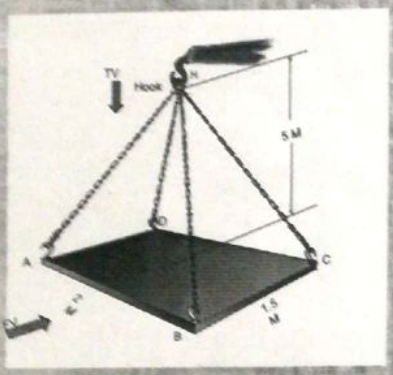


PROBLEM 18: A person observes two objects, A & B, on the ground, from a tower, 15 M high. At the angles of depression 30° & 45°. Object A is in the North-West direction of observer and object B is due West direction. Draw projections of the situation and find distances from observer and from tower also.

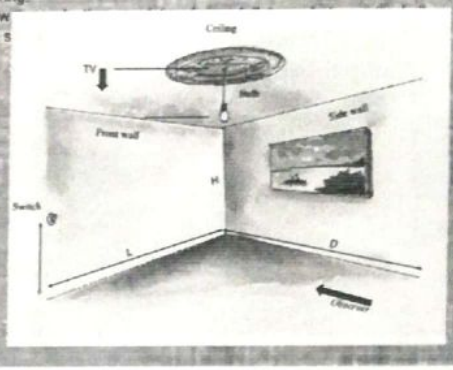


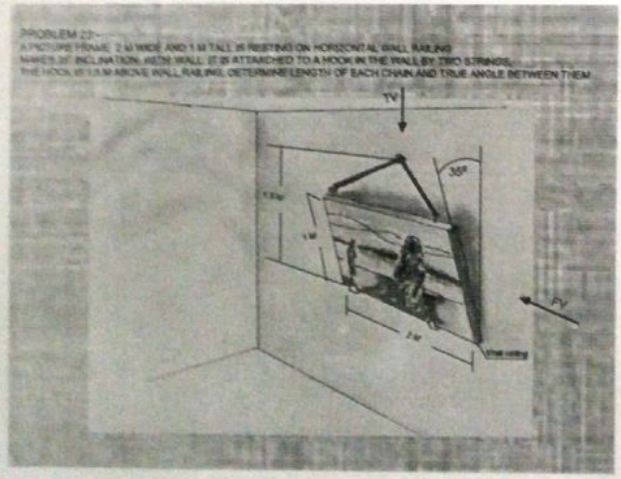


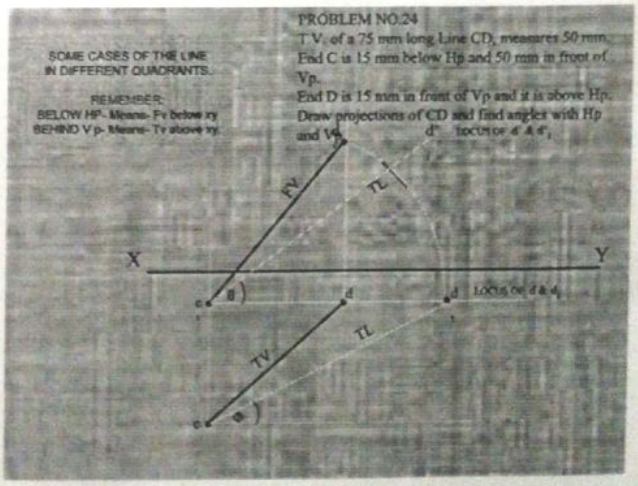


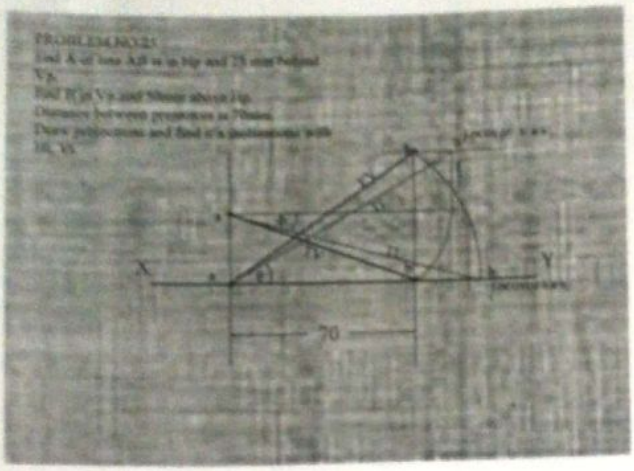


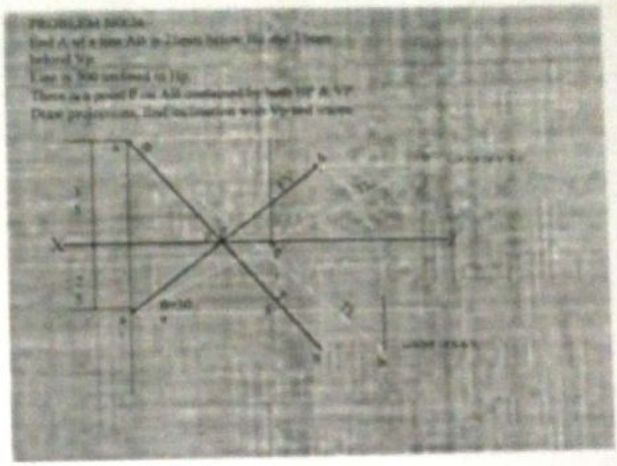
PROBLEM 22.
A room is of size 6.5m L ,5m D,3.5m high.
An electric bulb hangs 1m below the center of ceiling.
A switch is placed in one of the corners of the room, 1.5m above the flooring.
Draw
and s

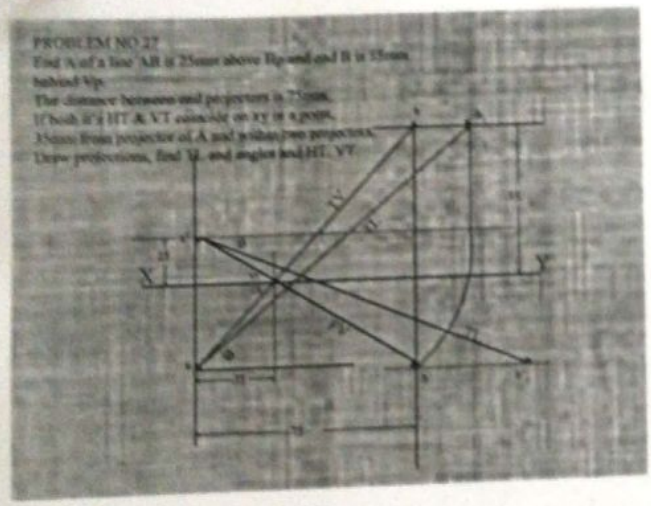












11. UNIVERSITY PREVIOUS QUESTION PAPERS

R16

Code No: 131AF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech I Year I Semester Examinations, December - 2018
ENGINEERING GRAPHICS
(Common to ME, MMT, MSNT)

Time : 3 hours **Max Marks: 75**

Answer all five questions
All questions carry equal marks
- - -

1.a) Construct a heptagon with a side of 30 mm using general method.
b) Construct a vernier scale of R.F = 1: 2.5 to show decimeters, centimeters and millimeters. The scale should be capable of reading up to 4 decimeters. Mark on your scale the following distances: (i) 3.23 dm and (ii) 3.65 dm. [15]

OR

2.a) The actual length of 500 m is represented by a line of 15 cm on a drawing. Construct a vernier scale to read up to 600 m. Mark on it a length of 568 m.
b) The distance between directrix of an ellipse is 170 mm and the distance between its foci is 70mm. Determine its major and minor axes and construct the ellipse using 'arc of circles' method. [7+8]

3.a) Draw the projections of the following points, keeping the distance between the projectors as 25 mm on the same reference line:
(i) Point 'A' on HP and 20 mm behind VP.
(ii) Point 'B' 20 mm below HP and 30 mm behind VP.
b) Draw the projections of a 60 mm long straight line, in the following positions.
(i) Perpendicular to the HP, in the VP and its one end in the HP.
(ii) Inclined at 45^0 to the VP, in the HP and its one end in the VP. [5+10]

OR

4. A line AB measures 100 mm. The projectors through its VT and the end A are 40 mm apart. The point A is 30 mm below the HP and 20 mm behind the VP. The VT is 10mm above the HP. Draw the projections of the line and determine its HT, inclinations with the HP and VP. [15]

5. Draw the projections of a cylinder, base 30 mm diameter and axis 40 mm long, resting with a point of its base circle on HP such that the axis is making an angle of 30^0 with HP and its top view perpendicular to VP. [15]

OR

6. Draw the projections of a cone, base 75 mm diameter and axis 100 mm long, lying on the ground on one of its generators with the axis parallel to the VP. Assuming the cone to be resting on its base on the ground, draw its projections. [15]

7. A cube of 45 mm side rests with a face on HP such that one of its vertical faces is inclined at 30^0 to VP. A sectional plane parallel to VP cuts that cube at a distance of 15 mm from the vertical edge nearer to the observer. Draw its top and sectional front views. [15]

OR

8. A cone, base 50 mm diameter and axis 60 mm long, rests with its base on HP. A section plane perpendicular to VP and inclined at 45^0 to HP bisects the axis of the cone. Draw the development of lateral surface of the remaining portion of the cone. [15]

9. Draw the isometric view for the figure 1 shown below front and top views. All dimensions are in mm. [15]

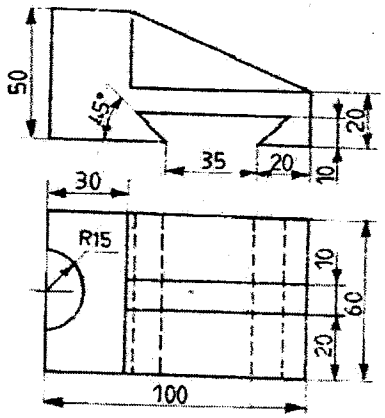


Figure: 1

OR

10. Draw (a) Front View (b) Top View (c) Side View (Figure 2). All dimensions are in mm. [15]

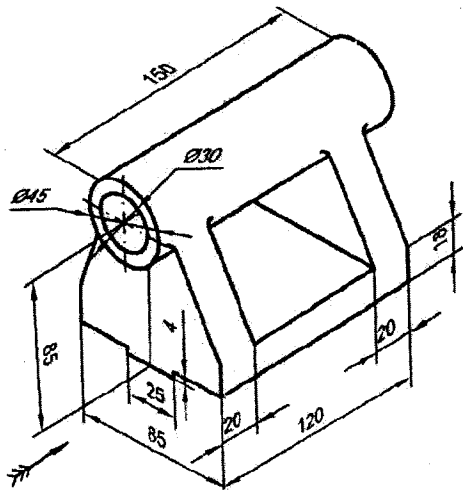


Figure: 2

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R16

Code No: 131AF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year I Semester Examinations, December - 2017

ENGINEERING GRAPHICS

(Common to ME, MCT, MMT, MSNT)

Time: 3 hours **Max Marks: 75**

Answer all five questions

All questions carry equal marks

1.a) Construct a diagonal scale to read up to 0.1 mm, and mark on it a distance of 6.63 cm. Take the scale as 3:1.

b) Inscribe an ellipse in a parallelogram of sides 150 × 100 mm with an inclined angle of 120^0. [7+8]

OR

2.a) Draw a parabola passing through three vertices of a triangle of sides 30, 45 and 60 mm. The corner of the triangle common to the 45 and 60 mm sides lies on the axis of parabola. Draw a tangent and normal at a point on the curve 20 mm from the axis.

b) Construct a plain scale of RF = 1:50,000 to show kilometers and hectometers and long enough to measure upto 7 km. Mark a distance of 5.3 km on the scale. [7+8]

3. A divider opened at 40^0 is placed on HP with its needle ends equidistant from V.P. If the height of hinged end of divider is 60 mm from H.P. and the distance between needle ends is 50 mm, draw the projections of the divider, and determine the a) true lengths of the divider legs, and b) inclinations of the legs with the HP and VP. [7+8]

OR

4. A line AB, 80 mm long, makes an angle of 30^0 with the VP, and lies in a plane perpendicular to both the HP and VP. Its end A is in the HP, and the end B is in the VP. Draw its projections and show its traces. [15]

5. A pentagonal prism is resting on one of the corners of its base in the HP. The longer edge containing that corner is inclined at 30 degrees to HP and the vertical plane containing that edge is inclined at 45^0 to the VP. Draw the projections of the solid. [15]

OR

6. A tetrahedron of side 45 mm is resting with one of its faces on the HP. Draw its projections when the edge of the face lying on HP is parallel to and 15 mm in front of VP. [15]

7. A hexagonal pyramid of side of base 40 mm and height of axis 110 mm is resting on one of its inclined vertical surface on H.P. such that its axis remains parallel to the V.P. It is cut by a cutting plane which is inclined at an angle 45^0 with H.P. and bisecting the axis of the pyramid. Draw front view, sectional top view. [15]

OR

8. A transition piece connects a square pipe of side 25 mm at the top and a circular pipe of 50 mm diameter at the bottom, the axes of both the pipes being collinear. The height of transition piece is 60 mm. Draw its development. [15]

9. An isometric view of a solid is shown in figure 1 below. Draw the front and top orthographic views of the solid. The dimensions may be assumed in suitable units and in proper proportion to the dimension shown in the figure 1. [15]

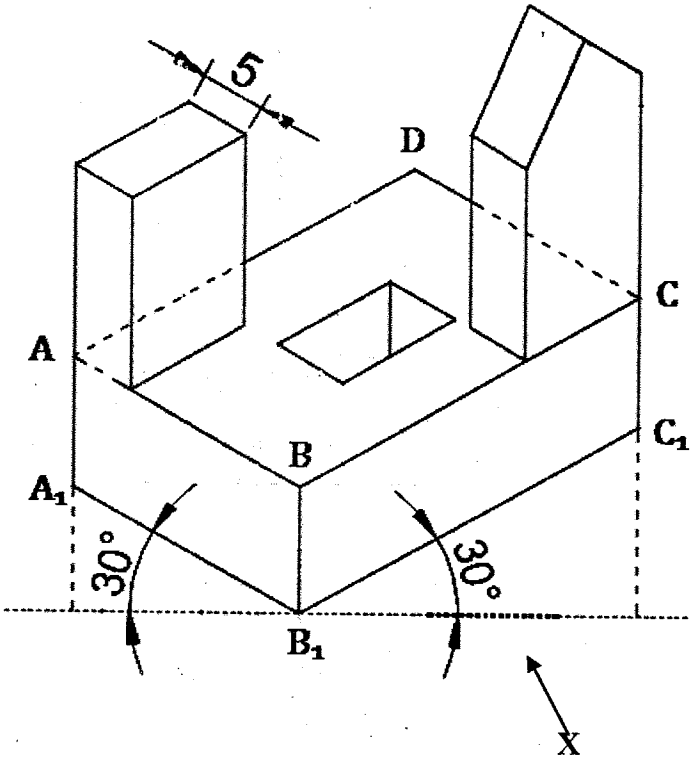
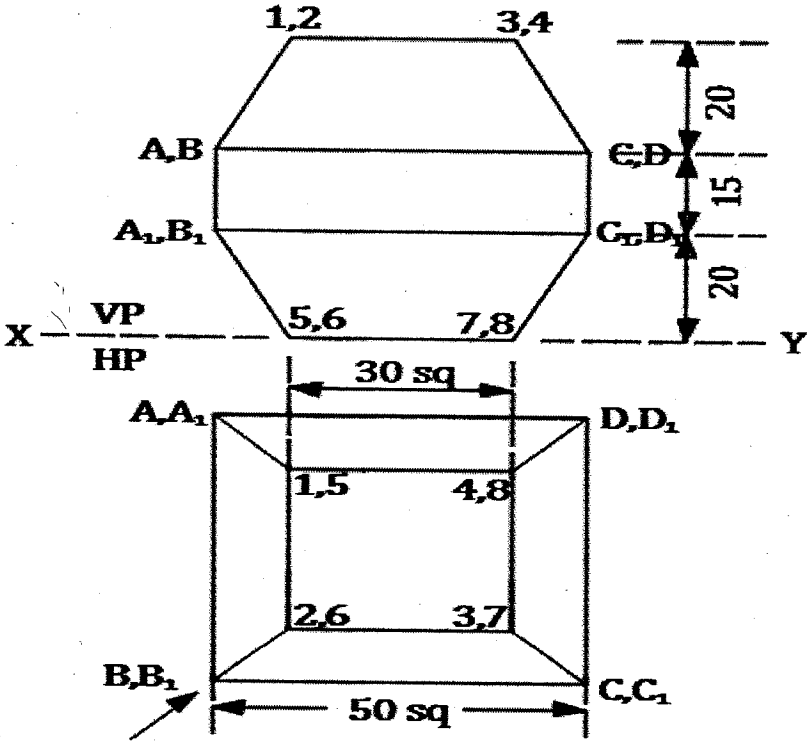


Figure: 1

OR

10. Draw the isometric view of the casting whose front and top views are shown in figure 2 below. All dimensions shown in the figure 2 are in mm. [15]



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18AG1A01A8 R.V.Shetty **R18**

Code No: 151AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B .Tech I Year I Semester Examinations, December - 2018
ENGINEERING GRAPHICS
(Common to CE, ME, EIE, MCT, MMT, AE, MHE, PTM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1. A stone is thrown from a 4 m high building and at its highest flight, the stone just crosses the top of a 10 m high tree from the ground. Trace the path of the projectile, if the horizontal distance between the building and the tree is 5 m. Find the distance of the point from the building where the stone falls on the ground. [15]

OR

2. Draw a hypocycloid generated by a rolling circle of 60 mm diameter for one complete revolution. The radius of the directing circle is 100 mm. draw a tangent and a normal to the hypocycloid at 50 mm from the centre of the directing circle. [15]

3.a) Draw the projection of two points on the same reference line, point C being 15 mm below HP and 50 mm in front of VP and point D being 25 mm above HP and 40 mm behind VP.

b) The top view of a 75 mm long line measures 50 mm. the end P is 15 mm above HP and 50 mm in front of VP. The end Q is 20 mm in front of VP and above the HP. Draw its projections and determine its true angles and apparent angles with the reference planes. [5+10]

OR

4. A triangular plane ABC has its 70 mm long base AB, and a 100 mm long altitude. The base is on the HP and inclined at 30^0 to the VP. The plane is inclined to the HP in such a manner that AC lies on a plane perpendicular to both the HP and VP. Draw the projections of the plane and find its inclination with HP. [15]

5. A hexagonal prism having a base with 25 mm edge and 60 mm long axis, has an edge of its base in the VP and is inclined at 60^0 to HP. Draw its projections when the edge of the other base farthest away from the VP is at a distance of 70 mm from the VP. [15]

OR

6. A square pyramid having a base with a 40 mm side and 60mm long axis rests on one of its triangular faces on the ground. The top view of the axis makes an angle of 30^0 with the VP. Draw the final projections of the square pyramid. [15]

7. A square prism, having a base with a 40mm side and a 70 mm axis, rests on its base on the H.P. with edges of the base equally inclined to the V.P. Draw front view, sectional top view and true shape of the section when it is cut by an A.I.P., such that the true shape of section is Equilateral triangle with a 45 mm side. [15]

OR

8. A vertical square prism having its faces equally inclined to VP is completely penetrated by a horizontal cylinder, the axis of which is parallel to VP and 6 mm away from that of the prism. Draw the projections of solids showing curves of intersection. The length of the side of the base of the prism is 50 mm and the diameter of the cylinder is 40 mm. [15]

9. Draw the front view, top view and right side view in the first angle projection of the following solid. Figure – 1 (All dimensions are in mm) [15]

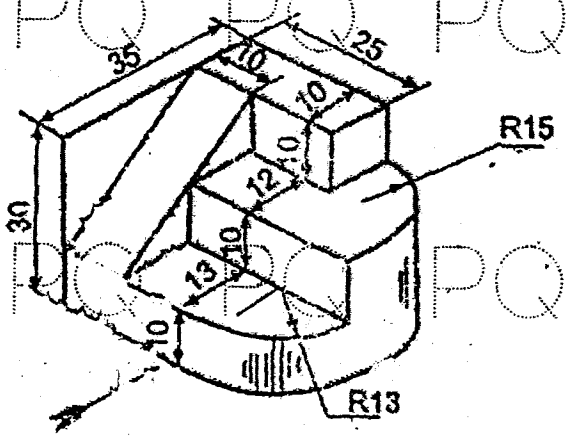

Figure -1

OR

10. Draw the isometric view of the following projections. Figure – 2 (All dimensions are in mm) [15]

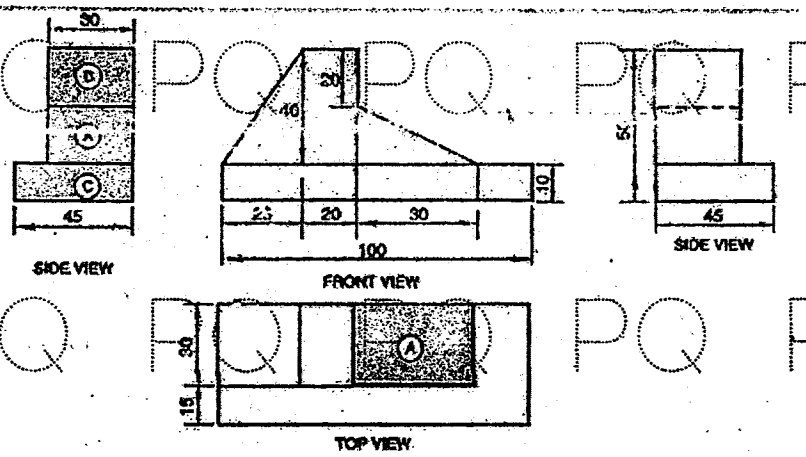

Figure -2

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R18

Code No:151AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B .Tech I Year I Semester Examinations, December - 2018

ENGINEERING GRAPHICS

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time : 3 hours **Max Marks: 75**

Answer any five questions

All questions carry equal marks

1.a) The foci of an ellipse are 100 mm apart and the minor axis is 50 mm long. Determine the length of the major axis and draw the ellipse, left half by concentric circles method and Right half by oblong method.

b) The length of 500 m represented by a lie of 15 cm on the drawing. Construct a vernier scale to read up to 600 m. Mark on a scale the length of 549 m. [15]

OR

2. A ball thrown up in the air reaches a maximum height of 45 meters and travels a horizontal distance of 75 meters. Trace the complete path of the ball, assuming it to be parabolic; Find the direction of travel of the ball at a height of 15 meters from the ground (Scale 1 :500). [15]

3.a) A regular pentagon of 30 mm sides is resting on HP on one of its sides while its opposite vertex (corner) is 30 mm above HP. Draw projections when side in HP is 30^0 inclined to VP.

b) Two points A and B are in the H.P. The point A is 30 mm in front of the V.P, while B is behind the V.P. The distance between their projectors is 75 mm and the line joining their top views makes an angle of 45^0 with xy. Find the distance of the point B, from the V.P. [15]

OR

4. A circle of 50 mm diameter is resting on the ground on a point with its plane inclined at 30^0 to the ground. Draw the projections of the circle when: a) The top view of the diameter through the resting point makes an angle of 45^0 with xy and b) The diameter passing through the resting point makes an angle 45^0 with the V.P [15]

5. A square prism of base 50 mm side and 100 mm height stands with its base on the ground such that all the rectangular faces are equally inclined to the V.P. It is cut by a section plane perpendicular to the V.P such that the true shape of the section is a rhombus of longer diagonal 90 mm. Find the inclination of the section plane with the H.P and draw the front view, sectional top view and true shape of the section. [15]

OR

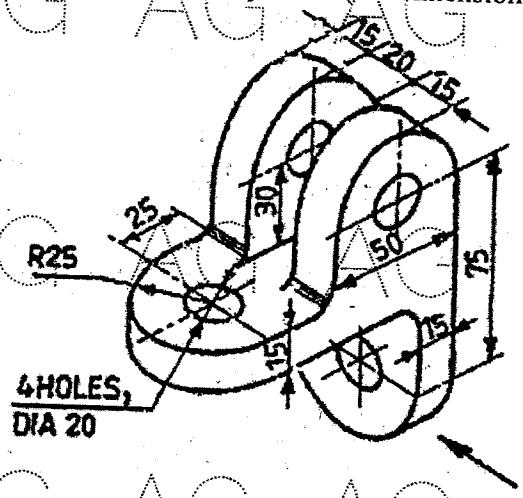
6. A pentagonal pyramid has an edge of the base in the V.P and inclined at 30^0 to the H.P, while the triangular face containing that edge makes an angle 45^0 with the V.P. Length of the side of the base being 30 mm and length of the axis 75 mm. Draw the projections of the solid. [15]

7. A pentagonal prism 20 mm side of base and 45 mm height stands vertically on its base with two of its rectangular faces equally inclined to the V.P. The V.T of the cutting plane inclined at 45^0 to the axis of the prism, passes through the left comer of the top face of the prism. Develop the lower portion of the lateral surface of the prism. [15]

OR

8. Cone with a base diameter of 64 mm and an axis length of 70 mm is kept on its base on the HP. A cylinder of diameter 30 mm and length 90 mm penetrates the cone horizontally. The axis of the cylinder is 20 mm above the base of the cone and 5 mm away from the axis of the latter. Draw the three views of the solids showing curve of intersection. [15]

9. Draw the front view, left side view, and top view. (All dimensions are in mm) [15]



OR

10. A circular block, 75 mm diameter and 25 mm thick, is pierced centrally through its flat faces by a square prism, base 35 mm side and 125 mm long, which comes out equally on both sides of the block. Draw the isometric projection of the combination when the combined axis is horizontal. [15]

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12.MID EXAM DESCRIPTIVE QUESTION PAPERS WITH KEY

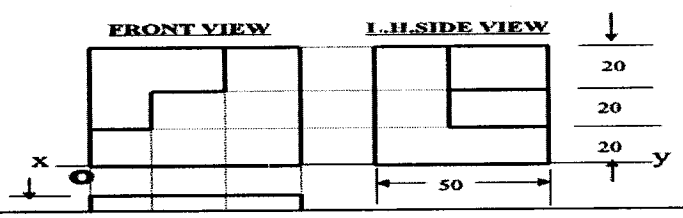
KG REDDY College of Engineering & Technology			College Code
(Approved by AICTE, New Delhi, Affiliated to JNTUH, Hyderabad) Chilkur (Village), Moinabad (Mandal), R. R Dist, TS-501504 Accredited by NAAC			QM
			Marks: 10
Name of the Exam:	I Mid Examinations, October-2019		
Year-Sem & Branch:	I B.Tech I Semester (R18) ECE	**Duration:**	60 Min
Subject:	ENGINEERING GRAPHICS	**Date & Session**	**25-10-19 (AN)**
Answer **ANY TWO** of the following Questions			**2X5=10**

Q.NO	Question	Bloom's Taxonomy Level	Course Outcome
1	A circle of 50 mm diameter rolls on a straight line without slipping; draw the curve traced by a point on circumference for one complete revolution of the circle. Name the curve. Draw the tangent to the curve at a point 40 mm from the line.	APPLY	CO2
2	Construct a diagonal scale of RF= 1/2000, to show meters and long enough to measure up to 300m. Mark on it a distance of 257m.	APPLY	CO2
3	The major and minor axes of an ellipse are 120 and 80. Draw an ellipse.	ANALYZE	CO2
4	Two points A and B are on HP; the point A being 30 in front of VP, while B is 45 behind VP. the line joining top views makes an angle of 45^0 with XY. Find the horizontal distance between two points.	ANALYZE	CO2

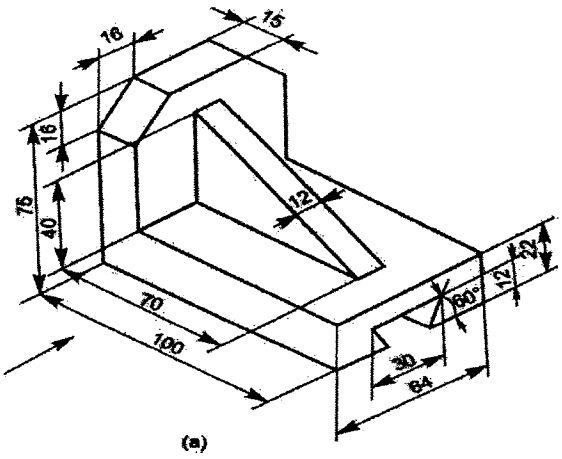
KG REDDY College of Engineering & Technology			College Code
(Approved by AICTE, New Delhi, Affiliated to JNTUH, Hyderabad) Chilkur (Village), Moinabad (Mandal), R. R Dist, TS-501504 Accredited by NAAC			QM
			Marks: 10
Name of the Exam:	I Mid Examinations, October-2019		
Year-Sem & Branch:	I B.Tech I Semester (R18) ECE	**Duration:**	60 Min
Subject:	ENGINEERING GRAPHICS	**Date & Session**	**25-10-19 (AN)**
Answer **ANY TWO** of the following Questions			**2X5=10**

Q.NO	Question	Bloom's Taxonomy Level	Course Outcome
1	A circle of 50 mm diameter rolls on a straight line without slipping; draw the curve traced by a point on circumference for one complete revolution of the circle. Name the curve. Draw the tangent to the curve at a point 40 mm from the line.	APPLY	CO2
2	Construct a diagonal scale of RF= 1/2000, to show meters and long enough to measure up to 300m. Mark on it a distance of 257m.	APPLY	CO2
3	The major and minor axes of an ellipse are 120 and 80. Draw an ellipse.	ANALYZE	CO2
4	Two points A and B are on HP; the point A being 30 in front of VP, while B is 45 behind VP. the line joining top views makes an angle of 45^0 with XY. Find the horizontal distance between two points.	ANALYZE	CO2

KG REDDY College of Engineering & Technology			College Code
(Approved by AICTE, New Delhi, Affiliated to JNTUH, Hyderabad) Chilkur (Village), Moinabad (Mandal), R. R Dist, TS-501504 Accredited by NAAC			QM
Name of the Exam:	II Mid Examinations, December-2019		**Marks :** 10
Year-Sem & Branch:	I B.Tech I Semester (R18) ECE	**Duration:**	60 Min
Subject:	ENGINEERING GRAPHICS	**Date & Session**	**20/12/2019 FN**
Answer **ANY TWO** of the following Questions			**2X5=10**

Q.NO	Question	Bloom's Taxonomy Level	Course Outcome
1	a) A pentagonal plane of 30 mm side rests on HP on one of its corners with its surface inclined at 30° to HP, making an angle of 60° to with the VP. Draw its projections. Or b) A hexagonal pyramid having a base of 30 mm side and 50 mm long axis rests on one of its base coroner on the ground with axis inclined at 45° to the HP .Draw its projections when the vertical plane containing the axis and the corner that lies in the HP is inclined at 30° to VP.	ANALYZE	CO2
2	a) A line AB 65mm long has its end A is 20 mm above HP and 25mm in front of VP. The end B is 40 mm above the HP and 65mm in front of VP. Draw the projection of AB. Determine its inclination with HP and VP Or b) A cone of base diameter 50 mm and axis 60 mm long rests with its base on HP .It is cut by a section plane perpendicular to HP and inclined at 60° to VP and at a distance of 10mm from the axis. Draw the sectional front view and true shape of the section.	APPLY	CO2
3	a) A cone of base diameter 30mm and height 40 mm resting over a frustum of a hexagonal pyramid of bas side 40 mm ,top base side 25 mm and height 60mm .draw the isometric projection of the solids. Or A hexagonal prism of side 30 and axis 75 long is resting on its base on HP such that a rectangular face parallel to VP. It is cut by a section plane, perpendicular to VP and inclined at 30° to HP. The section plane is passing through the top end of an extreme lateral edge of the prism. Draw the development of the lateral surface of the cut prism.	ANALYZE	CO2
4		APPLY	CO2

Or



(a)

Draw the front view, top view and the side view of given figure.

KG REDDY
College of Engineering
& Technology

Department Of Electronics And Communications Engineering

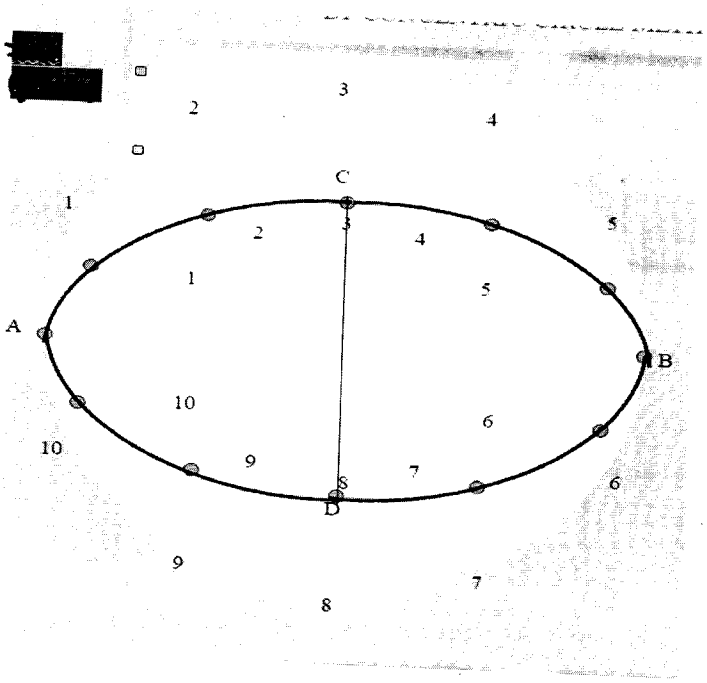
Descriptive Key

A.Y:2019-2020

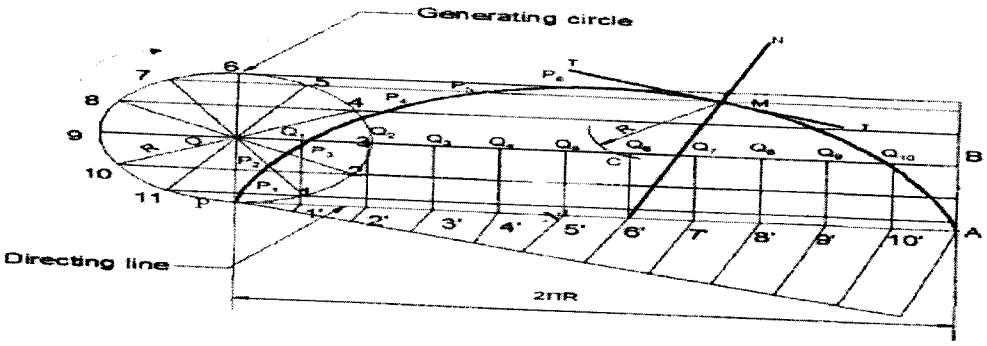
Mid-1

Section-A

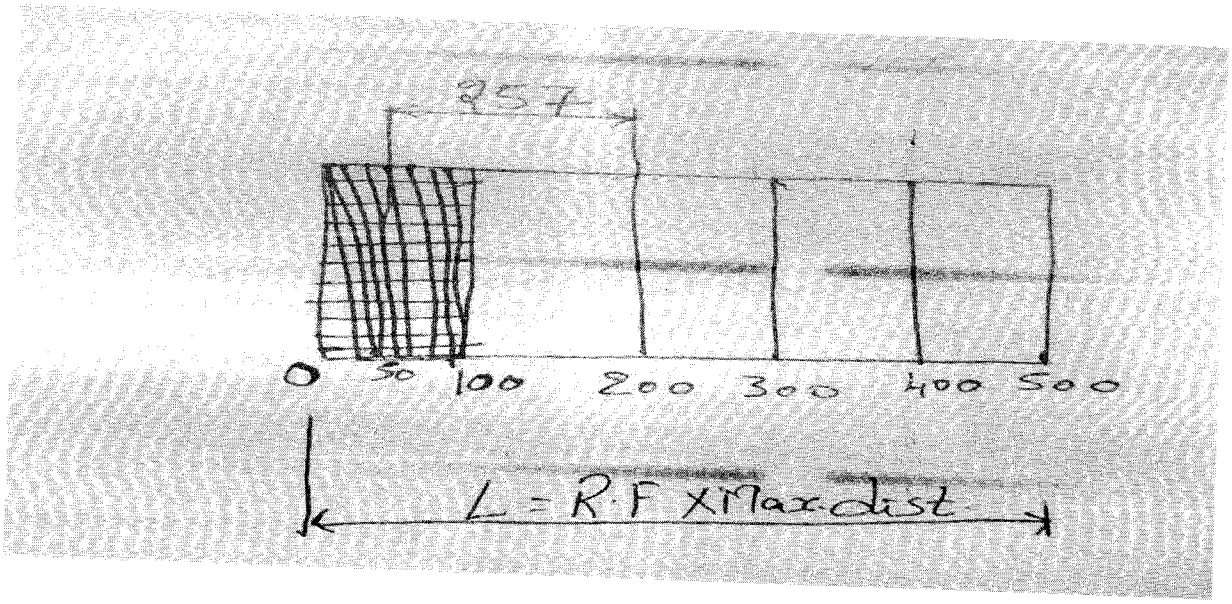
1.



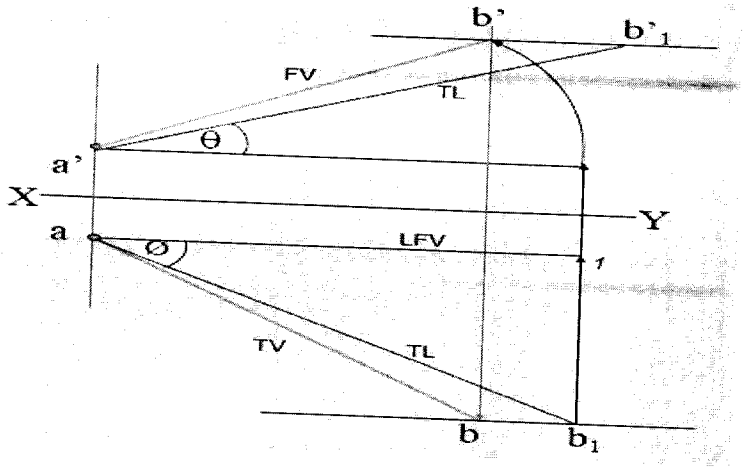
2.



3.


257
0
50
100
200
300
400
500
L = R.F X Max.dist

4.

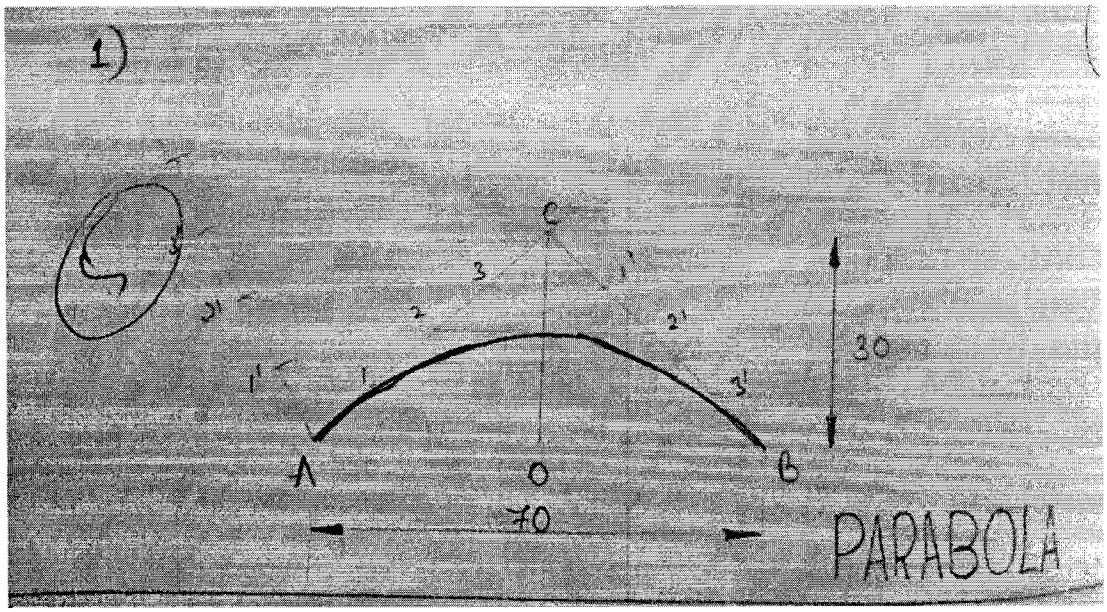

b'
b'1
FV
TL
θ
a'
X
Y
a
Ø
LFV
1
TV
TL
b
b1

13. MID EXAM OBJECTIVE:

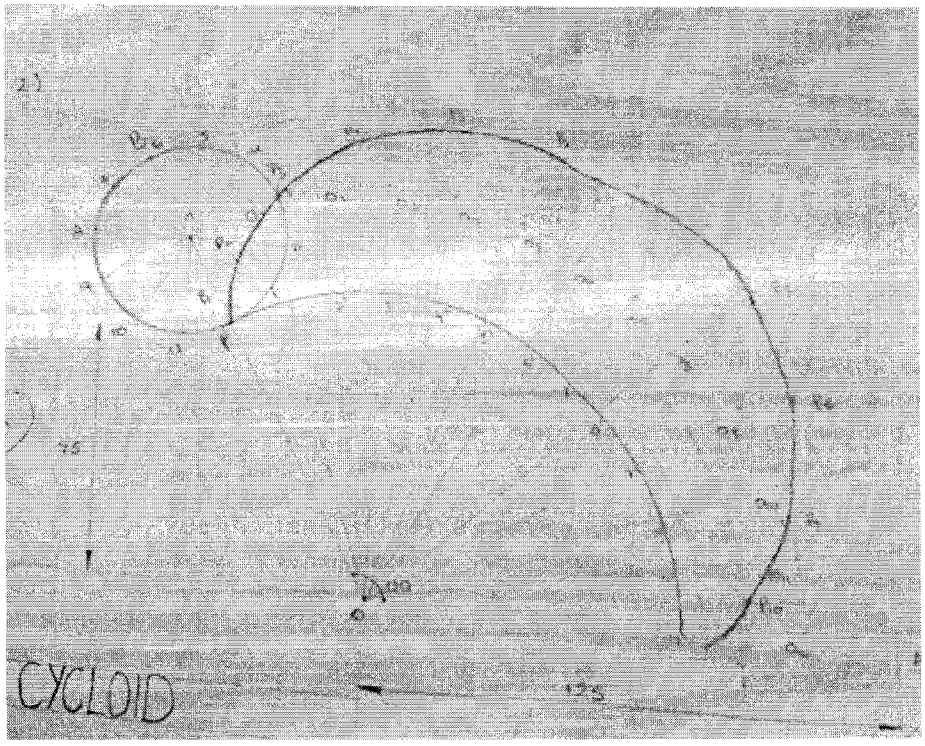
NOT APLLICABLE

14. ASSIGNMENT TOPICS WITH MATERIALS

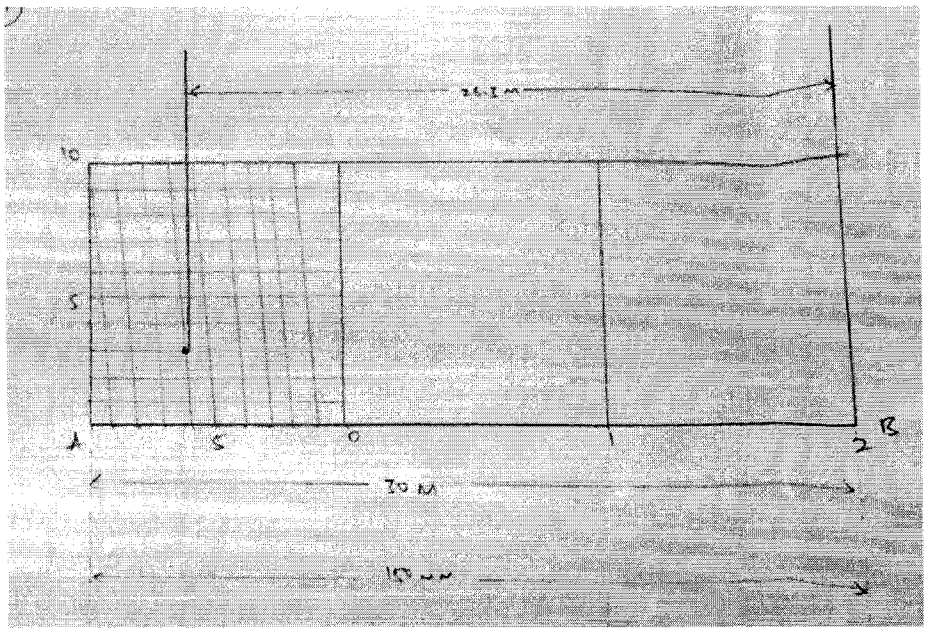
1) Draw a parabola having an abscissa of 30mm and the double ordinate are 70mm.



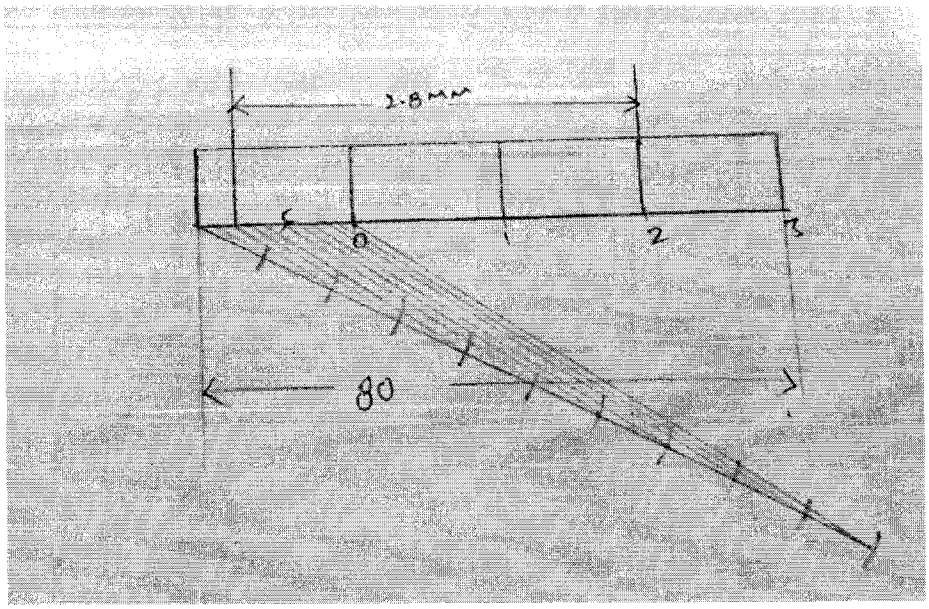
2) A circle of 50mm diameter rolls without slipping on the outside of another circle of diameter 150. Show the path on the periphery of the rolling circle.



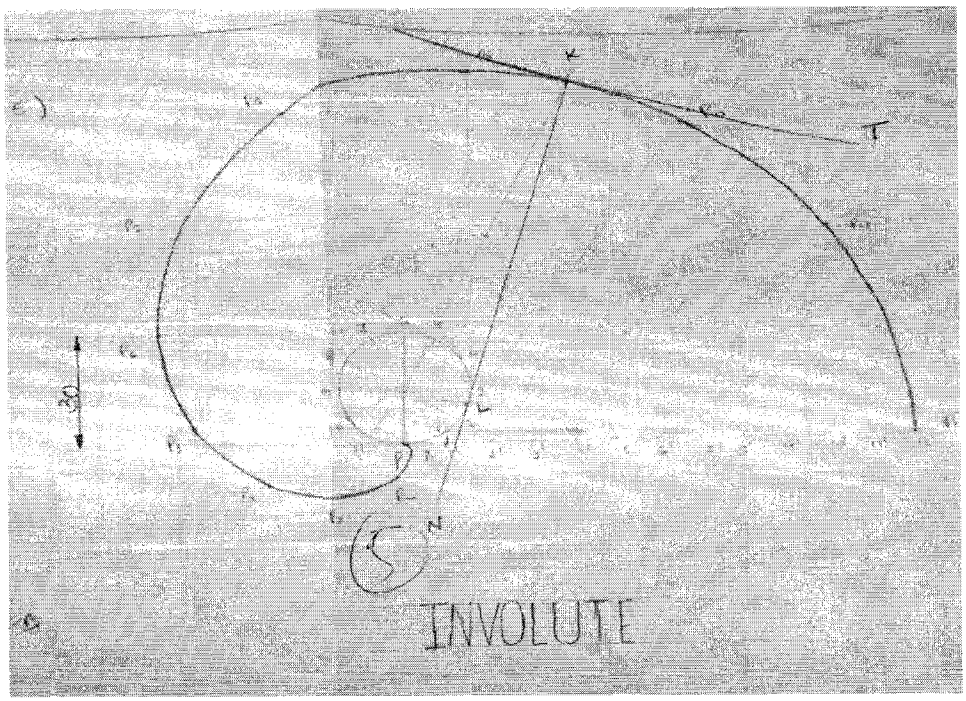
3) Construct a diagonal scales to read kilometers, hectometers and decameters given that 1 km is represented by 5cm on the drawing. Mark a distance of 1.54 km on the scale. What is the R.F?



4) The distance between city A and City B is 15km. On inspection of the road map, its equivalent distance measures 3cm. Draw a diagonal scale to read 5km minimum. Show on it a distance of 3.85km.



5) A coil is unwound from a drum of 30mm diameter. Draw the locus of the free end of the coil for unwinding through an angle of 360°. Draw also a normal and tangent at any point on the curve.



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Five marks questions:

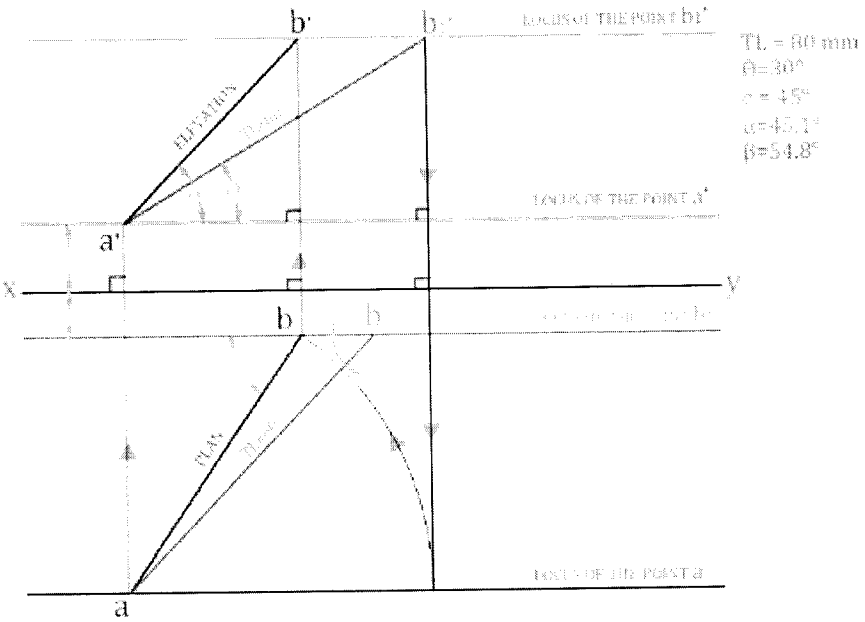
Unit 1:

1. Two fixed points A and B are 100 apart. Trace the complete path of the point P moving in such a way that the sum of its distances from A and B is always the same and equal to 125. Name the curve. Draw a tangent and normal to the curve thrugh a point 30 above AB line.

2.

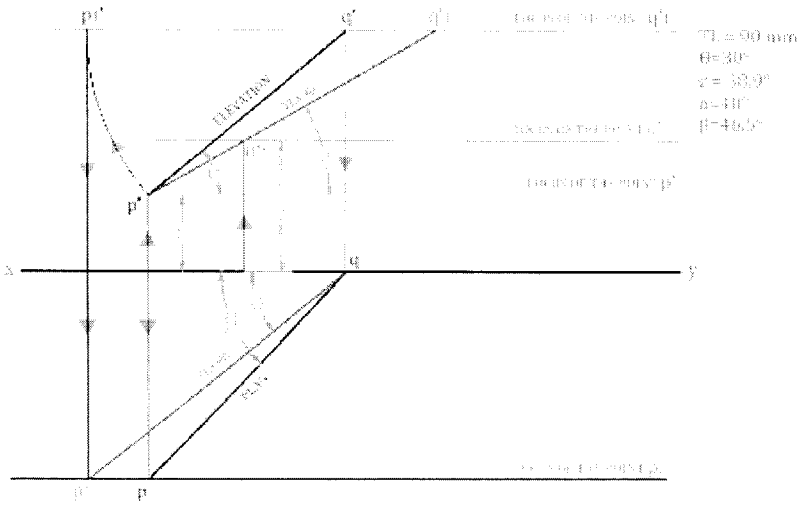
Unit 2:

1. A line AB is 80 mm long and the end A is 15 mm above H.P. The other end B is 10 mm in front of V.P. The line is inclined at 30° with H.P. and 45° with V.P. Draw the projections of the line when it is in 1st quadrant.

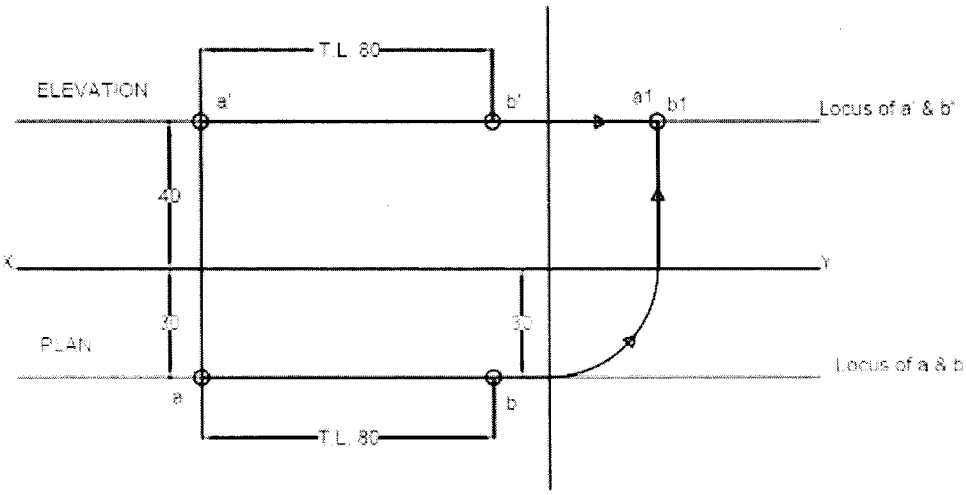


2. A line PQ contains a point O on it such that the ratio of the distance of the PO: OQ is 1:2. The end P is 20 mm above H.P. and it is in 1st quadrant. And the other end Q is

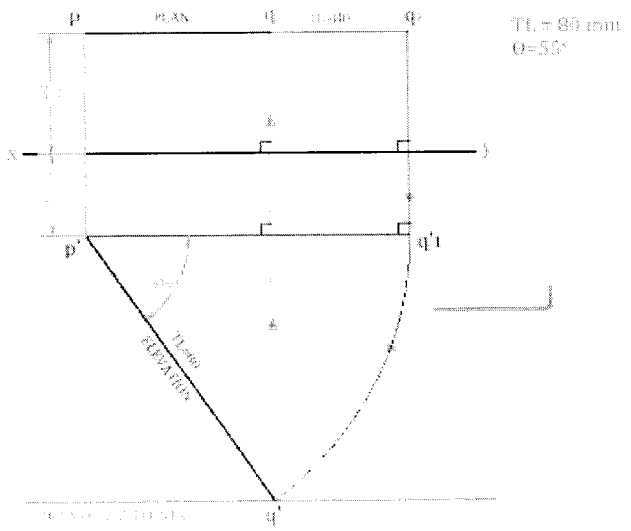
in V.P. The point O is 35 mm above H.P. The line is inclined with the H.P. at an angle 30°. The elevation length of the line PQ is 70 mm. Draw the projections of the line PQ.



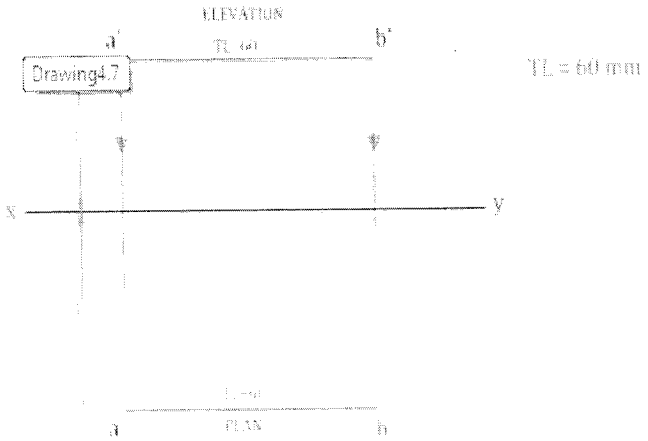
3. Problem 4.11 Projection of Straight Lines – A line AB is 80 mm long. It is perpendicular to profile plane. The point A is 40 mm above H.P. and 30 mm in front of V.P. Draw the projections.



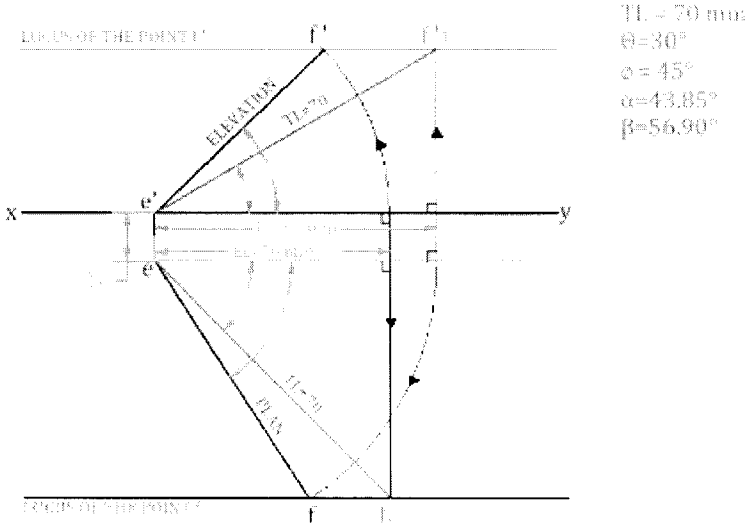
4. Problem 4.8 Projection of Straight Lines – A line PQ 80 mm long is parallel to V.P. and inclined to H.P. by 55°. The end point P is 20 mm below H.P. and 30 mm behind V.P. Draw the projections of the line PQ.



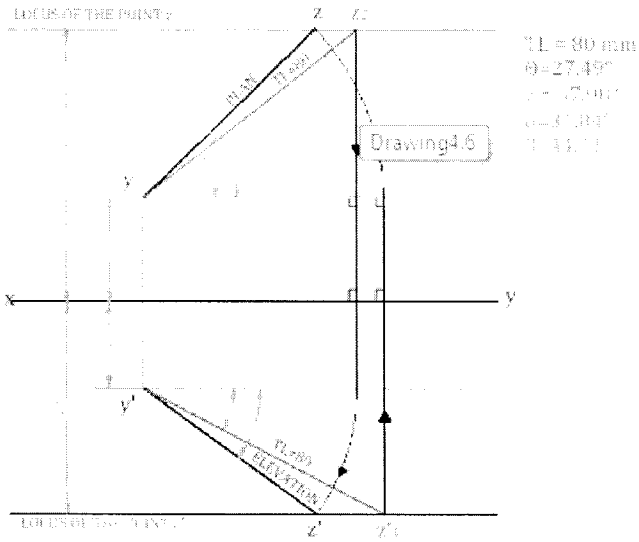
5. Problem 4.7 Projection of Straight Lines – A line AB 60 mm long is parallel to V.P. & H.P. both. The end A is 30 mm above H.P. and 40 mm in front of V.P. Draw the projection of line AB.



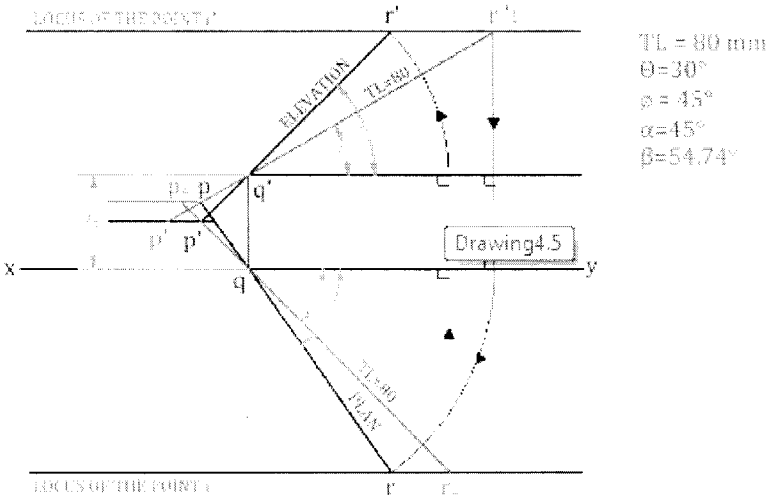
6. Problem 4.4 Projection of Straight Lines – The top view and the front view of the line EF, measures 60 mm and 50 mm respectively. The line is inclined to HP and VP by 30 degree and 45 degree, respectively. The end E is on the HP and 10 mm in front of VP. Other end F is in the 1st quadrant. Draw the projections of the line EF and find its true length.



7. Problem 4.6 Projection of Straight Lines – A line YZ, 65 mm long, has its end Y 20 mm below HP and 25 mm behind VP. The end Z is 50 mm below HP and 65 mm behind VP. Draw the projections of line YZ and finds its inclinations with HP and VP.

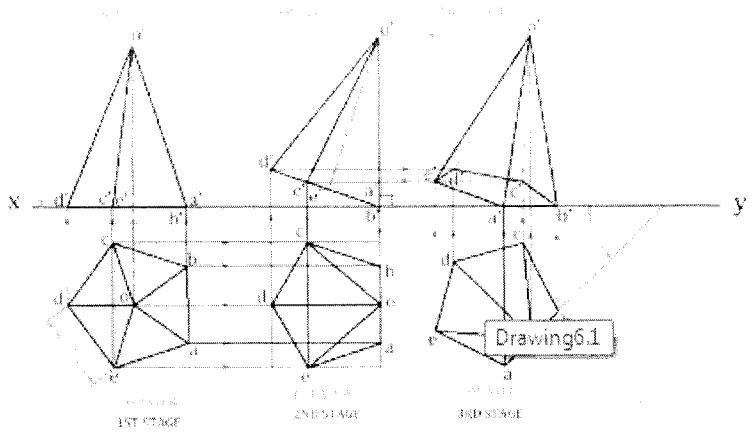


8. Problem 4.5 Projection of Straight Lines – A line PQR, 80 mm long, is inclined to H.P. by 300 and V.P. by 450. PQ:QR :1:3. Point Q is in V.P. and 20 mm above H.P. Draw the projection of the line PQR when the point R is in the 1st quadrant. Find the position of the point P.

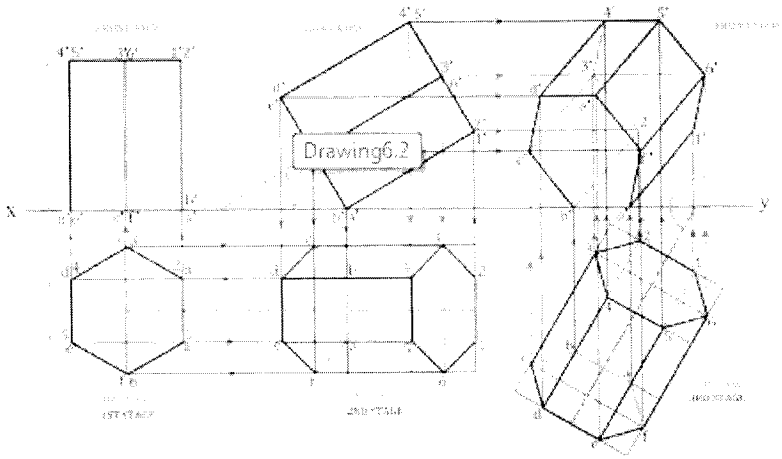


Unit:3

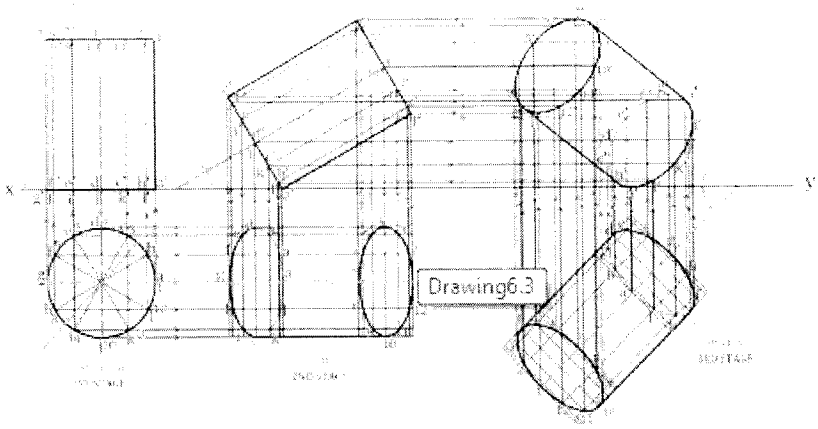
1. Problem 6.1 Projection of Solids – A pentagonal pyramid has height 60 mm and the side of a base 30 mm. The pyramid rests on one of its sides of the base on the H.P. such that the triangular face containing that side is perpendicular to the H.P. and makes an angle of 45 degree with the V.P. Draw its projections.



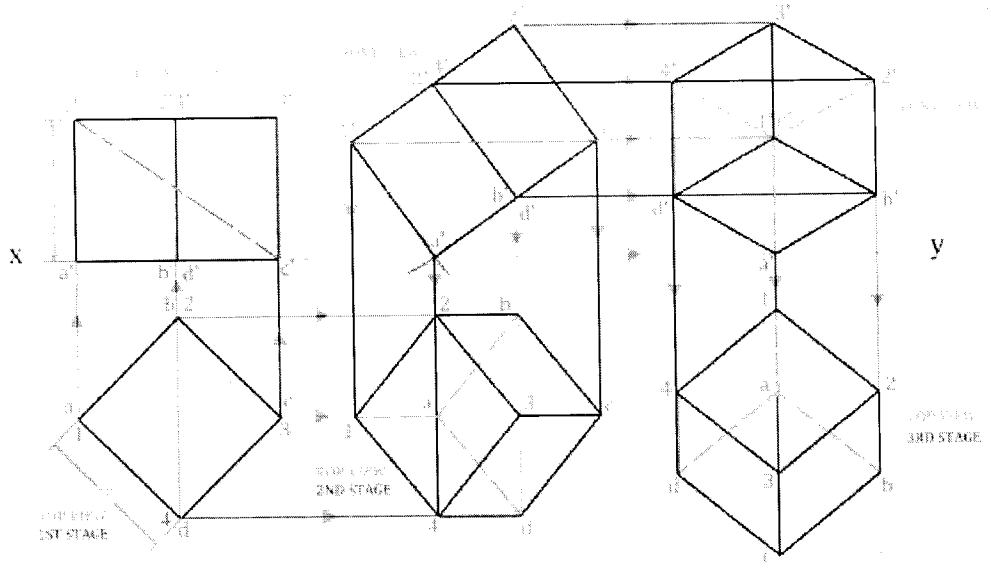
2. Problem 6.2 Projection of Solids – A hexagonal prism of 30 mm side of base and 70 mm height, resting on the H.P. such that the axis is inclined at 300 to the H.P. and 600 to the V.P. Draw its projections. Keep the top end of the prism near to the V.P.



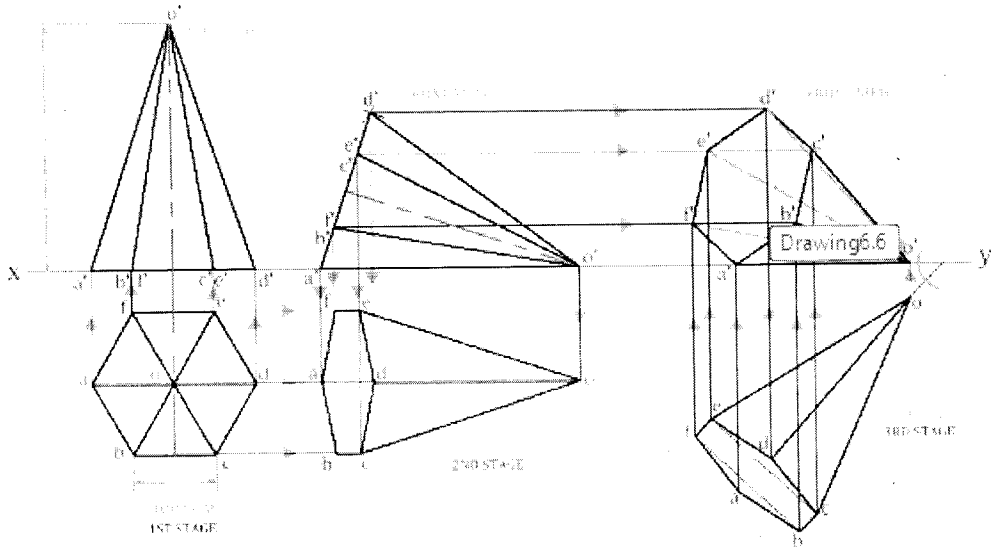
3. Problem 6.3 Projection of Solids – A cylinder diameter of base 50 mm and height 70 mm is resting on the H.P. on a point of its periphery of the base. The axis of the cylinder is inclined to H.P. by 300 and the axis is inclined at 450 to the V.P. Draw the projections. Keep top end of the cylinder near to observer.



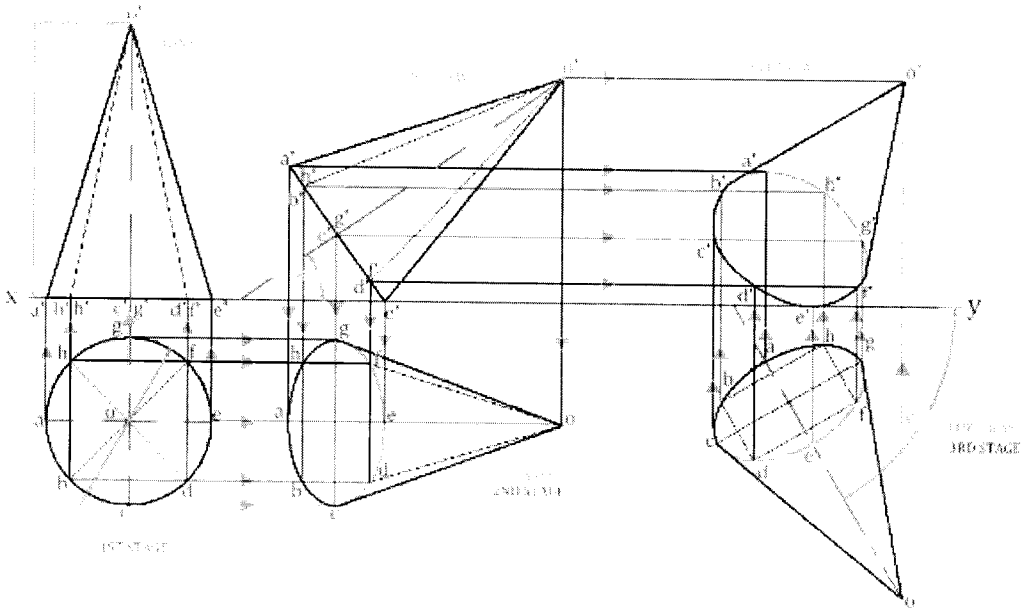
4. Problem 6.5 Projection of Solids – Draw the projections of a cube of side 50 mm which rests on a point of its corner on H.P. and one of its solid diagonal is parallel to H.P. and perpendicular to V.P.



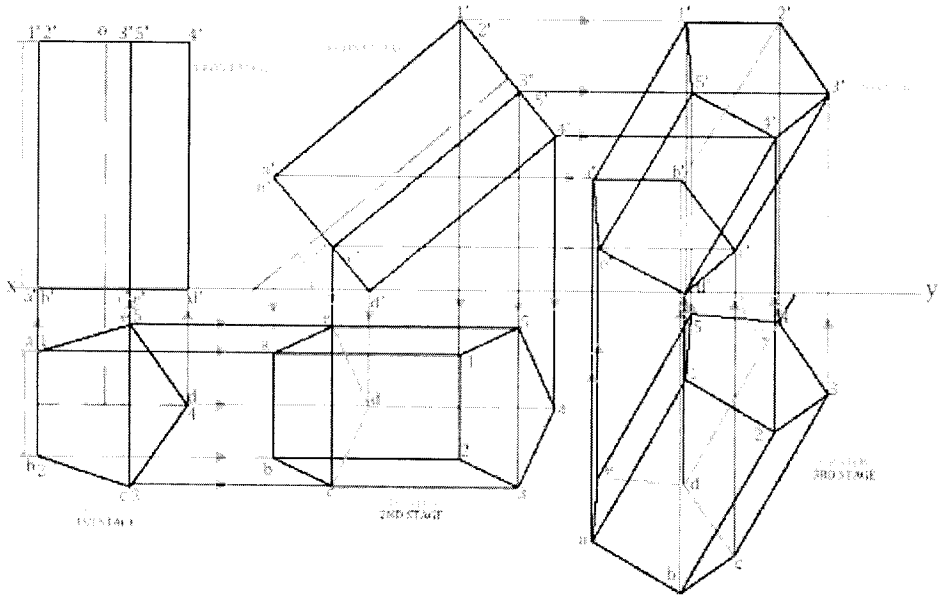
5. Problem 6.6 Projection of Solids – A hexagonal pyramid of side of base 30 mm and axis length 90 mm rests on one of its slant edge on the H.P. such that the plane containing that slant edge on which it rests on H.P. is inclined at 45° to V.P. and the apex is near to the V.P. Draw the projection of it.



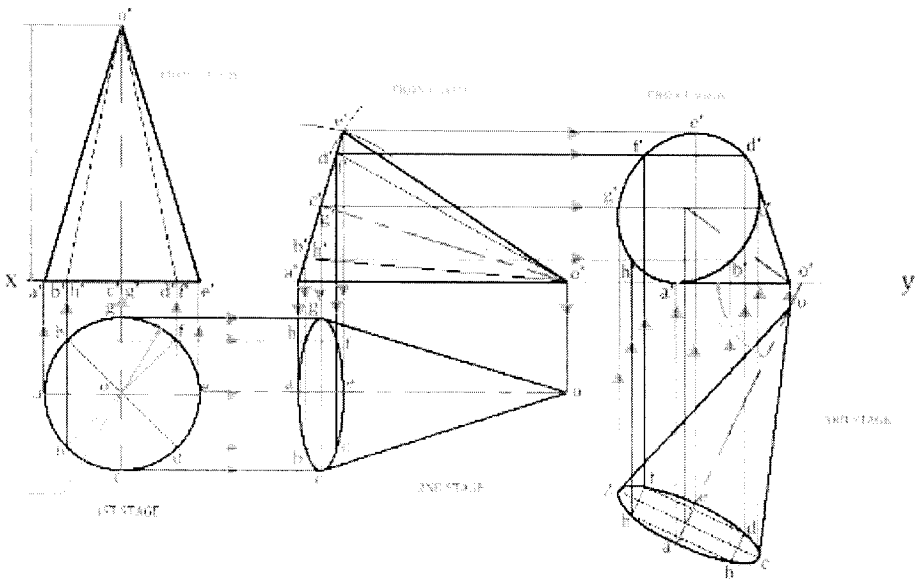
6. Problem 6.7 Projection of Solids – A cone of diameter of base 60 mm and axis length equal to 100 mm rests on a point of its periphery of the base on H.P. such that its axis is inclined at an angle of 35° with the H.P. and 60° with the V.P. and the apex is near to the observer. Draw its projection.



7. Problem 6.8 Projection of Solids – A pentagonal prism of side of base equal to 40 mm and axis height 110 mm rests on one of its corner of its base on H.P. such that the axis is inclined at an angle of 40° with H.P. and 60° with the V.P. Draw its projection.

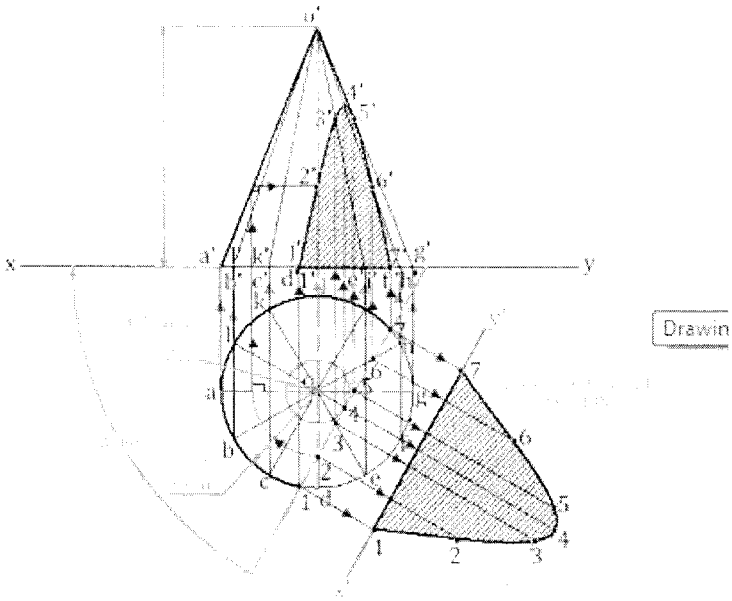


8. Problem 6.9 Projection of Solids – A cone of diameter of base 60 mm and axis length equal to 100 mm rests on one of its slant generators on H.P. such that its axis is inclined at an angle of 65° with the V.P. Keep its apex near to the V.P. and draw the projections.



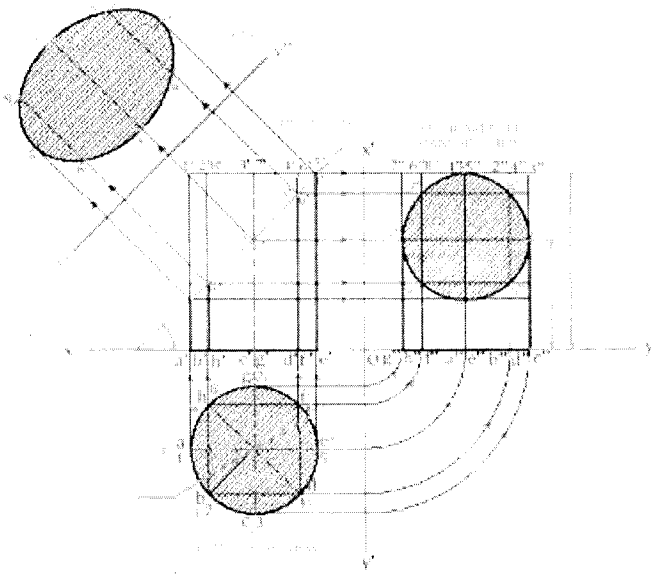
Unit:4

1. Problem 7.1 Section of Solids – A cone with base circle diameter 60 mm and axis length 75 mm is kept on its base on the ground. It is cut by a sectional plane perpendicular to H.P. and inclined at 60 degree to V.P. at a distance of 8 mm away from the top view of axis. Draw sectional elevation and true shape of the section.

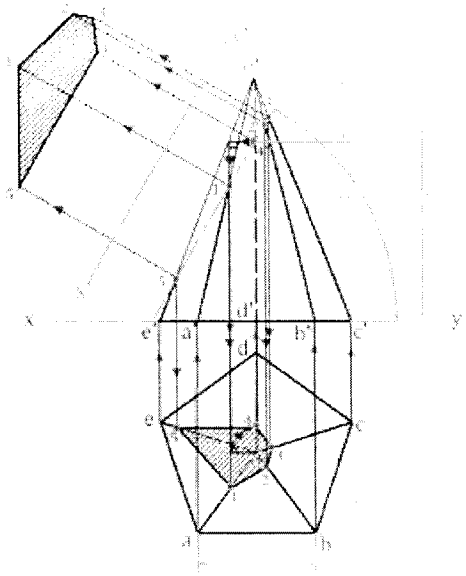


2. Problem 7.2 Section of Solids – A cylinder diameter of base 50 mm and height 70 mm is resting on H.P. on its base. It is cut by A.I.P. in such a way that it makes an angle of 45

degree with H.P. and passing 10 mm above the center of its height. Draw elevation, sectional top view, Sectional side view and true shape of the section

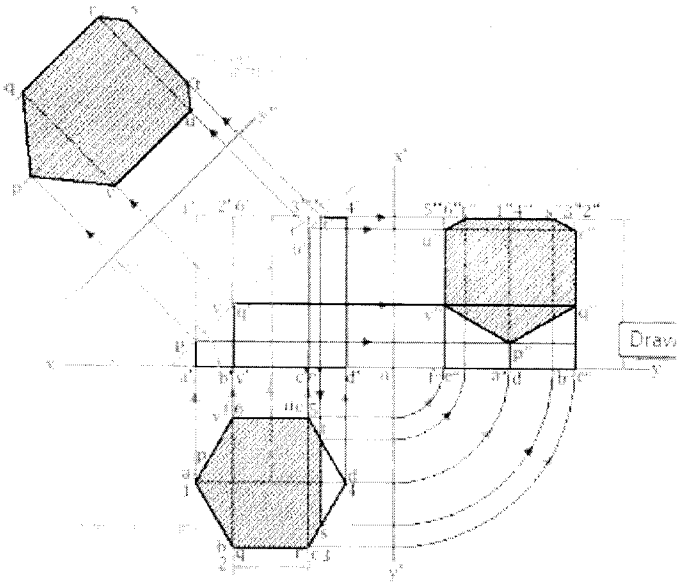


3. Problem 7.3 Section of Solids – A pentagonal pyramid, side of base 40 mm and height 80 mm is resting on H.P. on its base with one of the edges of the base away from V.P. is parallel to V.P. It is cut by an A.I.P. which is inclined at 60 degree with H.P. and passing 20 mm below the apex. Draw its elevation, sectional plan and true shape of section.

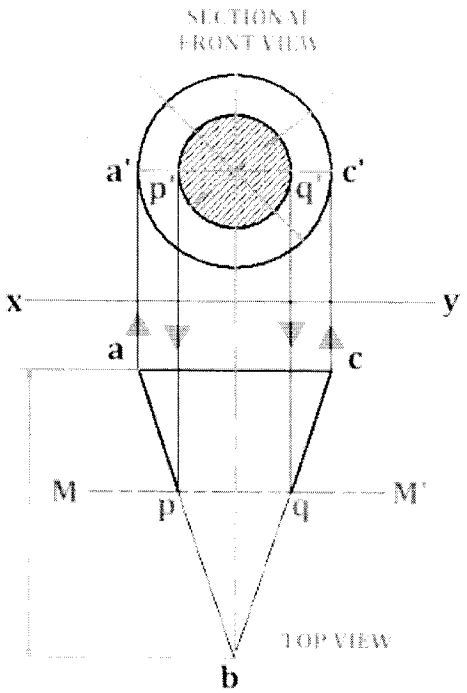


4. Problem 7.4 Section of Solids – A hexagonal prism is resting on H.P. on its base with two edges of base parallel to V.P. It is cut by an A.I.P. which is perpendicular to V.P. and inclined to H.P. by 45 degree and passing through a point 40 mm above the base & on axis.

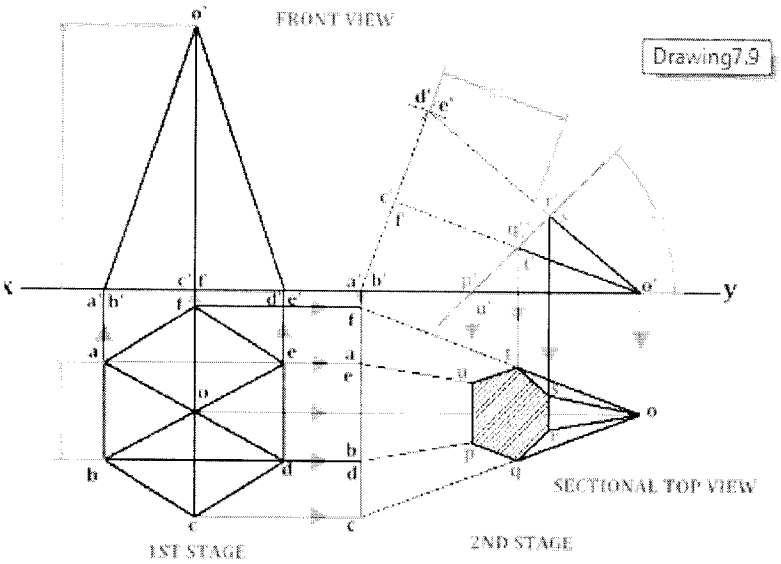
Draw elevation, sectional plan, sectional side view and true shape of section. Take side of base 30 mm and height 60 mm.



5. Problem 7.8 Section of Solids – A cone of base diameter 60 mm and axis height 90 mm is resting on its base on V.P. One cutting plane parallel with V.P. and perpendicular to H.P. is cutting the cone such that true shape of the section of the cone is a circle of diameter 35 mm. Draw sectional front view and top view of the cone.



6. Problem 7.9 Section of Solids – A hexagonal pyramid of side of base 40 mm and height of axis 110 mm is resting on one of its inclined vertical surface on H.P. such that its axis remains parallel to the V.P. It is cut by a cutting plane which is inclined at an angle 45° with H.P. and bisecting the axis of the pyramid. Draw front view, sectional top view.



15. TUTORIAL TOPICS AND QUESTIONS: NIL

16. UNIT-WISE QUESTION BANK : NIL

17. BEYOND SYLLABUS TOPICS WITH MATERIAL:NIL

18. RESULT ANALYSIS

Academic Year	Students Appeared	Students Passed	Pass Percentage (%)
2014-15			
2015-16			
2016-17			
2017-18			

KG REDDY College of Engineering & Technology

KG Reddy College of Engineering and Technolgoy
(Approved by AICTE, Affiliated to JNTU Hyderabad)

Department of Electronics and Comunication Engineering

CO-PO Attainment

Accredited by NAAC

Academic Year: 2019-2020 | I B.Tech II SEM | Section: A

Course Code: ME104ES | Course Name: EG LAB

Course Instructor: K KALPANA

CO-PO & PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2															
CO2	2	2			1											
CO3	2			1												
CO4	2															

Course Outcomes: Students will be able to

CO1	Impart knowledge about standard principles of orthographic projection of objects
CO2	Draw sectional views and pictorial views of solids
CO3	Prepare working drawings to communicate the ideas and information
CO4	Read, understand and interpret engineering drawings.

Program Outcomes(POs)

PO1	**Engineering knowledge:**Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:**Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.
PO3	**Design/development of solutions:**Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
PO4	**Conduct investigations of complex problems:**Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:**Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment sustainability:**Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:**Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:**Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:**Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broader context of technological change.

Program Specific Outcomes (PSOs)

PSO1	Problem Solving Skills – Graduate will be able to apply computational techniques and software principles to solve complex engineering problems pertaining to software engineering.
PSO2	Professional Skills – Graduate will be able to think critically, communicate effectively, and collaborate in teams through participation in co and extra-curricular activities.
PSO3	Successful Career – Graduates will possess a solid foundation in computer science and engineering that will enable them to grow in their profession and pursue lifelong learning through post-graduation and professional development.
PS04	Graduate will be able to work with the community and collaborate to develop technological solutions that would promote sustainable development in the society.

Course Coordinator | Module Coordinator | Program Coordinator / HOD

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Department of Electronics and Comunication Engineering
Overall CO Attainment

Academic Year: 2019-2020 I B.Tech I SEM Section: A
Course Code: ME104ES Course Name: EG LAB
Course Instructor: K KALPANA

Overall Mid Attainment

COs	Internal Examination Attainment %	Attained Level
CO1	100.00	3
CO2	100.00	3
CO3	100.00	3
CO4	100.00	3
Overall Mid Attainment	100	3

Attainment Level		Thresold Value
H	3	61% of students got >=40% marks.
M	2	51% of students got >=40% marks.
L	1	41% of student got >=40% of marks

Action Taken Report	
COs	Action Taken
CO1,CO2, CO3 &CO4	Attained

Course Coordinator Module Coordinator Program Coordinator / HOD

HEAD
DEPT. OF ME ENGINEERING
K.G. REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
CHILKUR (V), MOINABAD, R.R. DIST, Ph: 9391 004.

KG REDDY College of Engineering & Technology

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Department of Electronics and Commuication Engineering

CO-PO Attainment

Academic Year: 2018-2019 III B.Tech Semester-II Section: A

Course Code: Course Name: DSP

Course Instructor:

CO-PO & PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3		3	3							3	3	3	3	
CO2	3	3	1	3	3							3	2	2	2	2
CO3	3	3		3	3							3	3	3	3	2
CO4	3	3	3	3	3							3	2	2	2	2
CO5	2	2	1	2	3								2	2	2	2

Attainment Levels: H: Substantial (High) M: Moderate (Medium) L: Slight (Low)

Course Outcomes: Students will be able to

CO1 Construct time, frequency and Z -transform analysis on signals and systems.

CO2 Compare the inter-relationship between DFT and various transforms.

CO3 Describe the significance of various filter structures.

CO4 Design a digital filter for a given specification.

CO5 Identify the tradeoffs between normal and multi rate DSP techniques and finite length word effects

K1-Remembering, **K2**-Understanding, **K3**-Applying, **K4**-Analyzing, **K5**-Evaluating, and **K6**-Creating

Program Outcomes(POs)

PO1	**Engineering knowledge:**Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:**Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering sciences.
PO3	**Design/development of solutions:**Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
PO4	**Conduct investigations of complex problems:**Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:**Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment sustainability:**Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:**Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:**Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:**Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broader context of technological change.

Program Specific Outcomes (PSOs)

PSO1	Problem Solving Skills – Graduates will be able to apply their knowledge in emerging electronics and communication engineering techniques to design solutions and solve complex engineering problems.

PSO2	Professional Skills – Graduate will be able to think critically, communicate effectively, and collaborate in teams through participation in co and extra-curricular activities.
PSO3	grow in their profession and pursue lifelong learning through post-graduation and professional development.
PSO4	Society Impact – Graduate will be able to work with the community and collaborate to develop technological solutions that would

Course Coordinator

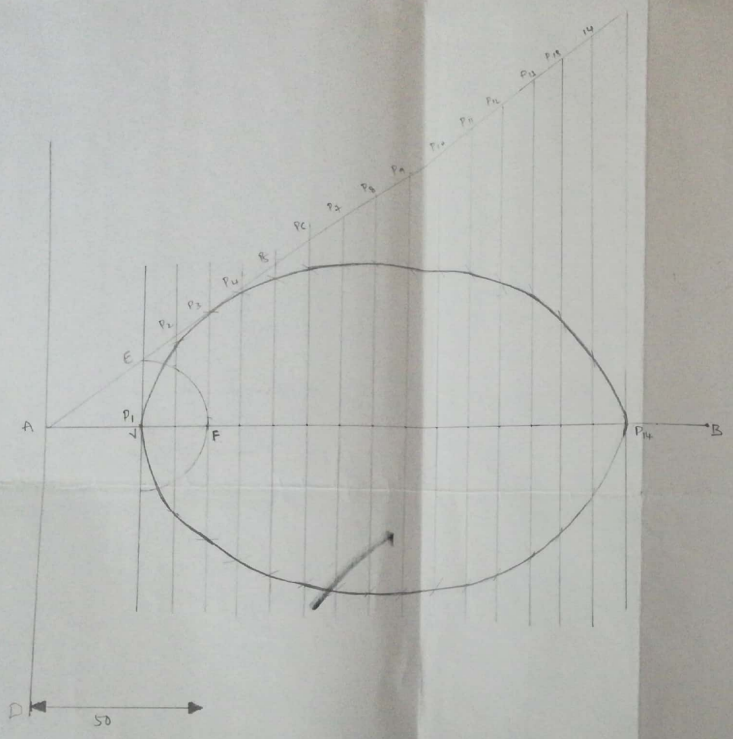
Module Coordinator

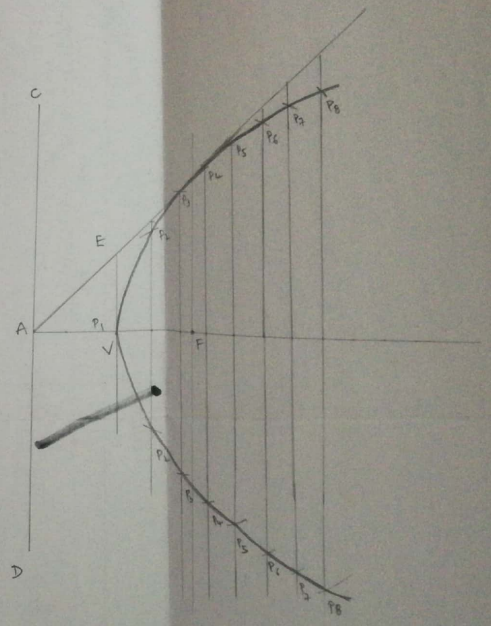
Program Coordinator / HOD

HEAD
DEPT. OF MECHANICAL ENGINEERING
K.G. REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
CHILKUR (V), MOINABAD, R.R. DIST, TS-501 504.

KG REDDY
College of Engineering
& Technology

ASSIGNMENT SAMPLE COPIES





All dimensions are in mm.

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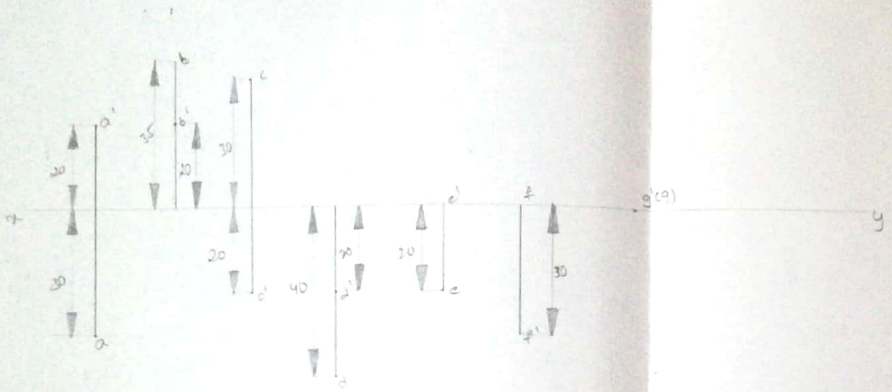
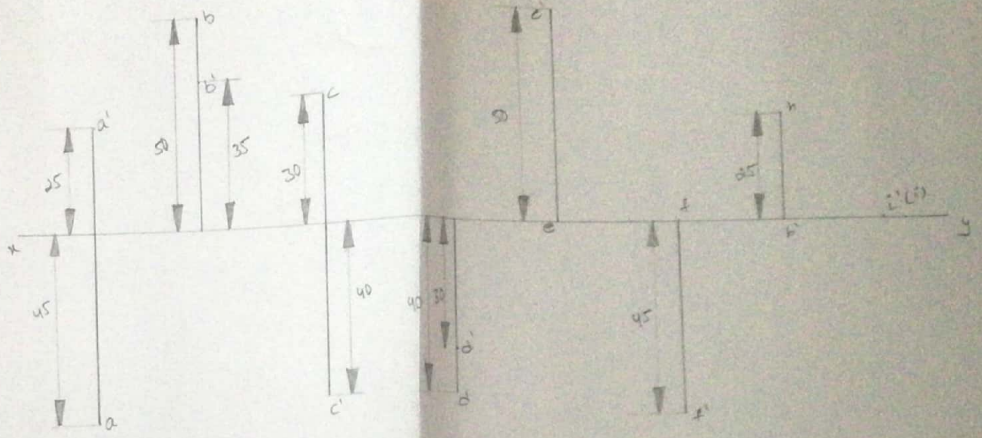
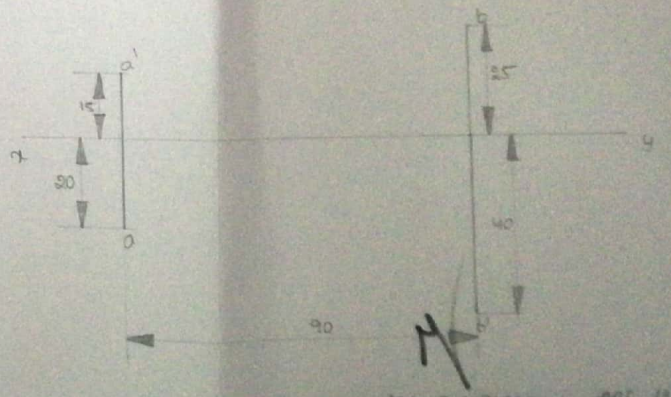
ROLL NO. 19-413	BRANCH ECE	
SECTION	PLATE	

PRINCE, HYDERABAD







ALL DIMENSIONS ARE IN mm

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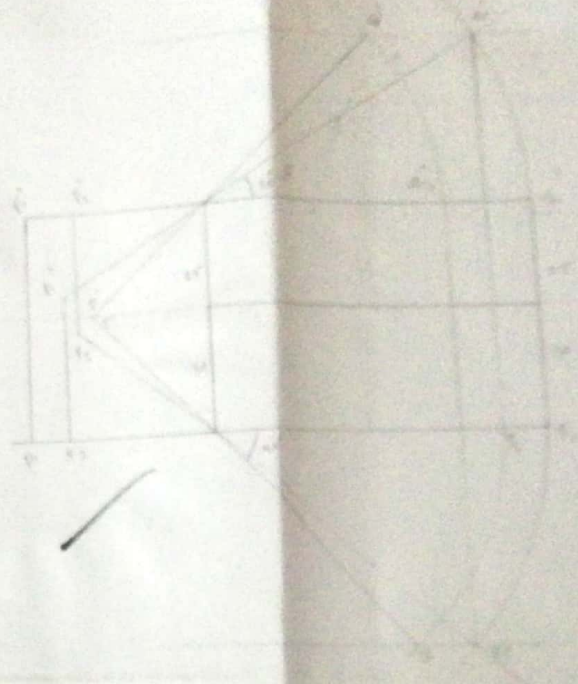
ROLL NO. 438	BRANCH ECE	SHEET NO - 10
SECTION	PLATE	



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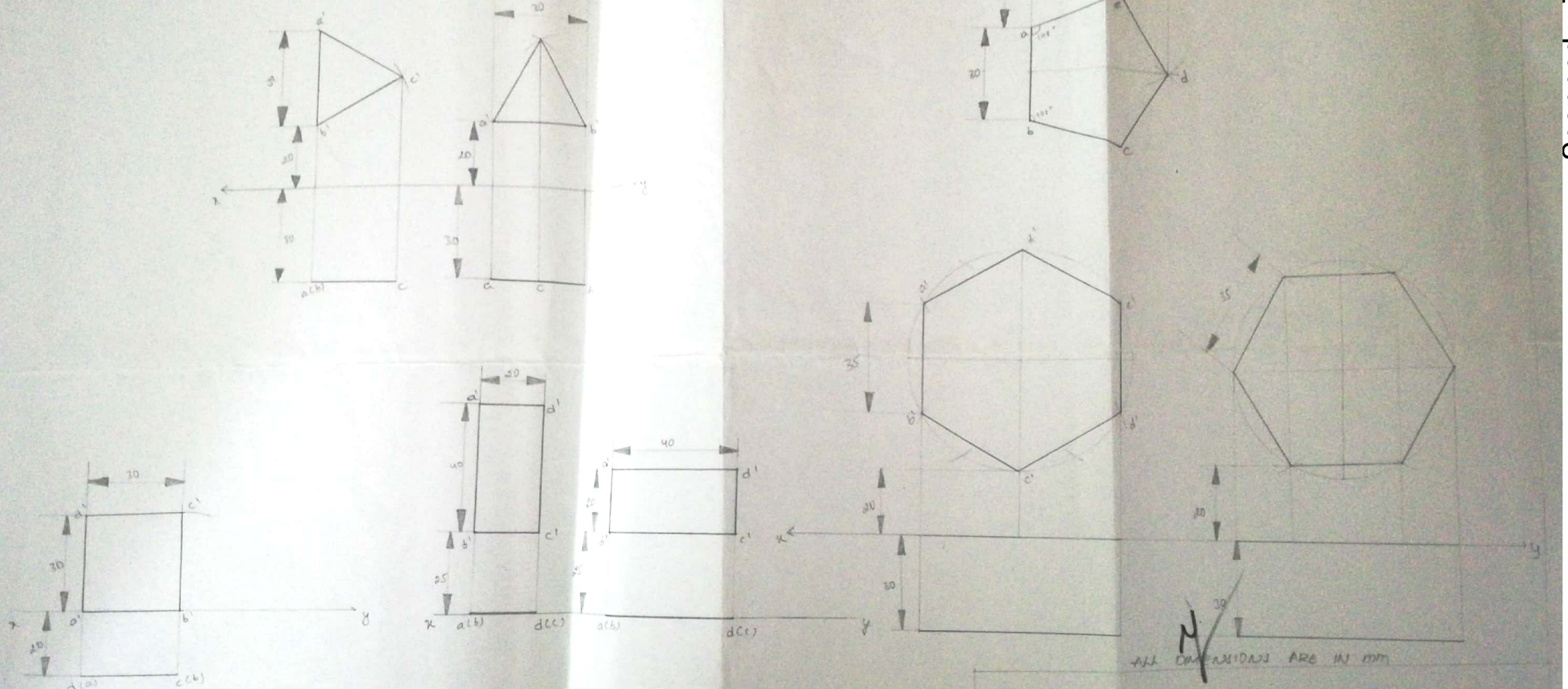
SECTION	PLATE	



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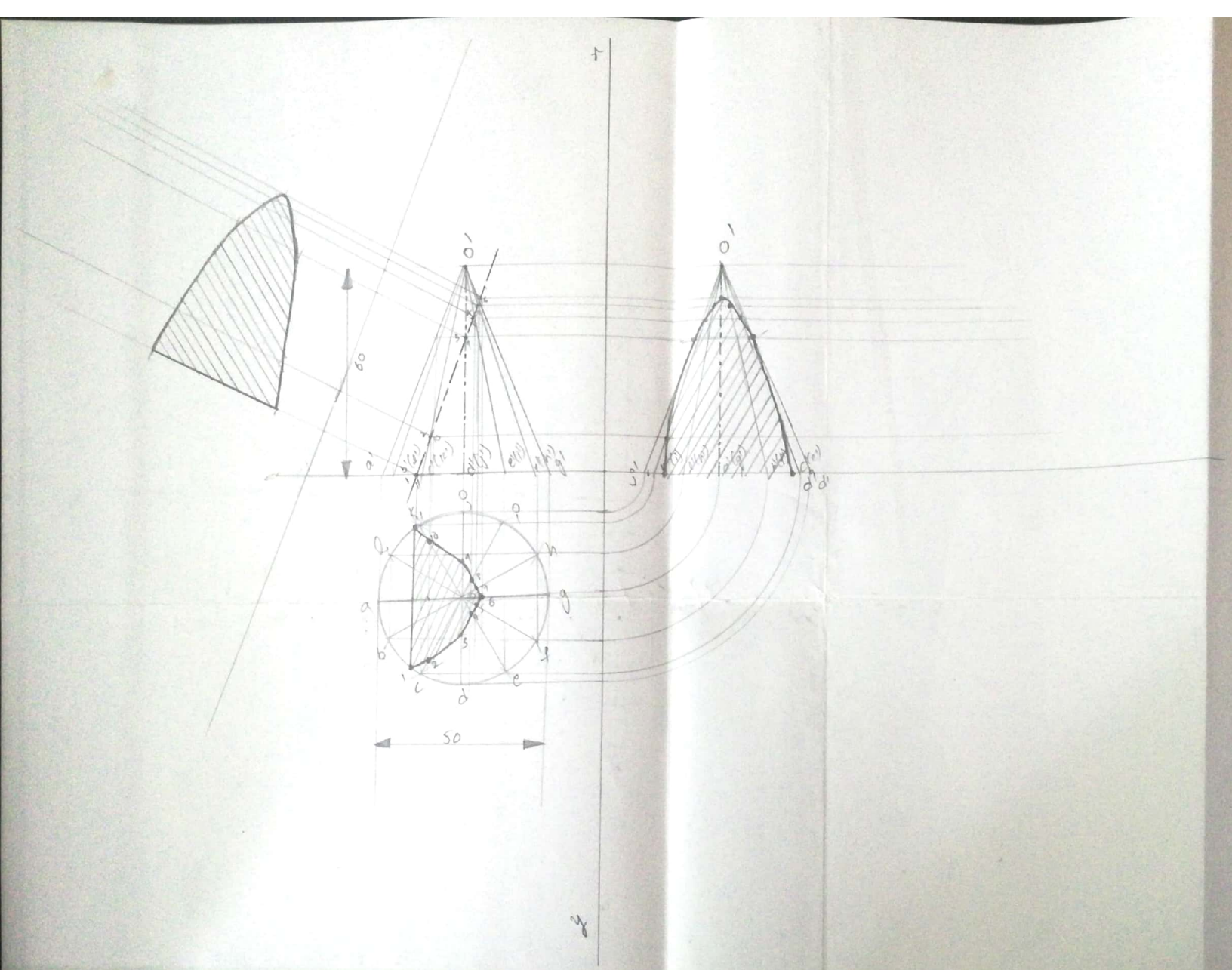
NAME :- K. SRIKANTH

ROLL NO :- 438

BRANCH :- ECE

SHEET NO :- 12



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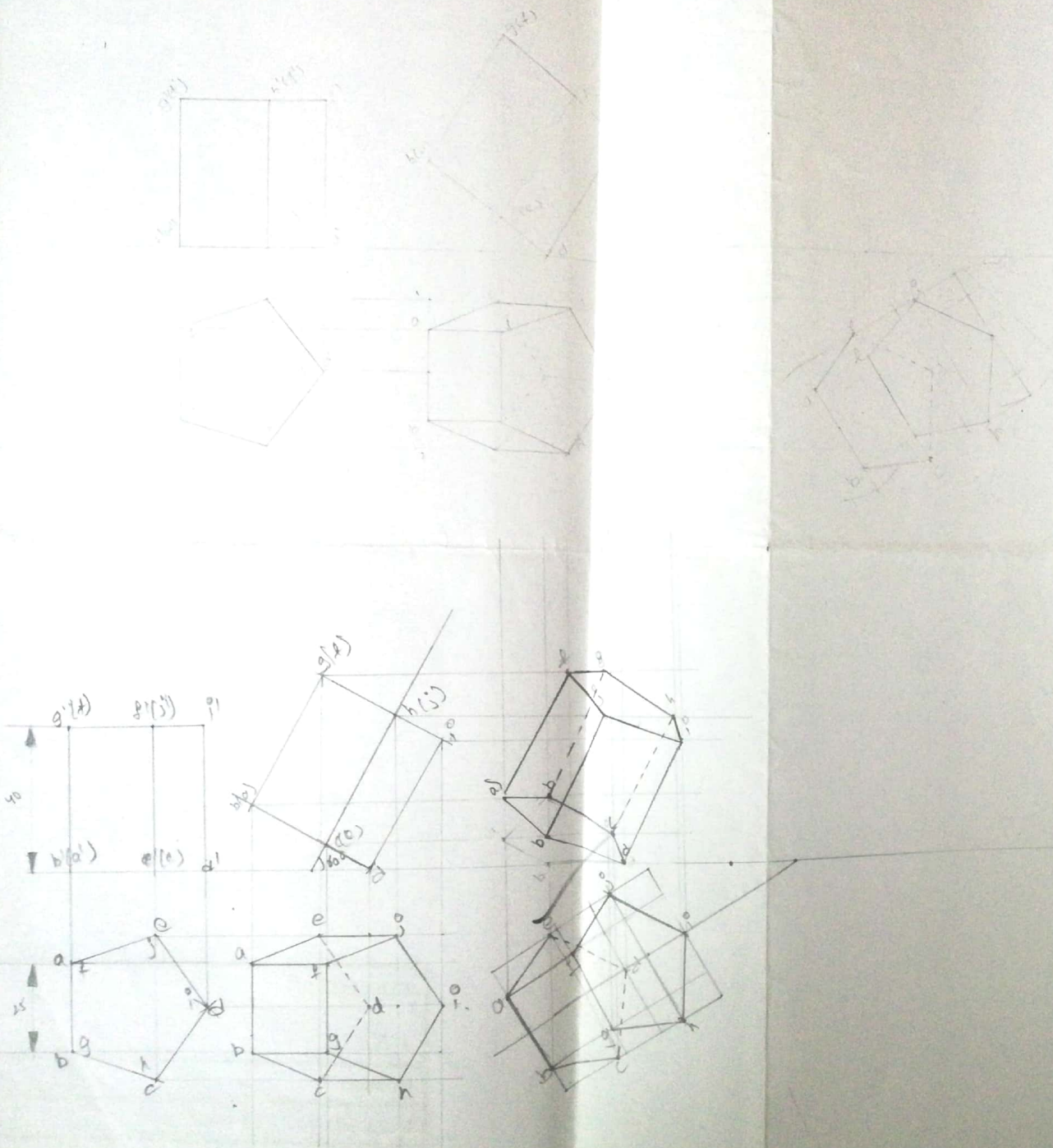
SECTION	PLATE	



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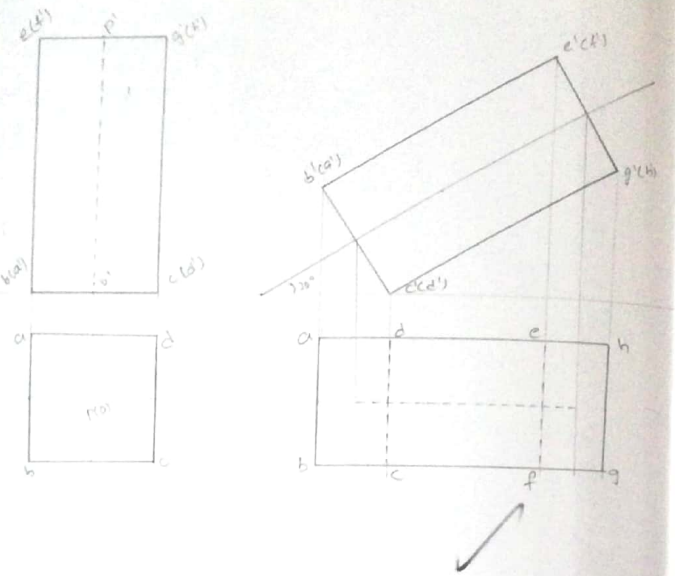
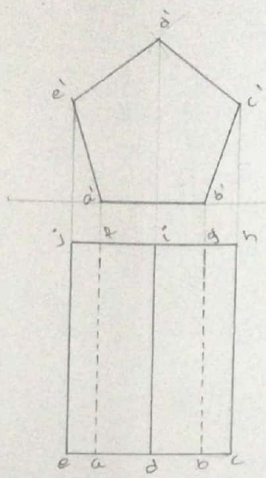
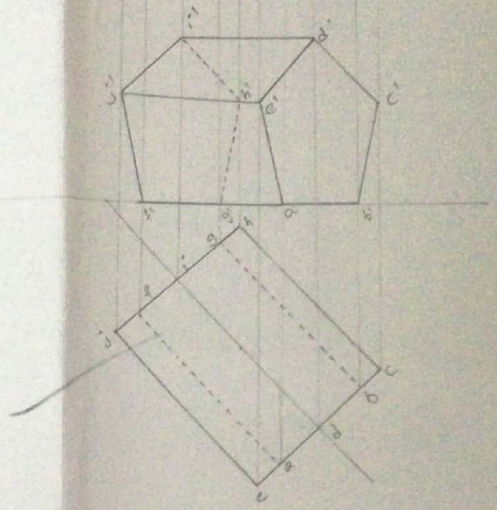
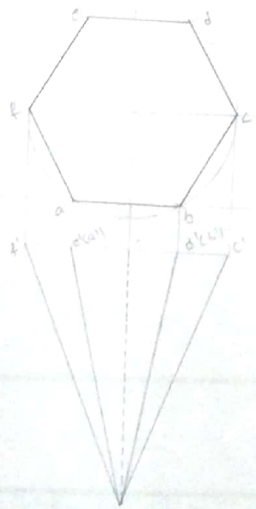
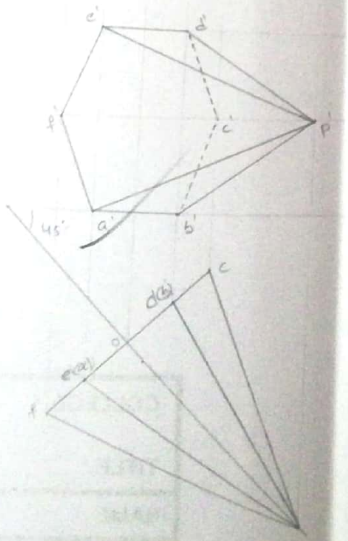
SECTION	PLATE	

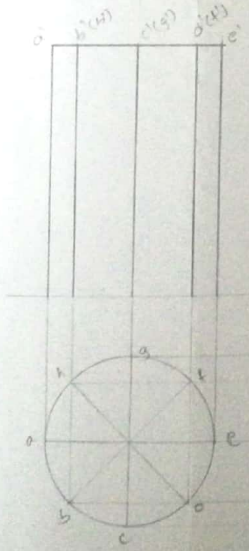


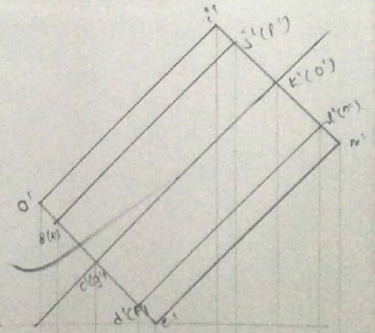


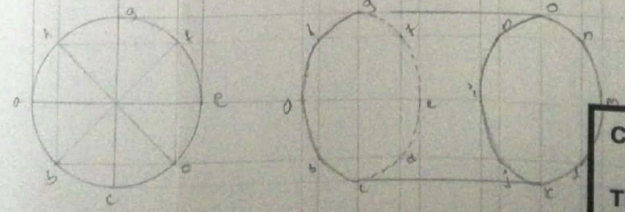












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ALL DIMENSIONS ARE IN mm

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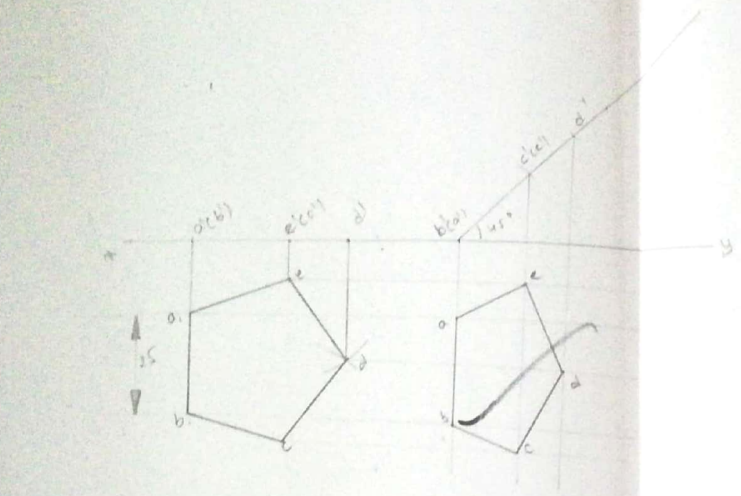
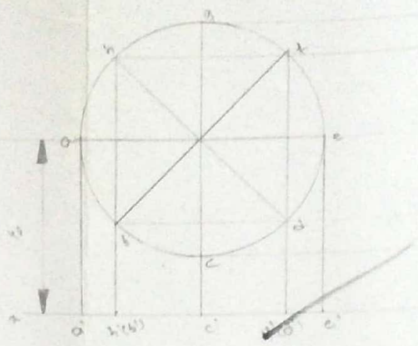
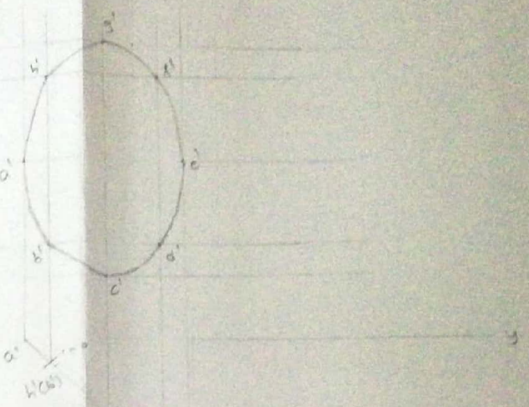
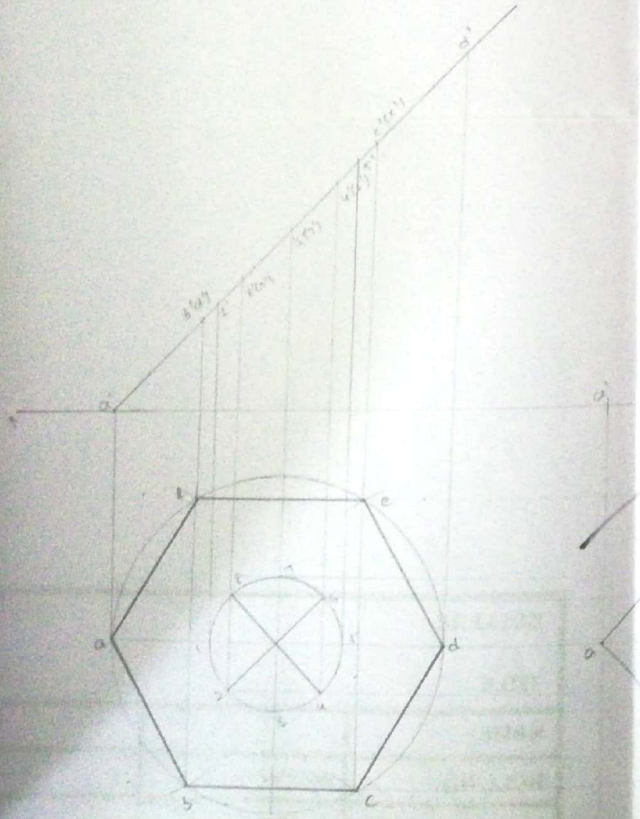
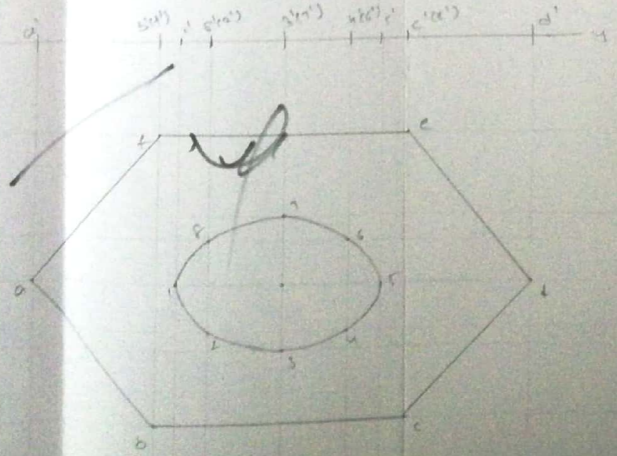
ROLL NO. 438	BRANCH : ECE	SHEET NO:- 16
SECTION	PLATE	











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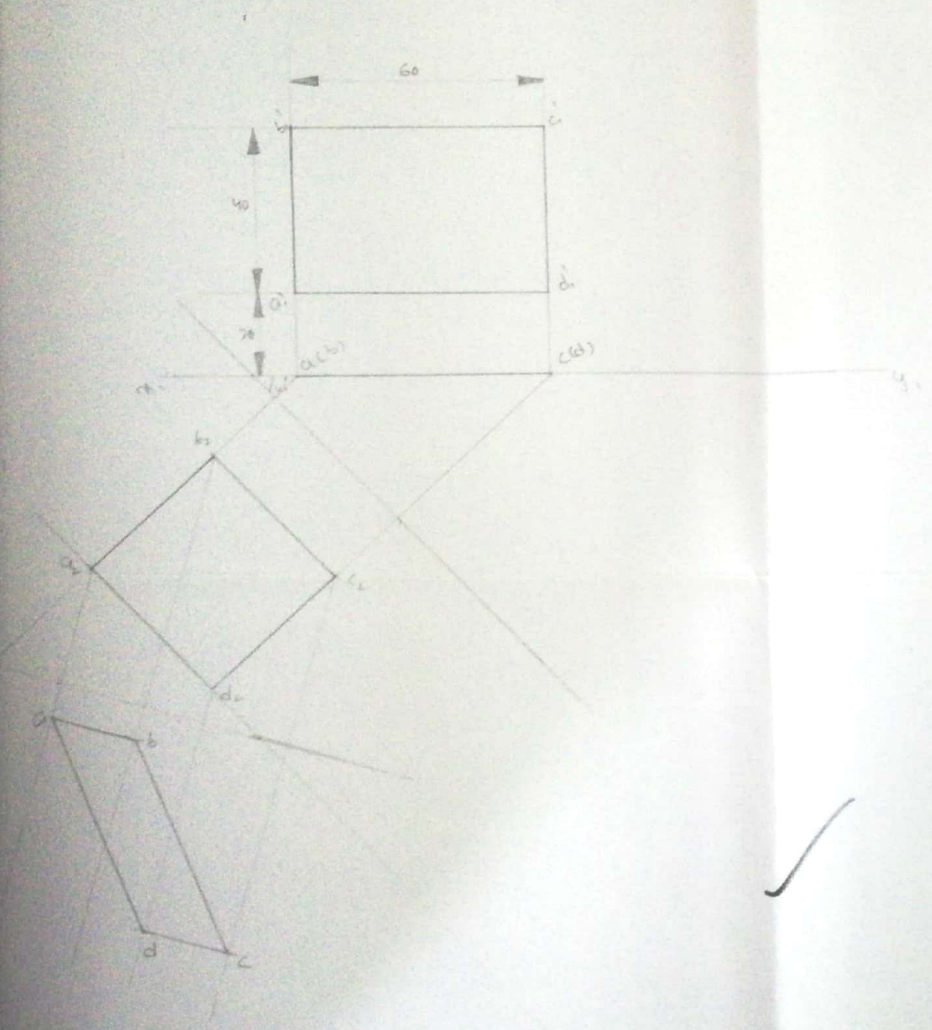
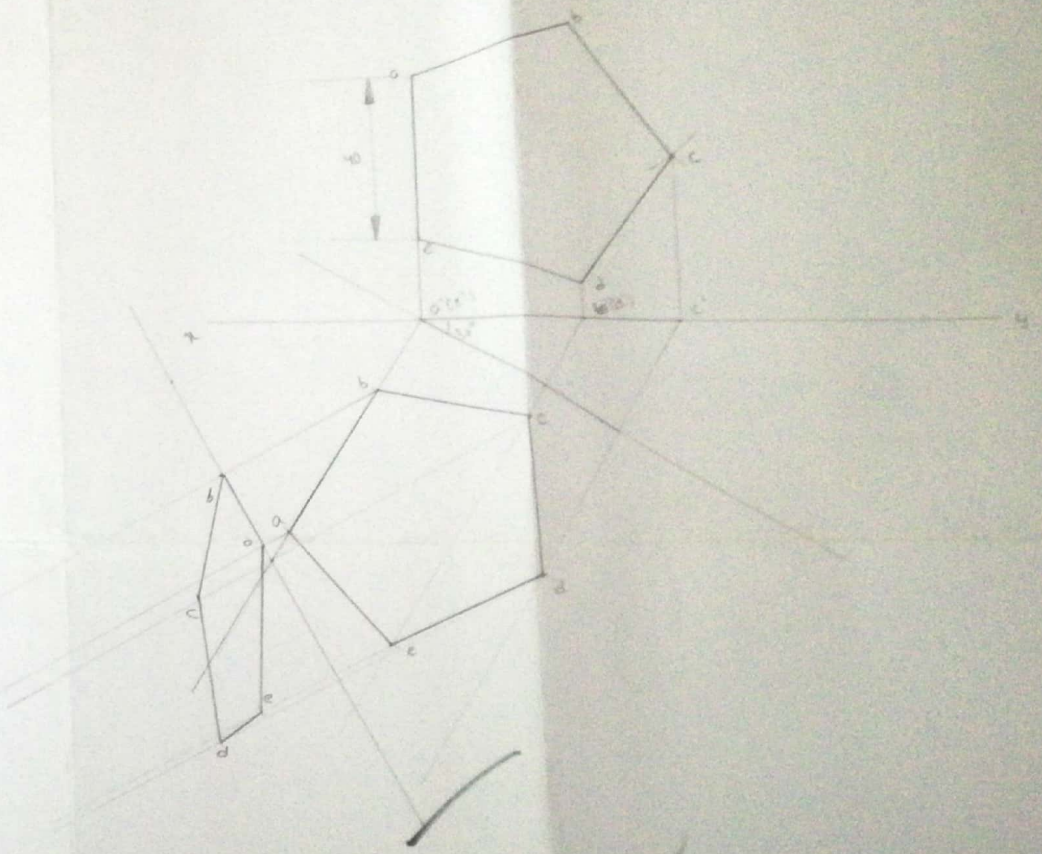
SECTION	PLATE	





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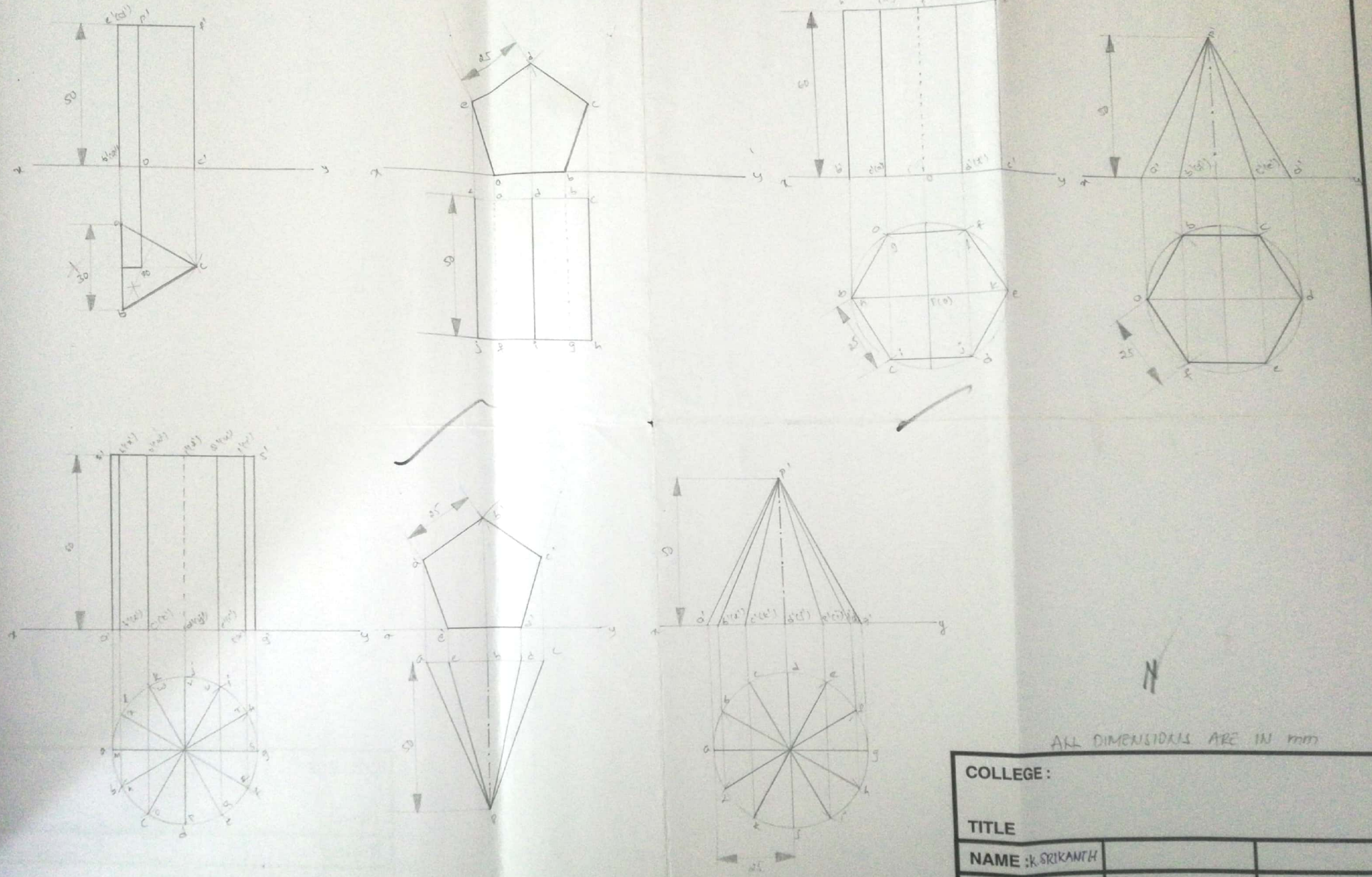
SECTION	PLATE	



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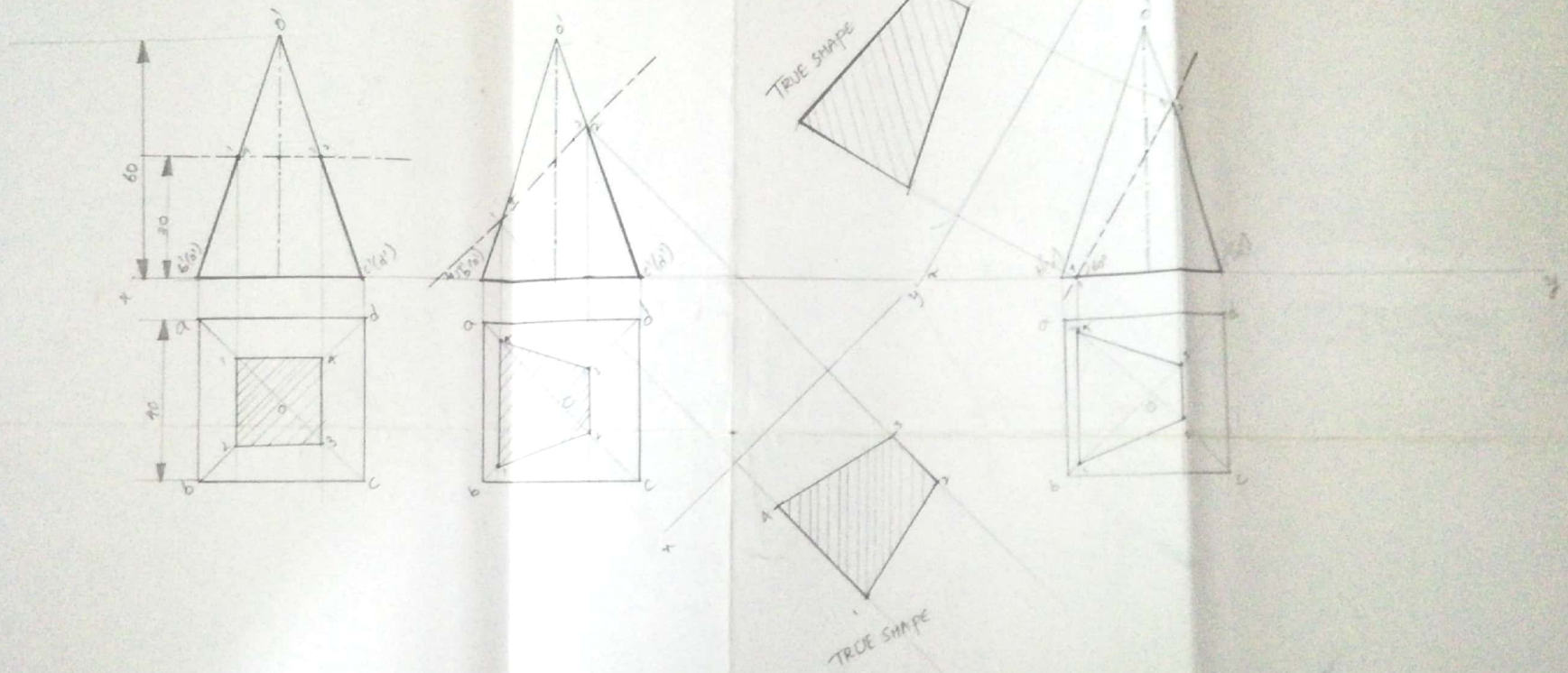
SECTION	PLATE	

JAI GANESH PAPER MART



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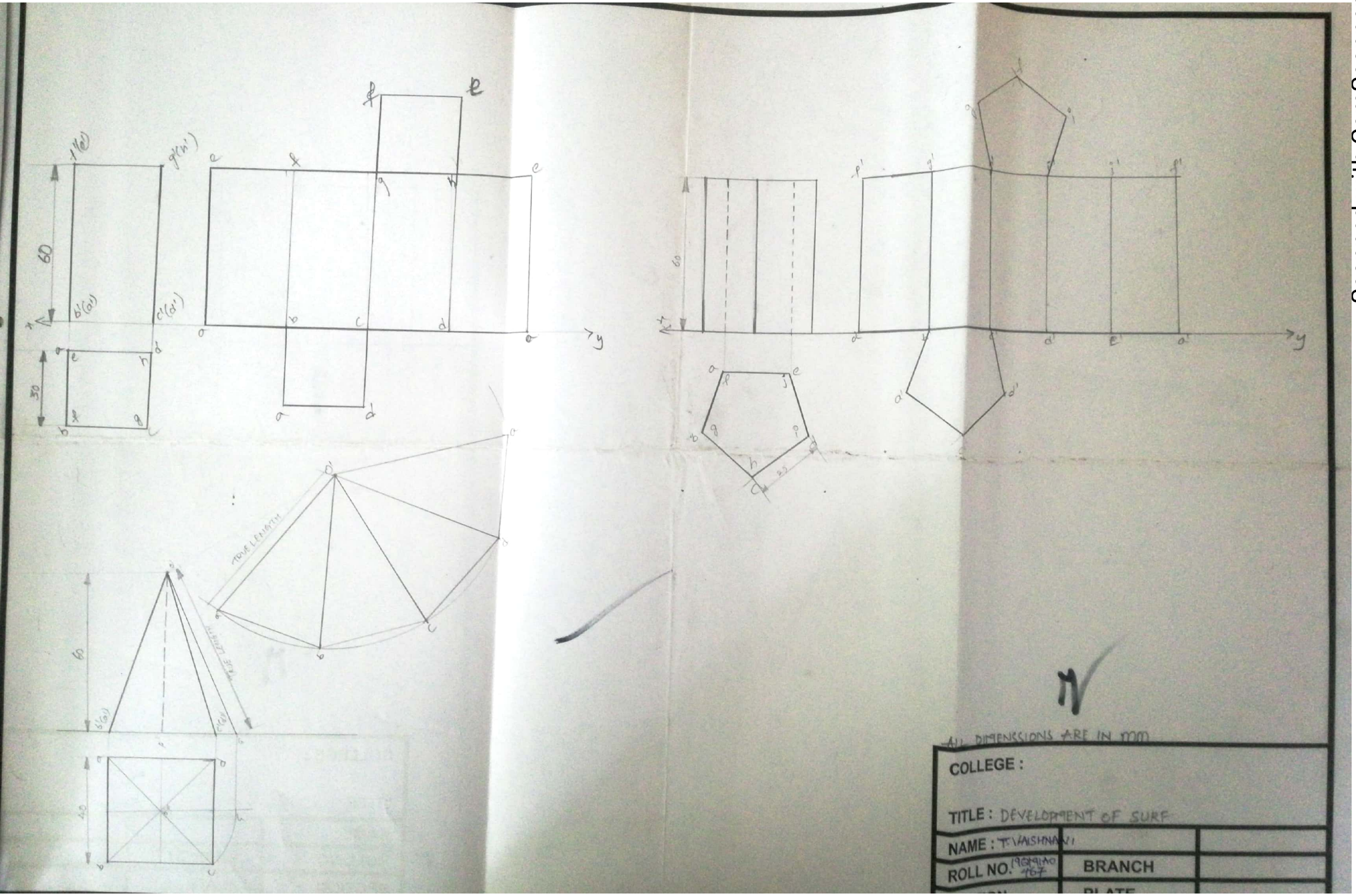
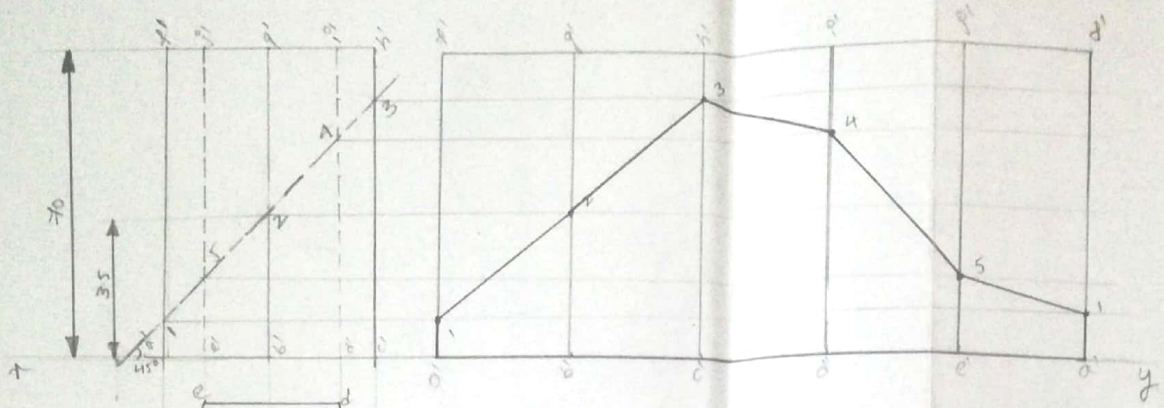
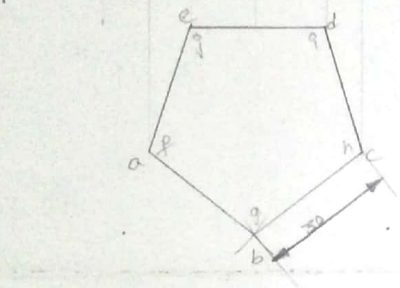
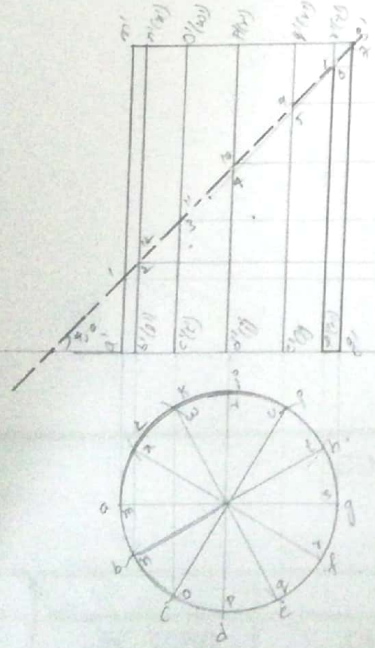
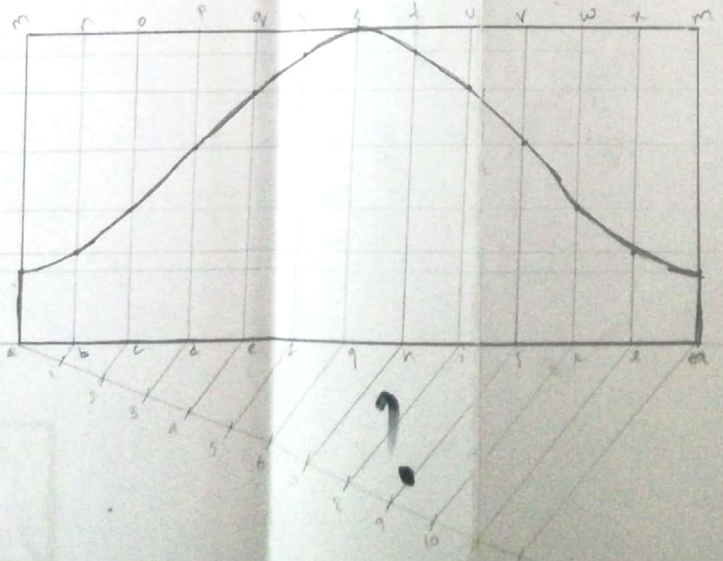
ROLL NO.	BRANCH ECE	
SECTION	PLATE	











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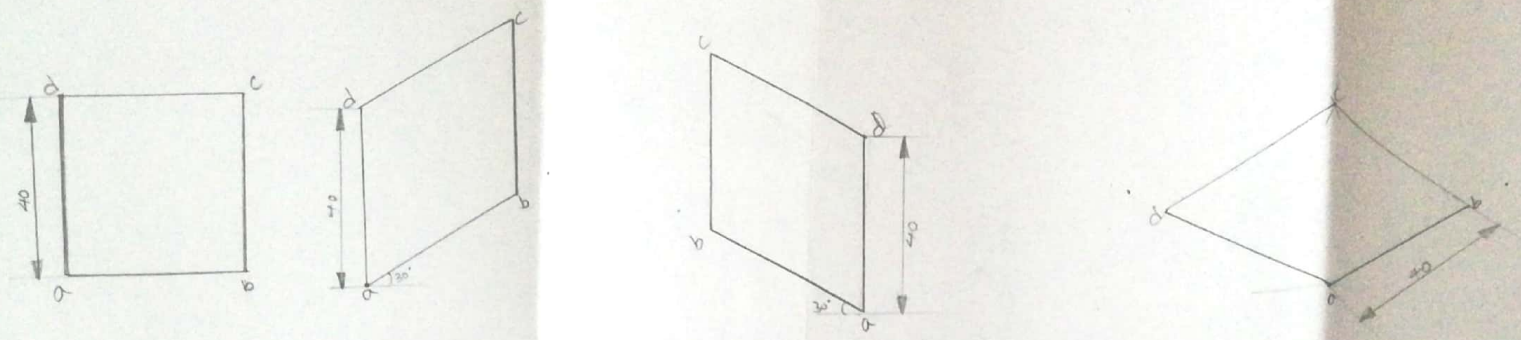
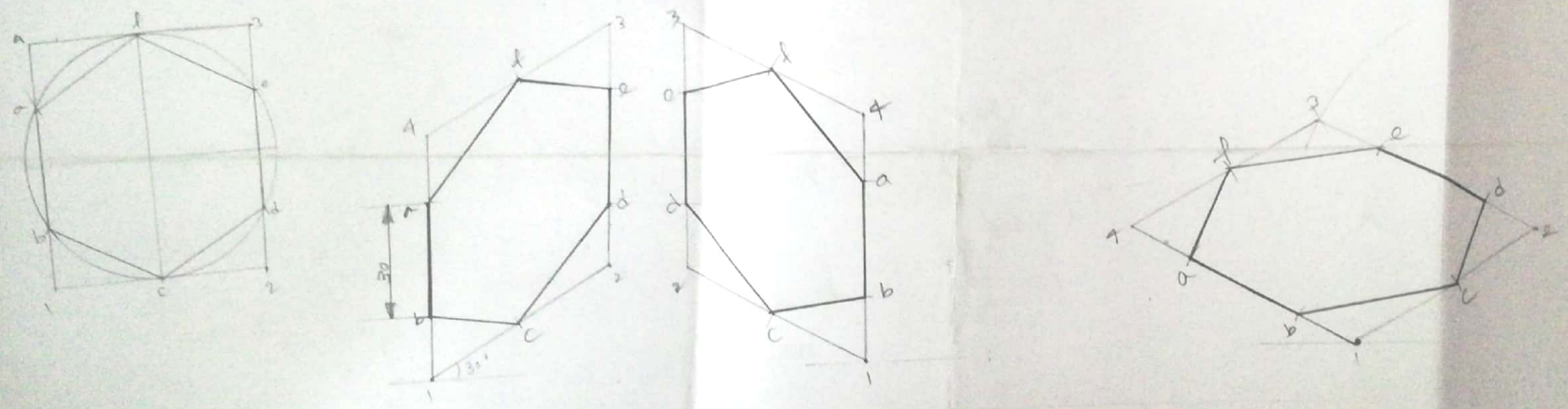
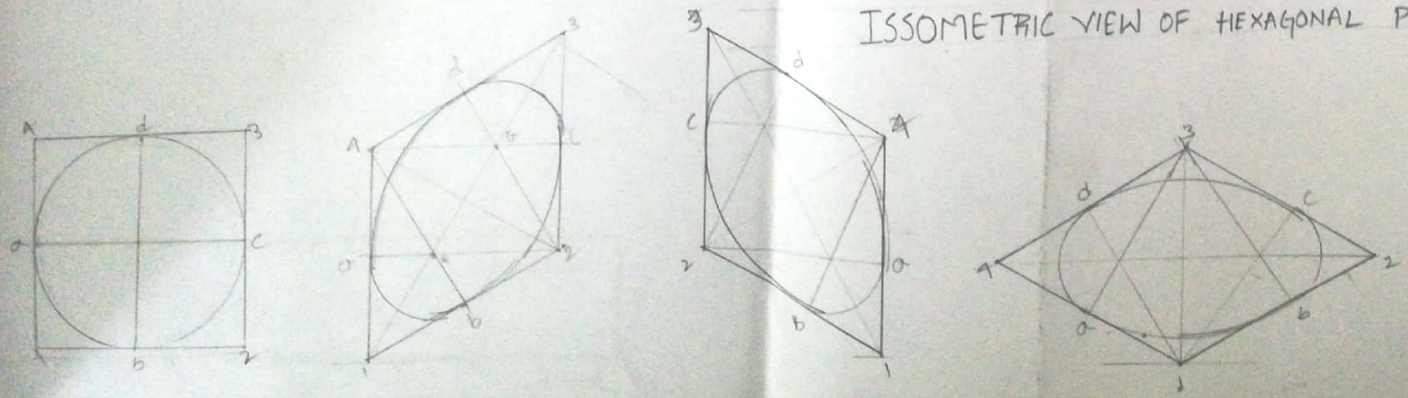
ROLL NO.	BRANCH	
SECTION	PLATE	



ISSOMETRIC VIEW OF SQUARE PLANE



ISSOMETRIC VIEW OF HEXAGONAL PLANE



ISSOMETRIC VIEW OF CIRCULAR PLANE

ALL DIMENSIONS ARE IN MM

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NAME : T. VAISHNAVI		
ROLL NO. 19CM1A0467	BRANCH ECE	
SECTION	PLATE	