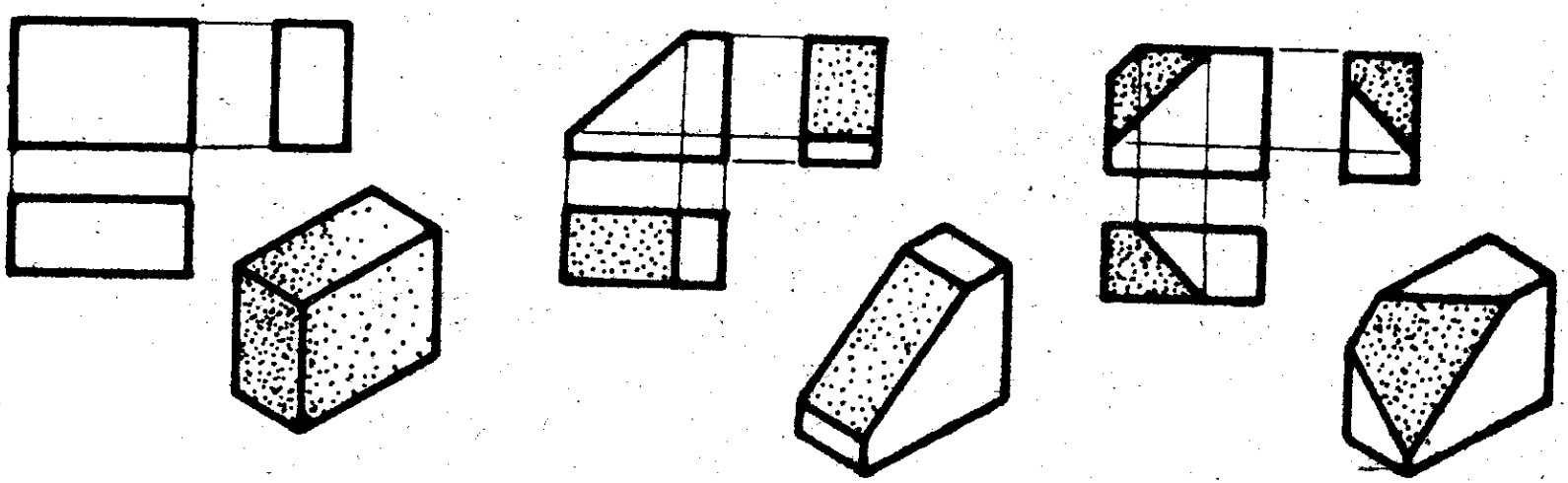
ME 101 ENGINEERING GRAPHICS

CHAPTER 4

ORTHOGRAPHIC DRAWING

4.8. CLASSIFICATION OF SURFACES AND LINES

Any object, depending upon its shape and space position, may or may not have some surfaces parallel or perpendicular to the planes of projection.



A- Horizontal, frontal and Profile surfaces

B-One auxiliary inclined surface

C- One oblique surface

Fig.4.15. Classification of surface positions

Surfaces are classified according to their space relationship with the planes of projection (Fig.4.15). Horizontal, frontal, and profile surfaces are shown at (A). When a surface is inclined to two of the planes of projection (but perpendicular to third) as at (B), the surface is called auxiliary or inclined; if the surface is at an angle to all three planes of projection as at (C) the term oblique or skew is used.

The edges (represented by lines) bounding a surface may, because of the shape or position of the object also be in a simple position or inclined to the planes of projection, A line in or parallel to a plane of projection takes its name from the plane, Thus a horizontal line is a line in a horizontal plane a frontal line is a line in a frontal plane, and a profile line is a line in a profile plane. When a line is parallel to two planes, the line takes the name of both planes, as horizontal-frontal, horizontal-profile or frontal-profile line. A line not parallel to any plane of projection is called an oblique or skew line. (Fig.4.16) shows various positions of lines.

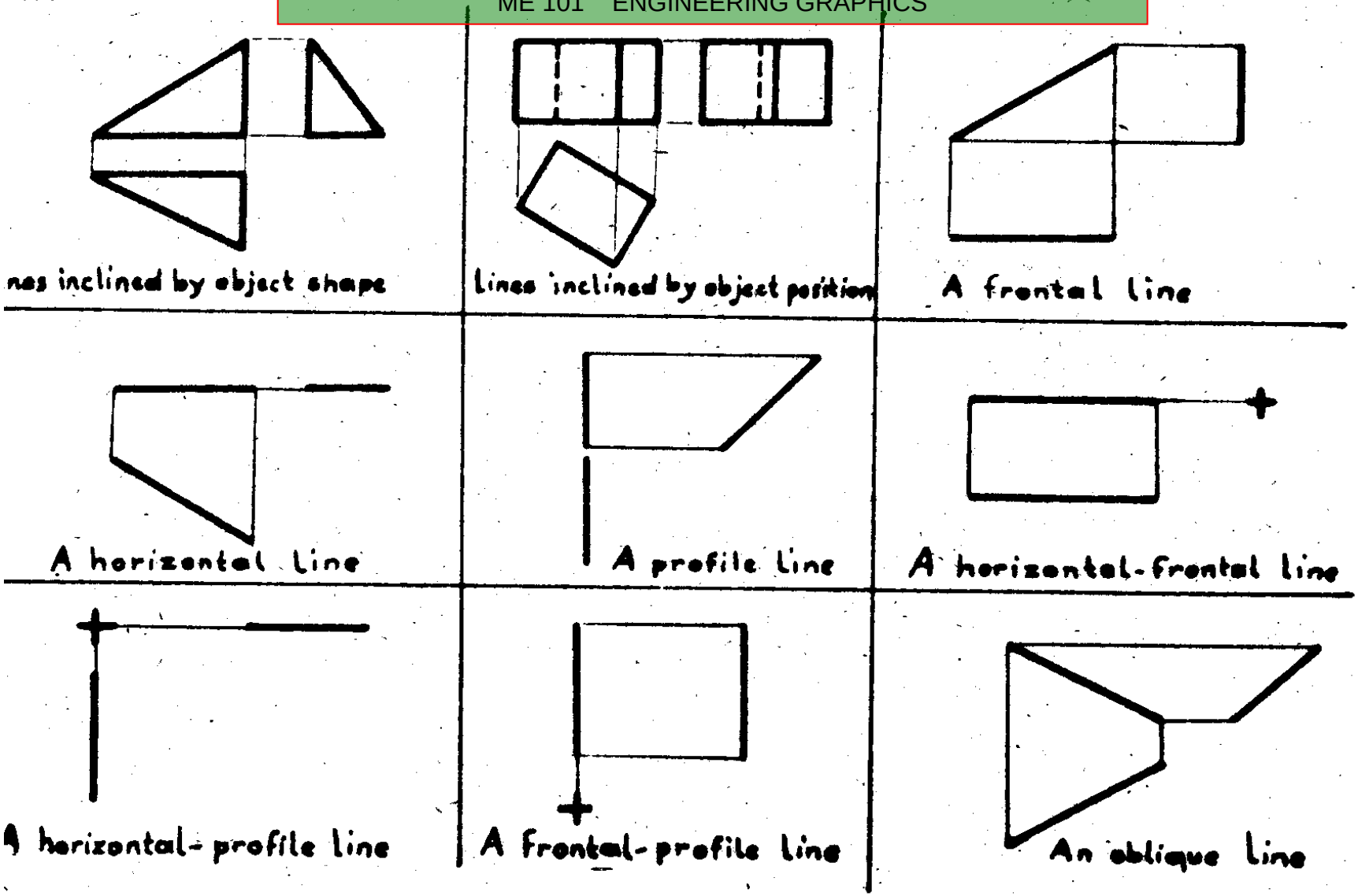


Fig. 4. 16 Classification of line positions

4.9. REPRESENTATION OF LINES

The lines on a drawing may indicate three different-types of direction change on the object. An edge view is a line showing the edge of a receding surface that is perpendicular to the plane of projection. An intersection is a line formed by the meeting of two surfaces when either one surface is parallel and one at an angle to the plane of projection. A surface limit is a line that indicates the reversal of direction of a curved surface or the series of points of reversal on a warped surface. (Fig.4.17) illustrates the different line meanings. So; a line on a drawing indicates:

1. The edge view of a surface
2. The intersection of two surfaces
3. The surface limit.

Representation of Lines

The lines on a drawing may indicate three different types of directional change on the object.

- An edge view is a line showing the edge of a receding surface that is perpendicular to the plane of projection.
- An intersection is a line formed by the meeting of two surfaces when either one surface is parallel and one at an angle, or both at an angle to the plane of projection.
- A surface limit is a line that indicates the reversal of direction of a curved surface (or the series of points reversal on a warped surfaces).

A line on a drawing indicates:

a) The edge view of a surface

b) The intersection of two surfaces

c) The surface limit

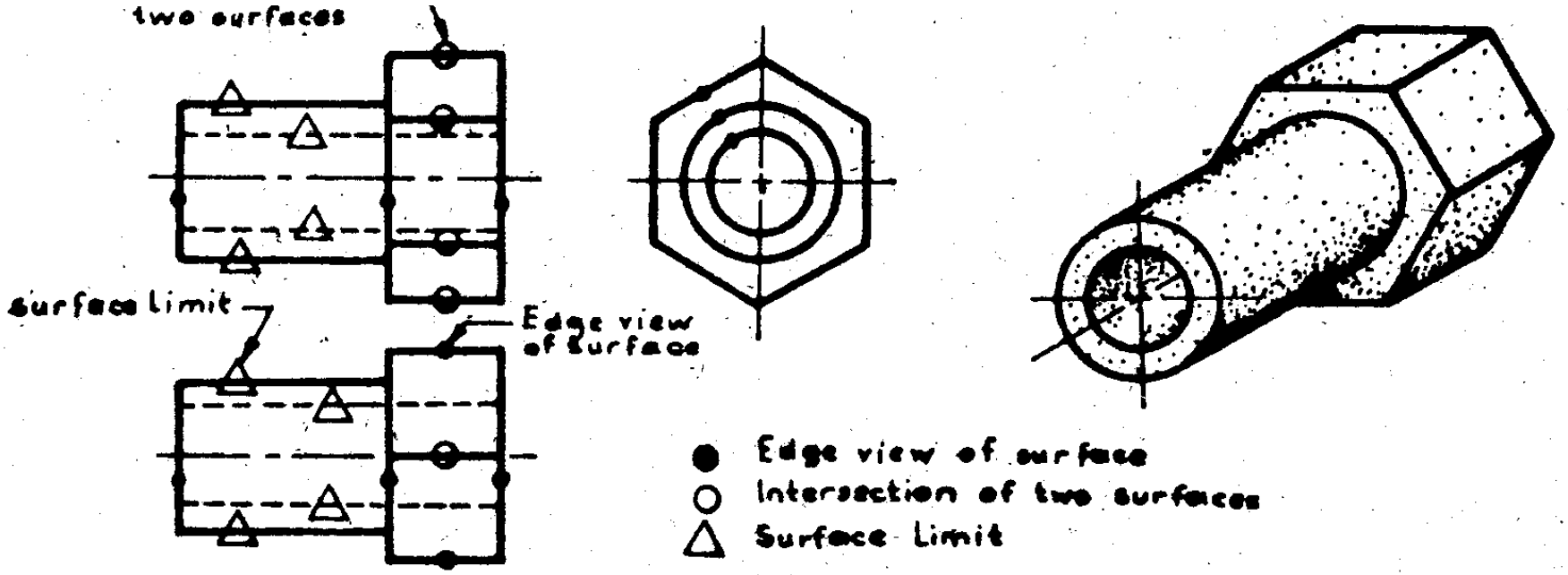
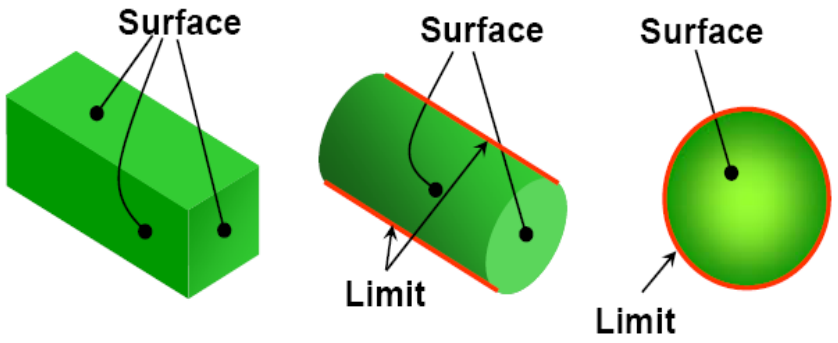


Fig.4.17. What a line indicates

Representation of Lines

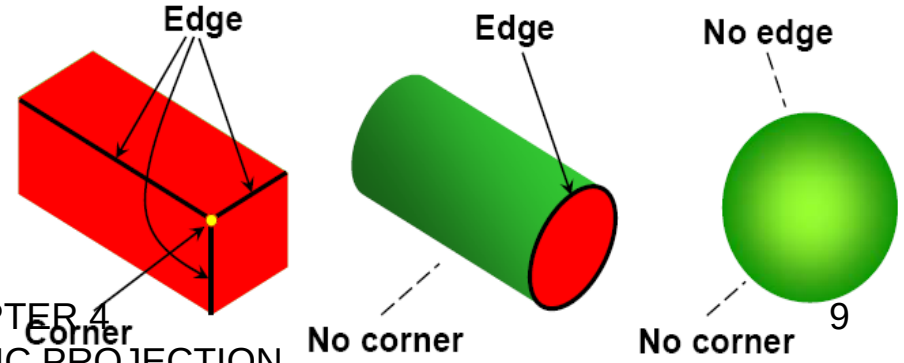
Object features

- Surfaces are areas that are bounded by edges of limited element.
- Limiting element is a line that represents the last visible part of the curve surface.



Object features

- Edges are lines that represent the boundary between two faces.
- Corners represent the intersection of two or more edges.



4.10. HIDDEN FEATURES

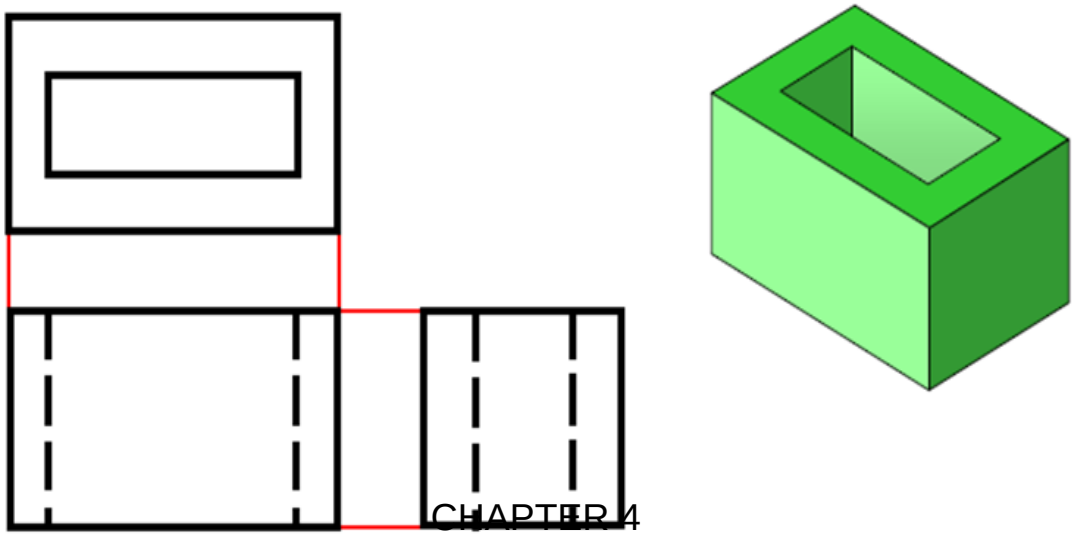
To describe an object completely, a drawing should contain lines representing all the edges, intersections and surface limits of the object. In any view there will be some parts of the object that cannot be seen from the position of observer, as they will be covered by portions of the object closer to observers eye. The edges, intersections and surface limits of these hidden parts are indicated by a discontinuous line called a dashed-line. For line indicating hidden features so sometimes the term hidden line used. However in this treatise the term dashed line will be used because it accurately describes the appearance of the line.

4.10 Hidden Features

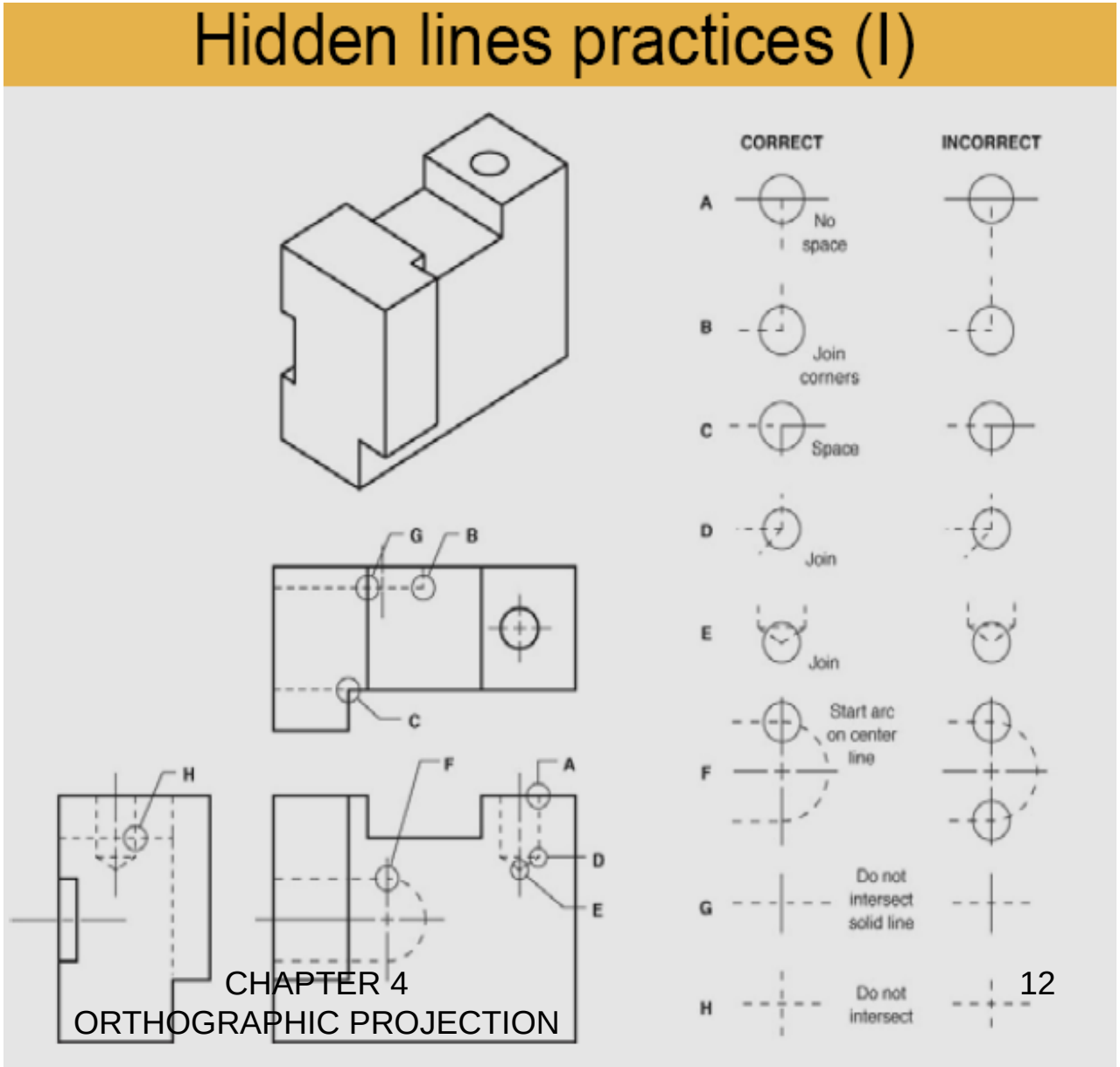
➢ In order to describe an object completely, a drawing should contain lines representing al the edges, intersections and surface limits of the object.

➢ In any view there will be some parts of the object that cannot be seen from the position of observer, as they will be covered by portions of the object closer to observers eye.

➢ The edges, intersections, and surface limits of these hidden parts are indicated by a discontinuous line called a dashed line (or hidden line).

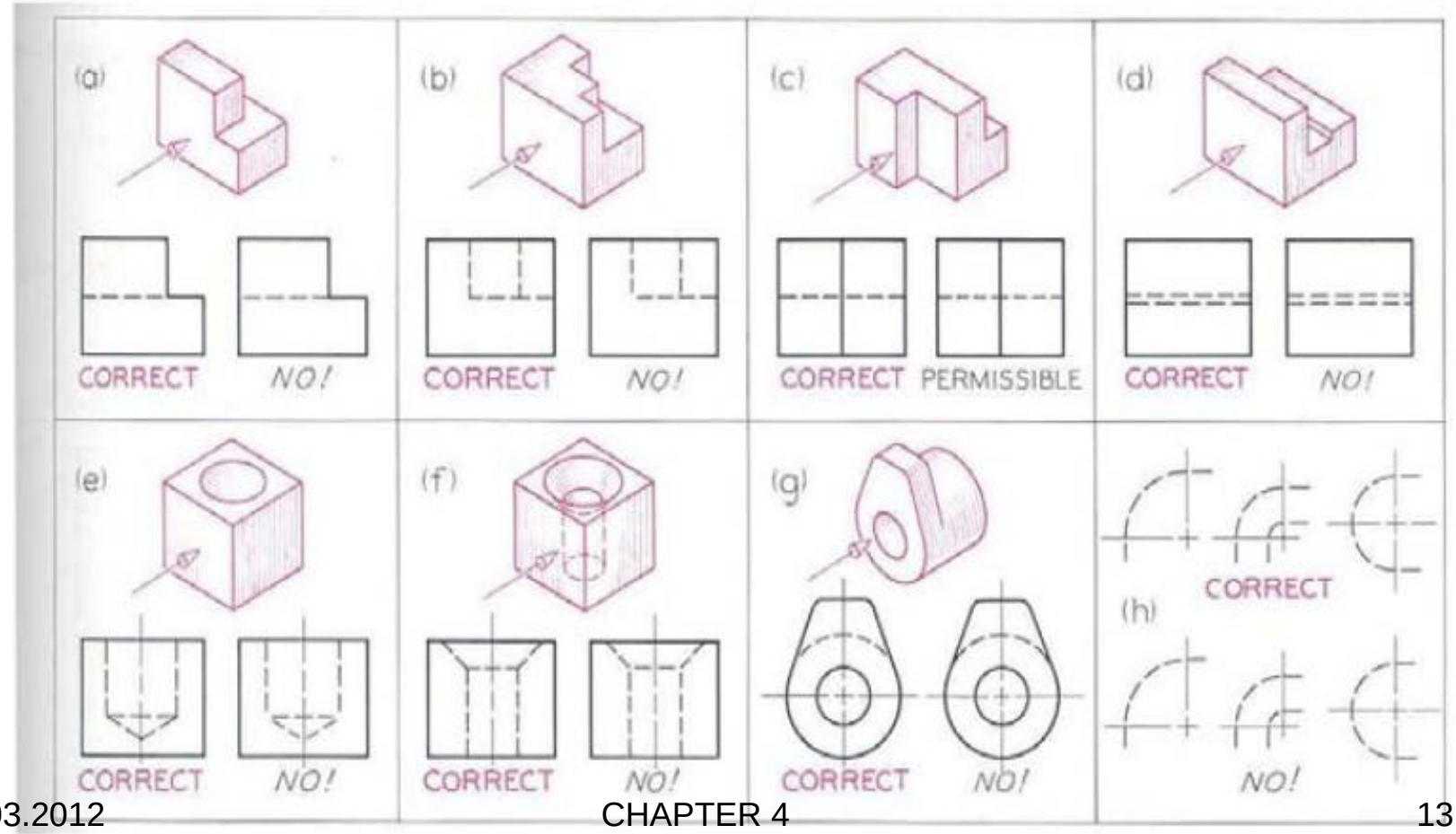


Hidden Features



Hidden Features

Hidden lines practices (II)



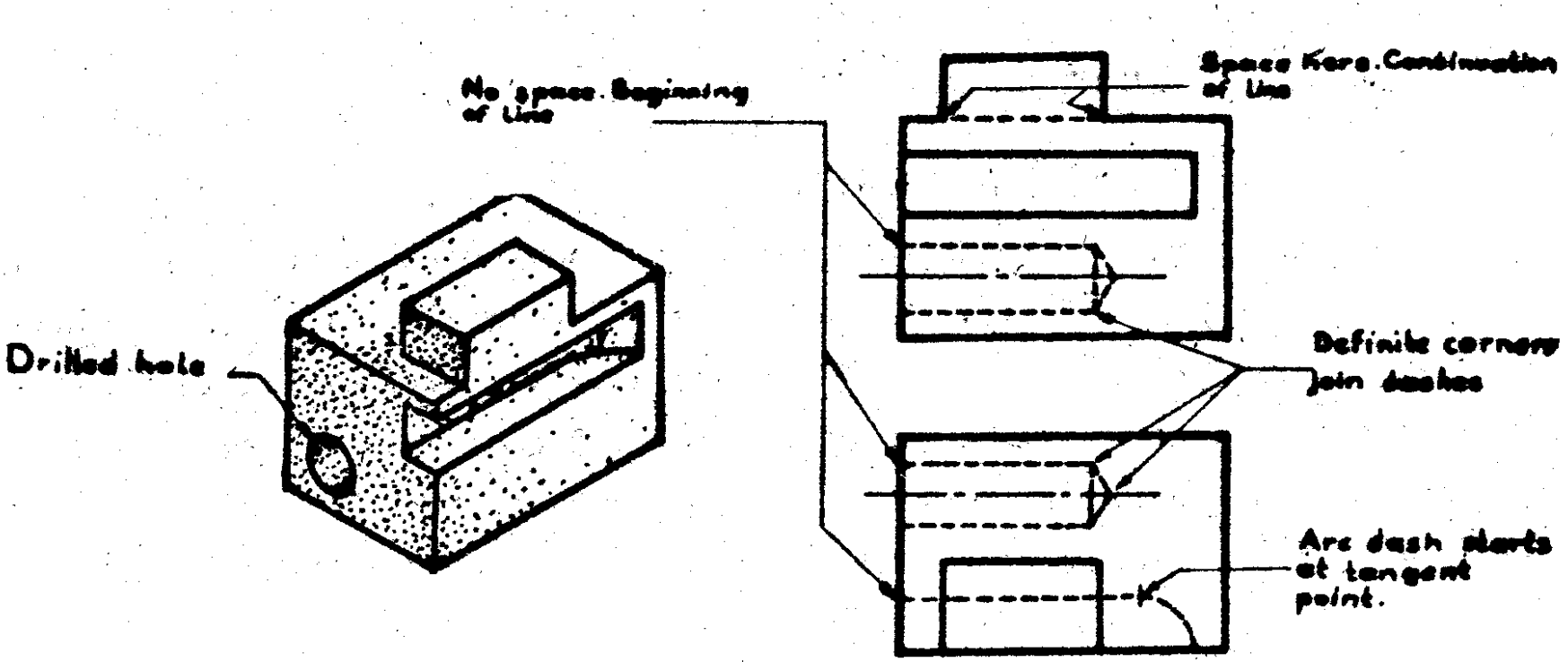


Fig. 4. 18 Dashed-line technique. Note especially that a dashed-line begins with a space when it continues in the same direction as a full line.

In (Fig.4.18) the drilled hole that is visible in the left side view is hidden in the front and top views. And therefore it is indicated in these views by a dashed line showing the hole and the shape as left by the drill point, The milled slot is visible in the front and side views but is hidden in the top view.

The beginner must pay particular attention to the execution of these dashed lines. If carelessly drawn, they ruin the appearance of the drawing and make it harder to read. Dashed lines are drawn lighter than full lines, of short dashes uniform in length with the space between them very short, about one-fourth the length of dash. Also it is important that they start and stop correctly. See and study carefully all dashed lines in (Fig. 4.19 and 4.20).

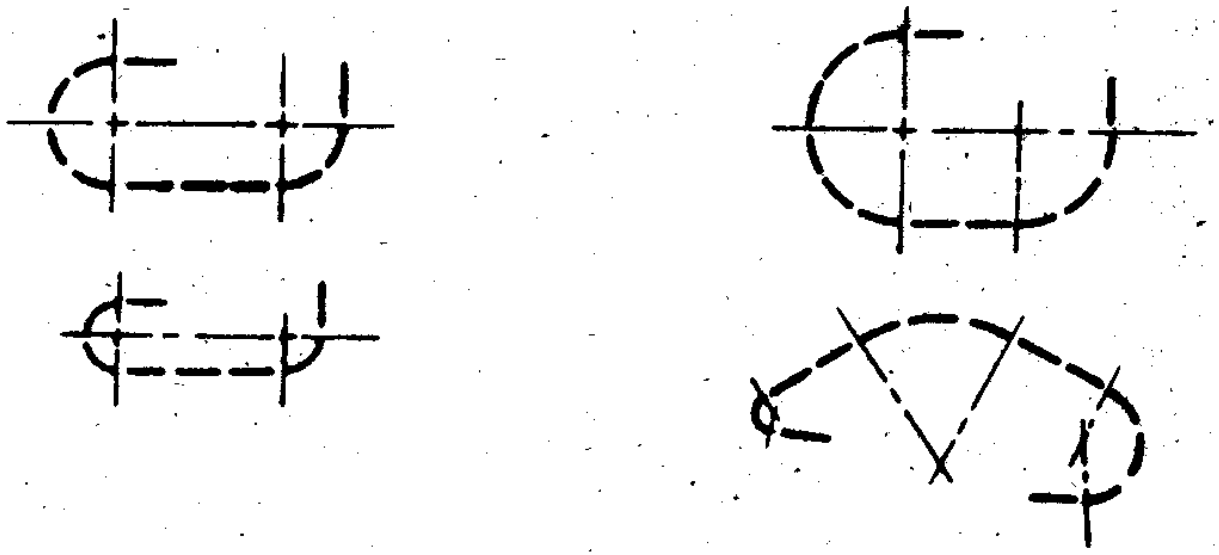


Fig. 4. 19 Dashed arcs.

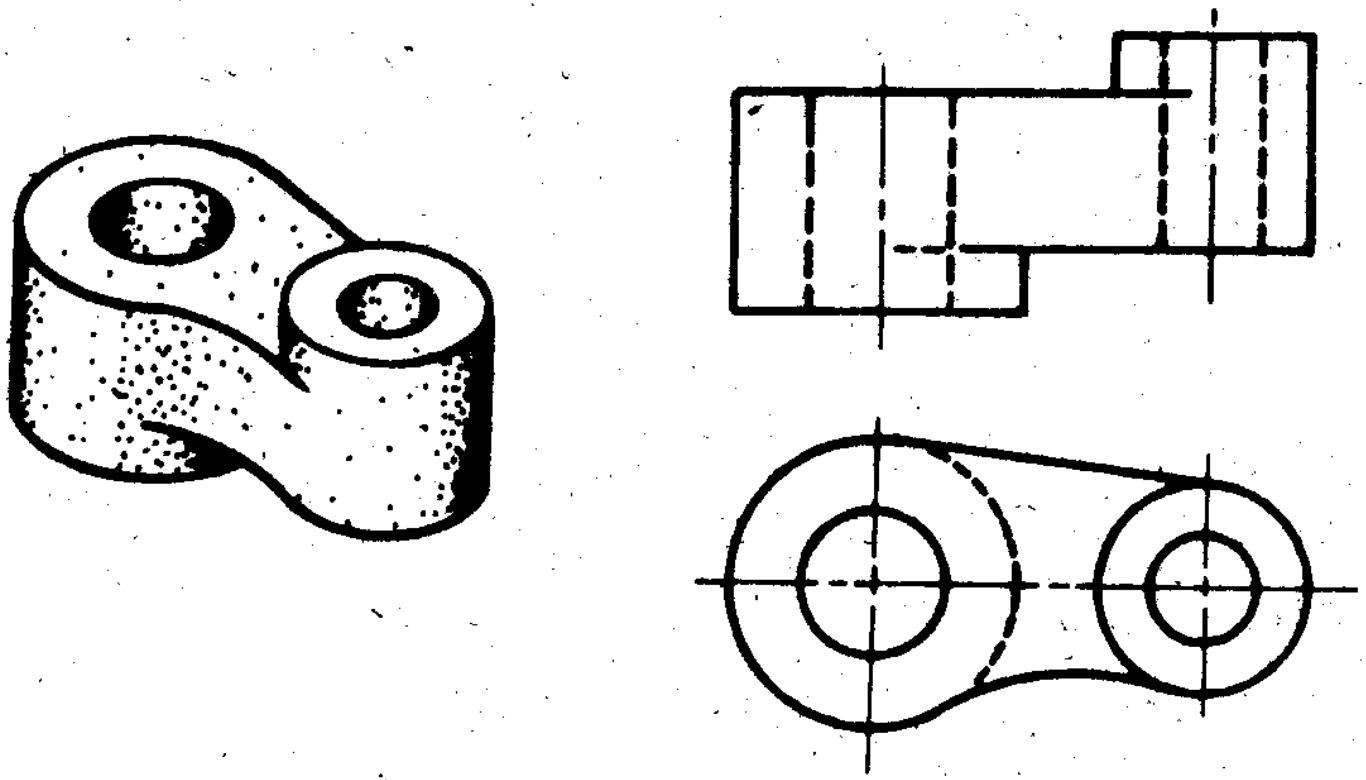


Fig.4.20. Dashed-lines and arcs.

4. 11 CENTER LINES

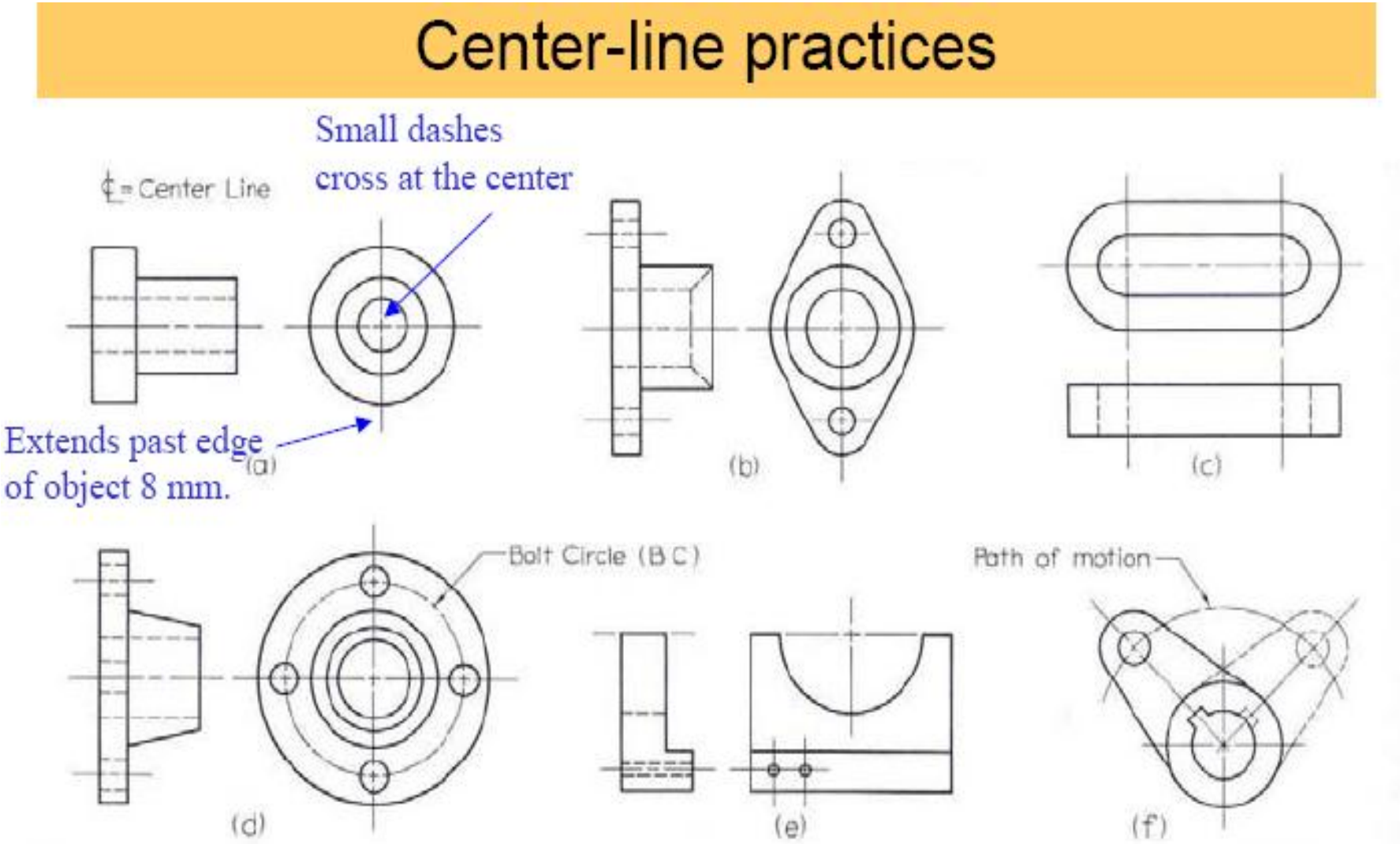
In general, the first lines drawn in the layout of an engineering drawing are the centre lines, which are the axes of symmetry for all symmetrical views or portion of views.

1. Every part with an axis such as a cylinder or a cone will have the axis drawn as a centre line before the part is drawn

2. Every circle will have its centre at the intersection of two mutually perpendicular centre lines

   The standard symbol for centerlines on finished drawings is a fine line made up of alternate long and short dashes as given in the alphabet of lines (Fig.1.24). Centre lines are always extended slightly beyond the outline of the view or portion of the view to which they apply. They form the skeleton construction of the drawing. The important measurements are made and dimensions given to and from these lines.

Center Lines



Precedence of lines

❑ In a drawing there might be coincidence of lines, invisible portions of the object may project to coincide with visible portions.

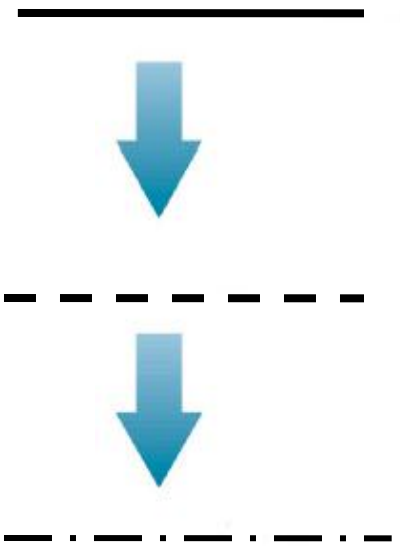
❑ The physical features of the object must be represented so, full and dashed lines take precedence over all lines. Since the visible outline is more prominent by space position, full line takes precedence over dashed lines.

The following list gives the order of precedence of lines:

1. Full line
2. Dashed line
3. Center line or cutting-plane line
4. Break line
5. Dimensions and extension lines
6. Crosshatching lines

Precedence of lines

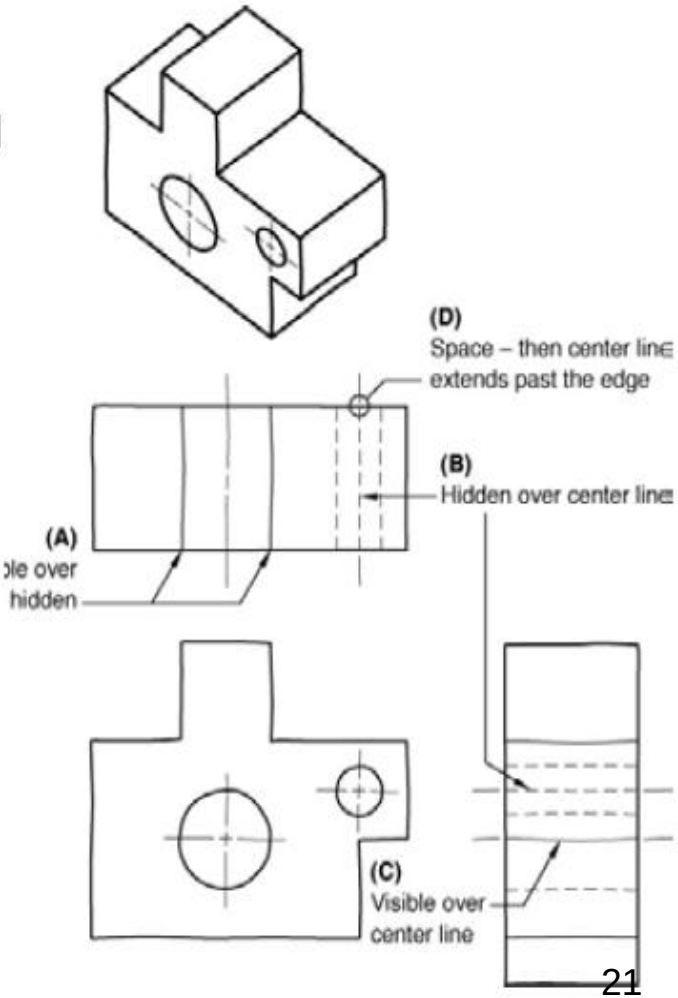
Precedence of lines



VISIBLE LINE takes precedence over all other lines

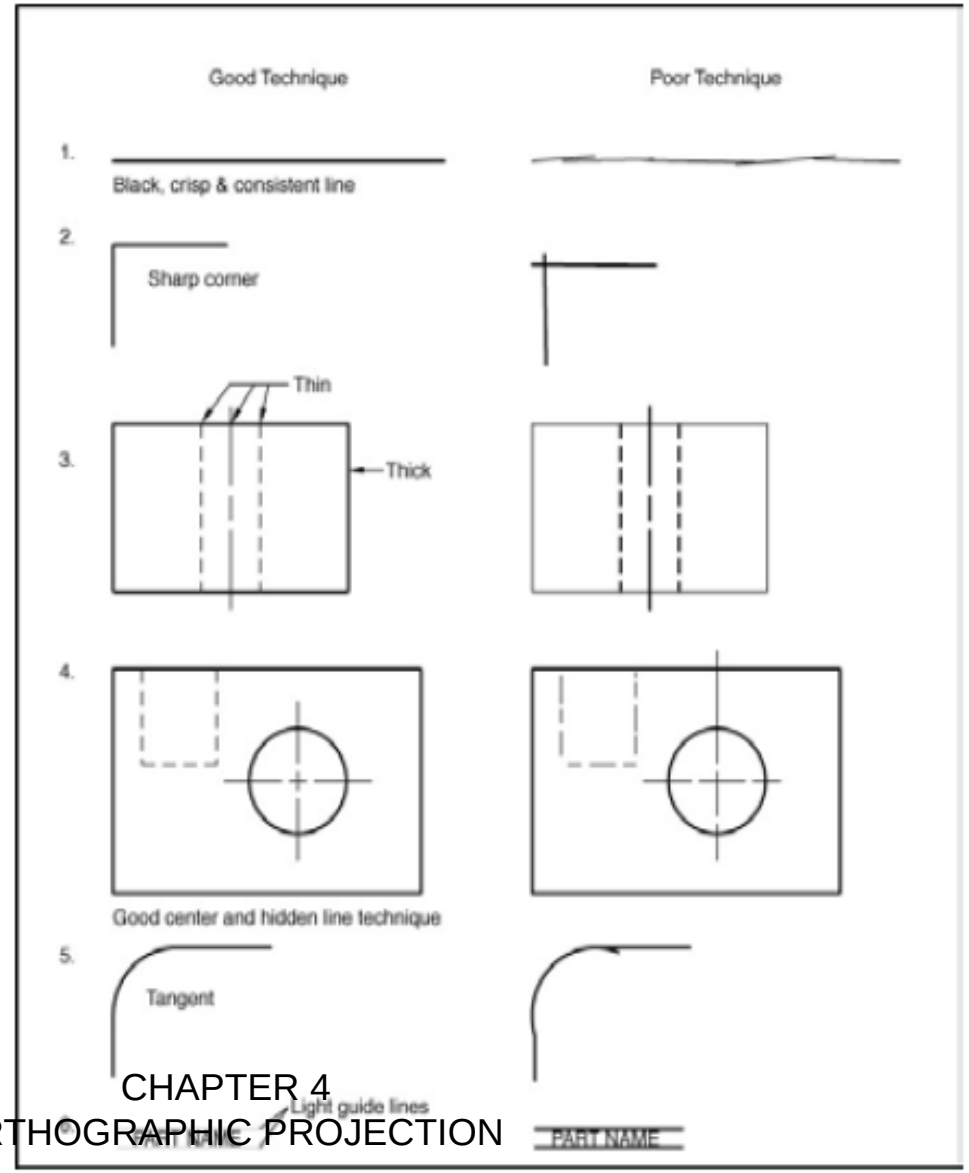
HIDDEN LINE and CUTTING PLANE LINE take precedence over center lines

CENTER LINE does not have precedence



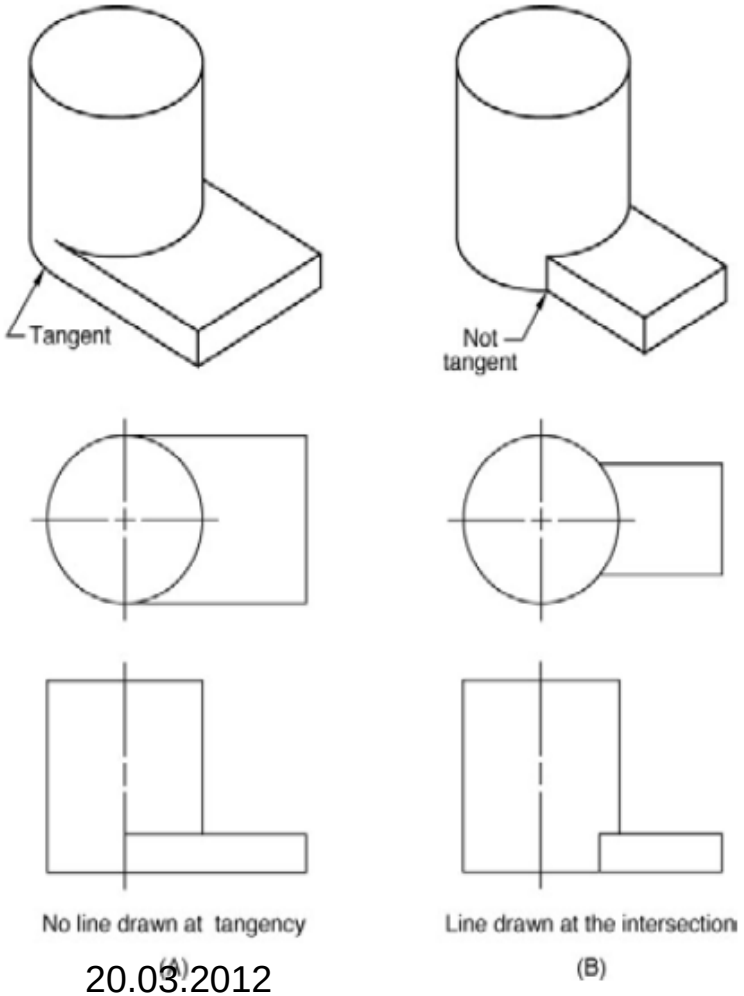
Drawing tips

Good & poor techniques

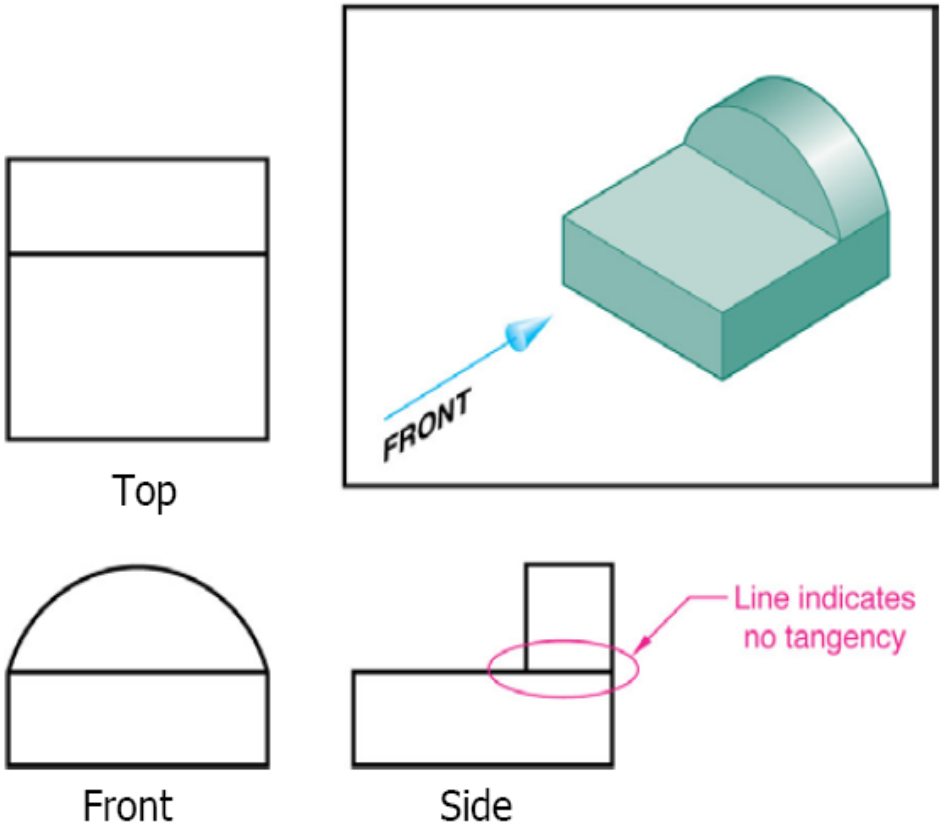


Drawing tips

Tangency v.s. Edges

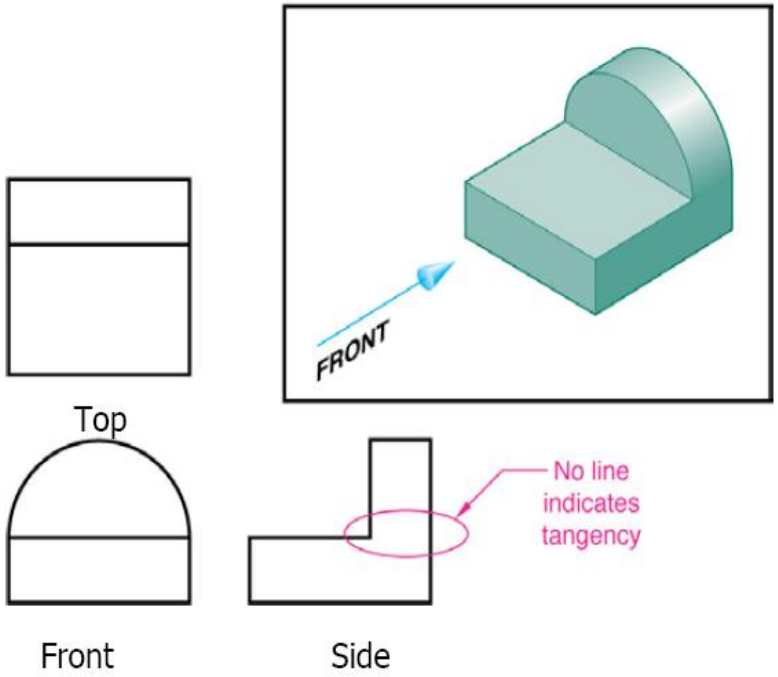


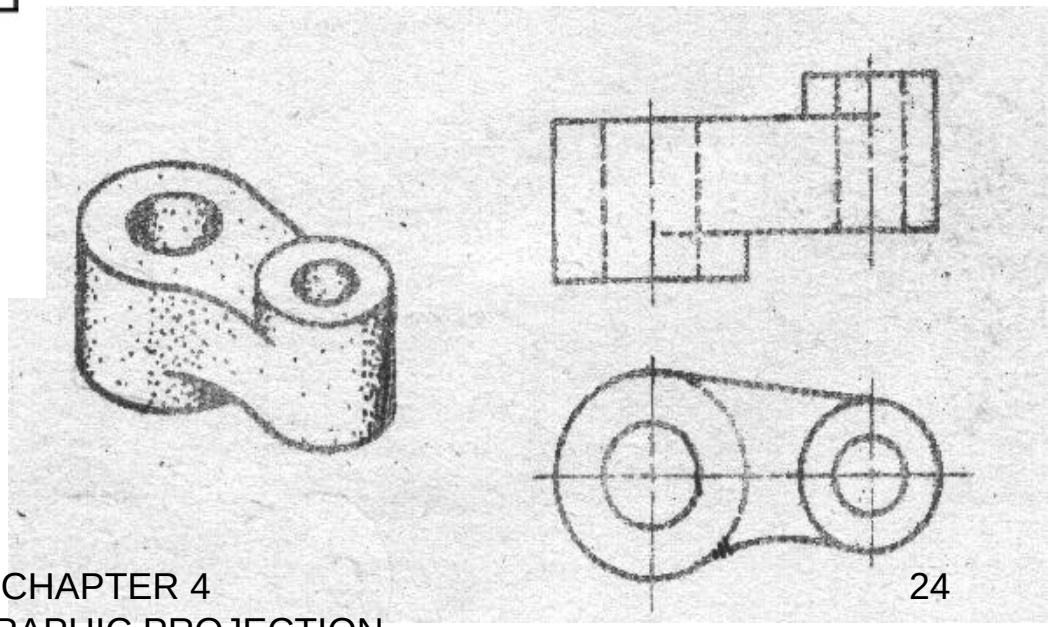
Representation of non-tangency



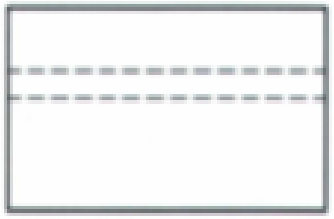
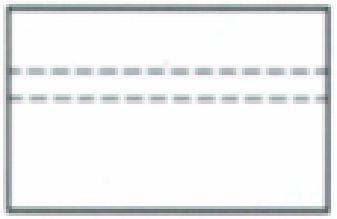
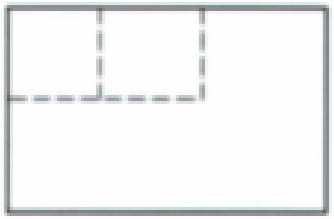
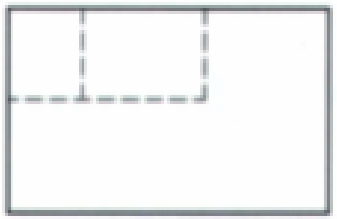
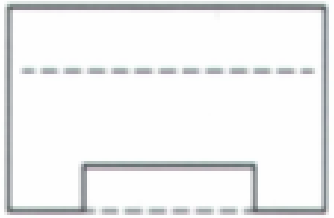
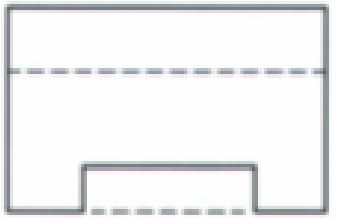
Drawing tips

Representation of tangency

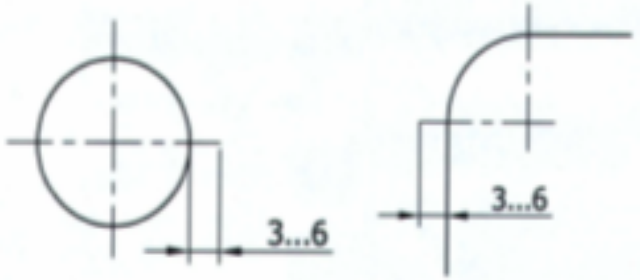
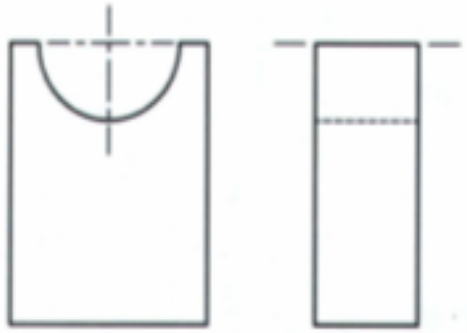




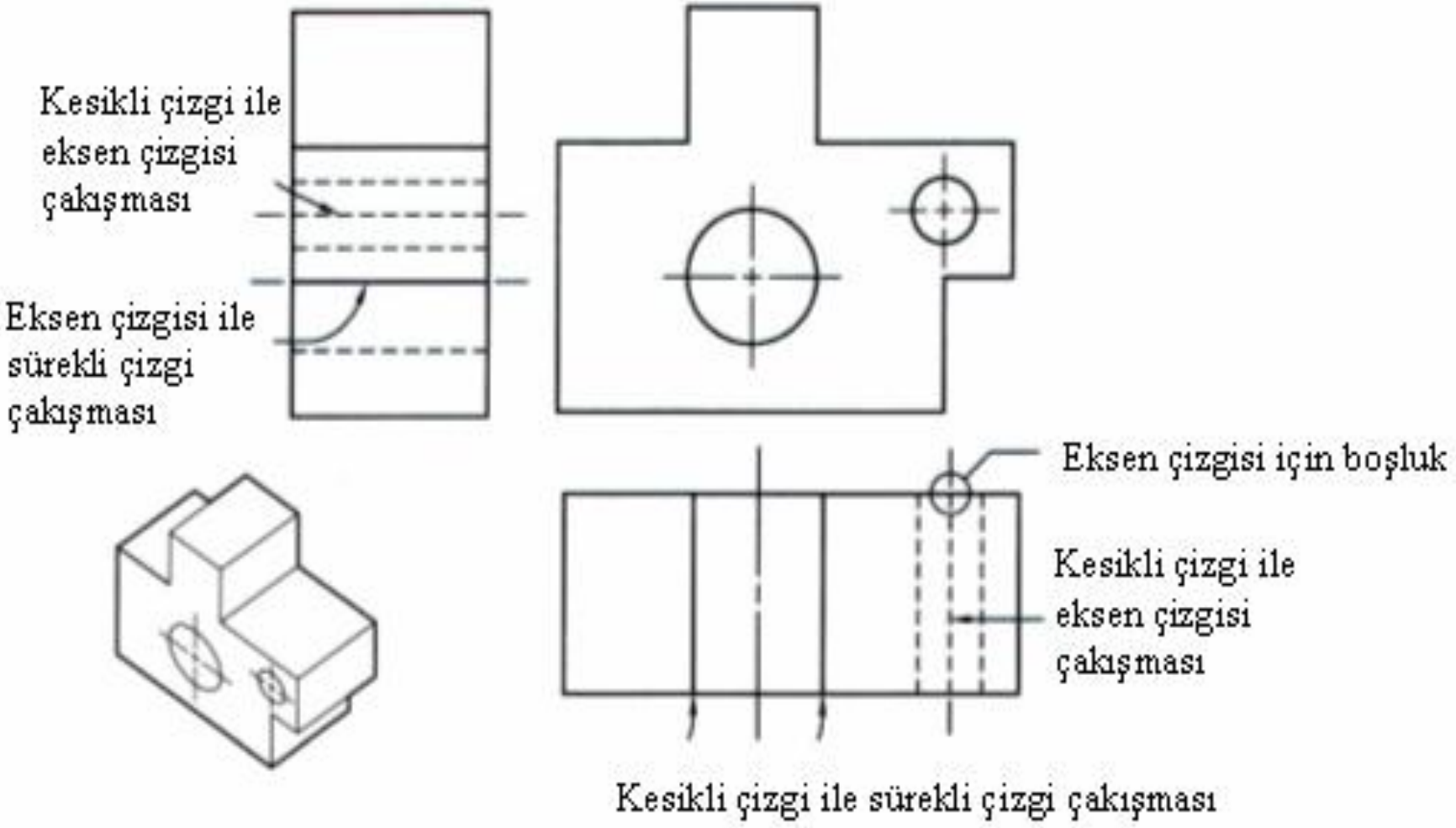
Drawing tips

	HATALI	DOĞRU
Kesikli çizgiler sürekli ve homojen olmalıdır		
İki kesikli çizgi, paralel olarak çizilecekse, birbirinden kaçık olmalıdır.		
İki kesikli çizgi bir noktada birleşiyorsa, birleştirilirler. Kesik çizgi ikinci bir kesik çizgiden başlamalıdır.		
Kesikli çizgi, sürekli kalın çizgiden başlıyorsa, sürekli çizgiye birleştirilir. Eğer sürekli çizginin devamı olarak çizilecekse, araya bir boşluk bırakılır.		

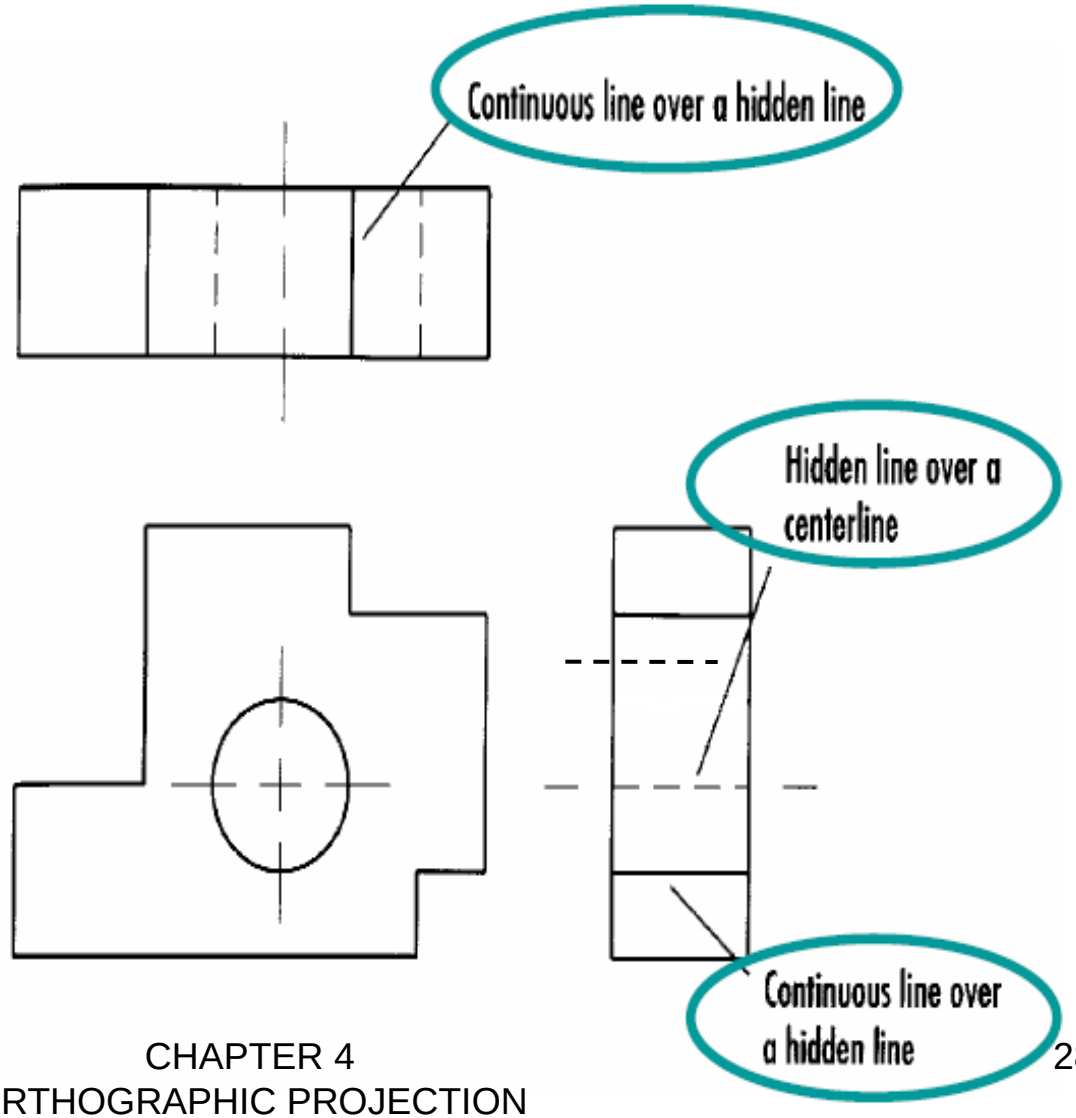
Drawing tips

Eksen çizgilerinde uzun çizgilerden sonra kısa çizgi kullanılmalı ve eksen çizgisi boyunca çizgilerin boyları değişmemelidir.	
Çember ve yayların çiziminde, eksen çizgileri geometriden 3...6 mm taşarak çizilmelidir.	
Çapı 12 mm den küçük olan çemberin veya 12 mm den küçük boyuta sahip dörtgenlerin simetri eksenleri için ince sürekli çizgi kullanılır.	
Sürekli çizgi ile birleştirilmemeli, arada boşluk bırakılmalıdır.	

Drawing tips



Drawing tips



4.12. PRECEDENCE OF LINES

In any view there is likely to be a coincidence of lines, invisible portions of the object may project to coincide with visible portions. Centre lines may occur where there is a visible or invisible outline of some part of the object.

The physical features of the object must be represented so, full and dashed lines take precedence over all lines. Since the visible outline is more prominent by space position, full line takes precedence over, dashed lines. A full line could cover a dashed line, but a dashed line could not cover a full line. It is a fact that a dash line could not occur as one of the boundary lines of a view.

The following list gives the order of precedence of lines:

1. Full line
2. Dashed line
3. Center line or cutting-plane line
4. Break lines
5. Dimensions and extension lines
6. Crosshatching lines.

4.13. PROJECTION EXERCISES

The principal task in learning orthographic projection is to become thoroughly familiar with the theory and then to practice this theory by translating from a picture of the object to the orthographic views. (Fig.4.21 and 4.22) contain a variety of objects shown by a pictorial sketch and translated into orthographic views. Study the objects and note:

1. How the object is oriented in space?
2. Why the orthographic views given were chosen?
3. The projection of visible features
4. The projection of invisible features
5. Centre lines and their usage

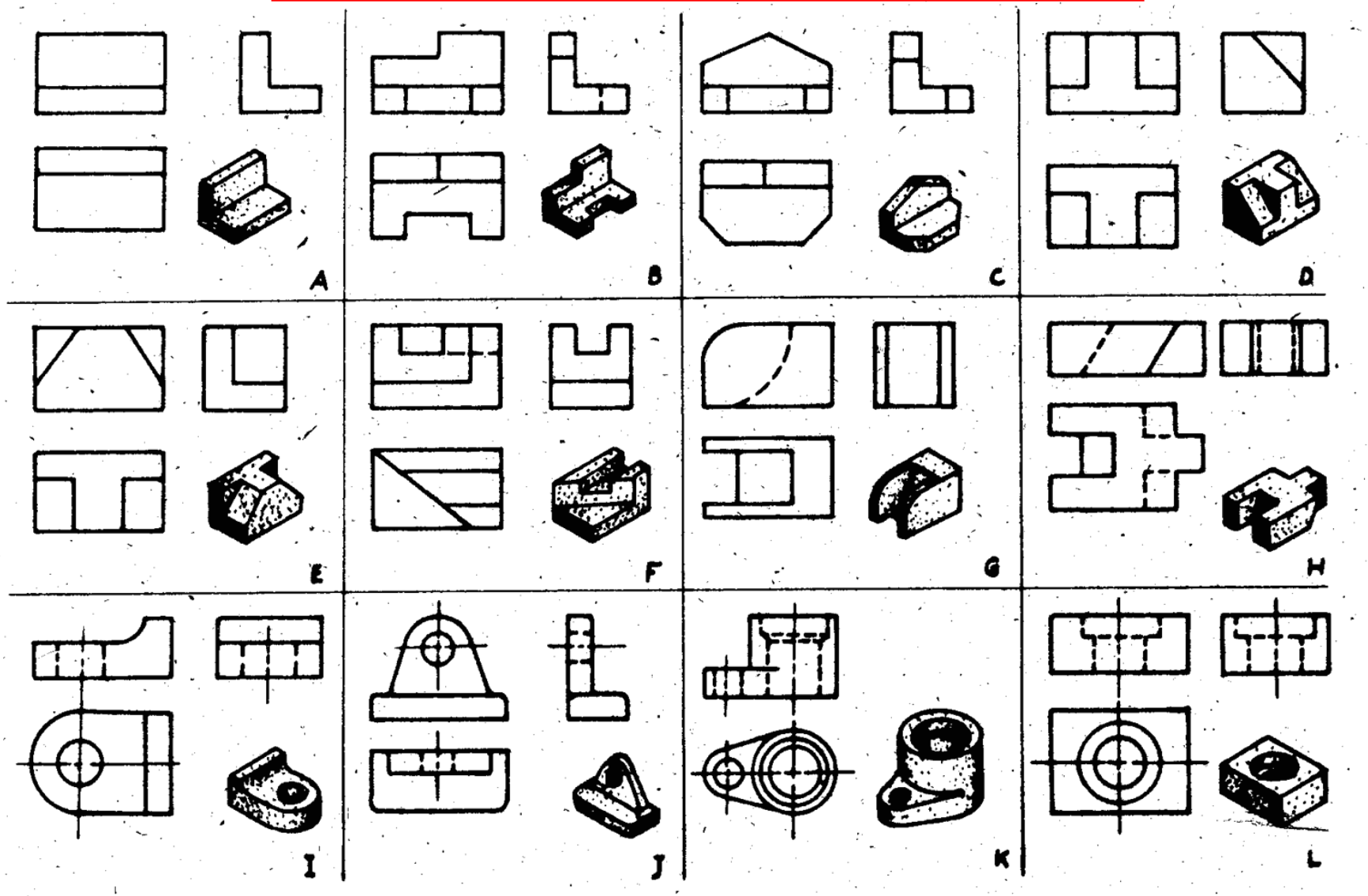


Fig. 4. 21. Projection studies. Study each picture and accompanying orthographic views and note the projection of all features.

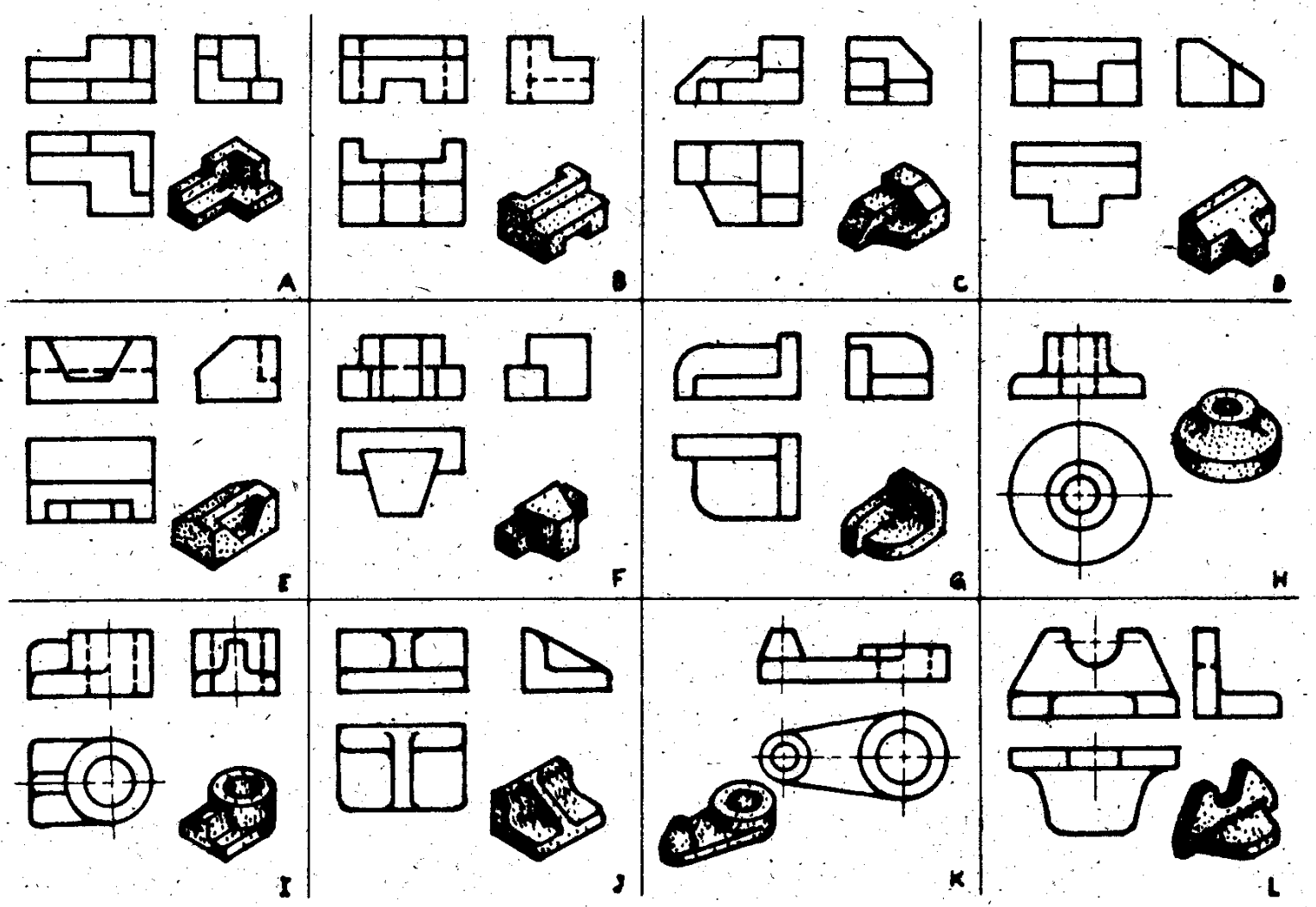


Fig. 4. 22 Projection studies. Study as same as previous fig.

4.14. OBJECT ORIENTATION

- An object can be drawn in any of several possible positions. The simplest position should be used, with the object oriented so that the principal faces are perpendicular to the looking directions for the views and parallel to the planes of projection as shown in (Fig.4.23)

- Any other position of the object, with its faces at some angle to the projection planes, would complicate the drawing, foreshorten the object faces and make the drawing difficult to make and read.

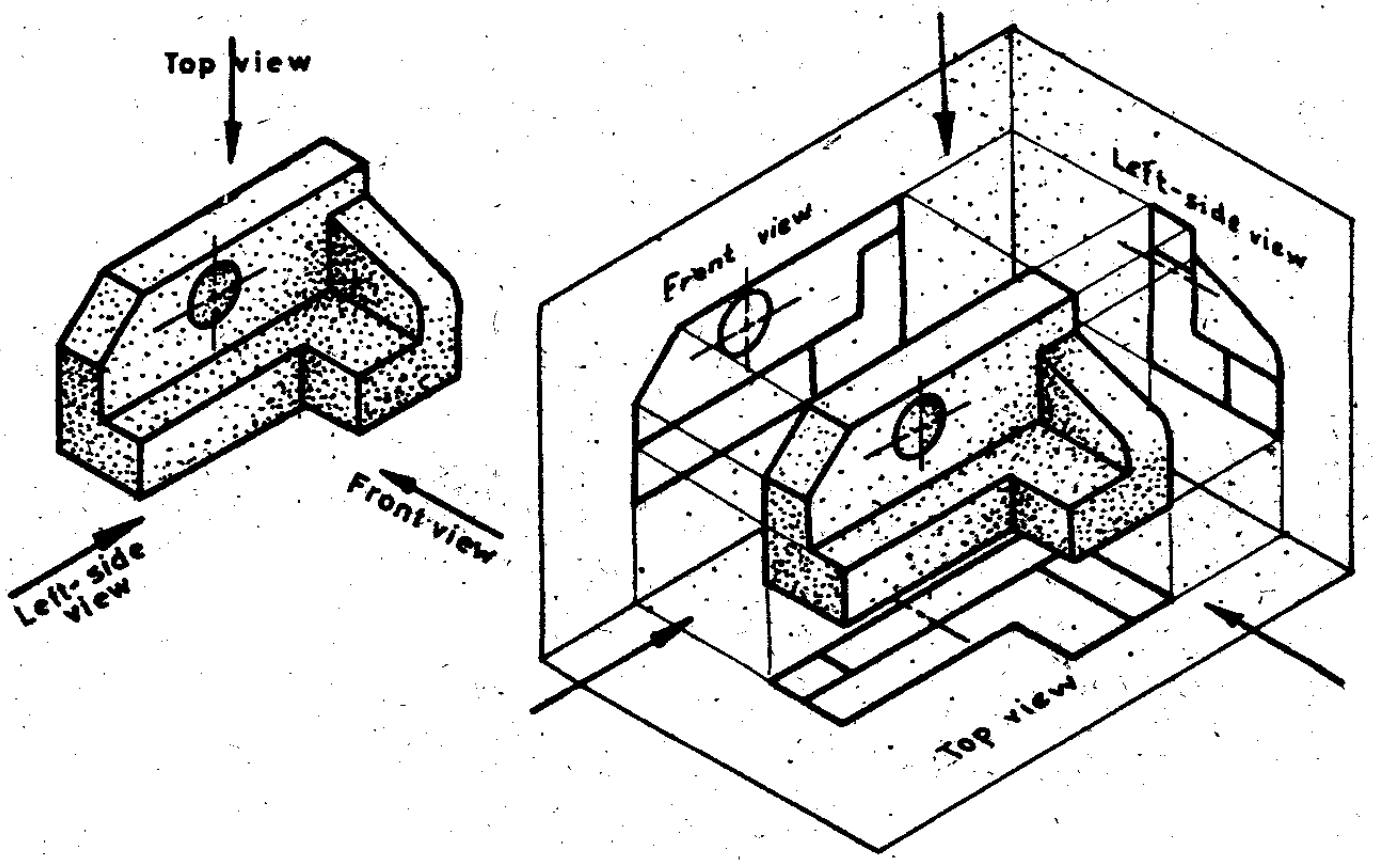


Fig. 4. 23. Object orientation. Use the simplest position. It will give the clearest possible representation and be the easiest to draw.