RV COLLEGE OF ENGINEERING®

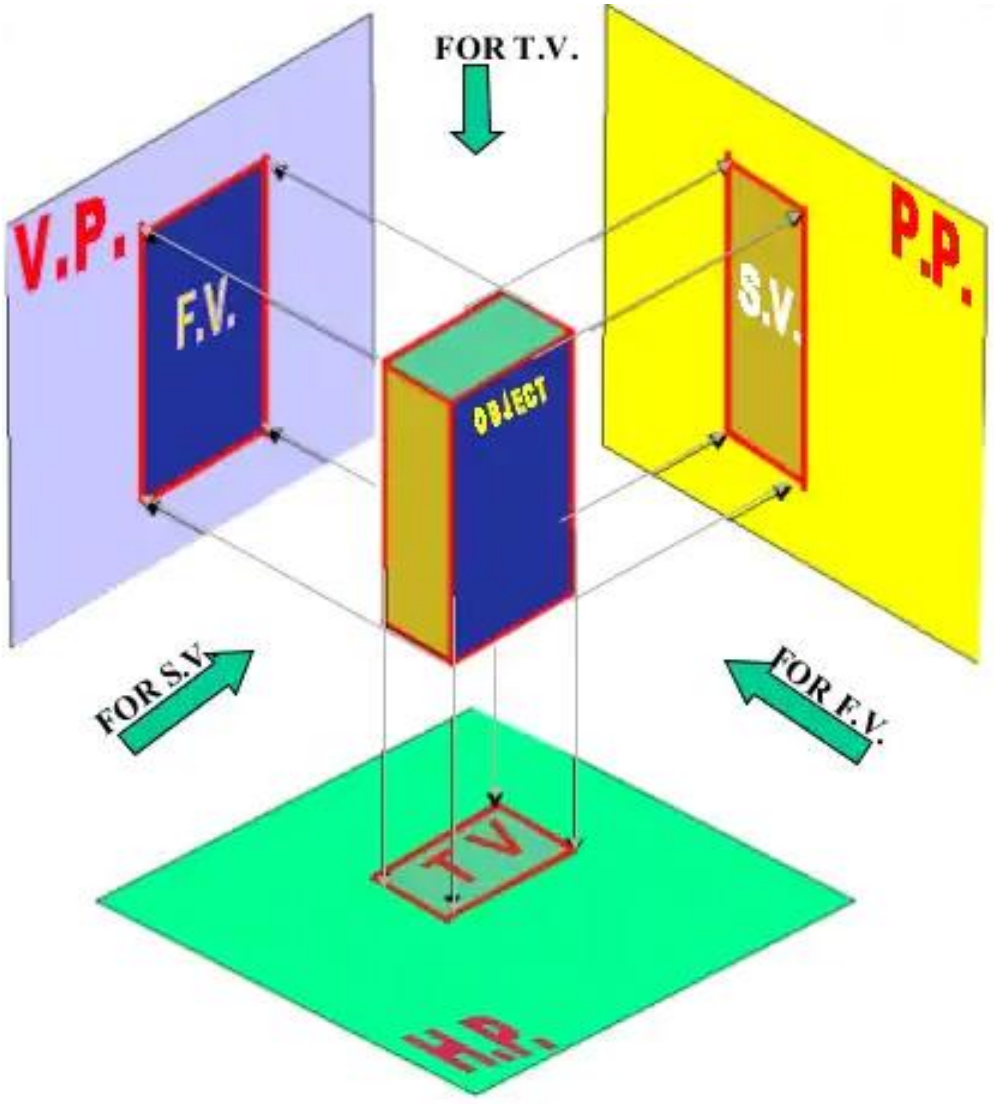
DEPARTMENT OF MECHANICAL ENGINEERING
(Autonomous Institution Affiliated to VTU, Belagavi)
RV Vidyaniketan Post, Mysuru Road, Bengaluru – 560059

SEMESTER: I/II

COURSE TITLE: **COMPUTER AIDED ENGINEERING GRAPHICS**

COURSE CODE: **22MED13/23**

LAB MANUAL



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Certificate

This is certify that Mr./Ms. ……...…….…… bearing USN……...……. has successfully completed the course in **22MED13/23-COMPUTER AIDED ENGINEERING GRAPHICS** laboratory prescribed by the department of Mechanical Engineering in the year ……..

50

Signature of faculty

Signature of HoD

Name:

Date:

1. Conventions and Standards

1.1 Conventions and Standards: Standard sizes of drawing sheets, Lines, Dimensioning, Scales, conventions for materials.

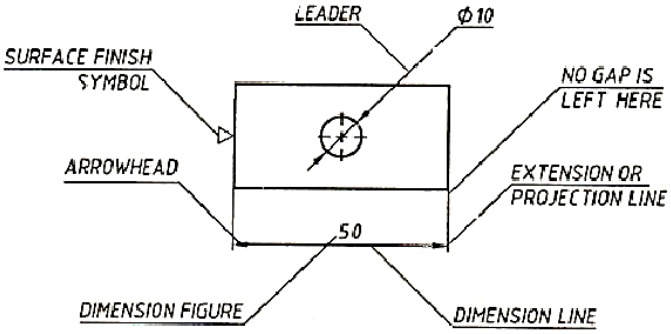
Standard sizes of drawing sheets:

Designation	Size (in mm)
A0	841 x 1489
A1	594 x 841
A2	420 x 594
A3	297 x 420
A4	210 x 297

Types of Lines:

Type	*Illustration*	*Application*
A	Continuous THICK	Visible outlines, Visible edges
B	Continuous THIN	Dimesion lines, Projection lines, Leader lines, Imaginary lines of intersections, Outlines of revolved sections
C	Continuous THIN Freehand	Boundaries or Limits of Partial or Interrupted views
D	Continuous THIN Zig-Zag	
E	Dashes THICK	Hidden outlines, Hidden edges
F	Dashes THIN	
G	Chain THIN	Centre lines, Lines of Symmetry, Trajectories
H	Chain THIN with THICK at ends & Changes of Direction	Cutting Planes
J	Chain THICK	Indication of surfaces to which special treatment applies
K	Chain THIN with Double Dash	Outlines of adjacent parts, Alternate and Extreme positions of movable parts, Centroidal lines, Initial outlines

Dimensioning

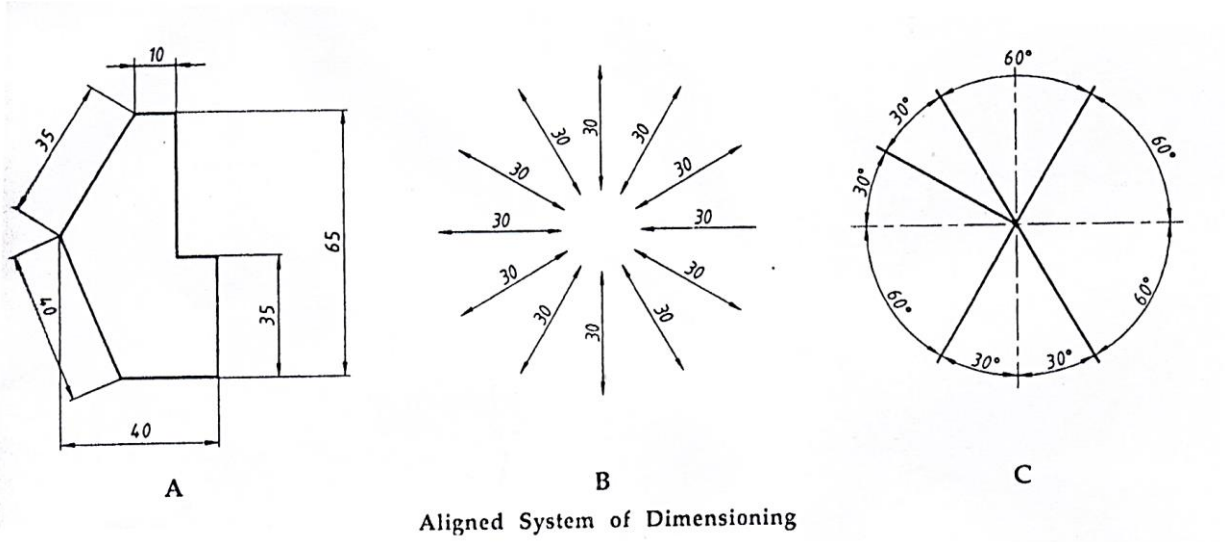


Elements of Dimensioning

Systems of Dimensioning

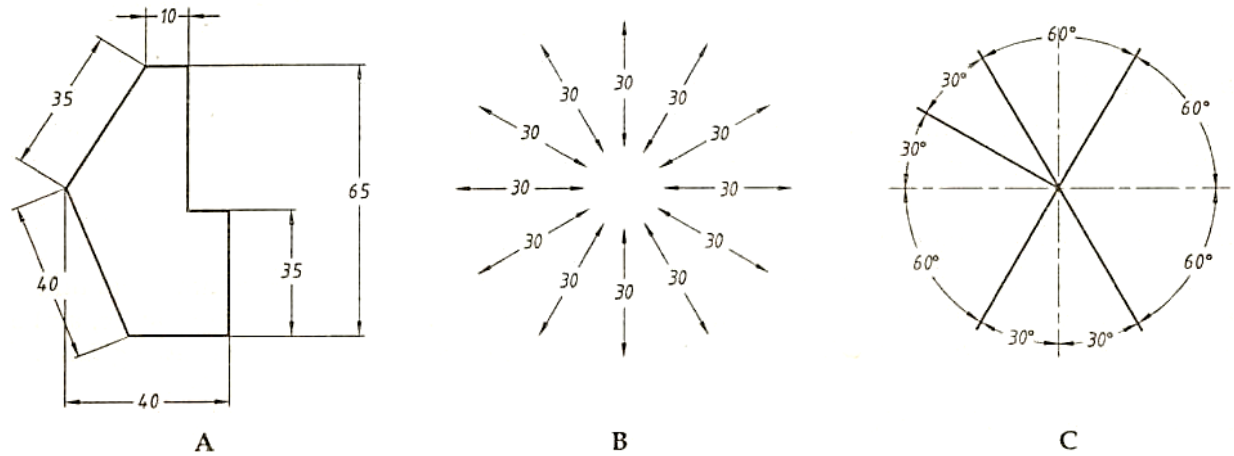
The two recommended systems of placing the dimension figures are : *Aligned System* and *Unidirectional System*.

Aligned System:



Aligned System of Dimensioning

Unidirectional System



Unidirectional System of Dimensioning

Scales

Representative fraction

RF is a ratio between drawing size and actual size(of same units).

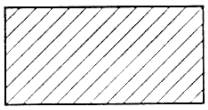
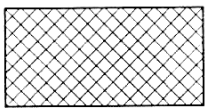
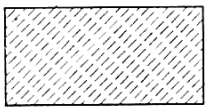
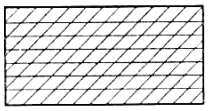
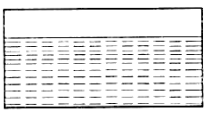
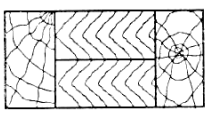
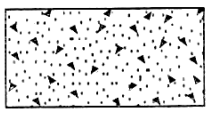
RF = drawing size / actual size

Eg. 1:2, 1unit on drawing represents 2units in actual.

Types of scales:

1:2	Reduced scale drawing
1:1	Full scale drawing
2:1	Enlarged scale drawing

Conventions for materials

Type	*Convention*	*Materials*
METALS		STEEL, CAST IRON, COPPER AND ITS ALLOYS, ALUMINIUM AND ITS ALLOYS, ETC
		LEAD, ZINC, TIN, WHITE-METAL, ETC
GLASS		GLASS
PACKING AND INSULATING MATERIALS		PORCELAIN, STONEWARE, MARBLE, SLATE, ETC
		ASBESTOS, FIBRE, FELT, SYNTHETIC RESIN PRODUCTS, PAPER, CORK, LINOLEUM, RUBBER, LEATHER, WAX, INSULATING & FILLING MATERIALS
LIQUIDS		WATER, OIL, PETROL, KEROSENE, ETC
WOOD		WOOD, PLYWOOD, ETC
CONCRETE		CEMENT CONCRETE

1. GEOMETRICAL CONSTRUCTIONS

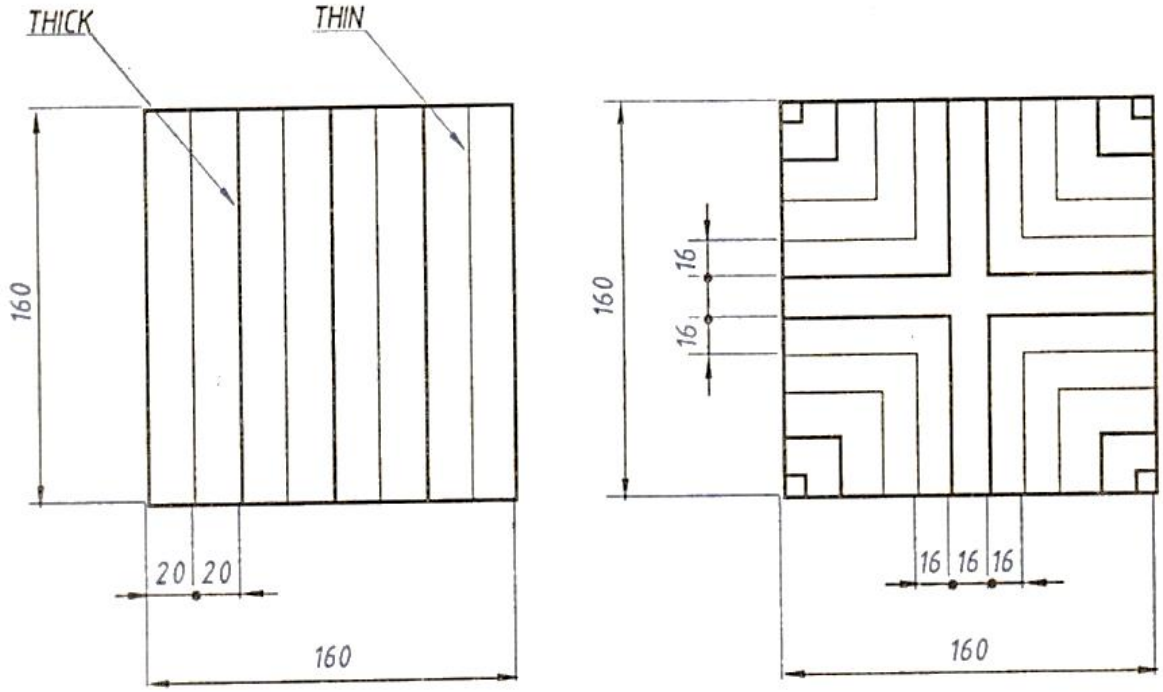
1.1 Divide a line AB 70mm into 6 equal parts.

1.2 Construct the following figures and dimension them.

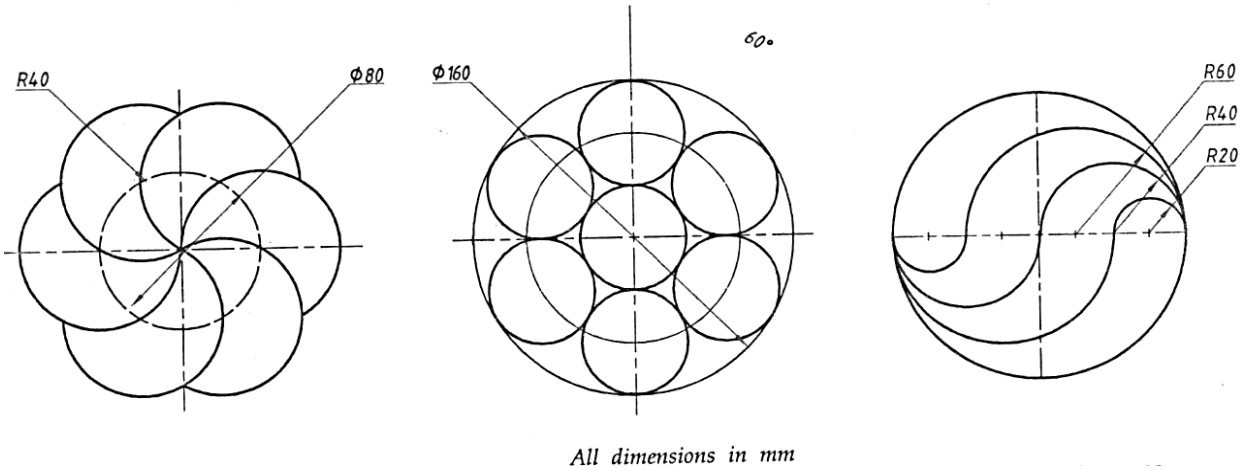
a) equilateral triangle of sides 30mm
b) regular pentagon of sides 30mm
c) regular hexagon of sides 25mm
d) circle of radius 20mm
e) concentric pentagons of sides 30mm and 50mm

1.3 Draw an equilateral triangle of 30mm sides. Construct a square, a pentagon and a hexagon of sides 30mm having one of their sides coinciding with the sides of triangle.

1.4 Redraw the drawing as shown.



1.5 Redraw the drawing as shown.



All dimensions in mm

2.0 Projection of Points (Manual Drawing)

2.1 Point A is 30mm in front of VP, 20mm above HP and 25mm infront of LPP. Draw the projections.

2.2 Point B is 20mm behind VP, 40mm above HP and 25mm infront of RPP. Draw its projections.

2.3 Point C is 25mm behind VP, 35mm below HP and 30mm behind RPP. Draw its projections.

2.4 Point D is 30mm in front of VP, 20mm below HP and 25mm infront of LPP. Draw the projections.

2.5 Draw the projections of the following points on the same XY line.

a) A is 20mm in front of VP and 30 mm above HP.
b) B is 30mm in front of VP and in HP.
c) C is 40mm behind VP and 20mm below HP
d) D is 40mm behind VP and 50mm above HP
e) E is 40mm in front of VP and 30mm below HP.

2.6 A point 20mm below XY line is the top view of three points P, Q and R. P is 25mm below HP, Q is 35mm above HP and R on HP. Draw the projections of the three points and state their positions with reference planes and the quadrants in which they lie.

2.7 A point 30mm above XY line is the front view of two points E and F. E is 35mm behind VP and F is 40mm infront of VP. Draw the projections of the two points and state their positions with reference planes and the quadrants in which they lie.

3.0 Projection of Lines (Manual Drawing)

3.1 A line AB 60mm long has one end 20mm in front of VP and 15mm above HP. The line is inclined at 25° to HP and 40° to VP. Draw the front view and the top view of the line.

3.2 The line AB measuring 70mm has its end A 15mm infront of VP and 20mm above HP, the other end B is 60mm infront of VP and 50mm above HP. Draw the projections of the line and find the inclinations of the line with both the reference planes of projection.

3.3 A line AB, 65 mm long, has its end 20 mm above HP and 25 mm infront of VP. The end B is 40 mm above HP and 65 mm infront of VP. Draw the projections AB and show its inclinations with the HP and VP.

3.4 The top view pq of a straight line is 70mm and makes an angle of 60° to XY line. End P is 10 mm in front of VP and 30mm above HP. The difference between the distances of P and Q above HP is 45mm. Draw the projections and determine the true length and true inclinations with HP and VP.

3.5 A line AB having one of its end 10mm above HP and 15mm infront of VP is inclined at 30° to HP and 45° to VP. Its top view is 50mm long. Draw the projections of the line and find out its true length.

3.6 Draw the projections of a straight line AB, 100mm long, inclined at 45° to HP and 30° VP. The end A is in HP and the end B is in VP.

3.7 The front view of a line is 50mm long and 55° to the XY line. The line is inclined at 30° to VP. Draw the projections of the line and find its true length and true inclination with HP. One end is 15mm above HP and the other end is 10mm infront of VP.

4.0 Projection of Planes (Manual drawing)

4.1 An equilateral triangular lamina of 30mm sides resting on one of its sides on HP. The lamina makes 45° with HP. Draw its front view and top view.

4.2 An equilateral triangular lamina of 30mm sides resting on one of its corners on HP. The lamina makes 40° with HP and the side opposite to the corner on which it rests is inclined at 30° to VP. Draw its front view and top view.

4.3 A square lamina of 30mm side rests on one of its sides on HP. The lamina makes 60° to HP. Draw its front view and top view.

4.4 A square ABCD of 40mm side has its diagonal AC inclined at 45° to HP and the diagonal BD inclined at 30° to VP and parallel to HP. Draw its front view and top view.

4.5 A rectangular lamina of sides 40mm X 60mm rests on HP on one of its longer edges. The lamina is tilted about the edge on which it rests till its plane surface is inclined to HP at 45°.The edge on which it rests is perpendicular to VP. Draw its front view and top view.

4.6 The pentagonal lamina of 30mm sides resting on one of its sides on HP. The lamina makes 45° with HP. Draw its front view and top view.

4.7 The hexagonal lamina of 25mm sides resting on one of its corners on HP. The lamina makes 45° with HP and the corner opposite to corner on which it rests is 25mm infront of VP and nearer to it. Draw its front view and top view.

4.8 A circular lamina of 50mm diameter rests on HP on a point A on the circumference, with its surface inclined at 45° to HP. The top view of the diameter passing through point A makes 60° to VP. Draw its front view and top view.

5.0 Projection of Solids (CAD)

5.1 A square prism of base sides 30mm and 60mm axis length rests on HP on one of its base edges which is inclined at 30° to VP. Draw its projections when the axis is inclined at 45° to HP.

5.2 A square prism of base sides 30mm and 60mm axis length rests on HP on one of its base corners in such a way that the axis is inclined at 45° to HP. Draw its projections when the axis is inclined at 30° to VP.

5.3 A pentagonal prism of base sides 25mm and 60mm axis length rests on HP on one of its base corners such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections when the axis is inclined at 40° to HP and appears to be inclined at 45° to XY line.

5.4 A hexagonal prism of base sides 25mm and 50mm axis length rests on HP on one of its base corners such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections when the axis is inclined at 40° to HP and 30° to VP.

5.5 A triangular pyramid 30mm base edges and 50mm axis length rests on HP on one of its slant edges. Draw the projection of the pyramid when the axis is inclined to VP at 45°.

5.6 A square pyramid 30mm base edge and 60mm axis length rests on HP on one of its base corners such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections when the axis is inclined at 45° HP and top view of the axis makes 40° to XY line when the apex is nearer to the observer.

5.7 A pentagonal pyramid 30mm base edges and 60mm axis length rests on HP on one of its triangular faces. Draw the projections of the pyramid when the axis is inclined to VP at 45° and the base is nearer to the observer.

5.8 A hexagonal pyramid of base edge 25mm and height 50mm rests on HP on one of its base corners such that the two base edges containing the corner on which it rests make equal inclinations with HP. Draw the projections when the axis is inclined at 45°to HP and top view of the axis makes 40° to XY line when the apex is nearer to the observer.

5.9 A cylinder of base circle diameter of 50mm and 65mm axis length rests on HP on one of its base point on HP with its axis inclined at 45° to HP and top view of the axis is inclined at 30° to VP. Draw the projections.

5.10 A cone of base circle diameter of 50mm and 65mm axis length is resting on a base point on HP. Base makes 30° to HP. Draw the projection of the cone when the axis is inclined at 25° to VP.

6.0 Isometric Projection (CAD)

6.1 A regular pentagonal prism of base edge 3mm and axis 60mm is mounted centrally over a cylindrical block of 80 mm diameter and 25mm thick. Draw isometric projection of the combined solids.

6.2 A cone of base diameter 40mm and height 50mm rests centrally over a frustrum of a pentagonal pyramid of base side 45mm, top side 35mm and height 55mm. Draw isometric projections of the combination of solids.

6.3 A hexagonal pyramid 30mm side and height 60mm rests on the center of the top of a square block of side 60mm and height 20mm. The base edge of the pyramid is parallel to the top edge of the square block. Draw the isometric projection of the combination of the solids.

6.4 The frustum of a square pyramid of sides of top face 20mm, bottom face 40mm and height 60mm rests centrally on top of a square block of side 60mm and height 20mm. The base edges of the pyramid are parallel to the top edges of the square block. Draw the isometric projection of combination of solids.

6.5 A sphere of diameter 60mm is placed centrally on the top face of a square prism side 60mm and height 70mm. Draw the isometric projection of the combination.

6.6 Draw the isometric projection of a hexagonal prism of side of base 40mm and height 60mm with a right circular cone of base 50mm diameter and height 60mm, resting on its top such that the axes are collinear.

6.7 Draw the isometric projection of the combination of solids shown in Figure 6.1.

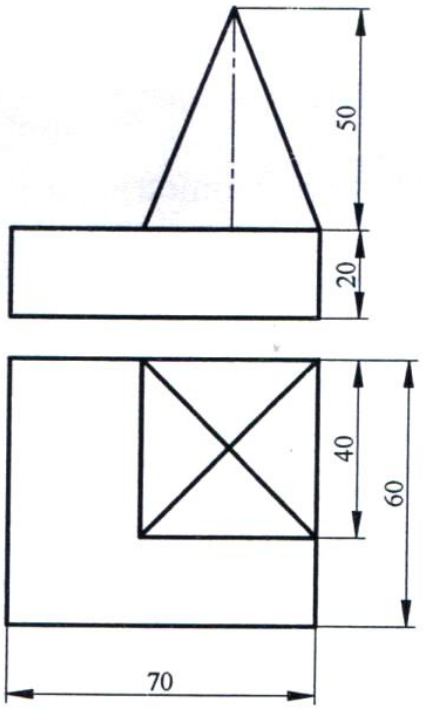
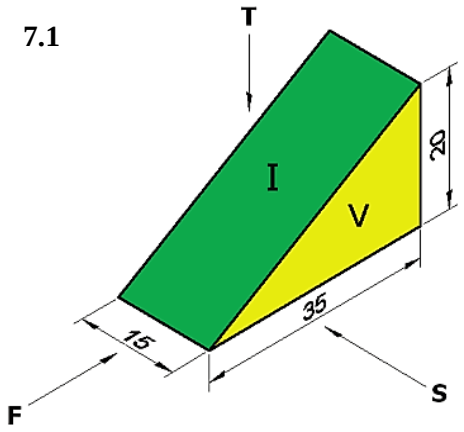


Figure 6.1

7.0 Conversion of isometric to orthographic views

7.1



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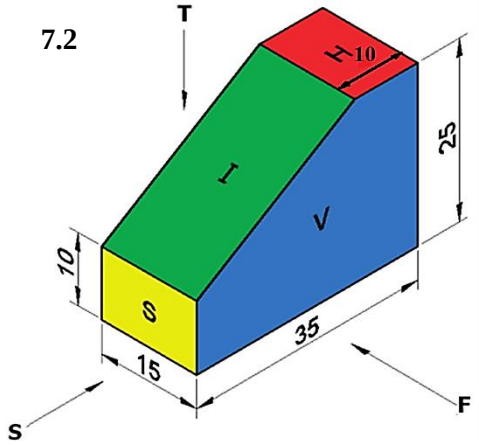

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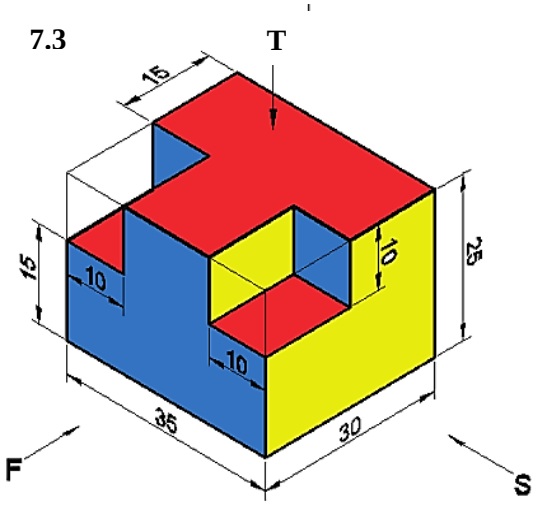

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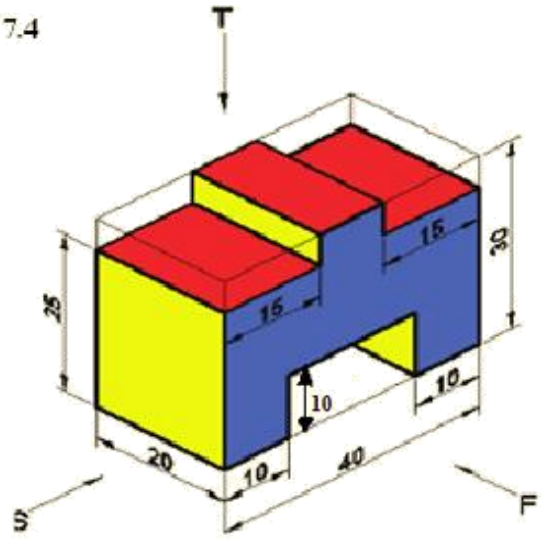

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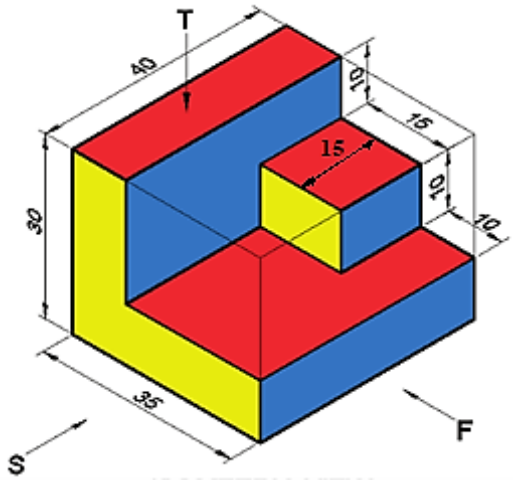

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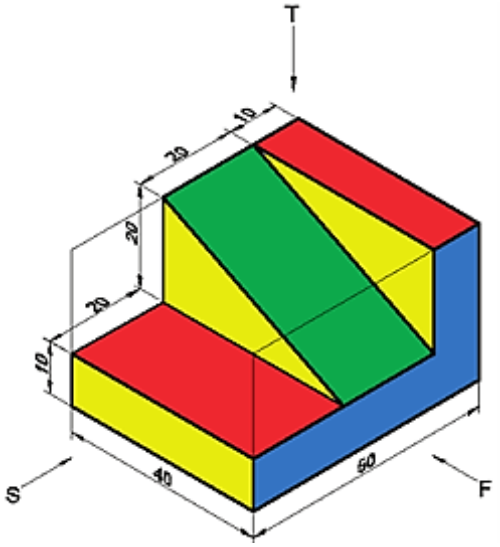
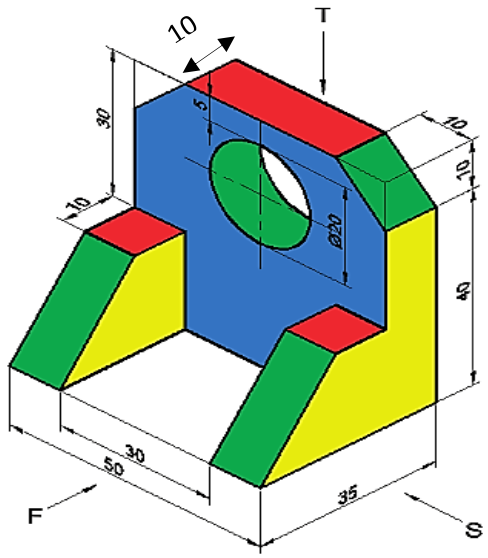


Assignment Problems

7.7



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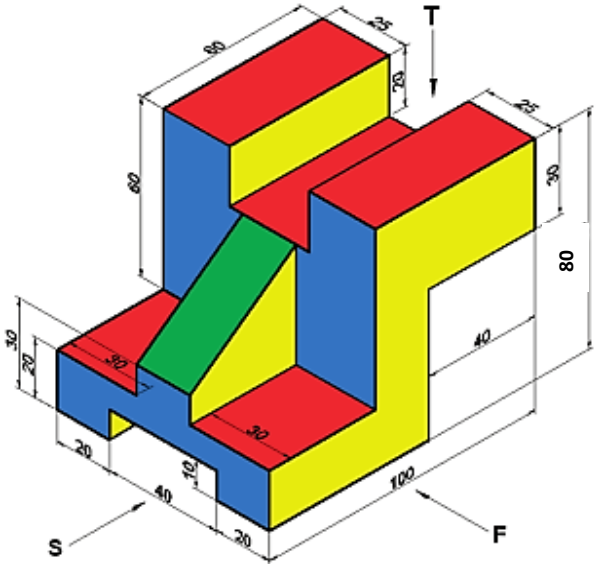
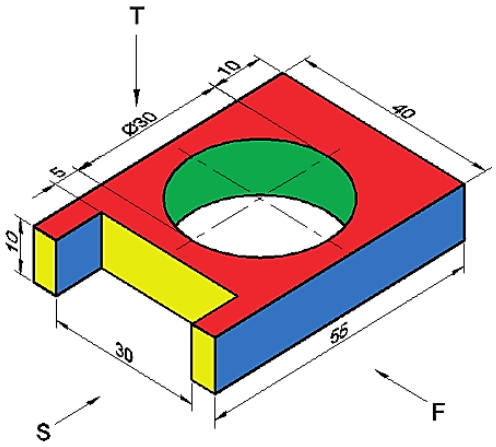
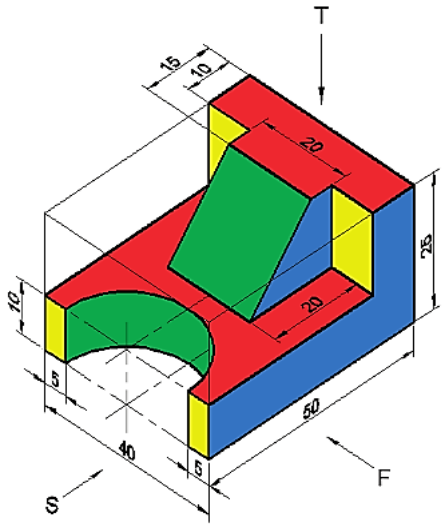


8.0 Sectional front view along the mid plane

8.1



8.2



9.0 Development of surfaces (CAD)

9.1 A triangular prism of base edge 30mm and height 50mm rests on HP with its axis vertical and a base edge parallel to VP and farther from it. A section plane perpendicular to VP and inclined at 45° to HP bisects the axis of the prism. Draw the development of lateral surface of retained portion of the solid.

9.2 A square prism of 30mm base edges and 65mm axis length rests on HP with its axis vertical and two of its lateral surfaces are equally inclined to VP. A section plane perpendicular to VP and inclined at 45° to HP bisects the axis of the prism. Draw the development of lateral surface of retained portion of the solid.

9.3 A pentagonal prism of 30mm base edges and 65mm axis length rests on HP with two of its lateral surfaces are equally inclined to VP and nearer to it. A section plane perpendicular to VP and inclined at 45° to HP bisects the axis of the prism. Draw the development of lateral surface of retained portion of the solid.

9.4 A hexagonal prism of 30mm base edges and 60mm axis length rests on HP with its axis vertical and one of its lateral surfaces is inclined at 30° to VP and nearer to it. A section plane perpendicular to VP and inclined at 45° to HP bisects the axis of the prism. Draw the development of lateral surface of retained portion of the solid.

9.5 A triangular pyramid of base edge 30mm and height 50mm rests on HP with its axis vertical and two of its base edges equally inclined to VP and nearer to it. A section plane perpendicular to VP and inclined at 45° to HP bisects the axis of the pyramid. Draw the development of lateral surface of retained portion of the solid.

9.6 Draw the development of the lateral surface of a truncated cylinder, 40mm diameter of base and height 50mm, if the truncated flat surface of the cylinder bisects the axis at 60° to it.

9.7 The frustum of a square pyramid has its base 60mm sides, top face 30mm and height 40mm. Its axis is vertical and a side of base is parallel to VP. Draw the development of lateral surfaces.

9.8 A right cone of 55mm base diameter and 75mm height stands on its base on HP. It is truncated with its surface inclined at 45° to the axis lying at a distance of 40mm from the apex of the cone. Obtain the development of the lateral surface of the truncated cone.

9.9 A hexagonal prism side of base 30mm and height 60mm is cut as shown in the Figure 9.1 Draw the development of the lateral surface of the prism.

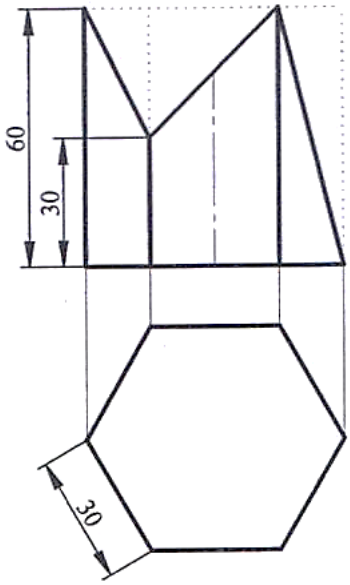


Figure 9.1

9.10 Draw the development of the lateral surface of the pyramid shown in Figure 9.2.

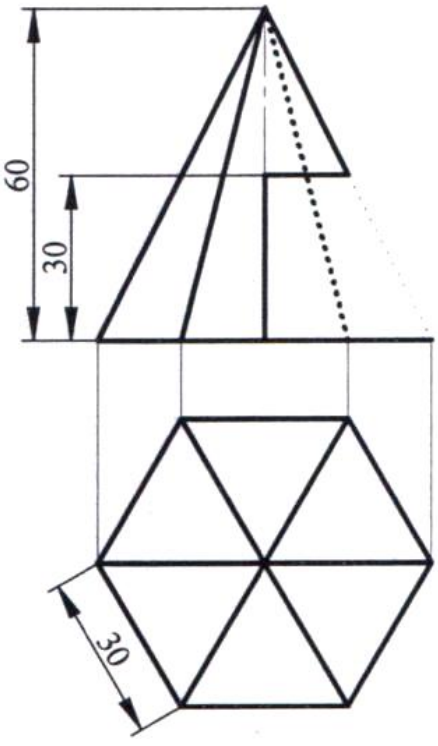
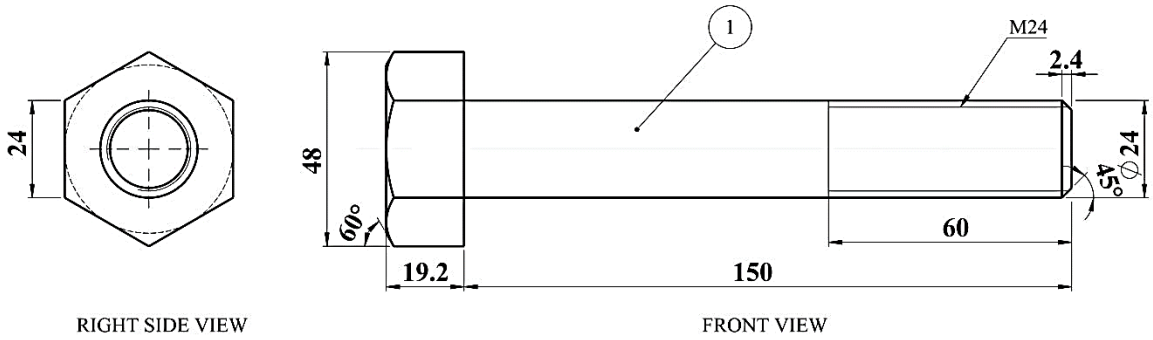
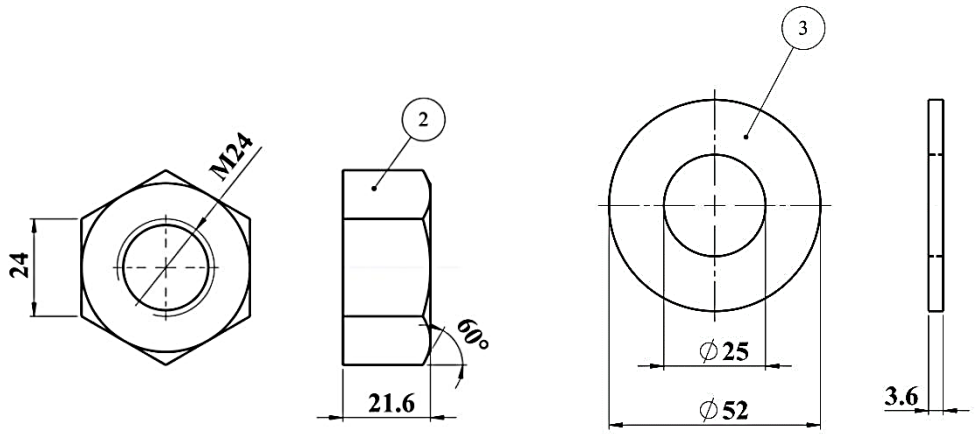


Figure 9.2

10. Engineering Components (CAD)

10.1 Create a 3D assembly model of Hexagonal headed bolt and nut with washer as shown in Figure 10.1. Generate front view, top view, left side view and isometric shaded model view.

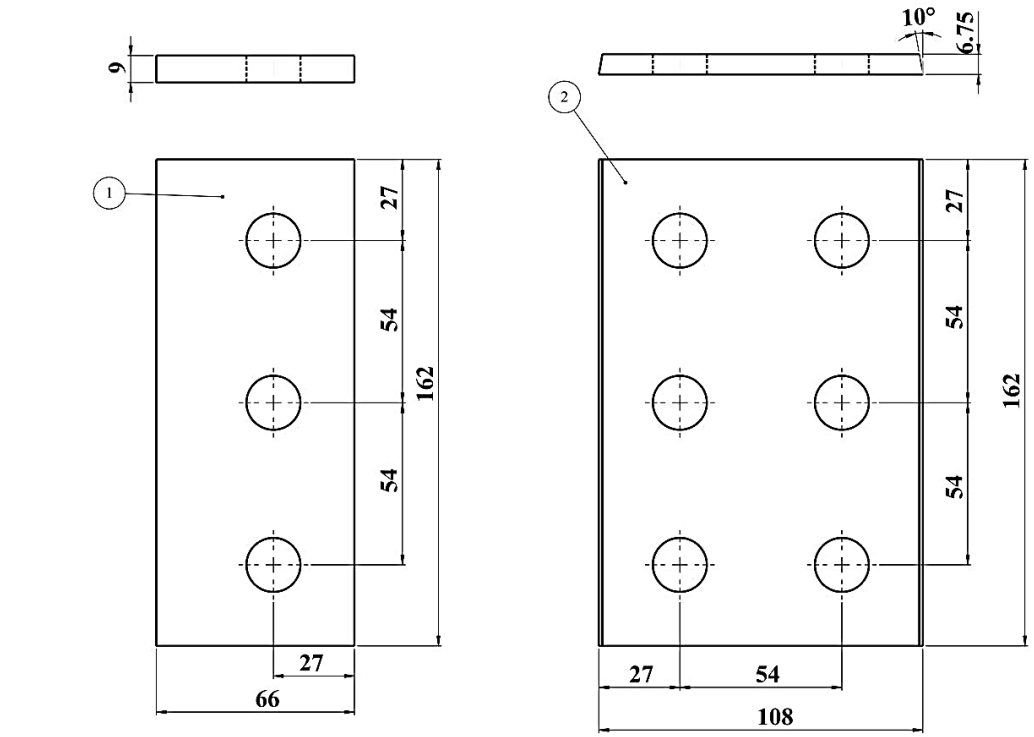


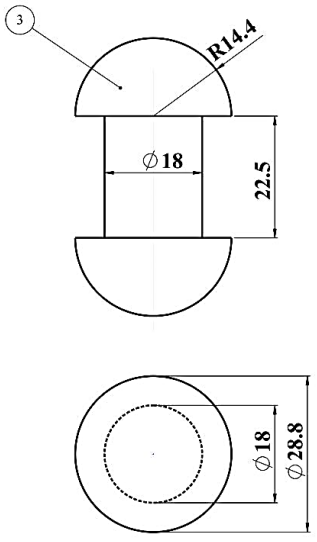


Part No.	Description	Quantity
1	Hexagonal headed bolt	1
2	Hexagonal nut	1
3	Washer	1

Figure 10.1: Part drawings of hexagonal headed bolt and nut with washer

10.2 Create a 3D assembly of double riveted butt joint with double cover plate chain riveting as shown in Figure 10.2. Show three rivets in each row.





Part No.	Description	Quantity
1	Butt plate	2
2	Cover plate	2
3	Rivet	6

Figure 10.2: Part drawings of Single riveted butt joint with double cover plate.

10.3 Create a 3D assembly model of Union joint, part drawings are shown in Figure 10.3. Generate front view, top view, left side view and isometric shaded model view of assembly.

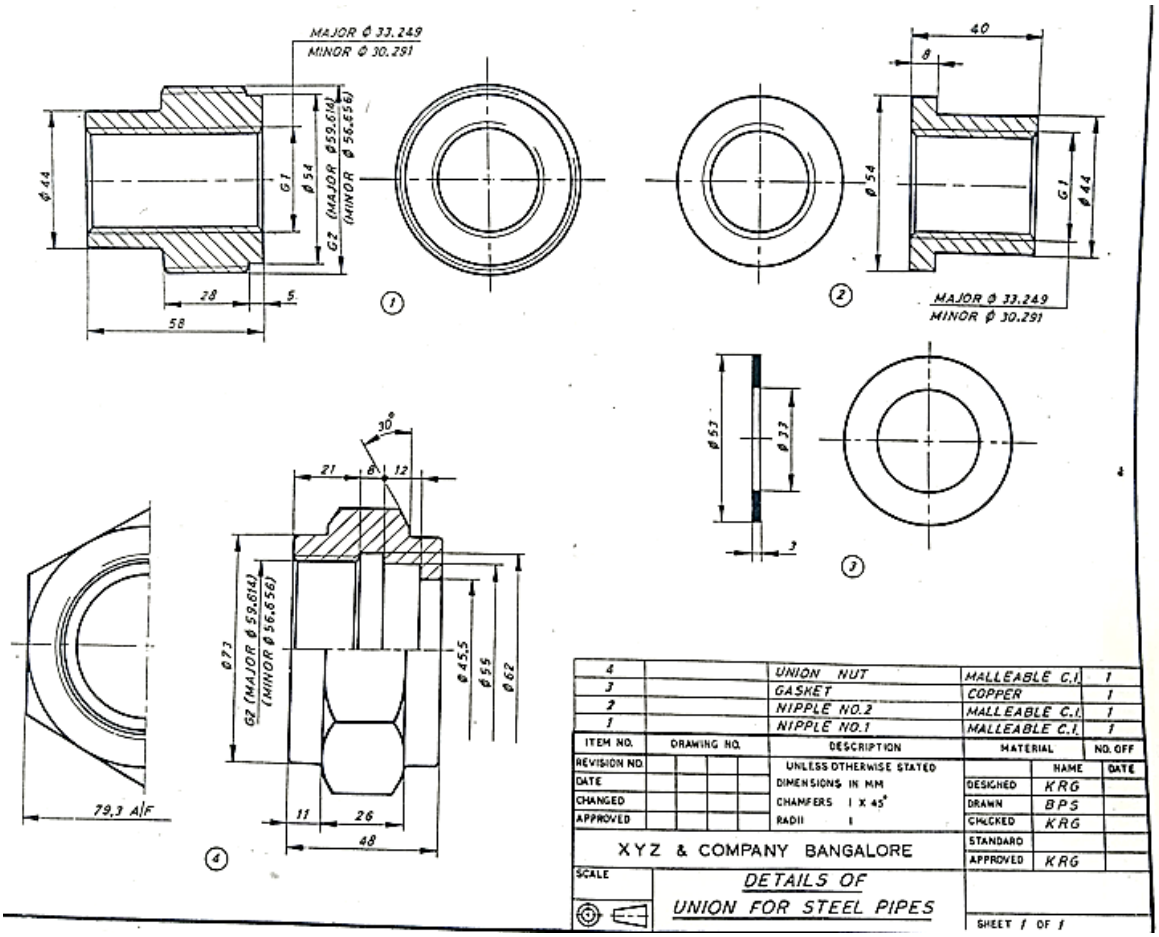


Figure 10.3: Details of Union joint.

10.4 Create a 3D assembly model of Butt Muff Coupling, part drawings are shown in Figure 10.4. Generate front view, top view, left side view and isometric shaded model view of assembly.

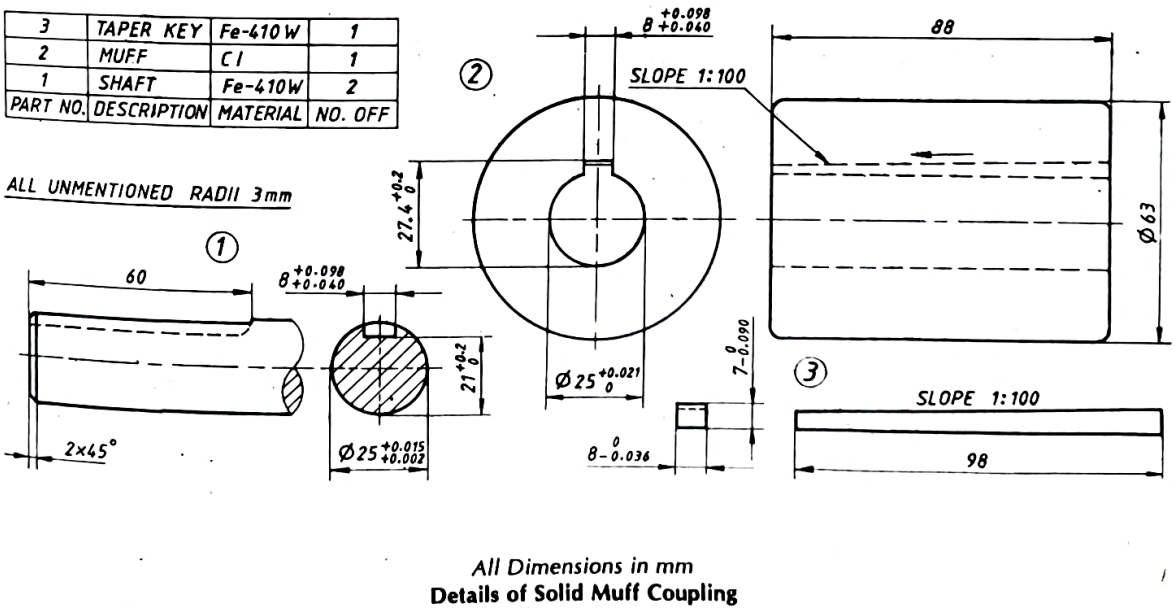


Figure 10.4: Details of Butt Muff Coupling

10.5 Create a 3D assembly model of Socket and Spigot Joint, part drawings are shown in Figure 10.5. Generate front view, top view, left side view and isometric shaded model view of assembly.

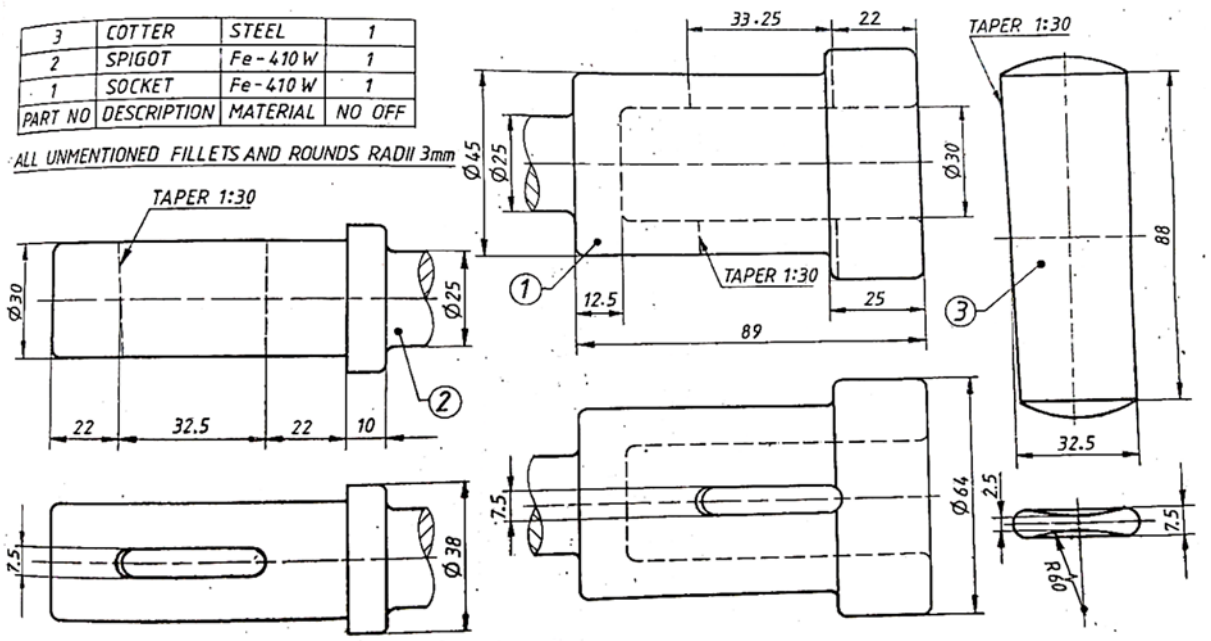


Figure 10.5: Details of Socket and Spigot Joint

11.0 Basic building drawing (Plan and Elevation): 2D

11.1 Draw single room plan of the building as shown in Figure 11.1. (Scale 1feet = 5mm)

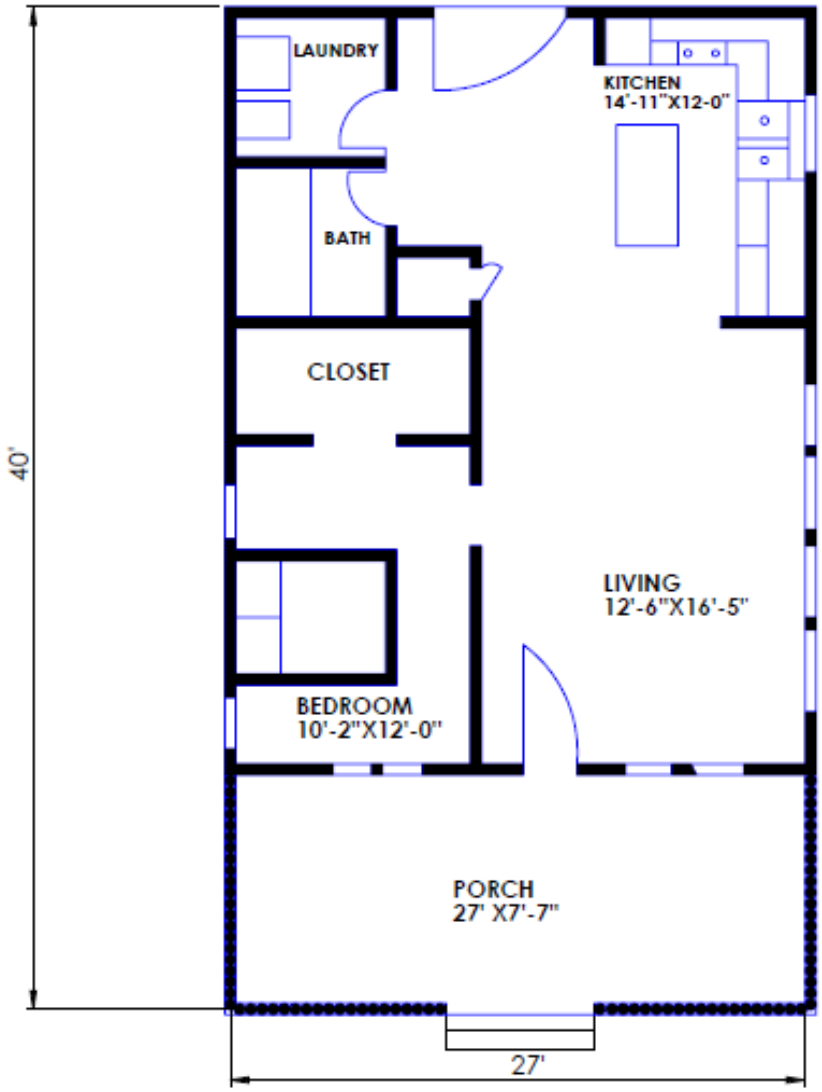


Figure 11.1: Details of single room plan

11.2 Draw the plan of two-storey building as shown in Figure 11.2. (Scale 1feet = 5mm)

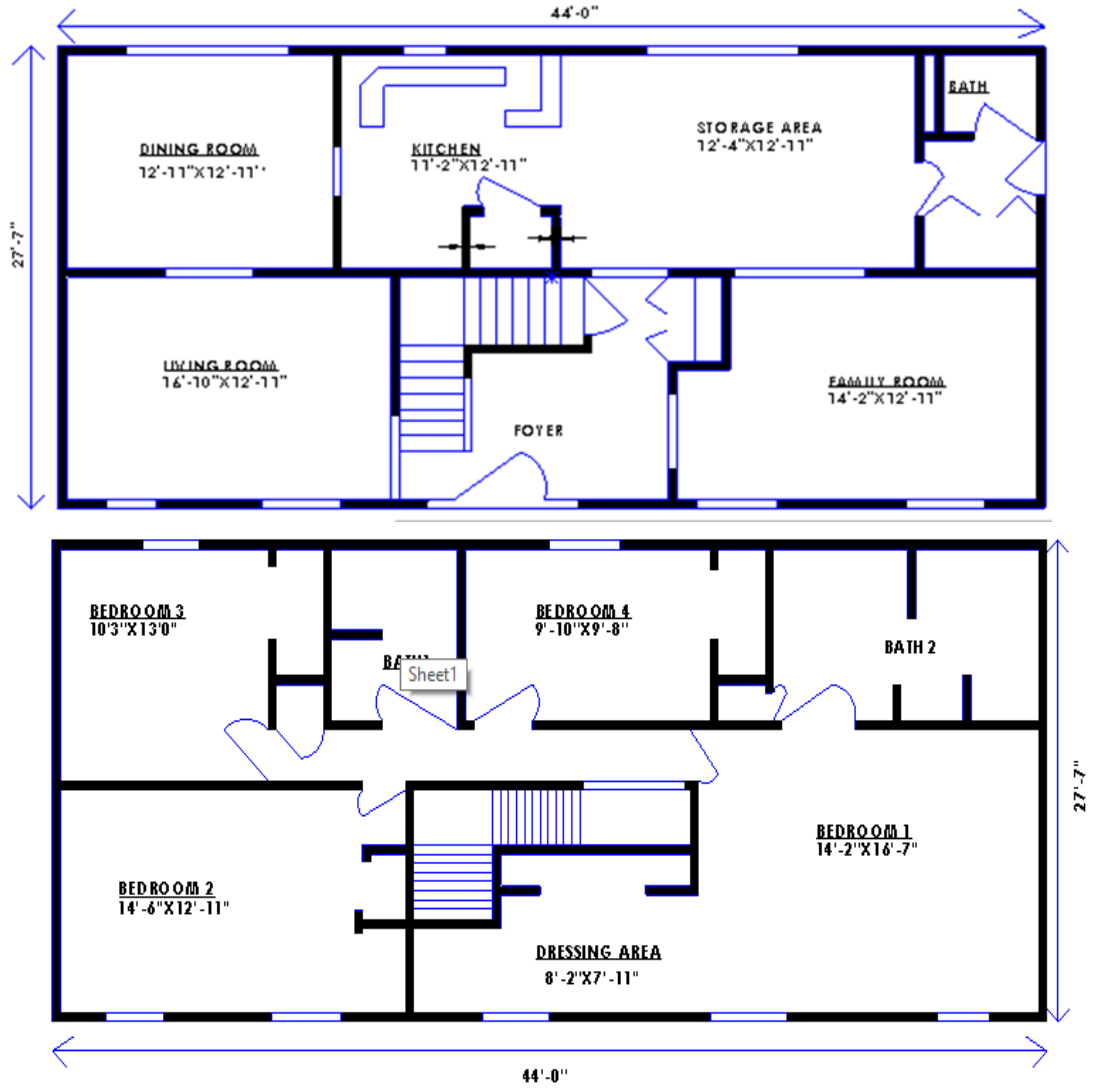


Figure 11.2: Details of Plan of Two-storey building

12.0 Electrical Drawings

12.1 Draw the electrical circuit diagram of a two-way control of lamp as shown in Figure 12.1

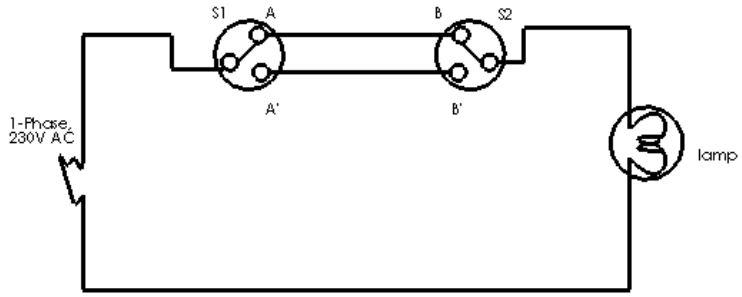


Figure 12.1: Circuit diagram of Two way control of lamp

12.2 Draw the electrical circuit diagram of three-way control of lamp as shown in Figure 12.2

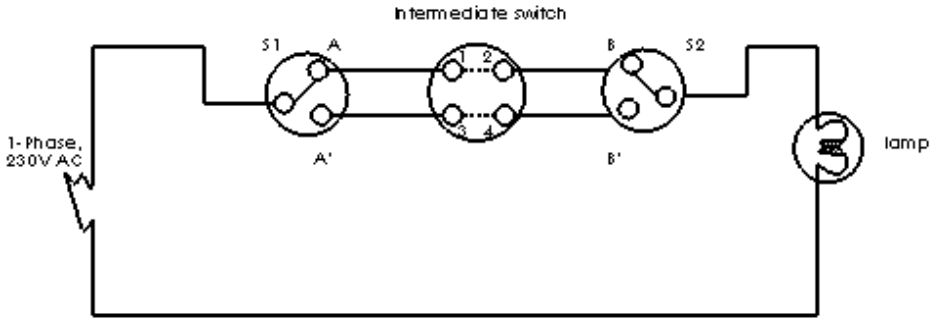


Figure 12.2: Circuit diagram of three-way control of lamp

12.3 Draw the electrical circuit diagram of Single Phase wiring diagram as shown in Figure12.3

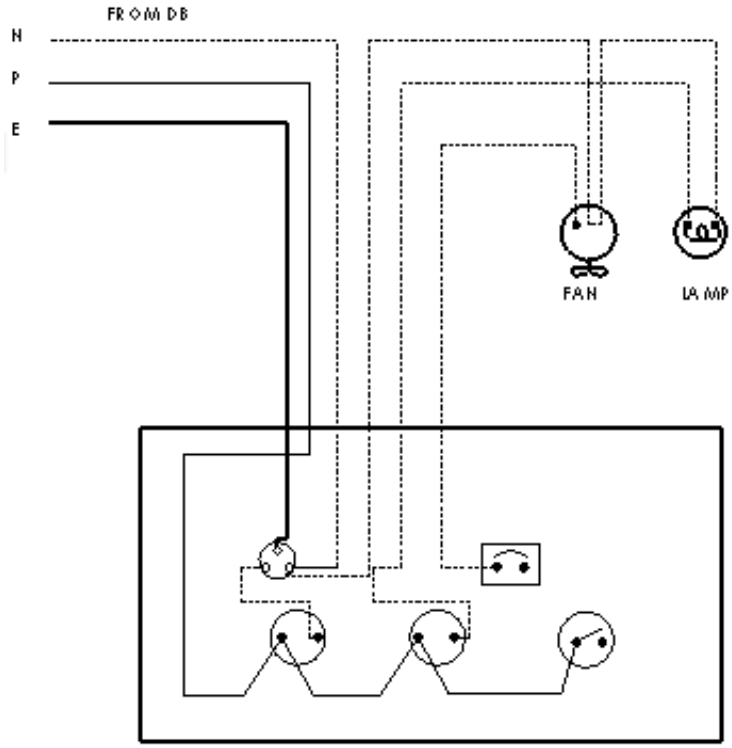


Figure 12.3: Single Phase wiring diagram

12.4 Draw the electrical circuit diagram of Single Line Diagram of 33 kV/11kVsubstation as shown in Figure 12.4

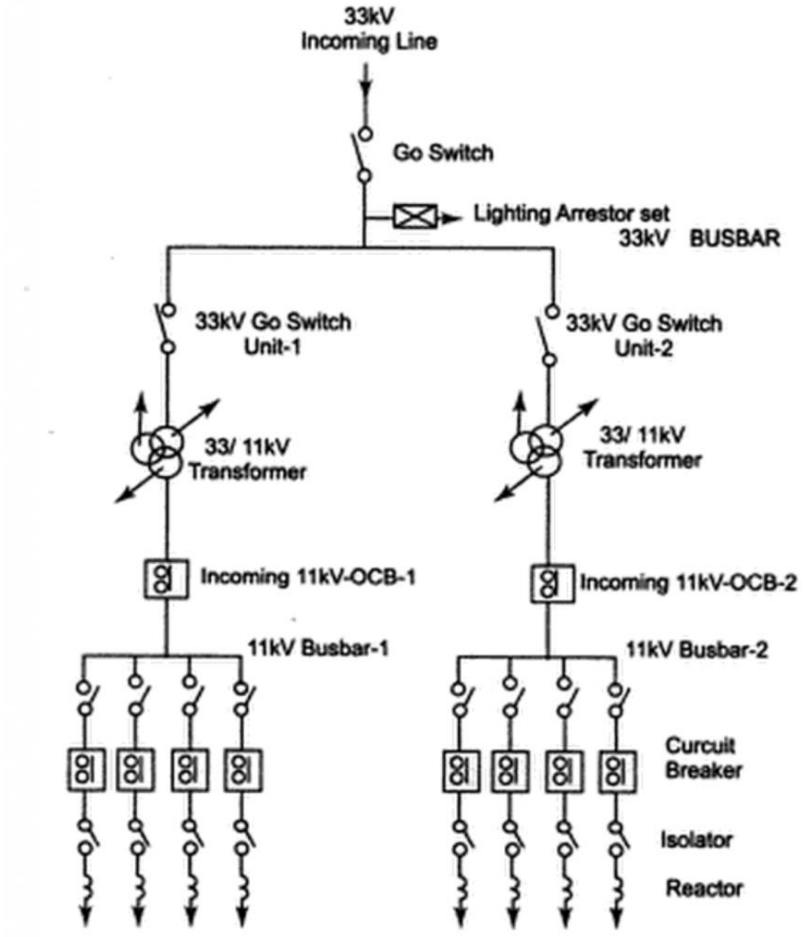


Figure 12.4: Line diagram of 33kV/11kV substation

12.5 Draw the electrical circuit diagram of 3-Phase Circuit substation as shown in Figure 12.5

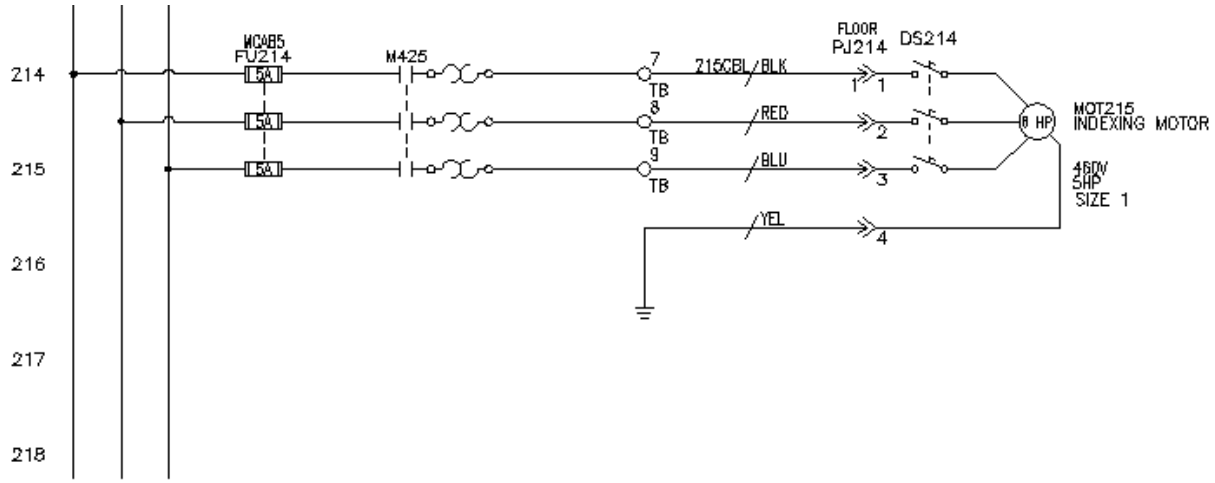


Figure 12.5: 3-Phase Circuit substation

13.0 Electronic PCB drawings: 2D

13.1 Draw electronic circuit diagram of a Positive Series Clipper as shownin Figure 13.1

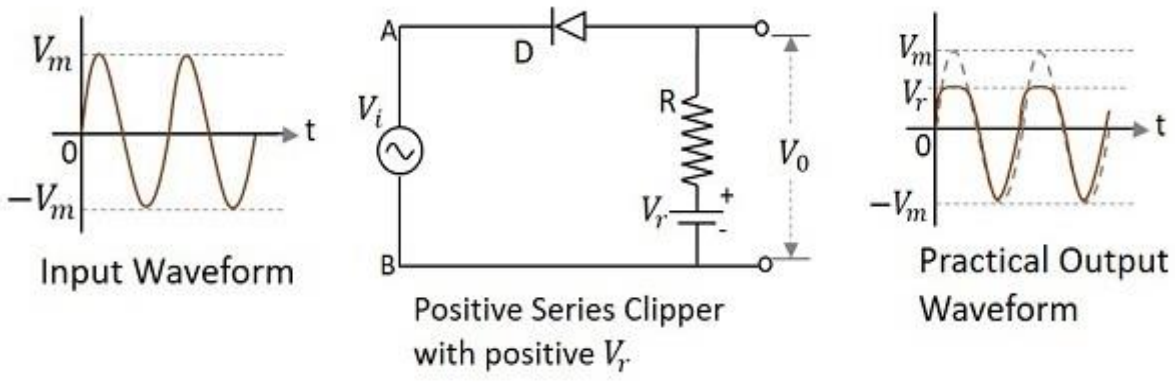


Figure 13.1: Circuit diagram of Positive series Clipper

13.2 Draw electronic circuit diagram of a Positive Clamper Circuit as shown in Figure 13.2

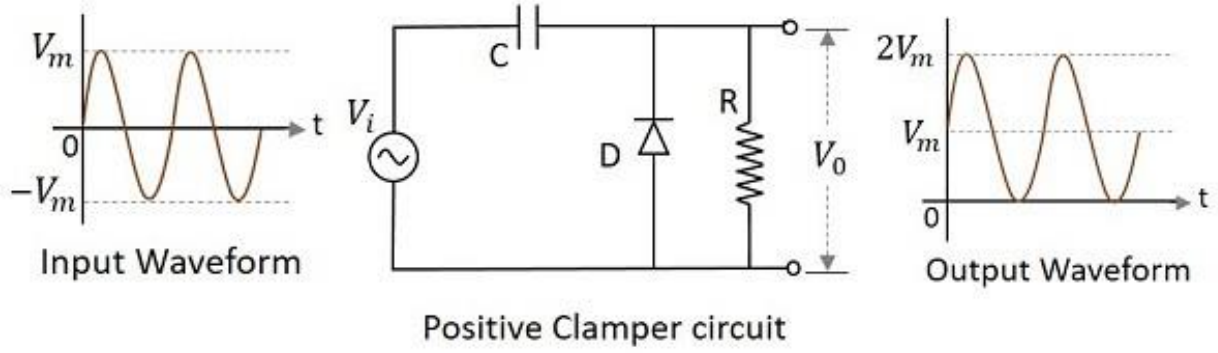


Figure 13.2: Circuit diagram of Positive Clamper Circuit

13.3 Draw electronic circuit diagram of a Full Wave Bridge Rectifier as shown in Figure 13.3

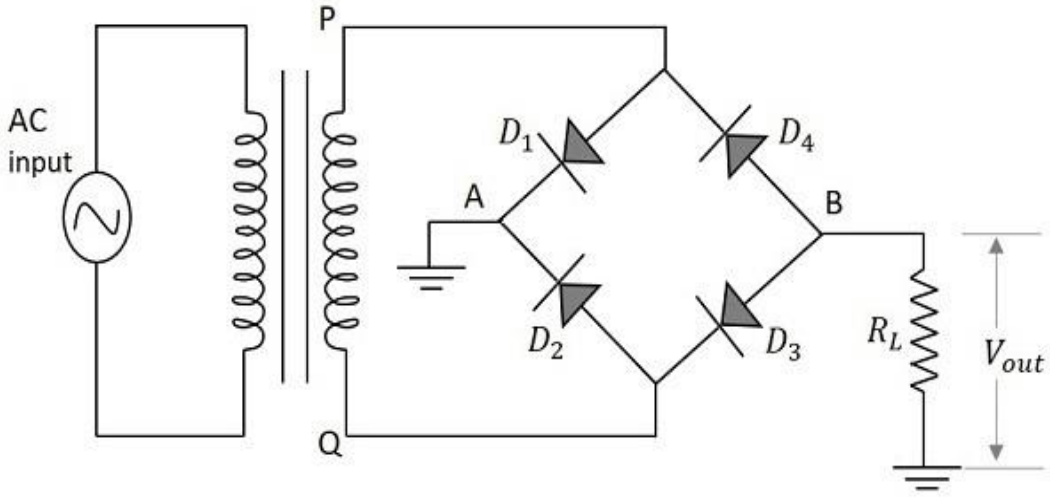


Figure 13.3: Circuit diagram of Full wave bridge Rectifier

13.4 Draw electronic circuit diagram of Center Tapped Full-Wave Rectifier as shown in Figure 13.4

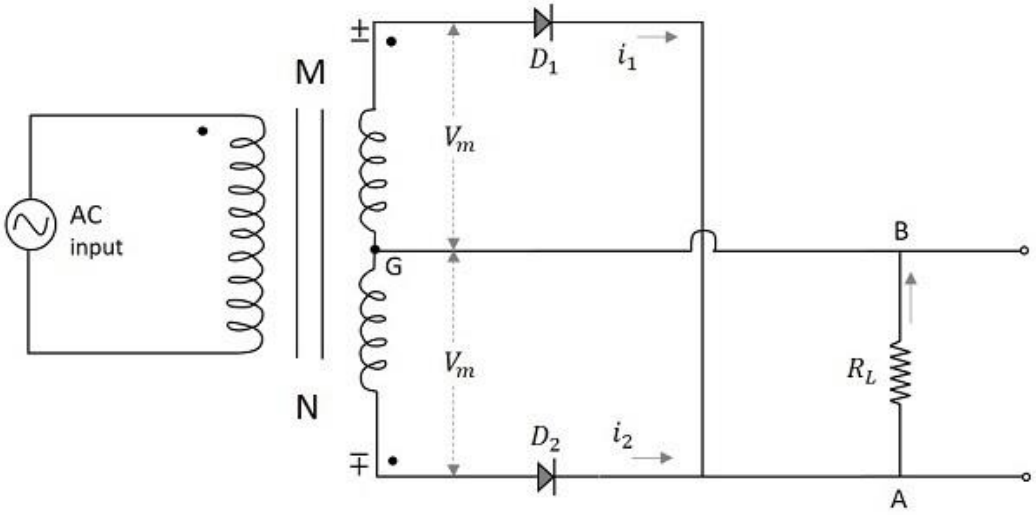


Figure 13.4: Circuit diagram of Center Tapped Full-wave Rectifier

13.5 Draw electronic circuit diagram of as shown in Inverting Amplifier Figure 13.5

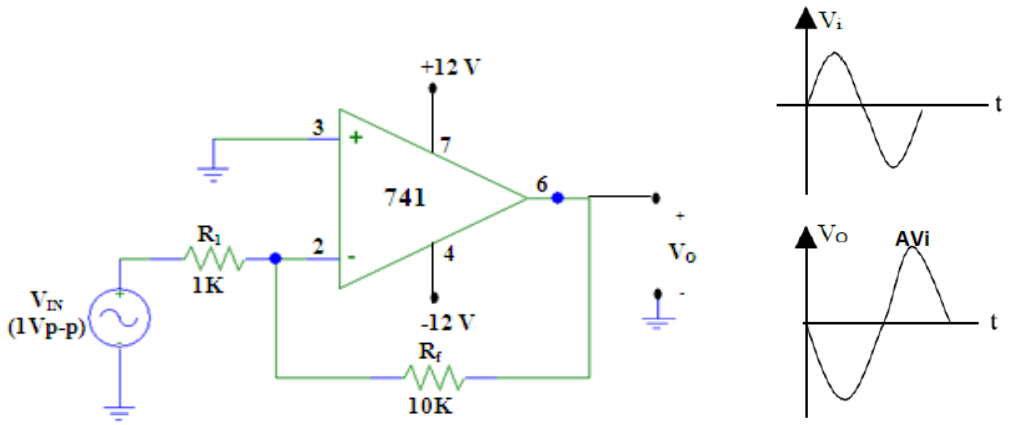


Figure 13.5: Circuit diagram of Inverting Amplifier

13.6 Draw electronic circuit diagram of Inverting Summer as shown in Figure 13.6

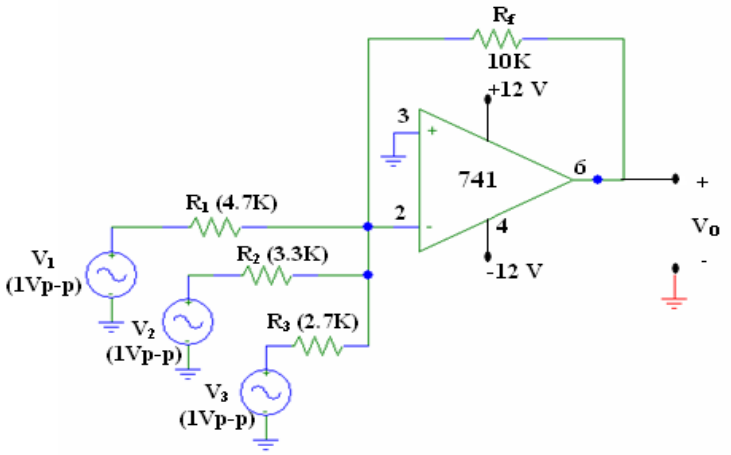


Figure 13.6: Circuit diagram of Inverting summer

13.7 Draw electronic circuit diagram of RC Coupled Amplifier as shown in Figure 13.7

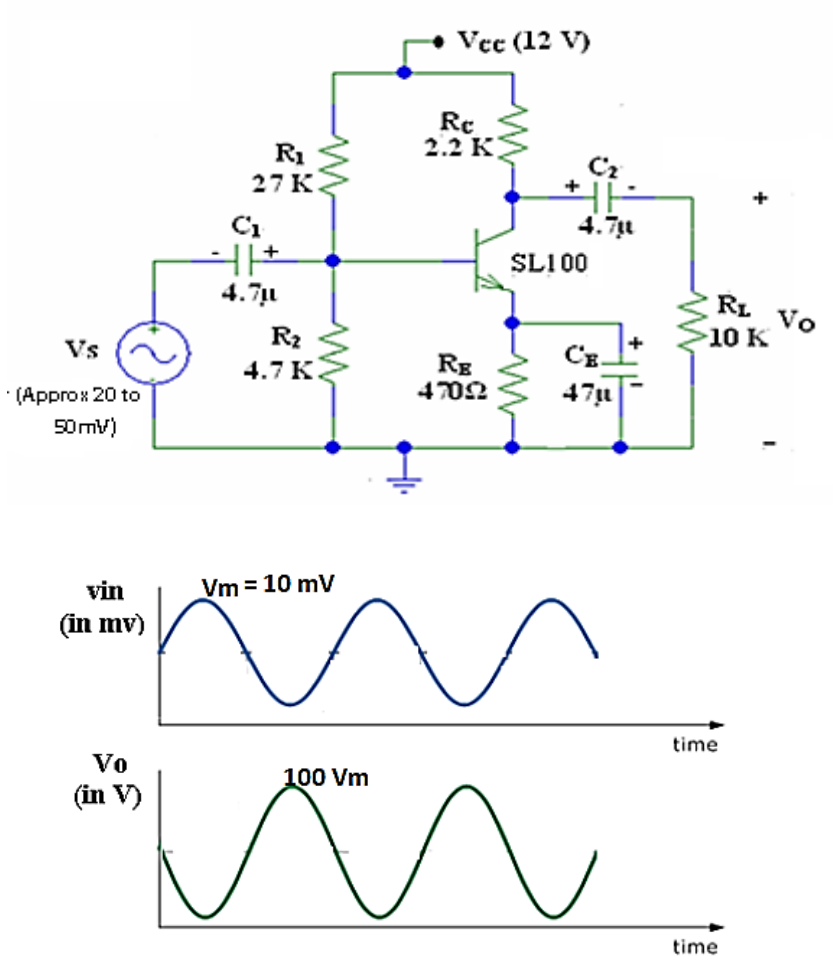


Figure 13.7: Circuit diagram of RC Coupled Amplifier