

DRAWING INSTRUMENTS AND SHEET LAYOUT

1

1-1 INTRODUCTION

Drawing is an art of representing objects or forms on a surface chiefly by means of lines, using any of a wide variety of tools and techniques. It generally involves making marks on a surface by moving graphite pencils, ink pen, wax colour pencils, crayons, charcoals, pastels, and markers on a plane surface such as paper, canvas etc.

Engineering drawing is a type of drawing used to fully and clearly convey graphically the ideas and information necessary for engineered items. They are usually created in accordance with standard conventions for layout, nomenclature, interpretation, appearance, size, etc. The purpose of engineering drawing is to provide exact geometrical configuration for the construction or analysis of machines, structures, or systems. Today the mechanics of the drawing task has been largely automated, and greatly accelerated, through the use of CAD systems. This chapter deals with the introduction and basic techniques associated with the use of drawing instruments and accessories commonly used in preparing engineering drawings and also the layout of the drawing sheet standard.

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MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) A drafter helps in drawing
 - (a) Parallel and perpendicular lines
 - (b) Concentric circles
 - (c) Smooth curves
 - (d) All the above
- ii) In the engineering system of paper sizes, which of the following is "A2" size?
 - (a) 841 mm × 1189 mm
 - (b) 594 mm × 841 mm
 - (c) 420 mm × 594 mm
 - (d) 210 mm × 297 mm
- iii) Which of the following pencil leads is hardest?
 - (a) HB
 - (b) H
 - (c) B
 - (d) F

- iv) Which of the following purposes is **not** served by a divider?
- (a) Divide lines or curves into a number of equal parts
 - (b) Transfer measurement from one part of the drawing to another part
 - (c) Make full size, reduced size or enlarged size drawing
 - (d) Step-off a series of equal distances on the drawing
- v) To lay off an angle from a given line, what marks on the protractor should you align for a higher accuracy?
- (a) Center mark and 0° mark only
 - (b) 0° and 180° marks only
 - (c) 0° , 180° , and center marks
 - (d) 0° , 90° and 180° marks
- vi) To draw smooth curves of any nature, draughting instruments used is
- (a) Mini-drafter
 - (b) French curve
 - (c) Templates
 - (d) Eraser Shield
- vii) Parallel lines can be drawn with the help of
- (a) Mini-drafter
 - (b) T-square
 - (c) Pair of set squares
 - (d) All of these
- viii) A typical layout of drawing sheet **do not** contain
- (a) Centering Mark
 - (b) Orientation Mark
 - (c) Trimming marks
 - (d) Identification Mark
- ix) The space for text on a drawing sheet **do not** provide the following information
- (a) Name of the company, title of the drawing, scale and angle of projection used
 - (b) Explanation of special symbols, abbreviations and units of dimensions
 - (c) Instruction related to material, surface treatment and assembly placing
 - (d) Reference made to supplementary drawings and other documents
- x) Grid References on a drawing sheet provide the following information
- (a) Location of details, additions, modifications, revisions, etc. of drawing
 - (b) To facilitate the positioning of the drawing when reproduced
 - (c) To facilitate brief record and initials of the person responsible
 - (d) To facilitate trimming
- xi) Revision tables on a drawing sheet provide the following information
- (a) Designation of revision
 - (b) Date of revision
 - (c) Initials of the person responsible for revision
 - (d) All the above
- xii) Which of the following is preferred containing the statement "All dimensions are in millimeters unless otherwise specified"
- (a) Frames and Borders
 - (b) Title block
 - (c) Item List
 - (d) Revision Table
- xiii) Item list on a drawing sheet provide the following information
- (a) Name of the company, title of the drawing, scale and angle of projection used
 - (b) Item references, name, quantity required and Material specifications
 - (c) Explanation of special symbols, abbreviations and units of dimensions
 - (d) All the above

- xiv) "A" series of paper has length to width ratio of approximately
(a) 3:2 (b) $\sqrt{3}:1$ (c) $\sqrt{2}:1$ (d) 5:3
- xv) Number of orientation mark generally contained by a drawing sheet is
(a) One (b) Two (c) Three (d) Four
- xvi) Extension arm used with engineering compass to facilitate
(a) To draw circles of larger diameter (b) To increase the gripping arm
(c) To adjust distance between the legs (d) To increase accuracy

Answers: (i) a (ii) c (iii) b (iv) c (v) c (vi) b (vii) d (viii) d (ix) a (x) a (xi) d (xii) b
(xiii) b (xiv) c (xv) b (xvi) a

LINES, LETTERING AND DIMENSIONING

2

2-1 INTRODUCTION

Engineering drawing is supposed to give complete information about the shape and size of the objects like machine parts, buildings etc. The shape of the object is conveyed through the appearance of the drawing while the size description is expressed in the form of figured dimensions and notes. The Bureau of Indian Standards has recommended various types of lines, letters and dimensions to be used. This chapter introduces the standard practice suggested by Bureau of Indian Standards for various types of lines to specify shape, size of letters for writing notes, dimensions to convey the size and their correct way of implementation.

MULTIPLE CHOICE QUESTIONS

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Choose the most appropriate answer out of the given alternatives:

- i) Which of following publications made by Bureau of Indian Standards includes standard techniques for line conventions and lettering in detail?
(a) SP 46 (b) BIS 9609 (c) ASME Y14.2M (d) ISO 9000
- ii) Center lines are drawn as
(a) Continuous narrow lines (b) Dashed narrow line
(c) Long-dashed dotted narrow line (d) Long-dashed double dotted narrow line
- iii) Long-dashed dotted narrow line is used to represent
(a) Line of symmetry (b) Center lines
(c) Pitch circle of gears and holes (d) All the above
- iv) When (1) Visible outlines (2) Hidden outlines (3) Projection lines and (4) Centre lines overlap, the recommended sequence of priority is
(a) 1-2-3-4 (b) 1-2-4-3 (c) 2-1-3-4 (d) 2-1-4-3
- v) The inclination of letters as recommended by BIS is
(a) 75° (b) 70° (c) 65° (d) 60°

- vi) The length to height ratio of an Closed filled arrow head is
 (a) 1:3 (b) 3:1 (c) 1:2 (d) 2:1
- vii) The two recommended systems of placing the dimensions are
 (a) Unidirectional and Aligned systems (b) Upright and inclined systems
 (c) Linear and oblique systems (d) Linear and inclined systems
- viii) Which of the following is the correct statement for dimensioning a view:
 (a) All of them should be placed within a view
 (b) All of them should be placed close to the parts being dimensioned
 (c) They should be marked from visible outlines rather than from hidden line
 (d) Dimensions indicated in one view may be repeated in another view
- ix) The dimension figure for diameter of a circle should be:
 (a) Preceded by the symbol 'Ø' (b) Suffixed by the symbol 'Ø'
 (c) Preceded by the symbol 'D' (d) Suffixed by the symbol 'D'
- x) Which of the following is **not** a specified method for dimensioning?
 (a) Parallel dimensioning (b) Perpendicular dimensioning
 (c) Continuous Dimensioning (d) Dimensioning by coordinates
- xi) Rounded interior corner is called
 (a) Round (b) Chamfer (c) Fillet (d) Countersink

ANSWER: (i) a (ii) c (iii) d (iv) b (v) a (vi) b (vii) a (viii) c (ix) a (x) b (xi) c

GEOMETRICAL CONSTRUCTIONS

3

3-1 INTRODUCTION

The engineers should be familiar with the principles of plane and solid geometry. A thorough knowledge of these principles is a prerequisite to solve engineering graphics problems. Plane figures such as circle, triangle, and different polygons frequently constitute a part of various objects for preparing engineering drawings. This chapter presents some of the important methods of geometrical constructions based on the principles of plane geometry studied earlier.

MULTIPLE CHOICE QUESTIONS

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Choose the most appropriate answer out of the given alternatives:

- i) When two graphic entities are at a constant distance apart along the length is commonly referred as
(a) Concentricity (b) Parallelism (c) Perpendicularity (d) Chordality
- ii) If a line intersects a circle at two points, not passing through the center, the line segment inside the circle is referred as
(a) Radial line (b) Chord (c) Quadrant (d) Sequent
- iii) Which of the following would be considered a primitive in a 3D solid modeling system?
(a) Cylinder (b) Square (c) Rhombus (d) Spline
- iv) If an octagon is circumscribed around the perimeter of a circle, which of the following statements is **true**?
(a) The diameter of the circle is equal to the across-the-corners measurement.
(b) The radius of the circle is equal to the across-the-flats measurement.
(c) The diameter of the circle is equal to the across-the-flats measurement.
(d) The radius of the circle is equal to the across-the-corners measurement.
- v) To draw perpendicular from a given point P on line XY, name the point where the compass needle shall be placed first.
(a) P (b) X or Y (c) Any convenient point along XY
(d) A point near the midpoint of PX and PY

- vi) Line XY is to be divided into 12 equal parts by geometric construction. Which of the following statements concerning this procedure is correct?
- (a) Ray line PY, drawn from Y, is the same length as XY
 - (b) A compass should be set to spread equal to one twelfth of the length of XY
 - (c) A line should be drawn from X to the 12th interval on ray line PY
 - (d) The acute angle formed by XY and ray line PY should be 30° or less
- vii) Which of the following actions should be your first step in constructing a square geometrically when you are given only the length of its diagonal?
- (a) Lay out a horizontal line equal to one half of the given length
 - (b) Lay out a vertical line equal to one half of the given length
 - (c) Lay out a horizontal line equal to twice the given length
 - (d) Lay out a horizontal line equal to the given length
- viii) When two diameters of a circle are drawn at right angles to each other, which of the following polygons will have all of the sides at 45° to these diameters?
- (a) A hexagon inscribed in a given circle
 - (b) An octagon inscribed in a given circle
 - (c) A pentagon inscribed in a given circle
 - (d) A square inscribed in a given circle
- ix) The included angle of a pentagon is
- (a) 68° (b) 72° (c) 108° (d) 112°
- x) When a circle passes through three given points, its center lies at the intersection of
- (a) The perpendicular bisector of the longest line and the perpendicular line drawn from the end of the shortest line
 - (b) The perpendicular bisector of the shortest line and the perpendicular line drawn from the end of the longest line
 - (c) The perpendicular bisectors of the lines that connect the points
 - (d) The tangents drawn through each point
- xi) To draw a circle of a given radius which is also tangent to the two sides of a given angle, the first step is to draw
- (a) Two nonparallel lines at right angles to the sides of the angle
 - (b) Two lines that are parallel to the sides of the angle at a distance equal to one half of the given radius
 - (c) Two lines that are parallel to the sides of the angle at a distance equal to the given radius
 - (d) Two parallel lines at right angles to the sides of the angle

ANSWER: (i) b (ii) b (iii) a (iv) c (v) a (vi) c (vii) c (viii) c (ix) c (x) c (xi) c

SCALES

4-1 INTRODUCTION

It is always convenient to represent objects to their actual size in drawings, if their size permits. eg. A 200 mm diameter plain disc should be represented by a circle of 200 mm diameter on the drawing sheet. This gives complete information of the object. When drawings are prepared equal to the actual size of the object, the scale is said to be full size scale and the drawings are said to be full size drawings.

However, it is not always possible to make drawings of all objects, such as large machines, buildings, town plans, etc. to their actual size. When the objects are of very large sizes, the actual dimensions of the object have to be reduced on some regular proportion to make their drawings on the sheet. eg. A rectangular plot of size 25m X 10m can be represented by a rectangle of 250 mm X 100 mm. The scale selected in the present case is 1 mm = 0.10 m. In other words 1 mm on the drawing represents 0.10 m length of the object. When the drawings are prepared smaller than the actual size of the object, the scale is said to be reducing scale and the drawings are said to reduce sized drawings.

Similarly very small objects, such as gear mechanism of a wristwatch, components of an electronics instrument, atoms configuration, etc., are shown by drawing them larger than their actual size. When the drawings are prepared larger than the actual size, the scale is said to be an enlarging scale and the drawings are said to enlarge sized drawings. This is being illustrated by drawing of a bottle.

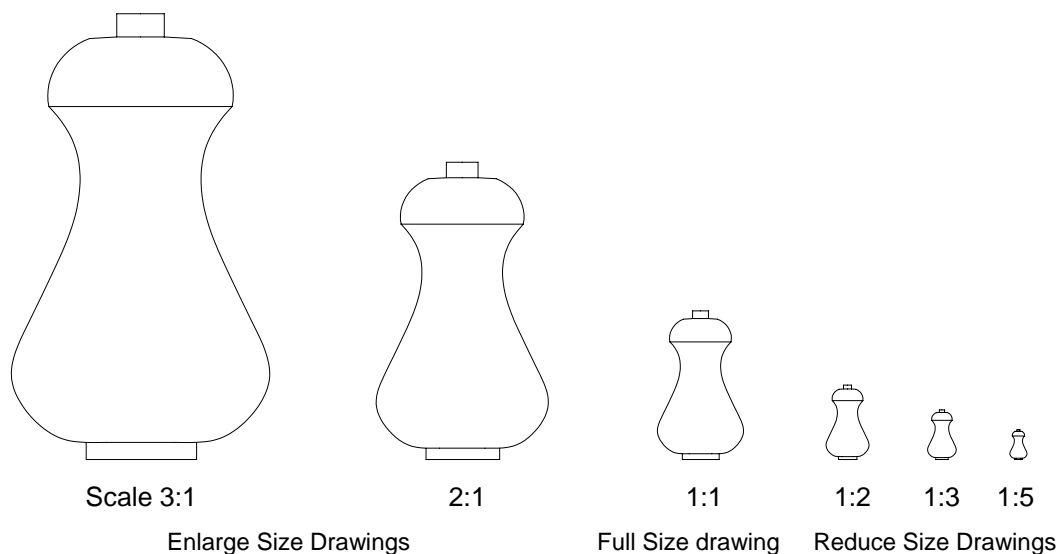


Fig. 4.1

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) For drawing the components of a wrist watch, the scale used is
(a) Reducing scale (b) Full scale (c) Enlarging scale (d) Any of these
- ii) The R.F. of scale is always
(a) Less than 1 (b) Equal to 1 (c) Greater than 1 (d) Any of these
- iii) The unit of R.F. is
(a) Cubic Centimeter (b) Square Centimeter
(c) Centimeter (d) None of these
- iv) The full form of R.F. is
(a) Reducing fraction (b) Representative fraction
(c) Reduction factor (d) Representative factor
- v) A map of 10 cm X 8 cm represents an area of 50000 sq. metre of a field. The R.F. of the scale is
(a) $1/25$ (b) $1/625$ (c) $1/2500$ (d) $1/6250000$
- vi) An area of 36 square kilometer is represented by 144 square centimeter on a map. What is the R.F.?
(a) $1/4$ (b) $1/2$ (c) $1/5000$ (d) $1/50000$
- vii) When measurements are required in three consecutive units, the appropriate scale is
(a) Plain scale (b) Diagonal scale (c) Isometric scale (d) Scales of chords
- viii) In the diagonal scale, the word "diagonal" is used because it is most suitable for the measurement of
(a) Diameter of a circle (b) Diagonal of a square
(c) Side of a pentagon (d) All of these
- ix) Scale used for two system of units measurement is
(a) Plain scale (b) Diagonal scale (c) Comparative scale (d) Vernier scale
- x) Diagonal of a square can be measured by a
(a) Plain scale (b) Diagonal scale (c) Vernier scale (d) All of these

- xi) Scale of chord is used to measure
(a) Length of chord (b) Arc length of chord
(c) Angle of chord (d) All of these
- xii) .F. of the scale on a mini-draughter is
(a) 0 (b) 1 (c) 10 (d) None of these
- xiii) Which of the following scale is used for converting miles into kilometers
(a) Diagonal scale (b) Comparative scale
(c) Direct Vernier scale (d) Retrograde Vernier scale

ANSWER: (i) c (ii) d (iii) d (iv) b (v) c (vi) d (vii) b (viii) d (ix) c (x) d (xi) c (xii) b (xiii) b

CONIC SECTIONS

5-1 INTRODUCTION

In engineering practice we come across a number of objects containing plane curves such as ellipse, parabola, hyperbola, etc. The curve, which is obtained by cutting a right circular cone with the help of a plane in different positions relative to the axis, is called a conic section. This chapter deals with a few common methods of construction of the conic sections and the field of their application.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) If a point moves in a plane in such a way that the sum of its distances from two fixed points is constant the curve so traced is called
(a) Ellipse (b) Parabola (c) Hyperbola (d) None of these
- ii) Name the curve traced out by a point moving in a plane such that the difference between its distances from two fixed points is constant
(a) Ellipse (b) Parabola (c) Hyperbola (d) Any of these
- iii) When a bullet is shot in air the path traversed by the bullet is called
(a) Cycloid (b) Semicircle (c) Parabola (d) Hyperbola
- iv) A right circular cone when cut by a plane parallel to its generator, the curve obtained is a
(a) Ellipse (b) Parabola (c) Hyperbola (d) Circle
- v) When a right circular cone is cut by a plane passing through its apex, the curve obtained is
(a) Ellipse (b) Parabola (c) Hyperbola (d) Triangle
- vi) When a right circular cone is cut which meets its axis at an angle greater than the semi-apex angle, the curve obtained is
(a) Ellipse (b) Parabola (c) Hyperbola (d) Triangle

- vii) When a right circular cone is cut which meets its axis at an angle less than the semi-apex angle, the curve obtained is
(a) Ellipse (b) Parabola (c) Hyperbola (d) Triangle
- viii) The angle between the asymptotes of a rectangular hyperbola is
(a) 30° (b) 45° (c) 60° (d) 90°
- ix) Name the curve which has zero eccentricity
(a) Ellipse (b) Parabola (c) Hyperbola (d) Circle
- x) Which of the following curves obeys the Boyle's law?
(a) Ellipse (b) Parabola (c) Hyperbola (d) Circle
- xi) Which of the following applications hyperbolic curve is used?
(a) Solar collector (b) Cooling tower (c) Lamp reflectors (d) Monuments
- xii) The eccentricity of an ellipse can be determined by
(a) $\frac{\text{length of major axis}}{\text{distance between directrices}}$ (b) $\frac{\text{distance between the foci}}{\text{length of major axis}}$
(c) $\frac{\text{distance of a point of ellipse from the focus}}{\text{distance of the same point from the dirctrix}}$ (d) All of these
- xiii) The major and minor axes of an ellipse are 100 mm and 60 mm respectively. What will be the distance of its foci from the end of the minor axis?
(a) 30 mm (b) 40 mm (c) 50 mm (d) 60 mm

Answer: (i) a (ii) c (iii) c (iv) b (v) d (vi) a (vii) c (viii) d (ix) d (x) d (xi) b (xii) d (xiii) c

ENGINEERING CURVES

6

6-1 INTRODUCTION

Roulettes are curves generated by the rolling contact of one curve or line on another curve or line. There are infinite varieties of roulettes. The most common types of roulettes used in engineering applications are cycloidal curves, involutes and spirals.

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MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The locus of a point lying on the circumference of the circle which rolls on a straight line is known as
(a) Cycloid (b) Hypocycloid (c) Epicycloid (d) Circle
- ii) Name the curve traced out by a point on the circumference of a circle, which rolls outside another circle of same diameter
(a) Cycloid (b) Hypocycloid (c) Cardioid (d) None of these
- iii) Name the curve traced out by a point on the circumference of a circle, which rolls on another circle of larger diameter
(a) Epicycloid (b) Involute (c) Spiral (d) None of these
- iv) When a circle rolls inside another circle of twice its diameter, the curve traced out by a point on the circumference of the rolling circle will be
(a) Straight line (b) Epicycloid (c) Spiral (d) None of these
- v) The curve traced by a point on a straight line which rolls on a circle, without slipping is called
(a) Cycloid (b) Epicycloid (c) Hypocycloid (d) Involute
- vi) When a straight line rolls on the circumference of a semi-circle, the locus of its end point is called
(a) Cycloid (b) Epicycloid (c) Hypocycloid (d) Involute
- vii) Involute curve is used in
(a) Chains (b) Gears (c) Cams (d) Pulleys

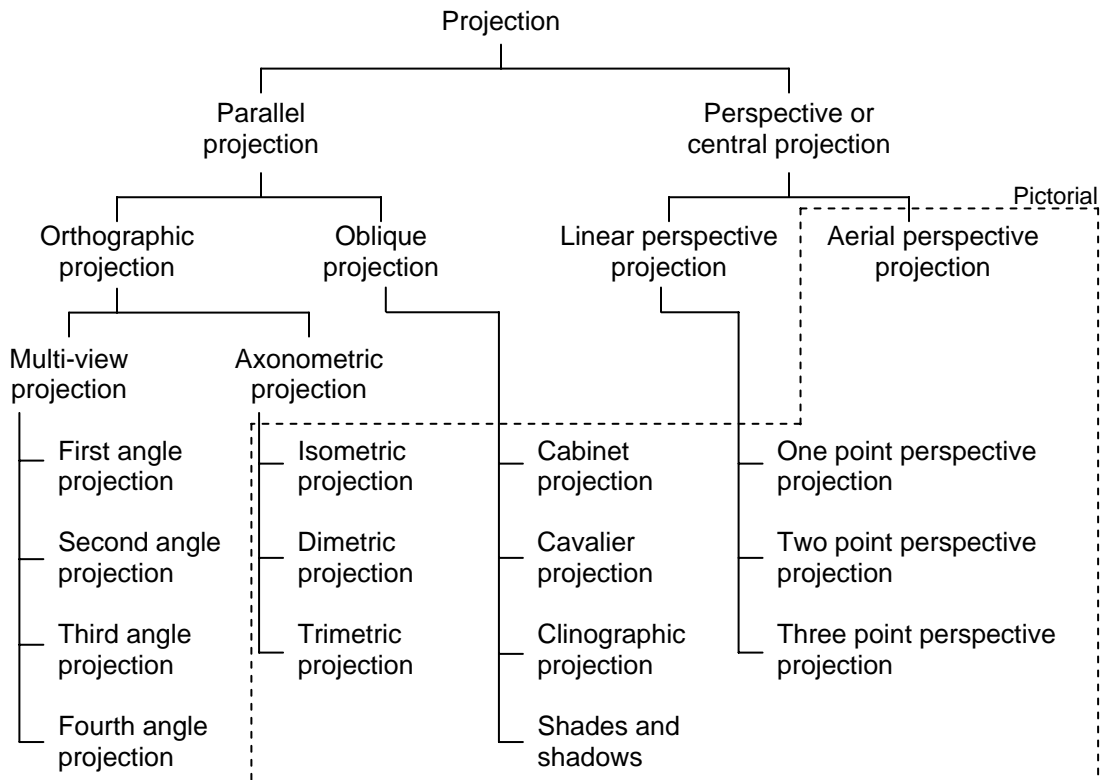
- viii) When a pendulum oscillates, name the locus of a point moving along its string at a constant speed
(a) Cycloid (b) Involute (c) Spiral (d) Helix
- ix) The geometrical name of the curvature of the coil used in spiral binding is
(a) Archimedean Spiral (b) Logarithmic Spiral
(c) Involute (d) None of these
- x) Which of the following methods is **not** used for drawing elliptical curves?
(a) Intersecting arcs method (b) Concentric circles method
(c) Oblong method (d) Tangent method

Answer: (i) a (ii) c (iii) a (iv) a (v) d (vi) d (vii) b (viii) c (ix) d (x) d

ORTHOGRAPHIC PROJECTIONS

7-1 PROJECTION

Projection is defined as an image or drawing of an object made on a plane. All drawings used in the field of engineering are based on the principles of projection. That is why engineering drawings are capable to precisely convey the external as well as internal features of objects in terms of their shape and size. Projections can be classified on the basis of line of sight and the position of plane on which the drawing is made.



MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) Projection of an object shown by three views is known as
 (a) Perspective (b) Isometric (c) Oblique (d) Orthographic

- ii) Which of the following describes the theory of orthographic projection?
- (a) Projectors parallel to each other and perpendicular to the plane of projection
 - (b) Projectors parallel to each other and parallel to the plane of projection
 - (c) Projectors parallel to each other and oblique to the plane of projection
 - (d) Projectors perpendicular to each other and parallel to the plane of projection
- iii) In orthographic projection, the elevation is obtained on a plane called
- (a) Horizontal
 - (b) Vertical
 - (c) Profile
 - (d) Auxiliary
- iv) In multiview projections, the XY line is also known as
- (a) Horizontal line
 - (b) Horizontal trace
 - (c) Reference line
 - (d) All of these
- v) In first angle projection method, the relative positions of the object, plane and observers are
- (a) Object is placed in between
 - (b) Plane is placed in between
 - (c) Observer is placed in between
 - (d) May be placed in any order
- vi) In first angle projection system, the right hand side view of an object is drawn
- (a) Above of the elevation
 - (b) Below of the elevation
 - (c) Left of the elevation
 - (d) Right of the elevation
- vii) If the front view of an object exhibits width and height, then what dimensions of an object are exhibited by a right side view?
- (a) Length and width
 - (b) Length and height
 - (c) Height and width
 - (d) Length and breadth
- viii) For orthographic projections, B.I.S. recommends the following
- (a) First angle projection
 - (b) Third angle projection
 - (c) Second angle projection
 - (d) Fourth angle projection

ix) The recommended symbol for indicating the angle of projection shows two views of the frustum of a

- (a) Square Pyramid
- (b) Triangular pyramid
- (c) Cone
- (d) Any of these

x) For the object shown in Fig. 7.23 select the correct front view

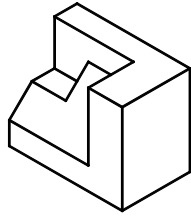
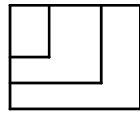
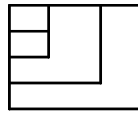


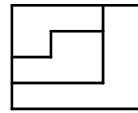
Fig. 7.23



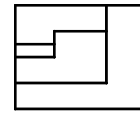
(a)



(b)



(c)



(d)

xi) For the object shown in Fig. 7.24 select the correct front view

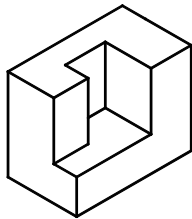
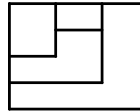
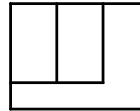


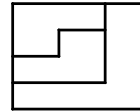
Fig. 7.24



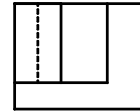
(a)



(b)



(c)



(d)

Answer: (i) d (ii) a (iii) b (iv) c (v) a (vi) c (vii) b (viii) a (ix) c (x) c (xi) b

PROJECTIONS OF POINTS

8

8-1 INTRODUCTION

A point is defined as a geometrical element that has no dimensions. In engineering drawing / graphics the point is represented as a dot. This chapter deals with the projections of points.

8-2 LOCATION OF A POINT

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We know that the reference planes divide the space in four quadrants. A point lying in the space may be situated in the following positions with respect to principle planes of projections.

1. Point situated above the HP and in front of the VP.
2. Point situated above the HP and behind the VP.
3. Point situated below the HP and behind the VP.
4. Point situated below the HP and in front of the VP.
5. Point situated on the HP and in front of the VP.
6. Point situated above the HP and on the VP.
7. Point situated on the HP and behind the VP.
8. Point situated below the HP and on the VP.
9. Point situated on the HP and VP both.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The line joining the front and top views of a point is called
(a) Reference line (b) Projector (c) Connector (d) Locus
- ii) A point lying in the HP, has its top view above XY line. Its front view will be
(a) On XY line (b) Above XY line (c) Below XY line (d) Any of these
- iii) A point whose elevation and plan are above XY, is situated in
(a) First angle (b) Second angle (c) Third angle (d) Fourth angle
- iv) A point whose elevation is above XY line may be situated in
(a) First angle (b) Second angle (c) Vertical plane (d) Any of these

- v) A point is 20 mm below HP and 30 mm behind VP. Its top view will be
(a) 20 mm below XY (b) 30 mm below XY
(c) 20 mm above XY (d) 30 mm above XY
- vi) The front view of a point is 50 mm above xy line and the top view is 20 mm below the front view. the point lies in
(a) First angle (b) Second angle (c) Third angle (d) Fourth angle
- vii) If both the front and the top views of a point lie on the opposite side of the reference line the point may be situated in following angles
(a) First or second (b) First or third (c) Second or fourth (d) Third or fourth
- viii) If both the front and the top views of a point lie on the same side of the reference line the point may be situated in following angles
(a) First or second (b) First or third (c) Second or fourth (d) Third or fourth
- ix) If top view of a point is situated 60 mm below the reference line and its front view is 20 mm above the top view, the point lies in
(a) First angle (b) Second angle (c) Third angle (d) Fourth angle
- x) The front view of a point is 40 mm above xy and the top view is 50 mm below xy, the position of point is
(a) 40 mm above HP (b) 40 mm below HP
(c) 50 mm above HP (d) 50 mm below HP
- xi) State the position of a point the front view of which lies on the reference line and the top view is 40 mm above it.
(a) 40 mm above HP and in the VP (b) 40 mm behind VP and in the HP
(c) 40 mm below HP and in the VP (d) 40 mm in front of VP and in the HP
- xii) State the position of a point the top view of which lies on the reference line and the front view is 30 mm below it.
(a) 30 mm above HP and in the VP (b) 30 mm behind VP and in the HP
(c) 30 mm below HP and in the VP (d) 30 mm in front of VP and in the HP

Answer: (i) b (ii) a (iii) b (iv) d (v) d (vi) b (vii) b (viii) c (ix) d (x) a (xi) b (xii) c

9

PROJECTIONS OF STRAIGHT LINES

9-1 INTRODUCTION

A straight line is defined as the locus of a point which moves linearly. A straight line is the shortest distance between two points. The projections of straight lines are drawn by joining the respective projections of its end points. We have used the word 'line' for straight lines for the sake of simplicity. The actual length of the line is known as true length and is denoted by TL.

9-2 ORIENTATIONS OF STRAIGHT LINES

The possible orientations of straight lines with respect to the principal planes are as following.

1. Line parallel to both HP and VP.
2. Line perpendicular to HP (and parallel to VP).
3. Line perpendicular to VP (and parallel to HP).
4. Line inclined to HP and parallel to VP.
5. Line inclined to VP and parallel to HP.
6. Line situated in HP.
7. Line situated in VP.
8. Line situated in both HP and VP (i.e. on the reference line).
9. Line inclined to both the reference planes.
 - a. Line inclined to both HP and VP such that $\theta + \phi \neq 90^\circ$.
 - b. Line inclined to both HP and VP such that $\theta + \phi = 90^\circ$.

Let us first consider the projections of straight lines situated in the first quadrant, is inclined to one of the reference planes. Projections of a straight line lying in the first quadrant will have its front view above the xy line (reference line) and the top view below xy line. Concept of projections of points and orthographic projections is required to understand the projections of straight lines.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) If a line is parallel to both HP and VP, its true length will be seen in
(a) Front View (b) Top View (c) Side view (d) Both front and top views

- ii) If the apparent and the true inclinations of a line with HP are equal, the line is
(a) Parallel to horizontal plane (b) Parallel to vertical plane
(c) Parallel to profile plane (d) Inclined to both reference planes
- iii) The point at which the line intersects the VP, extended if necessary, is known as
(a) Profile trace (b) Horizontal trace (c) Vertical trace (d) Auxiliary trace
- iv) If the front view of a line is parallel to the xy line its true length is shown in
(a) Front View (b) Top View (c) Side view (d) Both front and top views
- v) If top view of a line is a point, its front view is
(a) Parallel to xy line and of true length
(b) Parallel to xy line and of apparent length
(c) Perpendicular to xy line and of true length
(d) Perpendicular to xy line and of apparent length
- vi) Horizontal trace of a line exists when the line is
(a) Parallel to horizontal plane (b) Inclined to horizontal plane
(c) Perpendicular to vertical plane (d) Perpendicular to profile plane
- vii) If a line is inclined at 45° to the HP and 30° to the VP, its front view is inclined at
(a) 30° to xy (b) 45° to xy (c) Between 30° and 45° (d) Greater than 45°
- viii) If a line is inclined at 30° to the HP and 60° to the VP, its front and top views are inclined at an angle of
(a) 30° and 60° to xy respectively (b) 60° and 30° to xy respectively
(c) Both at 90° to xy (d) Both greater than 30° but less than 90°
- ix) For a line situated in the first angle which of the following is **not** correct
(a) HT and VT may lie below xy (b) HT lies below xy and VT lies above xy
(c) HT and VT may lie above xy (d) HT lies above xy and VT lies below xy
- x) A 90 mm long line PQ, inclined at 30° to the HP and 45° to the VP has end P 15 mm above HP and 25 mm in front of VP. The other end Q will lie in
(a) First angle (b) Third angle (c) Second or fourth angle (d) Any of these
- xi) If the front and top views of a line are inclined at 30° and 45° to the reference line, the true inclination of the line with HP will be
(a) 30° (b) 45° (c) Less than 30° (d) Greater than 45°
- xii) If both the front and top views of a line are perpendicular to the reference line, the true inclination of the line with HP and VP may be respectively
(a) 15° and 75° (b) 30° and 60° (c) Both 45° (d) Any of these

Answer: (i) d (ii) b (iii) c (iv) b (v) c (vi) b (vii) d (viii) c (ix) d (x) d (xi) c (xii) d

PROJECTIONS OF PLANES

10-1 INTRODUCTION

In this chapter we deal with two dimensional objects called planes. Planes are having length, breadth and negligible thickness (i.e. thickness equivalent to a line). Only those solids are considered in the chapter whose shape can be defined geometrically and are regular in nature. Some of them are shown in Fig. 10.1.

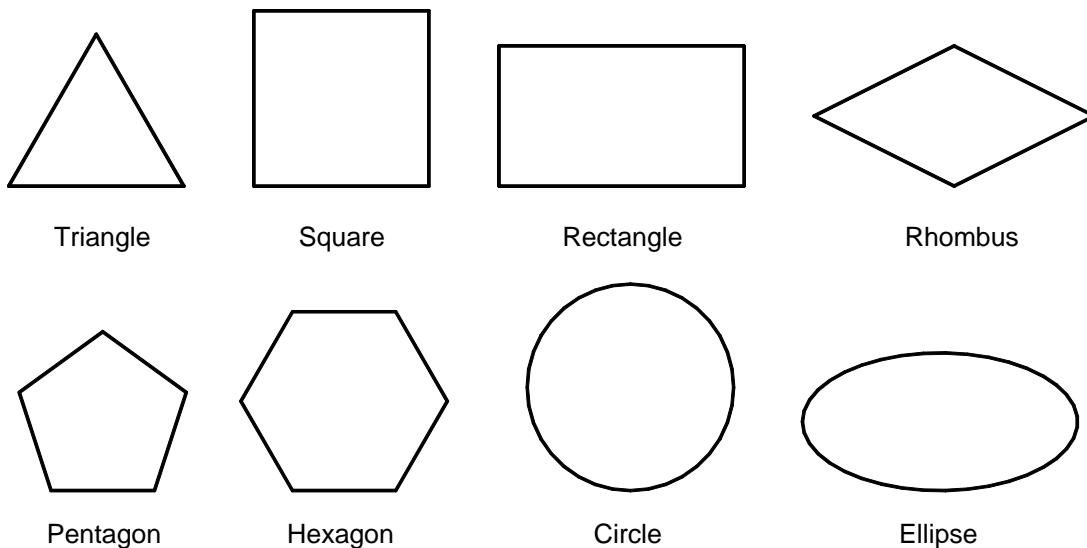


Fig. 10.1 Planes

10-2 ORIENTATIONS OF PLANES

The possible orientations of the surface of a plane with respect to the principal planes are given below:

1. Surface of plane is parallel to HP (and perpendicular to VP).
2. Surface of plane is parallel to VP (and perpendicular to HP).
3. Surface of plane is perpendicular to both HP and VP (i.e. parallel to profile plane).
4. Surface of plane is inclined to HP and perpendicular to VP.
5. Surface of plane is inclined to VP and perpendicular to HP.
6. Surface of plane is inclined to both HP and VP.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) If a thin set-square is kept perpendicular to both the horizontal and vertical planes, its true shape is seen in
 - (a) Horizontal plane
 - (b) Vertical plane
 - (c) Auxiliary inclined plane
 - (d) Profile plane
- ii) Planes which are inclined to both the horizontal and vertical planes are called
 - (a) Oblique planes
 - (b) Profile planes
 - (c) Auxiliary planes
 - (d) None of these
- iii) If a thin rectangular plate of 60 mm X 30 mm is inclined at an angle of 60° to HP its top view may be
 - (a) Square of 60 mm side
 - (b) Square of 30 mm side
 - (c) Rectangle of 60 mm X 45 mm
 - (d) Rectangle of 45 mm X 30 mm
- iv) In multi-view orthographic projection, the front view of a circular plane may be
 - (a) A circle
 - (b) An ellipse
 - (c) A straight line
 - (d) Any one of these
- v) If both front and top views of a plane are straight lines the true shape will lie on
 - (a) Profile plane
 - (b) Horizontal plane
 - (c) Vertical plane
 - (d) Any of these
- vi) If a circular plane is inclined at 30° with the HP and 60° with the VP its side view will be
 - (a) An ellipse
 - (b) A straight line
 - (c) A circle
 - (d) True shape
- vii) The front view of an elliptical plane may be
 - (a) An ellipse
 - (b) A circle
 - (c) A straight line
 - (d) Any of these
- viii) If the top view of a plane is a rhombus the object may be
 - (a) A square
 - (b) A rhombus
 - (c) Either (a) or (b)
 - (d) Neither (a) nor (b)
- ix) The trace of a hexagonal plane may be
 - (a) A straight line
 - (b) A point
 - (c) A hexagon
 - (d) An equilateral triangle
- x) A 60° set-square has its shortest edge in the VP. The surface is perpendicular to the HP and inclined to the VP. Its front view may appear as.
 - (a) An equilateral triangle
 - (b) An isosceles triangle
 - (c) An obtuse angled triangle
 - (d) A acute angled triangle
- xi) A 60° set-square has its shortest edge in the HP and the surface is perpendicular to the VP. Its top view may appears as.
 - (a) An isosceles triangle
 - (b) A right angled triangle
 - (c) A straight line
 - (d) Any of these

- xii) If both the principle views of a plane object are ellipse of the same size, the side view will be
(a) A horizontal line (b) A vertical line (c) An inclined line (d) An ellipse

Answer: (i) d (ii) a (iii) b (iv) d (v) d (vi) b (vii) d (viii) c (ix) d (x) b (xi) d (xii) b

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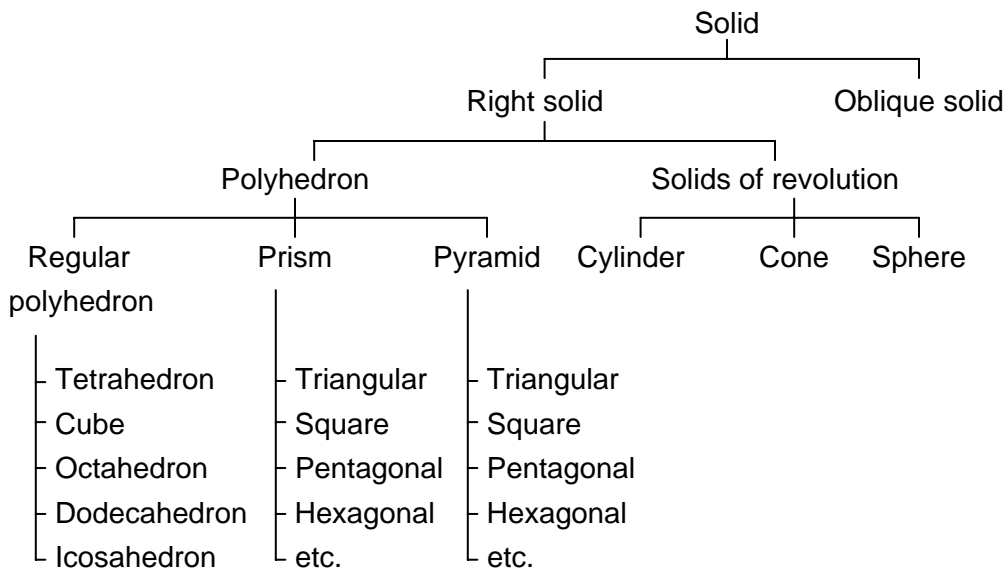
PROJECTIONS OF SOLIDS

11-1 INTRODUCTION

This chapter deals with the orthographic projections of three dimensional objects called solids. However, only those solids are considered, the shape of which can be defined geometrically and are regular in nature. The basic concepts of orthographic projections discussed in earlier chapters shall also apply here.

11-2 CLASSIFICATION OF SOLIDS

Solids are usually classified as:



MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) Among the following solids, a regular polyhedron is
(a) Square prism (b) Square pyramid (c) Cube (d) Sphere
- ii) A solid having minimum number of faces is
(a) Tetrahedron (b) Triangular prism (c) Square pyramid (d) cube
- iii) A pyramid is cut by a plane parallel to its base removing the apex, the remaining part is known as
(a) Truncated (b) Frustum (c) Sectioned (d) Prism
- iv) Number of faces in a dodecahedron are
(a) 4 (b) 8 (c) 12 (d) 20
- v) If three orthographic views of a sphere containing a circular hole are drawn, the maximum number of circles that may appear altogether
(a) 1 (b) 3 (c) 4 (d) 6
- vi) An orthographic view of a hemisphere may appear as
(a) Circle (b) Ellipse (c) Parabola (d) hyperbola
- vii) The number of stages that are necessary to get the orthographic views of a solid having its axis inclined to both the reference planes
(a) One (b) Two (c) Three (d) Four
- viii) A tetrahedron is resting on its face on the HP with a side perpendicular to the VP. Its front view will be
(a) Equilateral triangle (b) Isosceles triangle
(c) Scalene triangle (d) Right angled triangle
- ix) A square pyramid is resting on a face in the VP. The number of dotted lines will appear in the front view
(a) One (b) Two (c) Three (d) Four
- x) The solid will have two dotted lines in the top view when it is resting on its face in the HP
(a) Square pyramid (b) Pentagonal pyramid
(c) Hexagonal pyramid (d) All of these
- xi) A cube is resting on HP with a solid diagonal perpendicular to it. The top view will appear as
(a) Square (b) Rectangle (c) Irregular hexagon (d) regular hexagon
- xii) A right circular cone resting on a point of its base circle in the HP having the axis inclined at 30° to the HP and 45° to the VP. The angle between the reference line and top view of the axis will be
(a) 30° (b) Between 30° and 45° (c) 45° (d) More than 45°

- xiii) A right circular cone resting on a generator in the HP and axis inclined at 45° to the VP. The angle between the reference line and top view of the axis will be
(a) Less than 45° (b) 45° (c) More than 45° (d) Any of these
- xiv) A cylinder rests on a point of its base circle in the HP having the axis inclined at 30° to the HP and 60° to the VP. The inclination of the top view of the axis with the reference line will be
(a) 30° (b) 60° (c) 90° (d) None of these

Answer: (i) c (ii) a (iii) b (iv) c (v) c (vi) a (vii) c (viii) b (ix) b (x) d (xi) d (xii) d (xiii) c (xiv) c

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SECTIONS OF SOLIDS

12-1 INTRODUCTION

It is observed that the orthographic views of a solid may contain a number of dotted lines. These lines indicate the presence of hidden details which may lie behind or somewhere in the middle of the object. The interpretation of the object's shape becomes difficult with increasing number of such lines. As a remedy, it becomes obligatory to draw sectional views for a better and easier interpretation of the internal details. The present chapter describes the methods of obtaining sectional views and other related drawing.

The object considered to be cut by a plane called a section or a cutting plane. The portion of the object, which falls between the cutting plane and the observer, is assumed to be removed. Thus the exposed internal details become visible. The projections of the remaining object are termed as sectional views.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) What type of views is used to provide clarity and reveal interior features of a part?
(a) Section views (b) Oblique views (c) Auxiliary views (d) Pictorial views
- ii) A cube is resting on a face in the HP with vertical faces equally inclined to the VP. It is cut by an A.I.P. The true shape of section view is
(a) Triangle (b) Rhombus (c) Hexagon (d) Any of these
- iii) A cone is cut by a section plane parallel to the profile plane. Its true shape of section is seen in
(a) Front view (b) Top view (c) Side view (d) Auxiliary view
- iv) A square pyramid resting on its base in the HP and a side of base parallel to VP. It is cut by an A.I.P. Its true shape will be
(a) Square (b) Rectangle (c) Trapezium (d) Parallelogram
- v) A square pyramid 50 mm side resting on its base in the HP is cut by a horizontal section plane bisecting its axis. Its true shape of section is
(a) Square of 25 mm side (b) Trapezium with parallel sides 25 mm & 50 mm
(c) Square of 50 mm side (d) Triangle of base 50 mm side

- vi) A square pyramid 45 mm side and axis 60 mm long, resting on its base in the HP is cut by a horizontal section plane passing through a point on the axis 20 mm below the apex. Its true shape of section is a square of side
 (a) 15 mm (b) 30 mm (c) 40 mm (d) 45 mm
- vii) A triangular prism resting on a rectangular face in the HP. It is cut by a horizontal plane. Its sectional top view is
 (a) Equilateral triangle (b) Isosceles triangle
 (c) Rectangle (d) None of these
- viii) A cone resting on its base on the HP is cut by a section plane parallel to VP has its sectional front view
 (a) Ellipse (b) Parabola (c) Hyperbola (d) Semicircle
- ix) A cube is resting on a face in the HP with vertical faces equally inclined to the VP. It is cut by an A.I.P. passing through the solid diagonal. The true shape of section view is
 (a) Square (b) Rectangle (c) Hexagon (d) Rhombus
- x) A cylinder of 50 mm diameter and axis 120 mm long is lying on its generator in HP. It is cut by a vertical section plane to get largest ellipse as the true shape of section. The major axis of this ellipse will be
 (a) 50 mm (b) Between 50 mm and 120 mm
 (c) 120 mm (d) 130 mm
- xi) A cylinder of 60 mm diameter and axis 80 mm long is lying on its generator in HP. It is cut by a section plane to get an ellipse as the true shape of section. The minor axis of this ellipse will be
 (a) 60 mm (b) 80 mm (c) 100 mm (d) None of these
- xii) If a polyhedron is cut by any section plane, the true shape of section is a closed figure made up of
 (a) Straight lines (b) Curves
 (c) Combination of lines and curves (d) Any of these

Answer: (i) a (ii) d (iii) c (iv) c (v) a (vi) a (vii) c (viii) c (ix) d (x) d (xi) a (xii) a

DEVELOPMENT OF SURFACES 13

13-1 INTRODUCTION

In engineering practice, a large number of objects like funnel, bucket, hopper, chimney, duct of air conditioner, boiler shell, storage tank and tray etc. are made of metal sheets. The fabrication of these objects can be planned in an economic way if the accurate shape and size of metal sheet is known. This chapter deals with proper layout planning of the surface of the object on a single plane called the development of surfaces.

13-2 CLASSIFICATION OF SURFACES

Surfaces of various geometrical objects may be classified as:

1. Plane surfaces: Surfaces of prism, pyramids, cube and polyhedra are plane surfaces.
2. Singly curved surfaces: Surfaces of object like cylinder and cone are singly curved surfaces.
3. Doubly curved surfaces: Surfaces of spheres, paraboloid, ellipsoid, hyperboloid are doubly curved surfaces.

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MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The method by which the development of surface of an oblique solid is obtained
(a) Radial line (b) Parallel line (c) Triangulation (d) Approximation
- ii) Methods for the development of solids are
(a) Parallel line method (b) Radical line method
(c) Triangular method (d) All of them
- iii) Development of sphere is done by
(a) Zone or Lune method (b) Parallel line or Radial line method
(c) Triangulation method (d) Any of these methods

- iv) The nature of lateral surface of a cylinder is
 (a) Plane surface (b) Singly curved surface
 (c) Doubly curved surface (d) Singly or doubly curved surface
- v) The nature of surface of a sphere is
 (a) Plane surface (b) Singly curved surface
 (c) Doubly curved surface (d) Singly or doubly curved surface
- vi) If a semicircular thin sheet is folded to form a cone, then the front view of the cone appears as,
 (a) Equilateral triangle (b) Isosceles triangle
 (c) Rectangle (d) Semicircle
- vii) Sector of a circle of radius 60 mm and angle 120° represents development of the lateral surface of a cone. The top view of the cone is a circle of diameter
 (a) 20 mm (b) 40 mm (c) 60 mm (d) 80 mm
- viii) If the front view of a cone is represented by an equilateral triangle of 60 mm side. The area of its lateral surface is
 (a) 30π (b) 60π (c) 90π (d) 120π
- ix) The development of surface of a tetrahedron of 60 mm edge can be represented by an equilateral triangle of side
 (a) 60 mm (b) 90 mm (c) 120 mm (d) None of these
- x) The development of surface of a tetrahedron of 60 mm edge can be represented by a parallelogram of adjacent sides
 (a) 60 mm and 90 mm (b) 60 mm and 120 mm
 (c) 90 mm and 120 mm (d) None of these
- xi) A rectangle of 120 mm X 60 mm represents the development of the lateral surface of
 (a) A square prism of side 30 mm (b) A hexagonal prism of side 20 mm
 (c) A cylinder of diameter $120/\pi$ (d) All of these
- xii) A string is wound around a hexagonal prism of base 20 mm side and axis 50 mm long, to connect opposite ends of the same longer edge. The minimum length of string required is
 (a) 110 mm (b) 120 mm (c) 130 mm (d) 140 mm

Answer: (i) c (ii) a (iii) a (iv) b (v) c (vi) a (vii) b (viii) b (ix) c (x) b (xi) d (xii) c

INTERSECTION OF SURFACES 14

14-1 INTRODUCTION

When a solid penetrates into another solid, it is known as interpenetration of solids. Due to such interpenetration their lateral surfaces intersect to produce closed loop which may either be made of straight lines or curves. These loops are known as lines or curves of intersection.

Since two plane surfaces intersect in a straight line the intersection of prism with prism or pyramid with pyramid or prism with pyramid results in a polygon. Similarly if any one or both of the two solids have curved surface, it will result in a closed curve. In both the cases, the term "curve of intersection" is frequently used. It is important to note that the points lying on the curve of intersection are always common to the surfaces of both the solids.

MULTIPLE CHOICE QUESTIONS

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Choose the most appropriate answer out of the given alternatives:

- i) When two prisms intersect at right angle, the curve of intersection is made up of
(a) Circular arc (b) Elliptical arc (c) Curved line (d) Straight line
- ii) When two cylinders of equal diameters envelope a common sphere, the curve of intersection is made up of
(a) Parabola (b) Semicircle (c) Straight line (d) None of these
- iii) The line of intersection between cylinder and cone, **unless** they envelope a common sphere, is made up of
(a) Straight line (b) Curved line (c) Circular arcs (d) Parabolic curve
- iv) Which of the following method is **not** used for obtaining curves of intersection?
(a) Line method (b) Curve method
(c) Generator method (d) Cutting plane method
- v) The study of intersection of surfaces helps in
(a) Sheet metal work (b) Building drawing
(c) Architectural drawing (d) All of these

- vi) The intersection of a cone by a plane results in
 (a) Conic section (b) Cycloid (c) Helix (d) None of these
- vii) The curve of intersection of any solid with a line is
 (a) A point (b) A Line (c) A closed loop (d) None of these
- viii) When a cylinder penetrates into a vertical cone with their axes parallel to each other, the top view of the curve of intersection is
 (a) A Circle (b) An Ellipse (c) A parabola (d) A cycloid
- ix) When a vertical cylinder is penetrated by a horizontal cylinder, the top view of the curve of intersection is
 (a) Circular arc (b) Elliptical arc (c) Closed loop (d) None of these
- x) A cone resting on its base in the HP is penetrated by a horizontal cylinder. The top view of the curve of intersection results in
 (a) Circular arc (b) Elliptical arc (c) Closed loop (d) None of these
- xi) The curve of intersection of a vertical cylinder with an auxiliary vertical plane is
 (a) A point (b) A straight line (c) A curved line (d) A closed loop
- xii) The curve of intersection of a vertical cone with an auxiliary vertical plane is
 (a) Straight line (b) Elliptical curve (c) Parabolic curve (d) Hyperbolic curve
- xiii) The points at which the curve of intersection changes its nature are known as
 (a) Arbitrary points (b) Key points (c) Crucial points (d) Intersection points

Answer: (i) d (ii) c (iii) b (iv) b (v) a (vi) a (vii) a (viii) a (ix) a (x) c (xi) b (xii) d (xiii) b

ISOMETRIC PROJECTIONS

15

15-1 INTRODUCTION

Isometric projection is a type of single view projection in which a pictorial view is obtained by keeping the object in such a way that all the three mutually perpendicular geometrical axes are equally inclined to the plane of projection. The projectors follow the rules of multi-view projections i.e. they are parallel to each other and perpendicular to the plane of projection.

In multi-view orthographic projections, each view provides information of two axes (length & breadth or length & height or breadth & height). For a complete understanding, there is always a need of more than one view of the object. These views can only be correctly interpreted and visualized by those persons who have a good knowledge of principles used for these projections. Whereas in isometric projection, a single view is drawn in such a manner that it gives an overall view of the object at the first sight. Thus, it is necessary to draw a pictorial view of one kind or the other so as to enable a common man to understand.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The number of scales that is needed for making a dimetric projection is
(a) One (b) Two (c) Three (d) Four
- ii) Isometric drawings fall into a larger category of drawings known as
(a) Oblique drawings (b) Pictorial drawings
(c) Dimetric drawings (d) Perspective drawings
- iii) Isometric drawings fall into the category of
(a) Oblique drawings (b) Axonometric drawings
(c) Multi-view drawings (d) Perspective drawings
- iv) The projectors in isometric view are
(a) Converging (b) Diverging
(c) Parallel to plane of projection (d) Perpendicular to plane projection
- v) Pictorial views drawn on isometric scale are called
(a) Isometric drawing (b) Isometric Projection
(c) Isometric view (d) Any of these
- vi) The exact value of R.F. of an Isometric scale is
(a) $9/11$ (b) 0.815 (c) 0.8165 (d) $\sqrt{2} / \sqrt{3}$

- vii) The angle that isometric lines make with each other is
 (a) 45° (b) 60° (c) 90° (d) 120°
- viii) A square in a regular multi-view projection appears in an isometric view as
 (a) Box (b) Square (c) Parallelogram (d) Rhombus
- ix) The type of projection in which the surfaces are equally foreshortened is
 (a) Oblique (b) Cabinet (c) Isometric (d) Orthographic
- x) In comparison to an isometric projection, the appearance of an isometric view is
 (a) Larger (b) Smaller (c) More accurate (d) More realistic
- xi) On isometric plane, a circle appears as
 (a) An obloid (b) A circle (c) An ellipse (d) An involute
- xii) While making isometric projections the ellipse is preferably drawn by
 (a) Four center method (b) Oblong method
 (c) Concentric circles method (d) Parallelogram method
- xiii) Isometric projections can **not** be drawn by
 (a) Box method (b) Coordinate method
 (c) Offset method (d) Zone method
- xiv) A sphere in isometric projection appears as a circle of diameter
 (a) Equal to the diameter of sphere (b) 0.816 times the diameter of sphere
 (c) Less than 0.816 diameter of sphere (d) Greater than the diameter of sphere
- xv) The purpose of an isometric scale is
 (a) To lay off intersecting lines (b) To project the object on projection plane
 (c) To measure foreshortened lines (d) To measure diagonal lines
- xvi) Select the correct isometric view corresponding to the orthographic views shown in Fig. 15.21

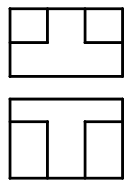
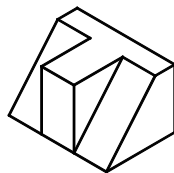
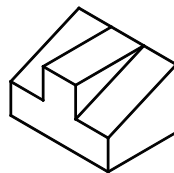


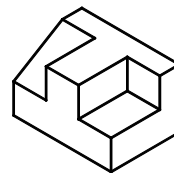
Fig. 15.21



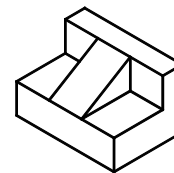
(a)



(b)



(c)



(d)

xvii) Select the correct isometric view corresponding to the orthographic views shown in Fig. 15.22

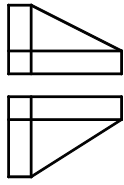
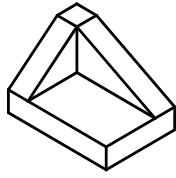
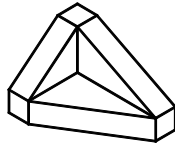


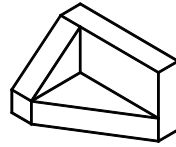
Fig. 15.22



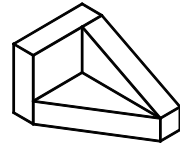
(a)



(b)



(c)



(d)

Answer: (i) b (ii) b (iii) b (iv) d (v) b (vi) d (vii) d (viii) d (ix) c (x) a (xi) c (xii) a
 (xiii) d (xiv) a (xv) c (xvi) c (xvii) b

16

OBLIQUE PROJECTIONS

16-1 INTRODUCTION

Oblique projection is defined as a pictorial projection in which projectors are parallel to each other and inclined to the plane of projection at any angle other than right angle.

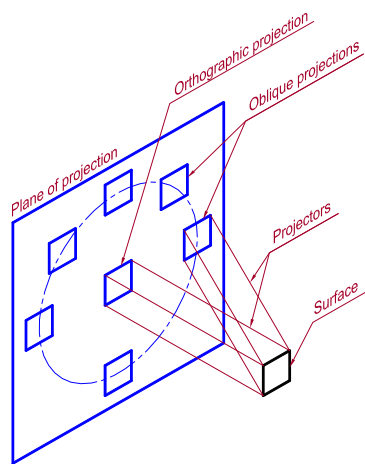


Fig. 16.1 Orthographic and oblique projections

In orthographic projections (both multi-view and axonometric) the projectors are parallel to each other and perpendicular to the plane of projection. Whereas in oblique projection the projectors, although parallel to each other, are oblique to the plane of projection. See Fig. 16.1. It may be seen that the face of an object parallel to the plane of projection will have the same appearance in both multi-view and oblique projections. To take this advantage, it is customary to have one of the faces of the object parallel to the plane of projection. This is the chief advantage of oblique projection over other forms of pictorial drawings.

MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The face of an object containing circles, irregular shapes etc. is kept parallel to the plane of projection is known as
 - (a) Isometric projection
 - (b) Perspective projection
 - (c) Oblique projection
 - (d) None of these
- ii) In an oblique projection, the front surface of the object is kept at an angle with respect to plane of projection is
 - (a) Perpendicular
 - (b) Parallel
 - (c) 45°
 - (d) either 30° or 60°
- iii) The drawings in which the receding lines are drawn to half the scale are called
 - (a) Isometric
 - (b) Cavalier
 - (c) Cabinet
 - (d) Perspective

- iv) The distortion in oblique projections can be decreased by
 - (a) Placing the projection in correct scale
 - (b) Reducing the length of the receding lines
 - (c) Placing the projection obliquely to the plane of projection
 - (d) Enlarging the dimensions parallel to the plane of projection
- v) In oblique projections, the receding lines meet the plane of projection at an angle
 - (a) 0°
 - (b) 30°
 - (c) 90°
 - (d) Less than 90°
- vi) To emphasize the features on the side of an object, the receding lines are drawn at the following angle to the plane of projection
 - (a) 45°
 - (b) 60°
 - (c) Greater than 45°
 - (d) Less than 45°
- vii) In oblique projections, a semi circle parallel to the plane of projection appears as
 - (a) Semicircle
 - (b) Semi-ellipse
 - (c) Cycloid
 - (d) Partial ellipse
- viii) The projectors in oblique projections are
 - (a) Converging at plane of projection
 - (b) Parallel to plane of projection
 - (c) Inclined to plane of projection
 - (d) Perpendicular to plane of projection
- ix) In the cavalier projection, an angle at which the projectors meet the plane of projection is
 - (a) 30°
 - (b) 45°
 - (c) $63^\circ 26'$
 - (d) None of these
- x) In the cabinet projection, an angle at which the projectors meet the plane of projection is
 - (a) 30°
 - (b) 45°
 - (c) $63^\circ 26'$
 - (d) None of these
- xi) In the general oblique projection, an angle at which the projectors meet the plane of projection is
 - (a) 45°
 - (b) $63^\circ 26'$
 - (c) 90°
 - (d) None of these
- xii) While making cavalier projections the ellipse is preferably drawn by
 - (a) Four center approximate method
 - (b) Oblong method
 - (c) Concentric circles method
 - (d) Parallelogram method

Answer: (i) c (ii) b (iii) c (iv) b (v) d (vi) d (vii) a (viii) c (ix) b (x) c (xi) d (xii) a

PERSPECTIVE PROJECTIONS 17

17-1 INTRODUCTION

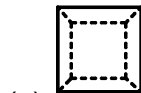
Perspective projection is a three dimensional representation of an object on a plane as it is perceived by the human eye from a particular point. It is a geometric method of obtaining images which are similar to the photographs taken by a camera.

The major difference between parallel projection, be it orthographic oblique or isometric, and perspective projection lies in the fact that in the later case the point of sight is at a finite distance from the object. The projectors from the object therefore converge to the point of sight instead of being parallel to each other as in the former types of projection. Such drawing is also known as scenographic projection or central projection.



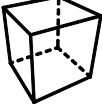
MULTIPLE CHOICE QUESTIONS

Choose the most appropriate answer out of the given alternatives:

- i) The type of pictorial projection generally used by the architects is
 (a) Orthographic (b) Oblique (c) Perspective (d) Isometric
- ii) The form of drawing similar to the view of objects as perceived by human eye is
 (a) Perspective (b) Oblique (c) Axonometric (d) Isometric
- iii) Perspective projections are drawn by
 (a) Single vanishing point method (b) Double vanishing point method
 (c) Triple vanishing point method (d) All of these
- iv) Two point perspective is also known as
 (a) Parallel perspective (b) Angular perspective
 (c) Oblique perspective (d) Atmospheric perspective
- v) One-point perspective view of a cube can be represented as



(d) None of these

- vi) Two-point perspective view of a cube can be represented as
- (a)  (b)  (c)  (d) None of these
- vii) The illusion of depth in paintings is depicting by
- (a) One-point perspective (b) Two-point perspective
(c) Three-point perspective (d) Aerial perspective
- viii) As the distance of an object from the observer increases, its size in the perspective view
- (a) Remains constant (b) Increases (c) Decreases (d) Any of these
- ix) The imaginary vertical plane passing through the observer's eye is called
- (a) Ground plane (b) Horizon plane (c) Central plane (d) Picture plane
- x) The imaginary horizontal plane passing through the observer's eye is called
- (a) Ground plane (b) Horizon plane (c) Central plane (d) Picture plane
- xi) The line joining any point on the object to the station point is known as
- (a) Axis of vision (b) Visual ray (c) Center line (d) Horizon line
- xii) Pictorial views are obtained by
- (a) Isometric projection (b) Oblique projection
(c) Perspective projection (d) All of these

Answer: (i) c (ii) a (iii) d (iv) b (v) a (vi) b (vii) d (viii) c (ix) c (x) b (xi) b (xii) d

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COMPUTER AIDED DESIGN (CAD)

18

18-1 INTRODUCTION





The drafting work can be automated and accelerated through the use of Computer Aided Design (CAD) systems. It may be applied for a wide variety of products in the field of automotive, electronics, aerospace, naval, architecture, civil and other disciplines of engineering. CAD systems were originally used for automated drafting only, but now they also include three-dimensional modeling and computer-simulated operations of the models. Sometimes CAD is translated as "computer-assisted drafting", "computer-aided drafting", or a similar phrase. Related acronyms are CADD, which stands for "computer-aided design and drafting"; CAID, for Computer-aided Industrial Design; and CAAD, for "computer-aided architectural design". All these terms are essentially synonymous, but there are some subtle differences in meaning and application.

MULTIPLE CHOICE QUESTIONS

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Choose the most appropriate answer out of the given alternatives:

- i) What should you pay attention to when learning AutoCAD?
 - (a) The Command Line
 - (b) The Status Bar
 - (c) The Title Bar
 - (d) Floating toolbars
- ii) What does WCS stand for?
 - (a) Western CAD System
 - (b) Worldwide Coordinate Sectors
 - (c) World Coordinate System
 - (d) Wrong CAD Setting
- iii) Status bar do not contain
 - (a) Snap
 - (b) Grid
 - (c) Erase
 - (d) Polar
- iv) Coordinates for the current position of crosshair of the cursor is seen in
 - (a) Menu bar
 - (b) Standard toolbar
 - (c) Properties toolbar
 - (d) Status bar
- v) Units command of AutoCAD is **not** used to set
 - (a) Units for linear measurement
 - (b) Units for angular measurement
 - (c) Limits of drawing
 - (d) Direction in which angle is to be measured
- vi) Polar coordinates are used mostly for drawing
 - (a) Circles
 - (b) Arcs
 - (c) Vertical lines
 - (d) Angled lines

- vii) The number of points needed to draw a line using Absolute Coordinates is
 (a) None (b) One (c) Two (d) Four
- viii) If a line is drawn between points 1,5 and -3,5 its absolute length is
 (a) Three unit (b) Four units (c) Five units (d) Insufficient data
- ix) How long will line from 1,5 to @5<10 be?
 (a) One unit (b) Four units (c) Five units (d) Ten units
- x) To move something Six units to the right, what would be the 2nd point of displacement?
 (a) @6,0 (b) @6<0 (c) Both 1 and 2 (d) Neither 1 nor 2
- xi) Which one is **not** a valid option of Units command?
 (a) Architectural (b) Decimal (c) Meter (d) Metric
- xii) Snap command is used to regulate the cursor movement to the specified increments along
 (a) Vertical axis (b) Horizontal axis
 (c) Cartesian coordinates (d) Polar angles
- xiii) What can be contained in a template drawing?
 (a) Sheet layout (b) Dimension styles (c) Text styles (d) All of these
- xiv) How many points do you need to define for the Rectangle command?
 (a) One (b) Two (c) Three (d) Four
- xv) Which one of the following is **not** a valid option for drawing a circle?
 (a) 3 Points (b) Tan Tan Center (c) Tan Tan Radius (d) Tan Tan Tan
- xvi) 2-points option is used to draw circles by specifying the
 (a) Two end points of a diameter (b) Two end points of a radius
 (c) Radius and tangent to two objects (d) Center and two end points of a chord
- xvii) Xline command is used to draw line that
 (a) Extends up to a specified point (b) Extends up to another line
 (c) Extends infinity in one direction only (d) Extends infinity in both directions
- xviii) Offset command can be used for drawing
 (a) Infinite long lines (b) Parallel lines
 (c) Intersecting lines (d) Perpendicular bisectors
- xix) Objects are rotated around the
 (a) Base point (b) Bottom right of the object
 (c) Centre of the object (d) Origin
- xx) Join command is executed by clicking the icon
 (a)  (b)  (c)  (d) 

- xxi) Scaling objects makes them
(a) Bigger (b) Smaller
(c) It only stretches them (d) Both Bigger and Smaller
- xxii) When using the TRIM command, which do you select first?
(a) The cutting edges (b) The object to be trimmed
(c) Everything (d) Nothing
- xxiii) The term used by most CAD systems for “rounding corners” is
(a) Chamfer (b) Curve (c) Fillet (d) Smooth
- xxiv) The fillet command creates
(a) Sharp corners (b) Round corners (c) Angled corners (d) Smooth corners
- xxv) Which of the following is **incorrect** statement
(a) Chamfer command is used to bevel the edges
(b) Fillet command is used to round the corners
(c) Array command is used to draw multiple copies
(d) Scale command is used to draw plain scales

Answer: (i) a (ii) c (iii) c (iv) d (v) c (vi) d (vii) c (viii) b (ix) c (x) c (xi) c (xii) c
(xiii) b (xiv) b (xv) b (xvi) a (xvii) d (xviii) b (xix) a (xx) b (xxi) d (xxii) a
(xxiii) c (xxiv) b (xxv) d