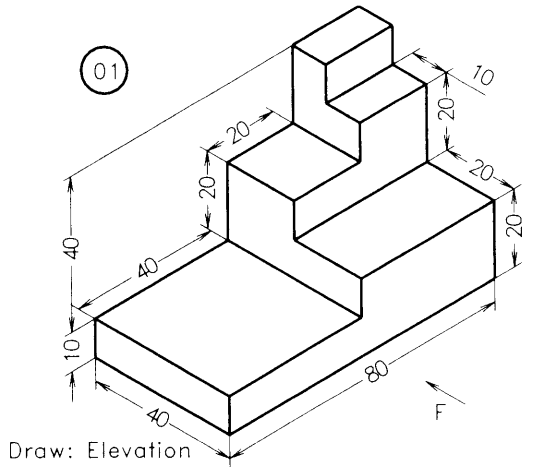
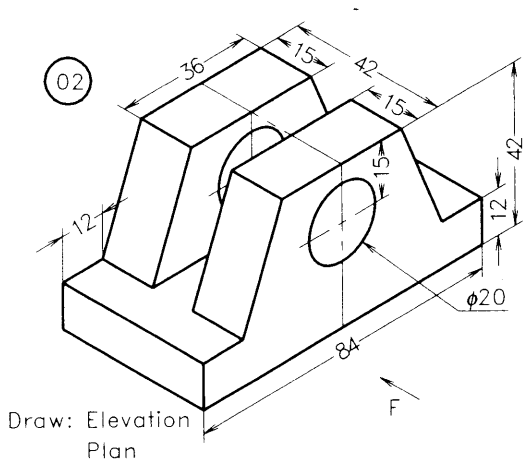
SECTION B

Questions 1 to 21: Draw orthographic views (multiviews) of the machine parts given in pictorial form (Figures 3.61 to 3.81). Name the views and dimension them as per BIS.



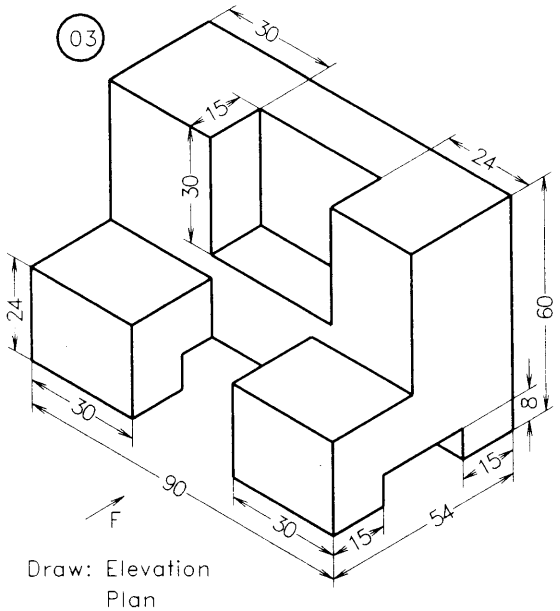
Draw: Elevation
Plan
Left side view

Figure 3.61 A block.



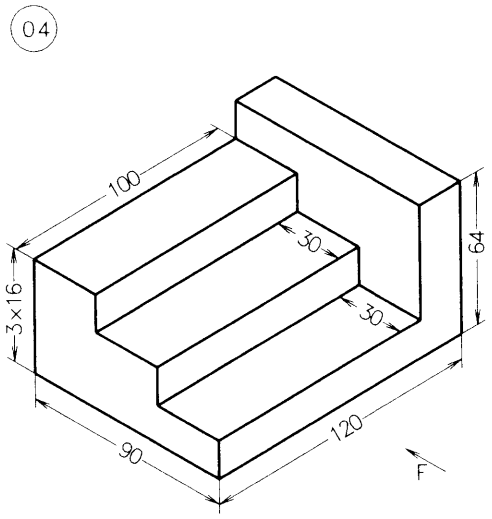
Draw: Elevation
Plan
Left side view

Figure 3.62 A block.



Draw: Elevation
Plan
Left side view

Figure 3.63 A block.



Draw: Elevation
Plan
Left side view

Figure 3.64 A block.

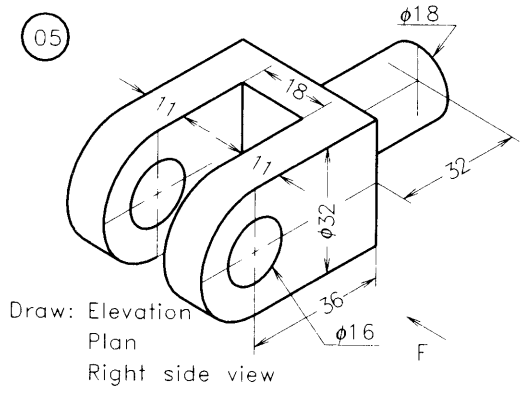


Figure 3.65 Fork end.

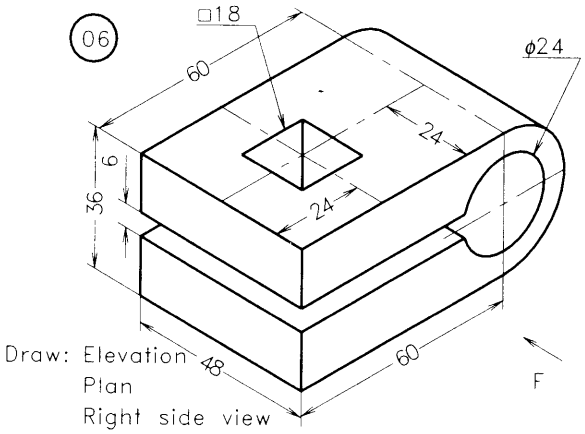


Figure 3.66 Fork end.

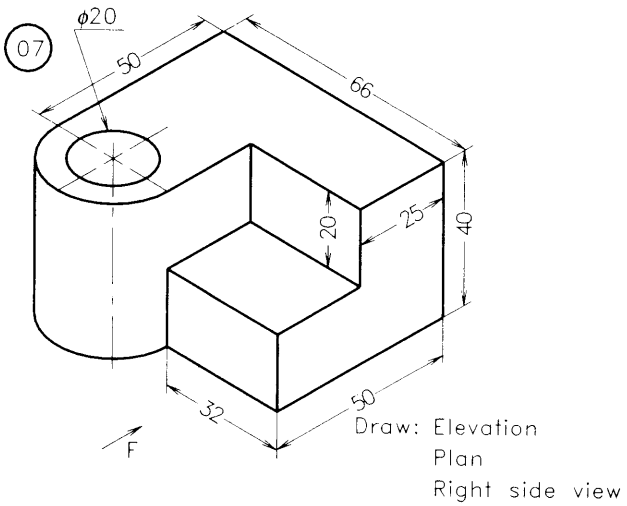


Figure 3.67 A cast iron block.

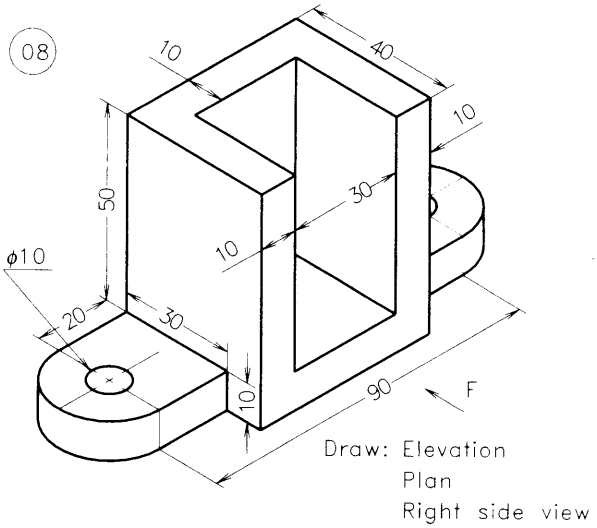


Figure 3.68 A stopper.

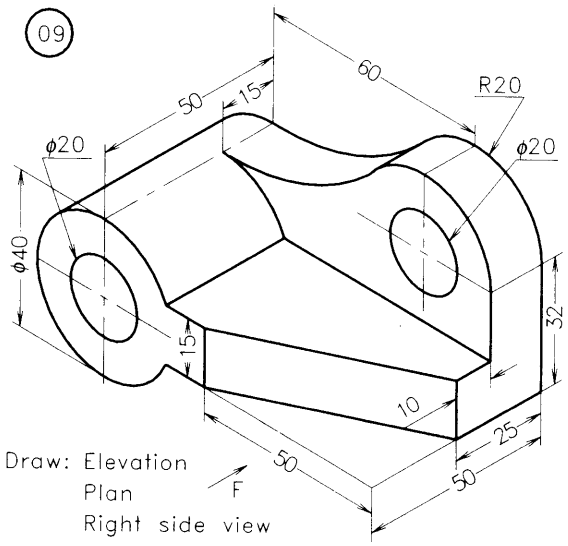


Figure 3.69 A shaft support.

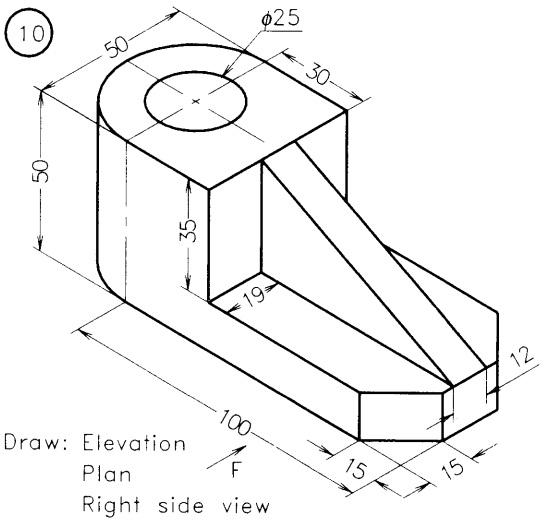


Figure 3.70 A steeped block.

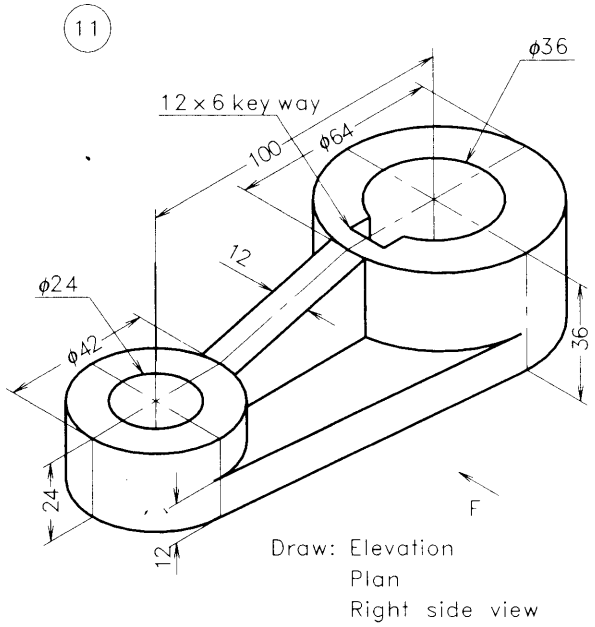


Figure 3.71 A lever.

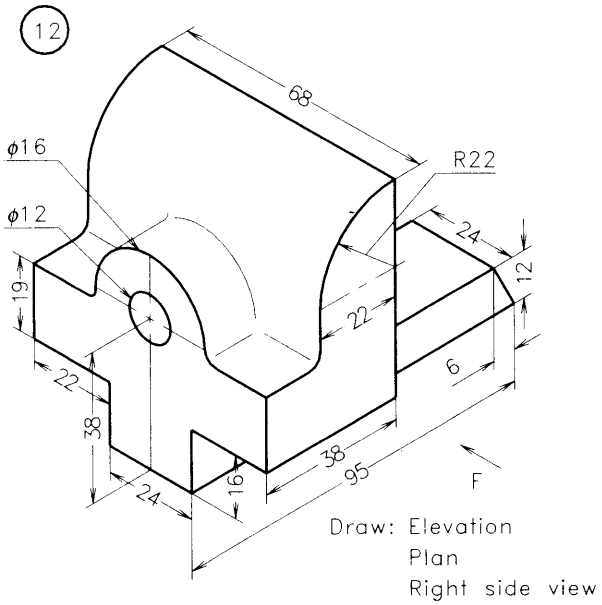


Figure 3.72 Jaw of a vice.

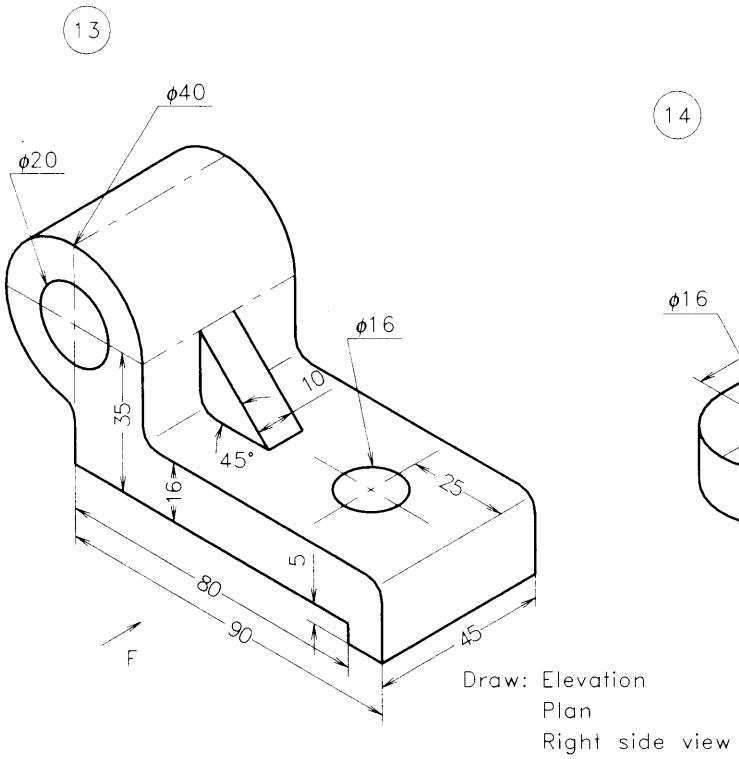


Figure 3.73 A bearing.

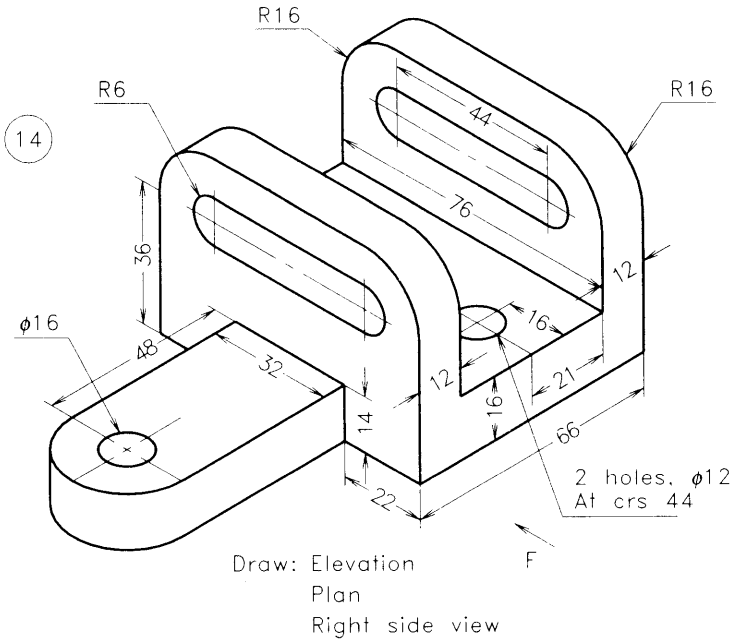


Figure 3.74 A bracket.

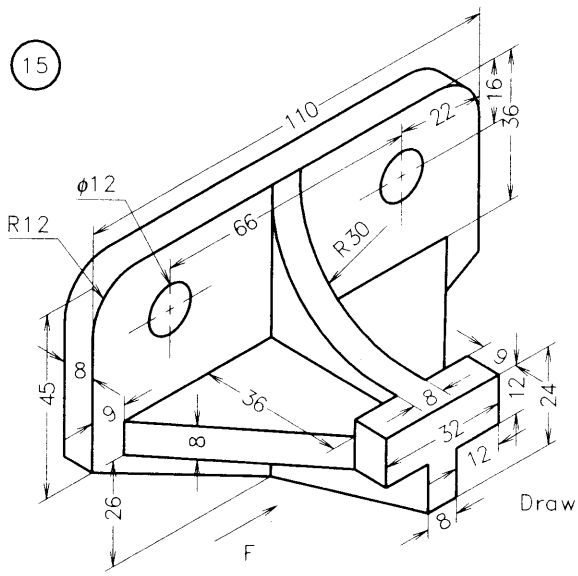


Figure 3.75 A wall bracket.

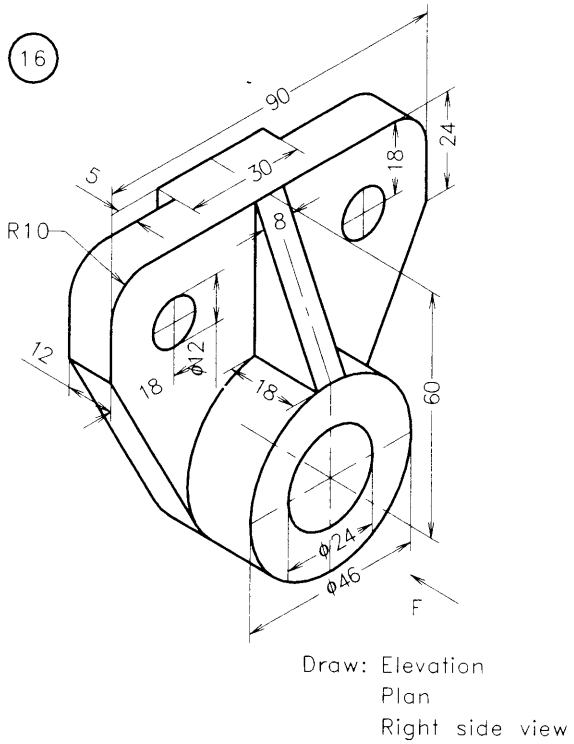


Figure 3.76 Rod support.

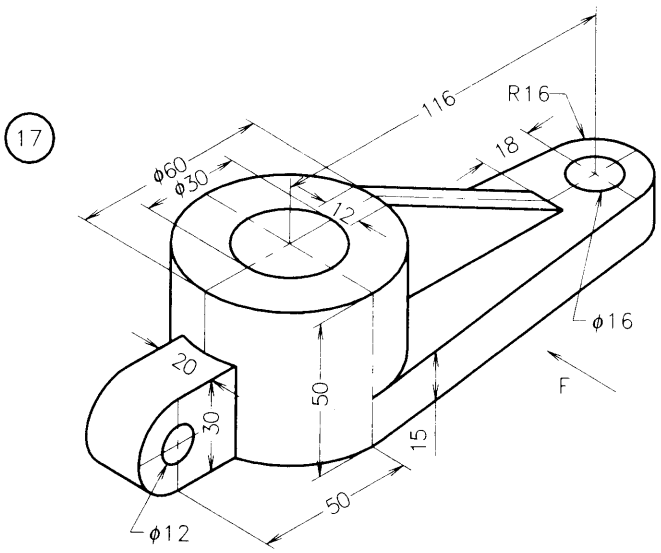


Figure 3.77 Alever.

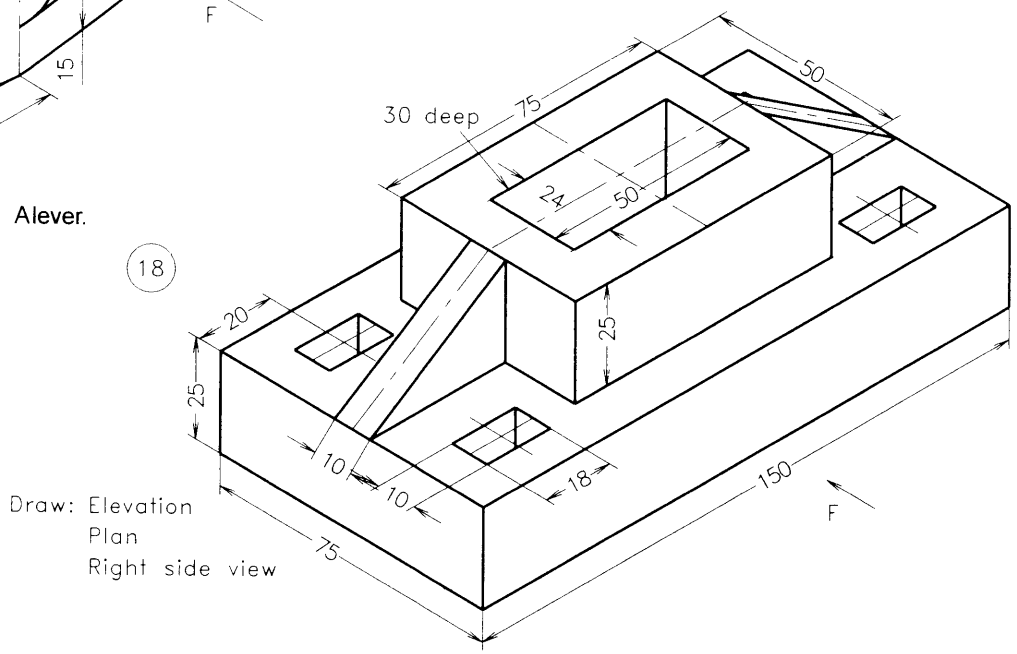


Figure 3.78 A cast iron block.

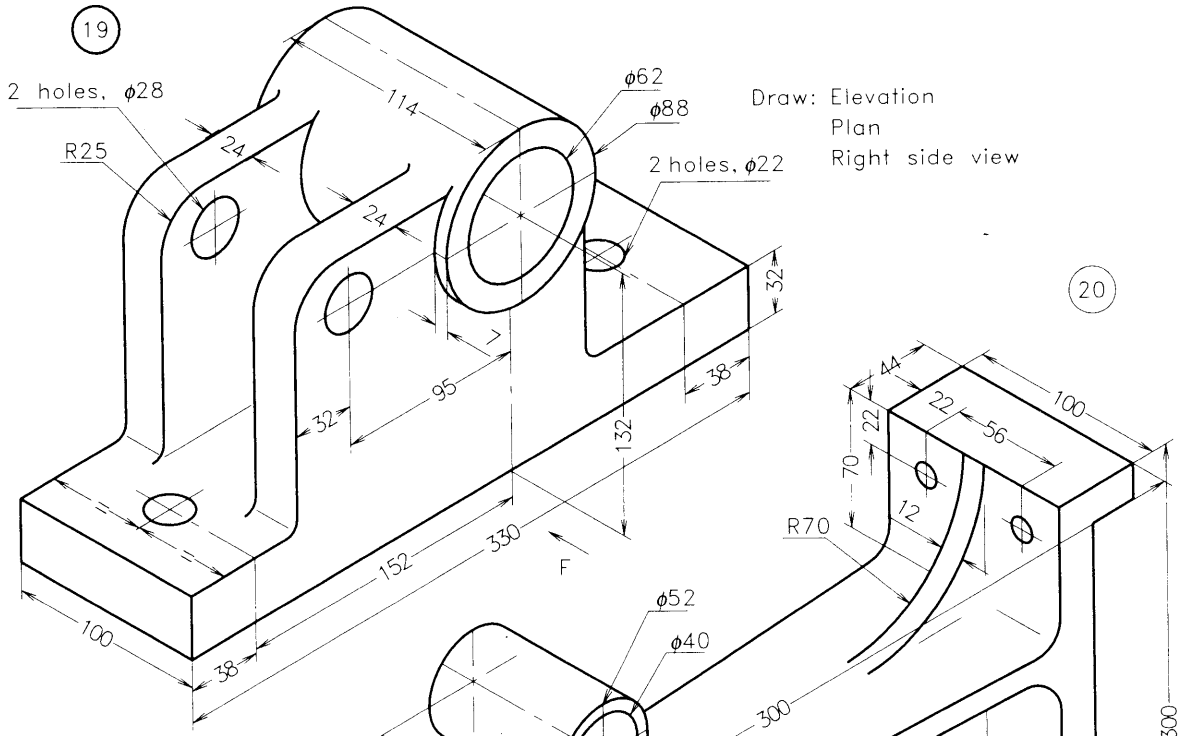


Figure 3.79 A bearing block.

Figure 3.80 A bracket.

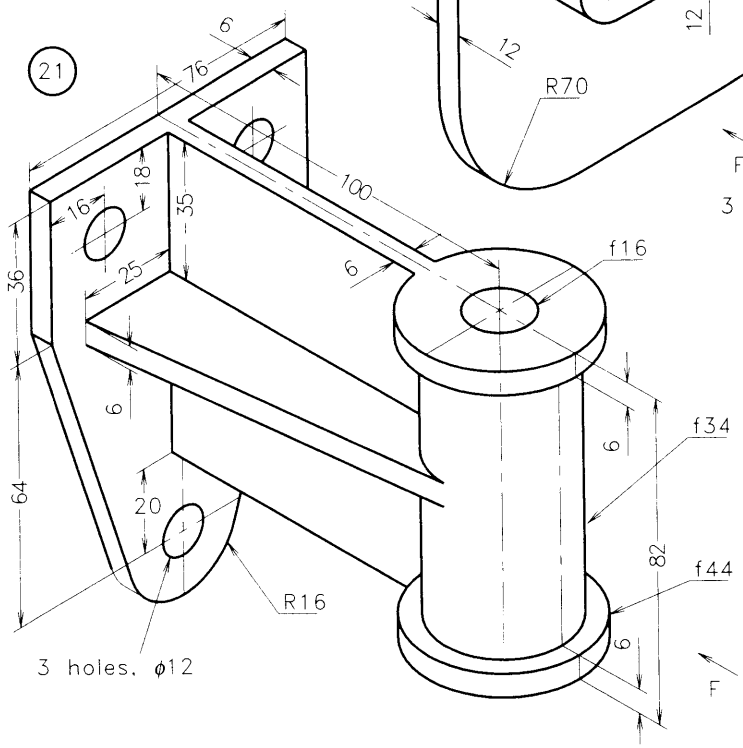


Figure 3.81 A bracket.

CHAPTER 4

Sectional Views

Interior details of an object are not clearly seen or not easy to read on the basis of principal exterior views, especially when there are too many hidden lines. In such cases, an imaginary cutting (sectioning) plane is used to cut through the object, so that the portion in front of the plane is assumed to be removed to expose the inner details. Drawings of complex machine parts, assemblies, etc. include sectional views also.

4.1 PRINCIPLE OF SECTIONAL VIEWS OF OBJECTS

In orthographic (multiview) projection, hidden lines are used to represent details of an object which are not seen from outside. In order to avoid too many hidden lines and to make the drawing more understandable, the object is cut by an imaginary cutting plane in such a way as to expose the required inner details of the object. The cutting plane is also called *section plane*. An object with a section plane is shown in Figure 4.1(i). After cutting the object by an imaginary plane *A*, the piece *N*, which is between the observer and the cutting plane, is assumed to be removed. The remaining portion *M* is shown in Figure 4.1(ii). The cut surface of the object is represented by section or hatching lines. Now, the hidden details are very clear from the cut surface. Orthographic projection of the remaining piece *M* of the object is called *sectional view* or *sectional projection.*

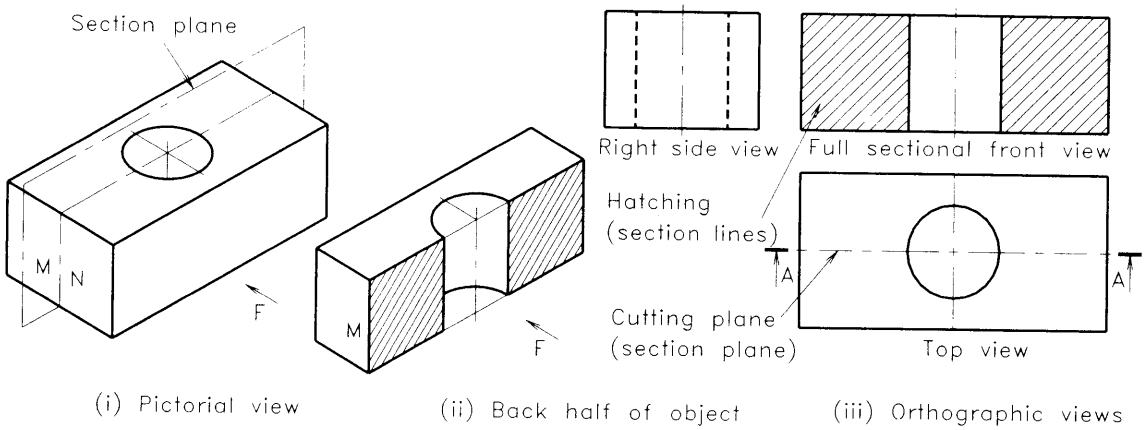


Figure 4.1 Principle of sectional view.

In multiview projection, the cutting plane is represented by chain thin lines-thickened at ends, i.e. Type H lines. The direction of viewing is shown by arrows and designated by capital letters. A cutting plane is also called *section plane*, *line of section* or *trace of the cutting plane*.

While drawing sectional orthographic views, the conventions followed may be noted by referring Figure 4.1(iii).

1. The front view is a fully sectioned one, while the top and the side views are full external views (no portion is removed by sectioning), because the object has not been actually cut.
2. The cut surface is indicated by *section lines* or *hatching lines* (parallel and equally spaced 45° inclined lines).
3. The cutting plane is shown by Type H line.
4. Arrows show the direction in which the section is viewed.
5. The cutting plane (Trace) is identified by letters like AA, BB, CC, etc.
6. The sectioned surface is enclosed by thick line boundaries.
7. Visible lines behind the cutting plane are shown as in orthographic views.
8. Hidden lines behind the cutting plane need not be shown in a sectional view.

Figure 4.2 shows examples to the conventional representation of cutting planes.

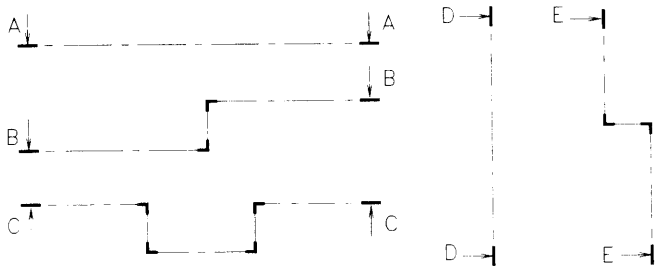


Figure 4.2 Conventional representation of cutting planes.

4.2 CLASSIFICATION OF SECTIONAL VIEWS

Sectional view of an object may be taken by cutting it by an imaginary section plane at any angle and location. But in machine drawing, the section is taken generally along the centre line of the object. For exposing details at some odd parts of the object, special sectional views are also prepared. The types of sectional views frequently used in machine drawing may be grouped as follows.

1. *Full sectional views*: Here the entire object is sectioned by the imaginary cutting plane. An example is Figure 4.3(i).

2. *Half sectional views:* Here, only one half of the view is under section, while the other half of the view is without section. [see Figure 4.3(ii)].

3. *Partial (local)* or *broken section:* In this type of section, only a small portion of the component is shown for the purpose of revealing details [see Figure 4.3(iii)].

4. *Revolved section:* Here, the cutting plane, which is perpendicular to the axis of the object, is revolved to bring the view into the plane of the axis. Outlines of the revolved section are shown in continuous thin lines [see Figure 4.3(iv)].

5. *Removed section*: When the above revolved section is removed outside the object, then it is called removed section. The outline is shown with thick continuous line [see Figure 4.3(v)].

6. *Offset section:* To expose more details by a single cutting, the section plane is offset through the details as shown in Figure 4.3(vi). In the related view, details of the offsetting should be shown by Type H cutting line.

4.3 FULL SECTIONAL VIEWS

To obtain a full sectional view, the entire object is sectioned by an imaginary cutting plane and the portion between the cutting plane and observer is assumed to be removed. Orthographic view of the remaining object is called *full sectional view*. Full sectional views may be classified as:

1. Full sectional front view (elevation)
2. Full sectional top view (plan)
3. Full sectional right side view (end view)
4. Full sectional left side view (end view)

Full sectional bottom and rear views are not generally drawn. For obtaining full sectional front view of an object, (see Figure 4.3) it is cut by a section plane, parallel to the vertical plane. This plane divides the object into two pieces *M* and *N*. Piece *M* is behind the section plane *A* and piece *N* is in front of the section plane *A*. The front piece *N* is assumed to be removed. This assumption is applicable only to this view; the other views are not affected. It may be noted that piece *N* is the portion of the object lying between the cutting plane and observer. Front view of the remaining piece *M* of the object, projected on the vertical plane, is called *full sectional front view*. The trace of section plane *A* is indicated by the section line *AA* in the top view. Here, the direction of viewing is indicated by two arrow heads as shown in Figure 4.4(iii).

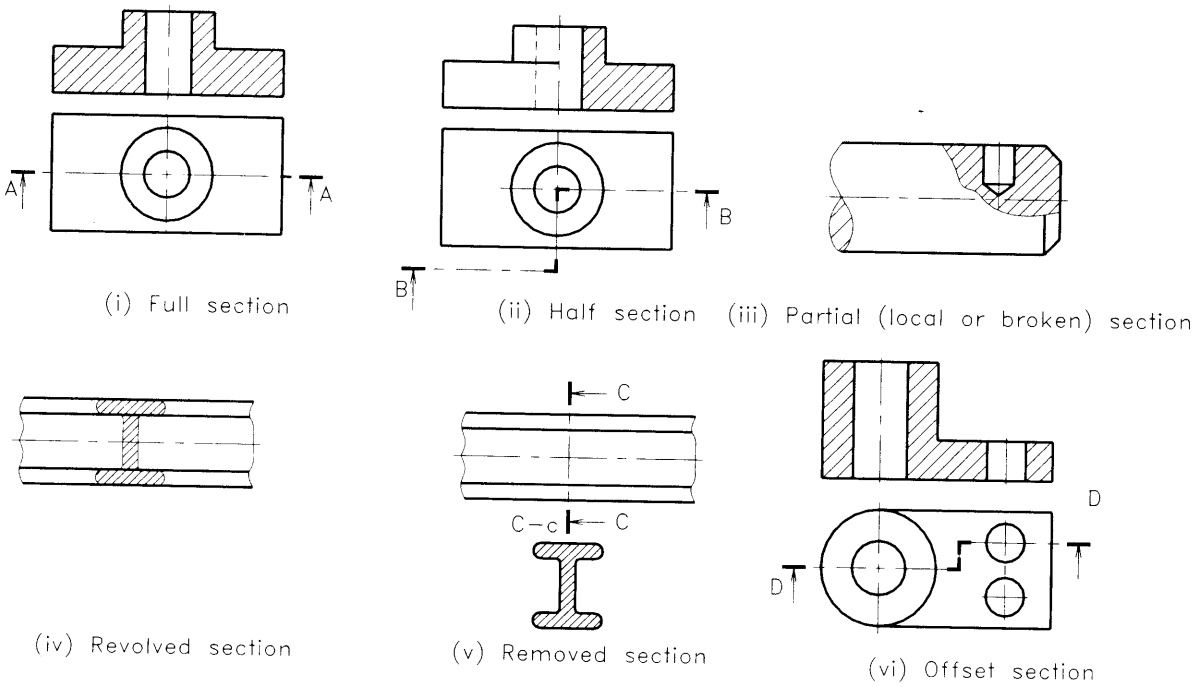


Figure 4.3 Types of sectional views.

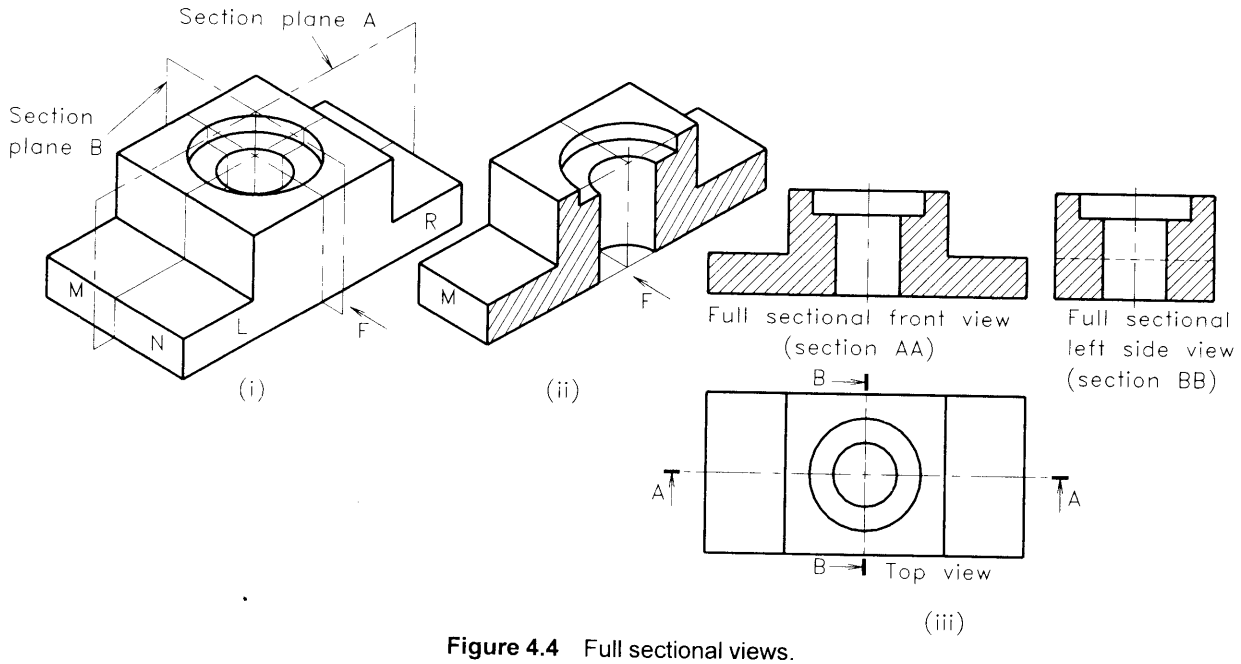


Figure 4.4 Full sectional views.

For obtaining full sectional left side view of an object, it is first cut by a section plane *B*, parallel to the profile plane, and then the object is viewed from the left side. This plane divides the object into two pieces *L* and *R*. Piece *L* is on the left side and piece *R* is on the right side of the section plane *B*. The piece *L* is assumed to be removed. It may be noted that piece *L* is the portion of the object lying between the cutting plane and the observer. The side view of the remaining piece *R* of the object, projected on the profile plane, is called *full sectional left side view. The* direction of viewing is shown in

the top view. Here, the trace of the section plane is indicated by section line *BB* in the top view. Full sectional left side view is shown in Figure 4.4(iii). Full sectional right side view can be obtained by removing the piece of the object lying to the right side of section plane *B* and viewing the portion *L* from the right.

Similarly, for obtaining the full sectional top view of an object, it is first cut by a horizontal section plane *CC*. This plane divides the object into two pieces, one above and the other below the section plane. The piece above the section plane is assumed to be removed. Top view of the remaining piece, lying below the section plane and projected on the horizontal plane, is called *full sectional top view*. Trace of this section plane can be indicated by type *H* line in the front view and two arrow heads are drawn in the downward direction to indicate the direction of viewing.

4.4 HALF SECTIONAL VIEWS

When an object is symmetrical about its centre line, one half of a full sectional is sufficient to be drawn to reveal the inner details. Such a view with one half in section and the remaining half without section is called *half sectional view.*

For getting a half sectional view, the object is cut by two imaginary cutting planes which are perpendicular to each other. Now, one quarter of the object is assumed to be removed and it is shown in Figure 4.5(i). Orthographic view of the remaining three-fourth portion of the object is called *half sectional view.* The sectional views obtained in this way are called *front view, left half in section* and *left side view, right half in section.* They are shown in Figure 4.5(ii). It may be noted that the top view is not affected by the sectioning.

Half sectional views may be classified as follows:

1. *Top half sectional views:*
   (a) Front view, top half in section
   (b) Top view, top half in section
   (c) Right side view, top half in section
   (d) Left side view, top half in section
2. *Bottom half sectional views:*
   (a) Front view, bottom half in section
   (b) Top view, bottom half in section
   (c) Right side view, bottom half in section
   (d) Left side view, bottom half in section
3. *Right half sectional views:*
   (a) Front view, right half in section
   (b) Top view, right half in section
   (c) Right side view, right half in section
   (d) Left side view, right half in section
4. *Left half sectional views:*
   (a) Front view, left half in section
   (b) Top view, left half in section
   (c) Right side view, left half in section
   (d) Left side view, left half in section

Half sectional bottom and rear views are not generally drawn. Thus, there are 4 external views, 4 full sectional views and 16 half sectional views, coming to a total of 24 views, excluding the bottom and rear views.

Figure 4.6 shows the different outside views and the sectional views of a simple guide block. Students are advised to identify and sketch the remaining 12 half sectional views of this block.

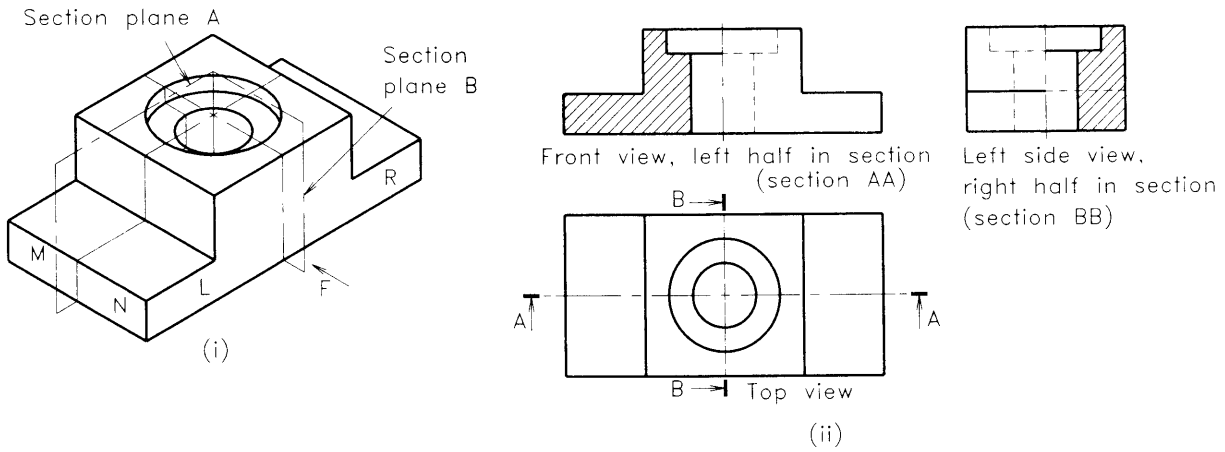


Figure 4.5 Half sectional views.

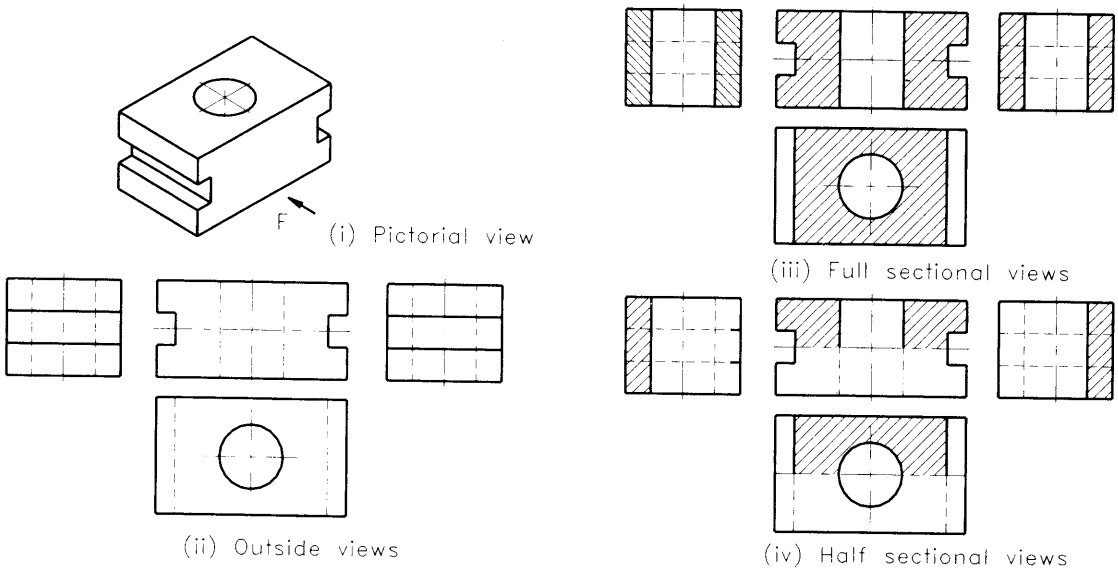


Figure 4.6 Different views of a guide block.

4.5 CONVENTIONS FOR SECTIONING

1. Hatching is used to represent the surface formed by cutting. Hatching is done by drawing continuous thin lines (Type B lines) at an angle of 45° to horizontal, principal outlines or lines of symmetry of the sections (see Figure 4.7).

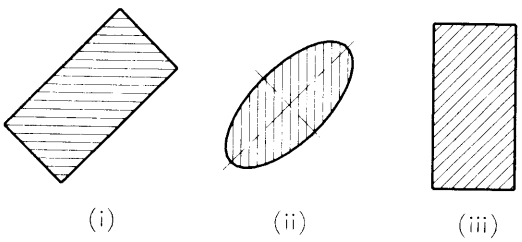


Figure 4.7 Preferred hatching angles.

2. Hatching of the adjacent components is done in the opposite direction and/or a indifferent spacing (see Figure 4.8).

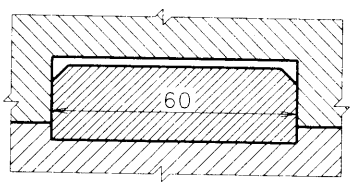


Figure 4.8 Hatching of adjacent parts and dimensioning.

3. Hatching may be interrupted for dimensioning, if it is not possible to place the dimensions outside the hatching. No text should be crossed by section lines.
4. In the case of large areas, hatching may be limited to a zone as shown in Figure 4.9.

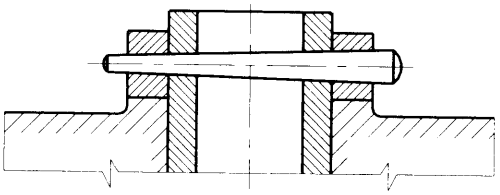


Figure 4.9 Sectioning of large areas.

5. If sections of the same component in parallel planes are to be shown side by side, the hatching should be identical; but the hatching may be offset along the dividing line between the sections (see Figure 4.10).

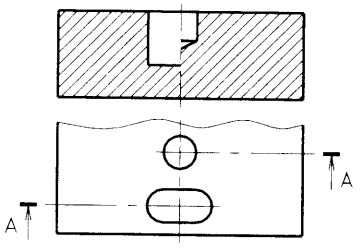


Figure 4.10 Hatching of offset section.

6. When a cutting plane passes longitudinally through the centre of a rib or a web, the rib should not be sectioned (see Figure 4.11). But the rib is shown in section when the cutting plane passes crosswise through the rib. Spokes or arms of wheels or pulleys, shafts and fasteners like bolts, nuts, rods, rivets, keys, pins, cotters, etc. are also not sectioned longitudinally. Hence, they should not be hatched. They are shown in section, if the cutting plane is at right angles to their axis.

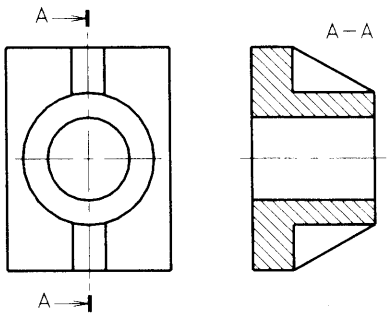


Figure 4.11 Sectioning of an object with web.

7. Thin sections may be shown entirely black but a space not less than 0.7 mm must be left between the adjacent sections (see Figure 4.12).

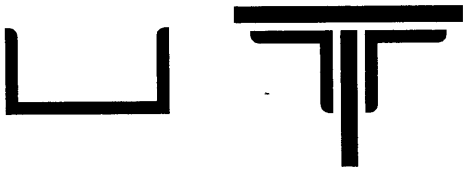


Figure 4.12 Hatching of thin section.

8. Different materials are shown symbolically in different hatching patterns. BIS gives the conventional representations of materials. The different hatching patterns to be adopted are shown in Figure 4.13. It may be noted that the materials should be indicated by notes on the drawings.

Example 4.1

Isometric view of a lever is shown in Figure 4.14. Draw sectional elevation and plan.

Refer Figure 4.15.

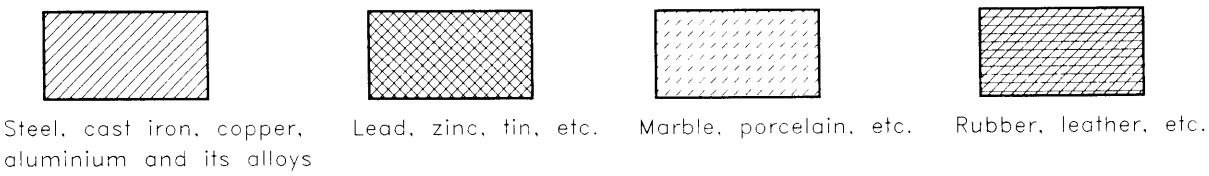


Figure 4.13 Hatching patterns.

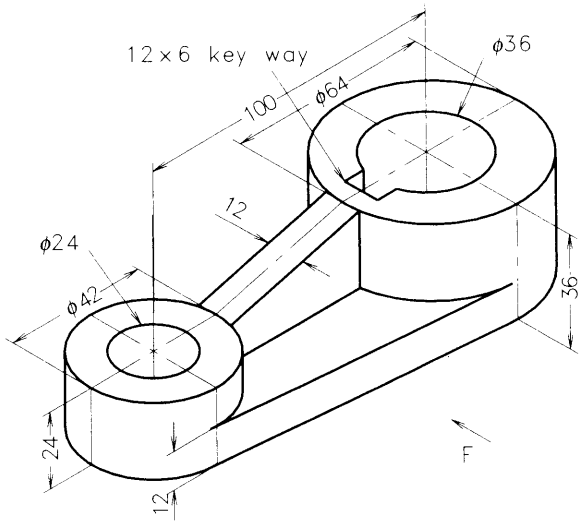


Figure 4.14 A lever (pictorial view).

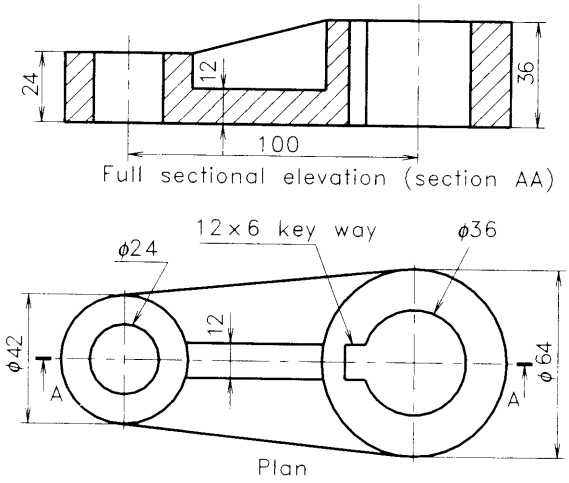


Figure 4.15 A lever (sectional view).

As per question, the section plane is to be taken parallel to VP. Draw the top view first and then the sectional front view. Section lines should be avoided at the holes and key way. As the cutting plane passes longitudinally through the centre of the web, it need not be sectioned.

Example 4.2

Orthographic views of a forked end of a machine part are shown in Figure 4.16. Draw the following views:

(i) Front view, top half in section,

(ii) Top view, bottom half in section.

Refer Figure 4.17.

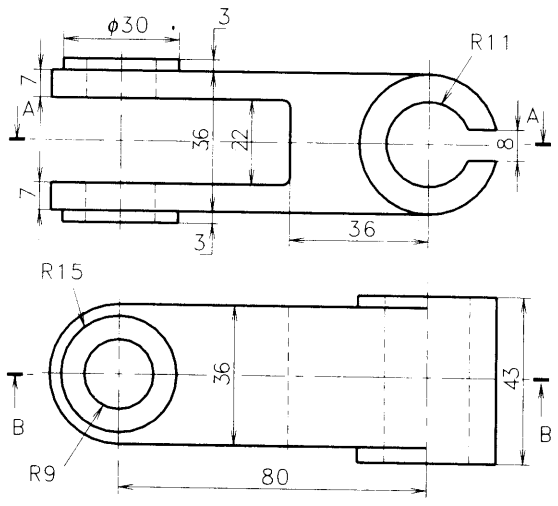


Figure 4.16 Forked end of a machine part (orthographic views).

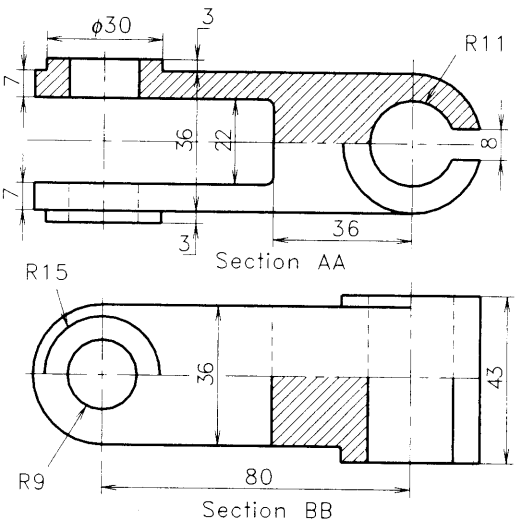


Figure 4.17 Forked end of a machine part (half sectional views).

EXERCISES

Draw the elevation top half in section and plan bottom half in section. Avoid hidden lines in the sectioned areas.

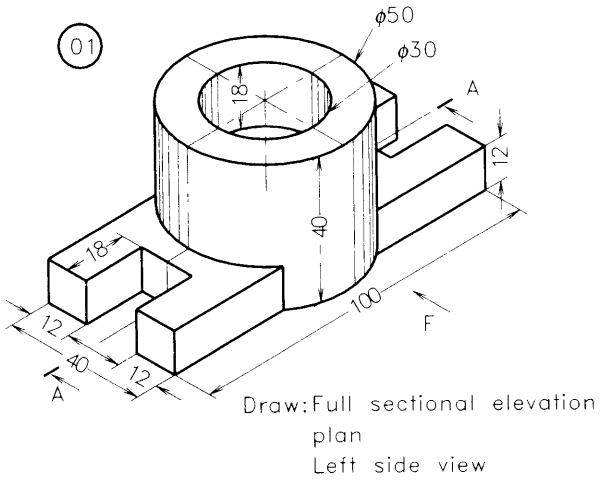


Figure 4.18 Cylindrical block.

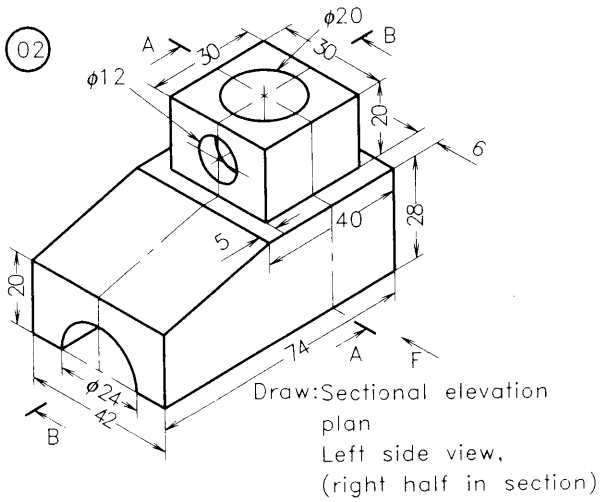


Figure 4.19 A machine part.

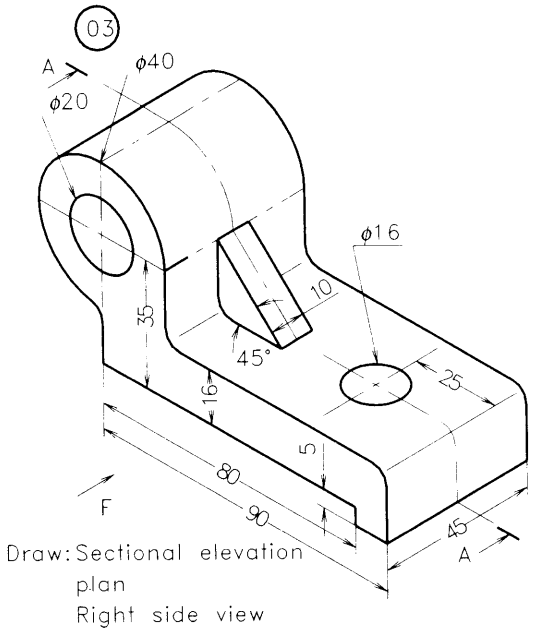


Figure 4.20 A bearing.

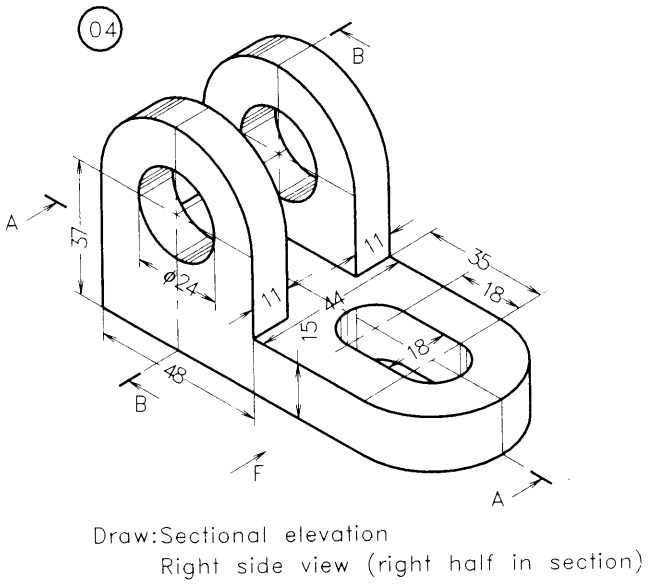
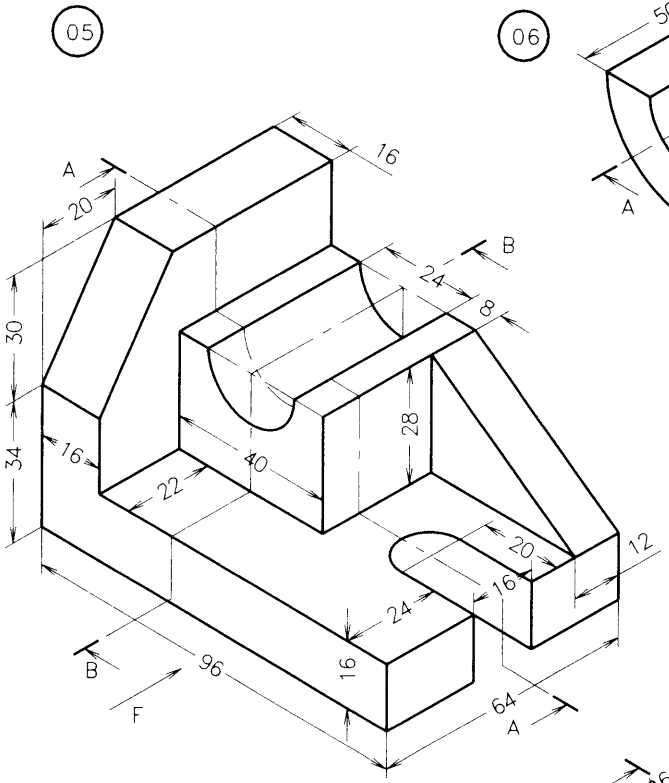
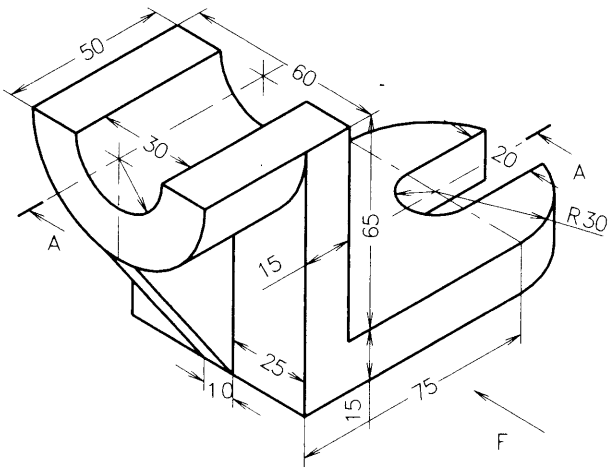


Figure 4.21 Bearing block.



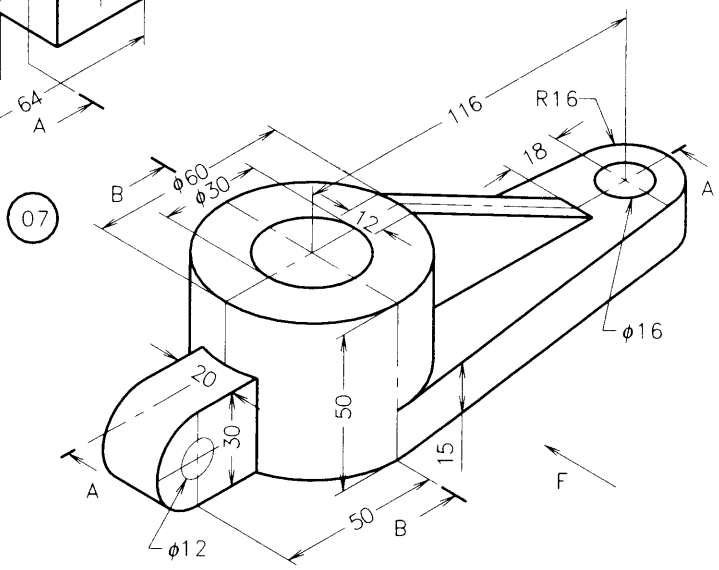
Draw: Sectional elevation
Sectional side view
Top view

Figure 4.22 Shaft support.



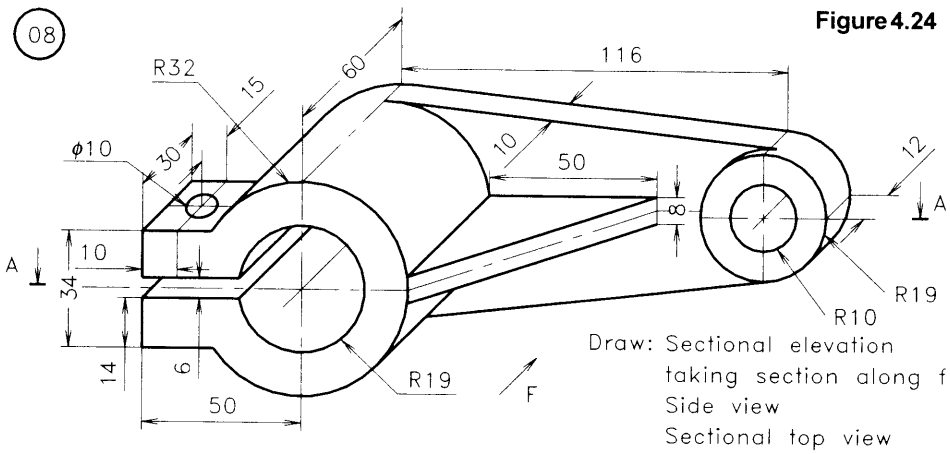
Draw: Sectional elevation
Side view
Top view

Figure 4.23 Road support.



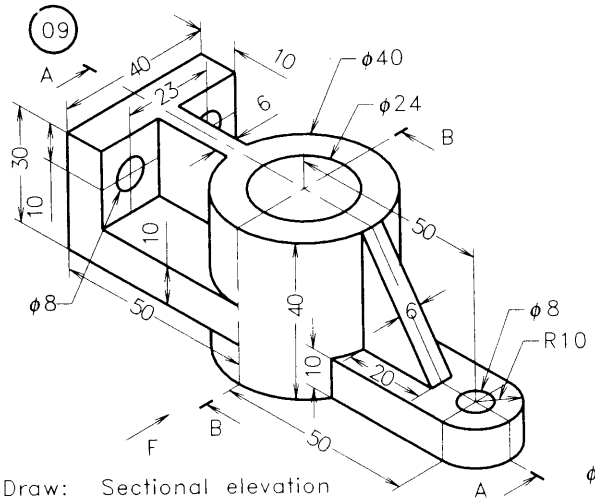
Draw: Sectional elevation
Sectional side view
Top view

Figure 4.24 Lever.



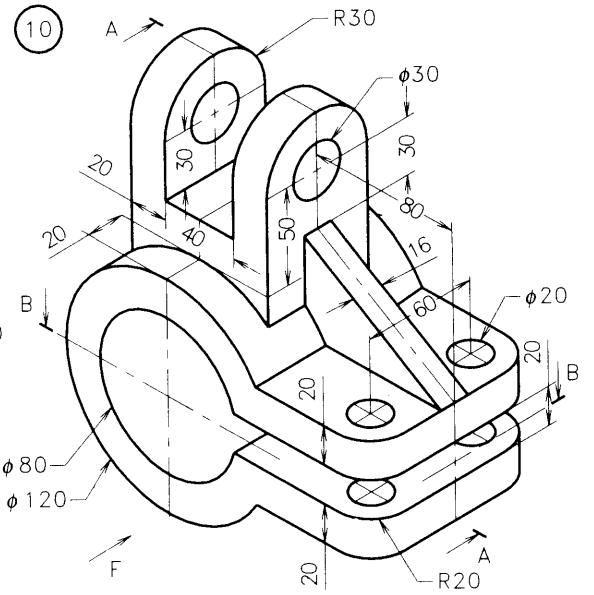
Draw: Sectional elevation
taking section along f10 hole
Side view
Sectional top view

Figure 4.25 Lever.



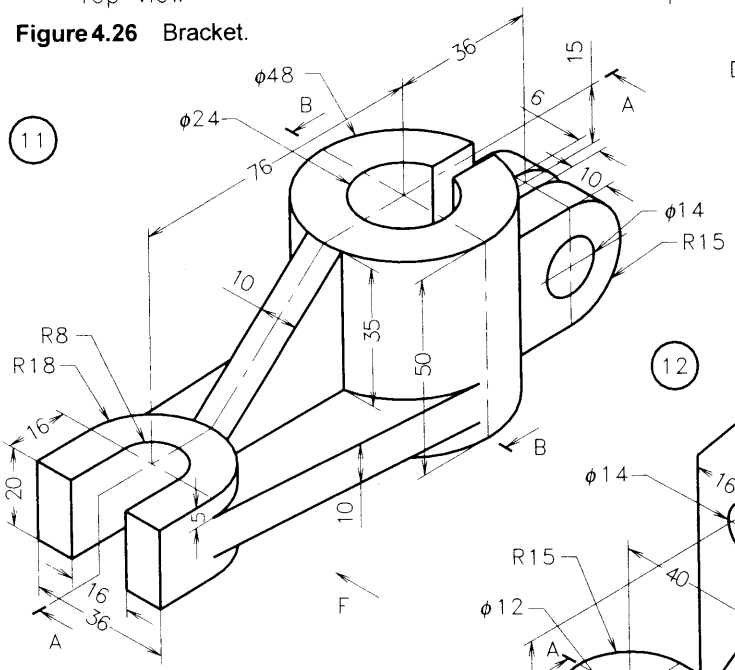
Draw: Sectional elevation
Sectional side view
(right half in section)
Top view

Figure 4.26 Bracket.



Draw: Sectional elevation
Sectional top view
Side view from right

Figure 4.27 Clamp.



Draw: Sectional elevation
Right side view
(left half in section)
Top view

Figure 4.28 Forked lever.

Draw: Sectional elevation
Sectional side view
Top view

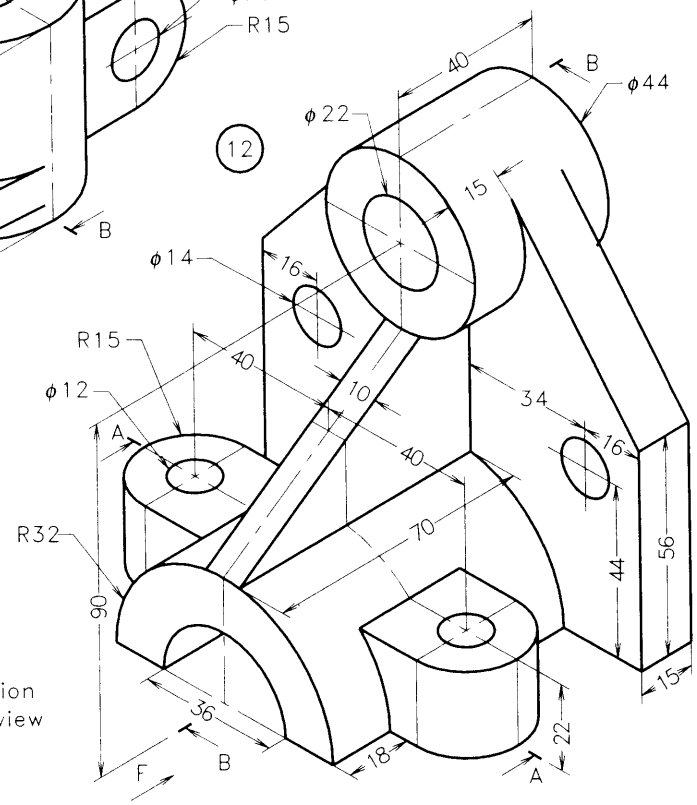
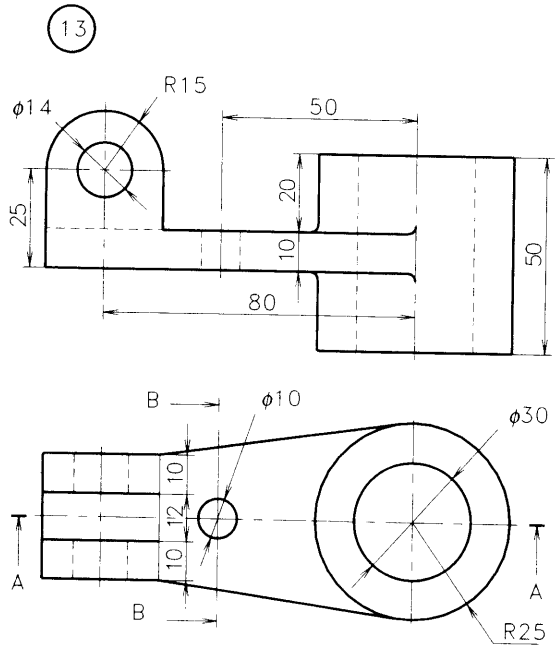
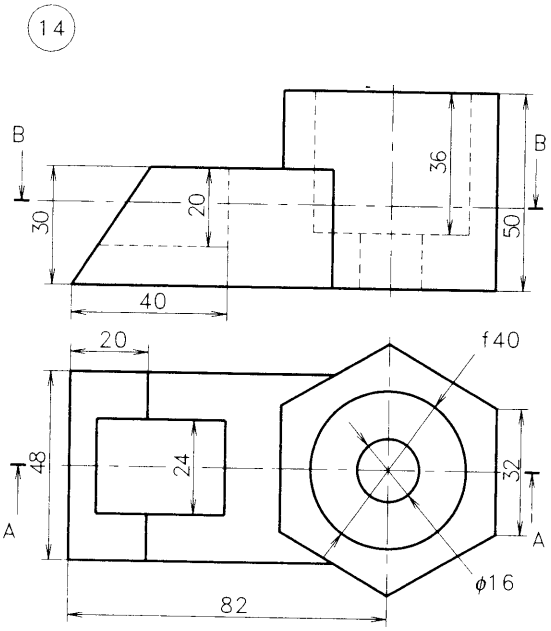


Figure 4.29 Cover bracket.



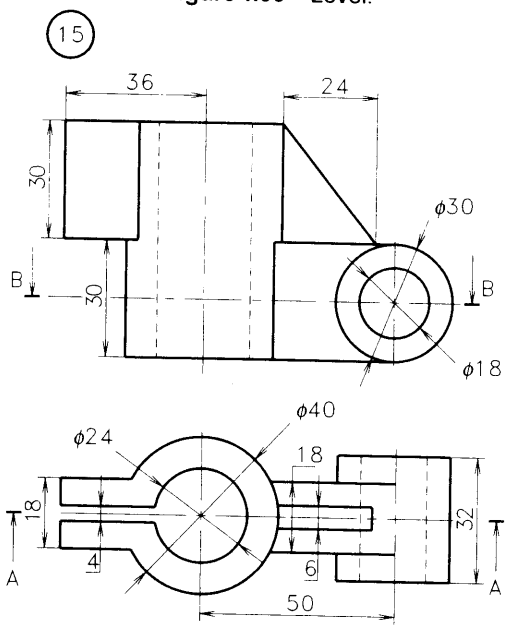
Draw: Sectional elevation
Side view from left
(Right half in section)

Figure 4.30 Level.



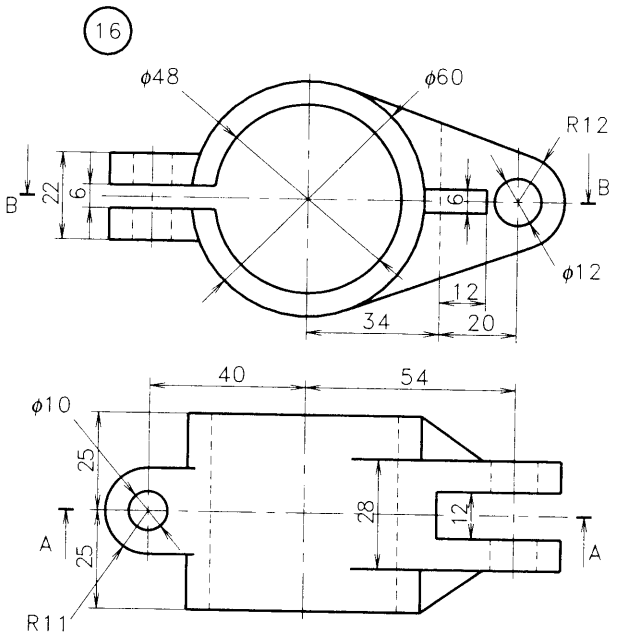
Draw: Sectional elevation
Sectional plan
Side view from left

Figure 4.31 Hexagonal block.



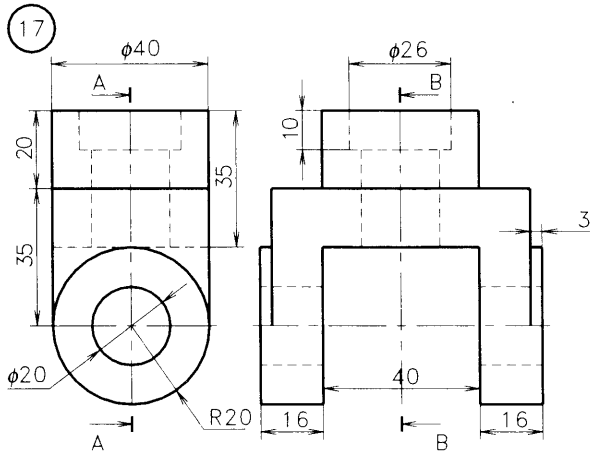
Draw: Sectional elevation
Sectional top view
(Right half in section)

Figure 4.32 Rod grip.



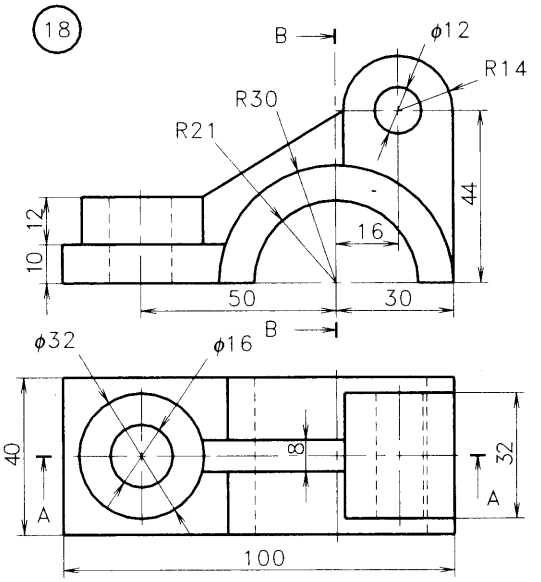
Draw: Sectional elevation
Sectional top view
Side view from right

Figure 4.33 Pipe clamp.



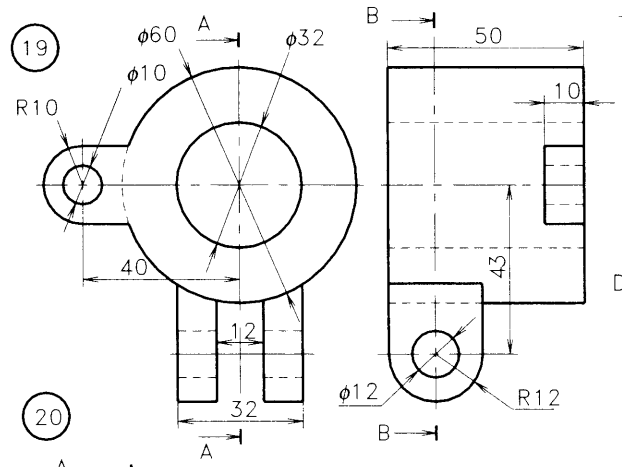
Draw: Sectional elevation (Section AA)
Side view (right half in section)

Figure 4.34 Fork.



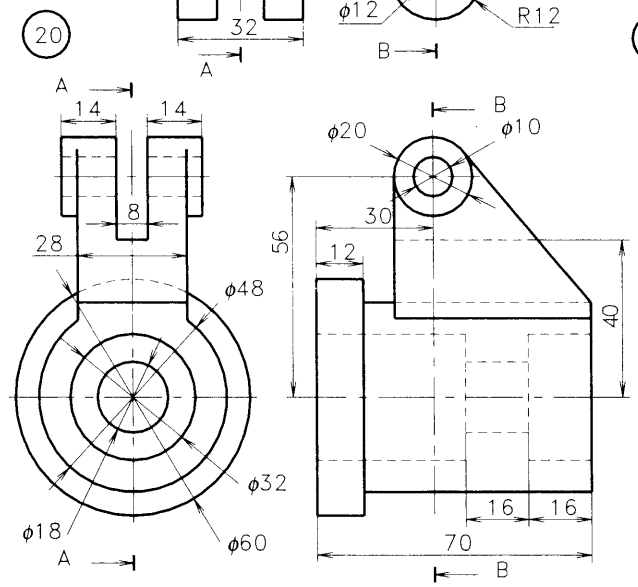
Draw: Sectional elevation
Sectional side view from left

Figure 4.35 Cover bracket.



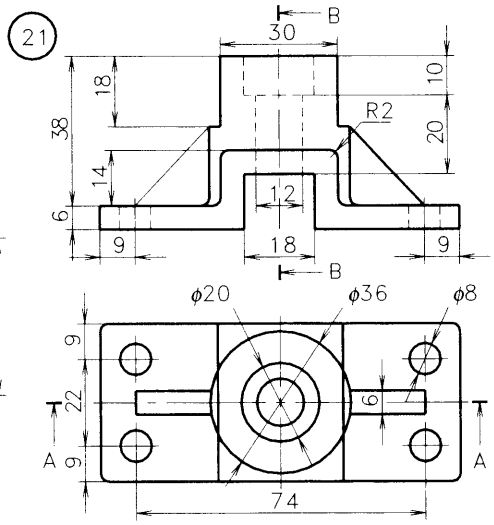
Draw: Sectional elevation (Section A–A)
Sectional side view from left

Figure 4.36 Cylindrical block.



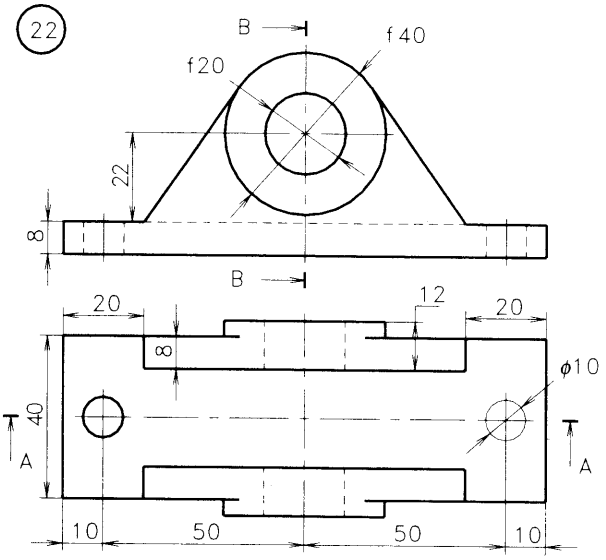
Draw: Sectional elevation
Sectional side view

Figure 4.37 Cylindrical housing.



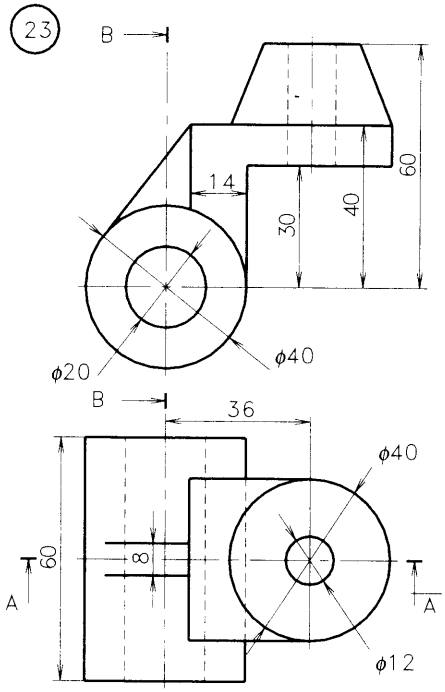
Draw: Sectional elevation
Sectional side view

Figure 4.38 Rod support.



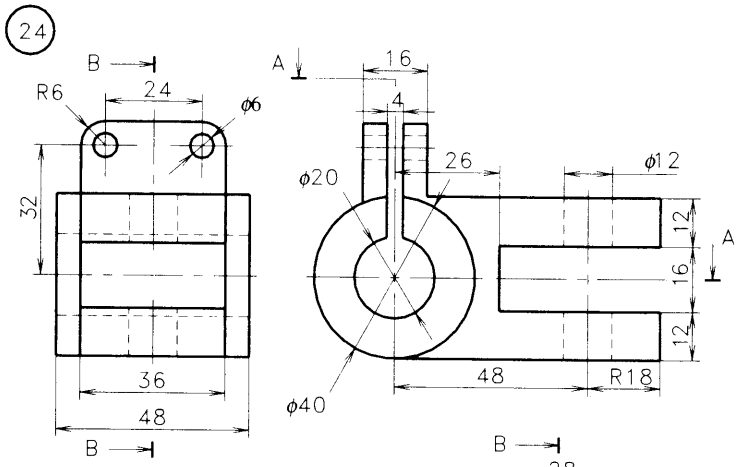
Draw: Sectional elevation
(Right half in section)
Sectional side view from left
(Right half in section)

Figure 4.39 Bearing bracket.



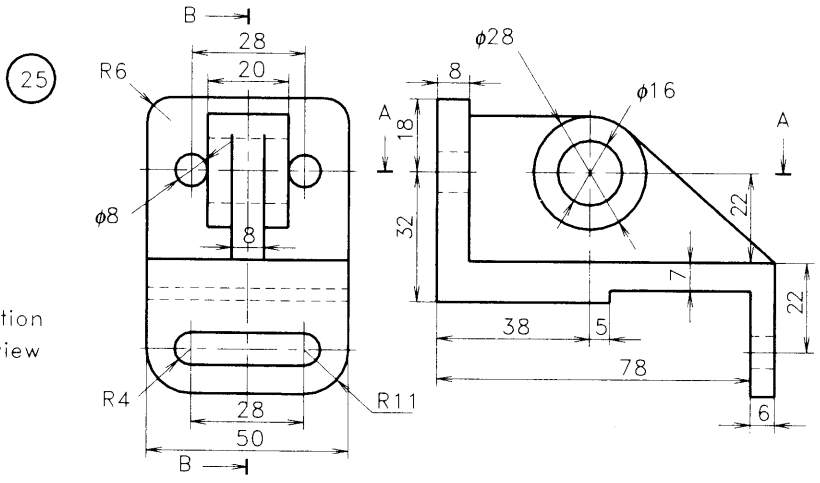
Draw: Sectional elevation
Sectional side view from left

Figure 4.40 L–bracket.



Draw: Sectional elevation
Sectional top view
(Section AA)

Figure 4.41 Conical bracket.



Draw: Sectional elevation
Sectional top view
(Section AA)

Figure 4.42 Bracket.