CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
Accredited with Grade A by NAAC

ELEMENTS OF ENGINEERING

LABORATORY MANUAL

Course Code - ME145

B. Tech 1st Year (CE/IT/EC/CSE)

Academic Year: 2021-22

ME145 ELEMENTS OF ENGINEERING-Course Outcome (CO)	
CO1	Describe the fundamentals of engineering drawing, engineering scale and engineering curve.
CO2	Interpret and describe the drawing of projection & section of solid.
CO3	Visualize and draw three-dimensional of engineering components through orthographic, sectional orthographic and isometric drawing and use the computer for geometric modelling.
CO4	Explain and write fundamental principles of mechanical engineering and different mechanical system.
CO5	Explain the importance of civil engineering and land surveying.
CO6	Interpret and describe the different building components, building planning and design of residential building.

List of Sheets/Experiments (ME145 EOE)		
Sr. No.	**Title**	**Course Outcomes**
1	Orthographic Projections & Isometric View	CO1, CO3
2	Computer Aided Drafting & Modeling	CO1, CO3
3	Scope of Civil Engineering	CO5
4	Introduction to Surveying-1	CO5
5	Introduction to Surveying-2	CO5
6	Building Components Drawing-1	CO6
7	Building Components Drawing-2	CO6
8	Principles of Building Planning	CO6

CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
Accredited with Grade A by NAAC

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
CHANGA – 388 421

CERTIFICATE

This is to certify that Mr. /Ms._____

of _____ Class, Roll No. _____

Exam No. _____ has satisfactorily completed his / her term

work in **ME145 Elements of Engineering** *for the term ending*

_____ in 2021/22.

Date :

Sign of the Faculty *Head of the Department*

INDEX

Sr. No.	Date	Sheet/Experiment No.	Page No.	Marks/ Grade	Date of Assessment	Sign of Faculty
1		Orthographic Projections & Isometric View				
2		Computer Aided Drafting and Modeling				
3		Scope of Civil Engineering				
4		Introduction to Surveying-1				
5		Introduction to Surveying-2				
6		Building Components Drawing-1				
7		Building Components Drawing-2				
8		Principles of Building Planning				

Drawing Equipment's & Materials (for Laboratory work)

- Mini Drafter.
- Set squares = 45° & 30°- 60° (Within built French curves and protractor).
- Instrument Box (Engineering Compass Box).
- Eraser and Drawing clips (or pins).
- 0.5 mm clutch pencil (with H & 2H Lead only).
- Stencils (Stencil 4, 6 & 8 mm - Small and Capital letters).
- Circle master, Scale and Roller scale.
- Sketch Books (A3 size), Drawing sheets (A2 size) and Sheet container.

How to begin your drawing?

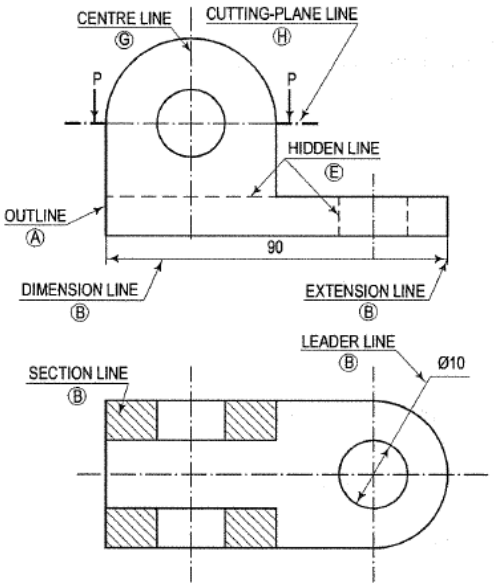
- Clean the drawing board and all the drawing instruments using handkerchief.
- Fix the drawing sheet on the drawing board (table).
- Fix the mini-drafter in convenient position.
- Draw borderlines on sheet
- Spacing of drawing between two problems /view is to be planned before the commencement of the drawing.
- Print the problem number on the left top and then commence the drawing work.

Important guidelines for students:

- Always be punctual in time. Latecomer won't be permitted without solid reason.
- Before starting each sheet, signature of concern batch teacher should be taken on the sheet without fail; else no credit would be given to that practical sheet.
- Students should bring the drawing sheet ready for the practical. The borderlines and
- Title block should be drawn on the drawing sheet before coming for the practical.
- Before starting each sheet in the college, each student will have to ensure that the work in the sketch Book pertaining to that sheet is completed in all respect; else the student will not be allowed to start his work in the sheet.
- Batch wise problems will be drawn on the sheet in the scheduled practical turn in the drawing hall only.
- Any data written on the sheets should be in the block (CAPITAL) letters only.
- All problems of all sheets should be drawn by first angle projection method if not specify.
- Name and ID No. Should be written on sheet in the title block with the ball pen.

Practice Drawings:

1. Representations of Lines



2. Dimensioning Terms and Notations

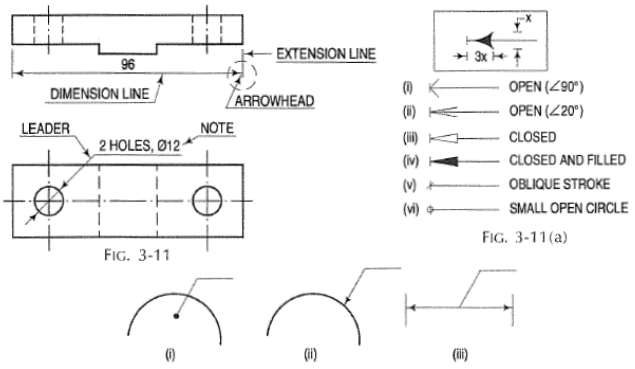
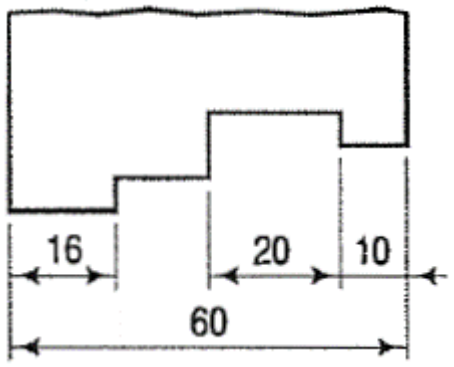


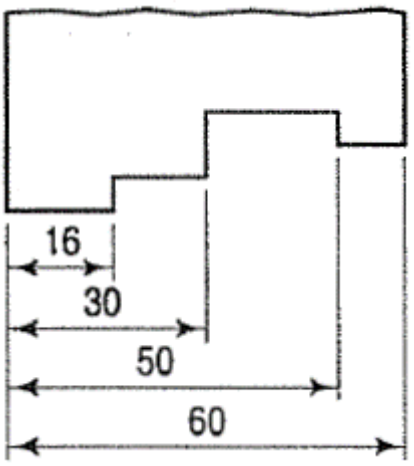
FIG. 3-11

FIG. 3-11(a)

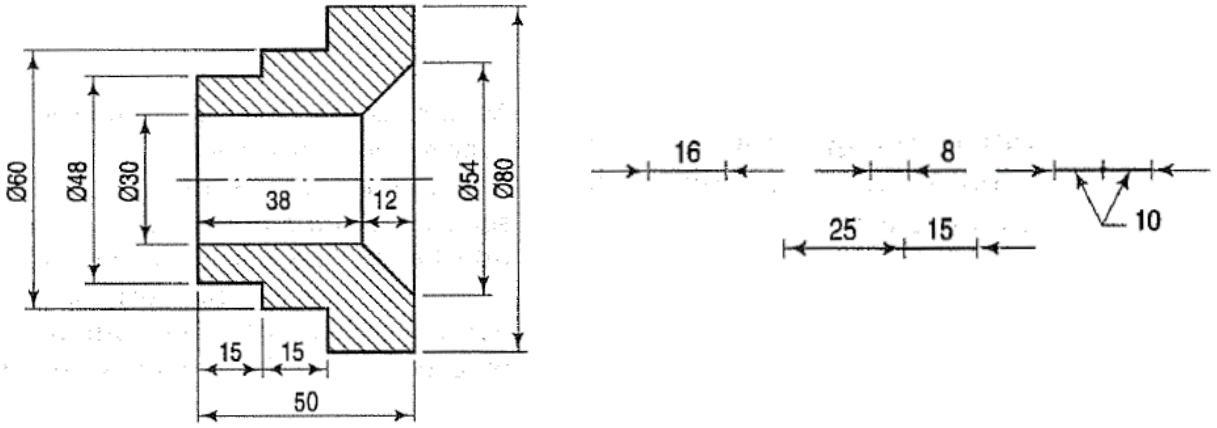
3. Practical Hints on Dimensioning



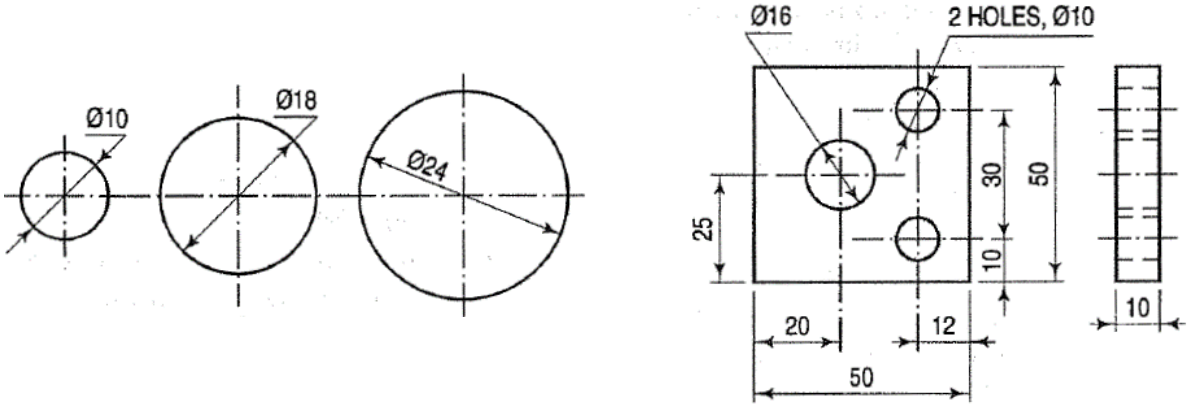
a. Continuous or Chain Dimensioning



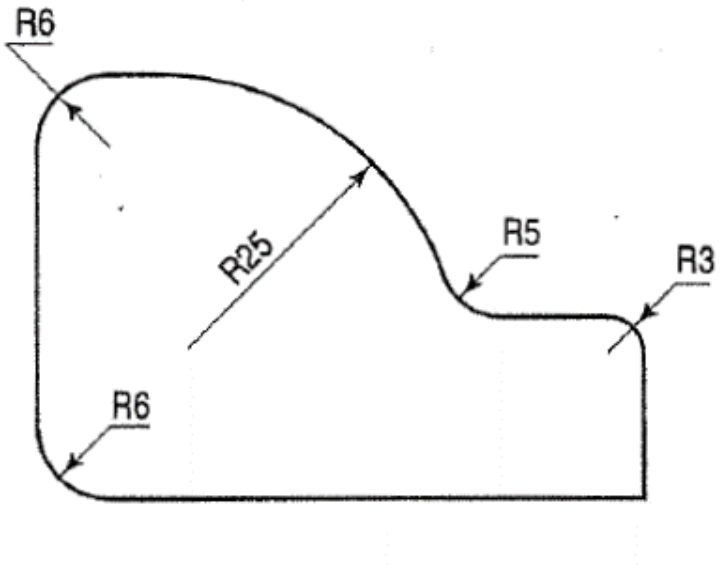
b. Progressive or Parallel Dimensioning



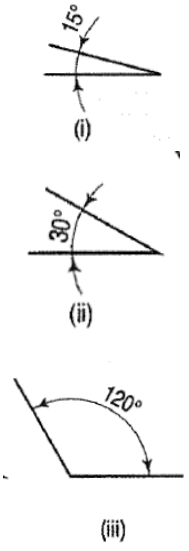
c. Parallel Dimensioning



d. Dimensioning of Circles

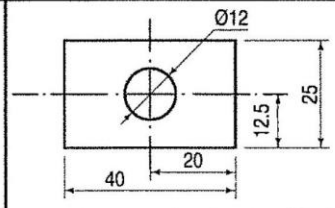
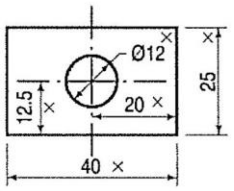
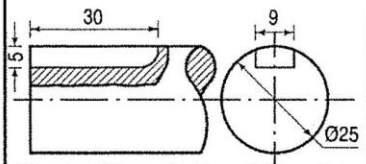
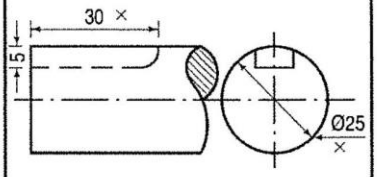
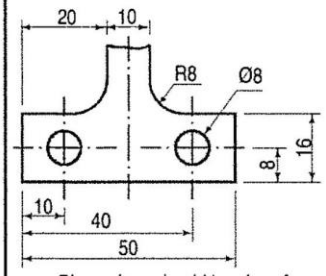
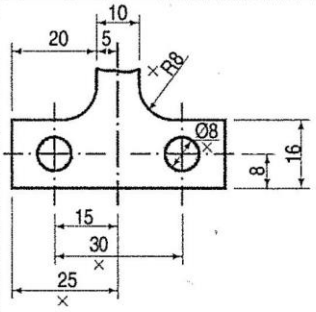
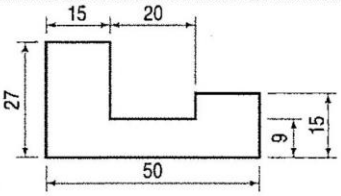
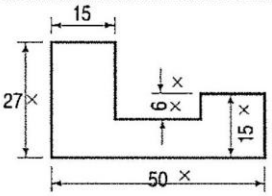
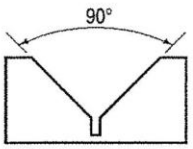
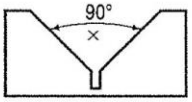
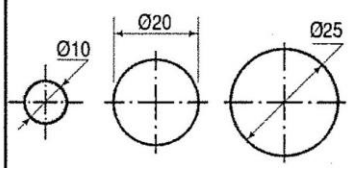
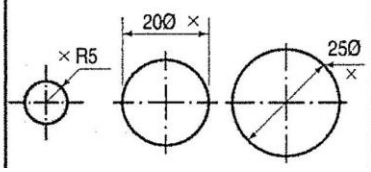


e. Different Methods of Showing the Radii of Arcs

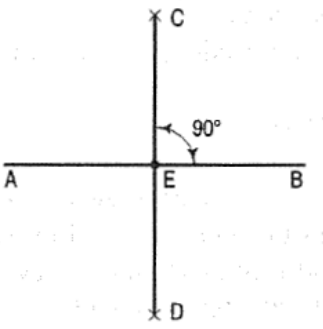


f. Angular Dimensions

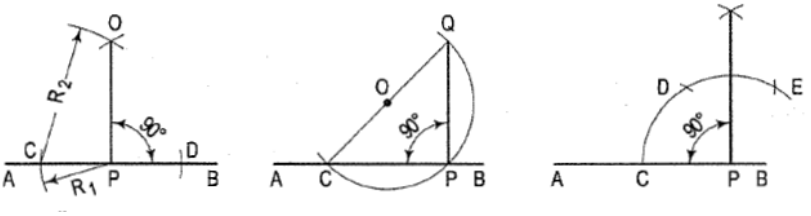
4. Correct Dimensioning

	CORRECT	INCORRECT	REASONS FOR INCORRECT
(i)	 Dimensions should be placed outside view		1. Arrow head not proportionate. 2. Hole dimension shown in figure. Leader line not ends horizontally. 3. Dimension '40' is too close. 4. Placing dimensions methods mix. Dimension '40' is according to aligned method.
(ii)	 Dim. should be marked from visible outlines		1. A key-way is shown with dotted line where the dimensions are placed. 2. Leader line for the shaft diameter is drawn horizontal touching the boundary line.
(iii)	 Dimensions should be given from the outlines (finished surface) or a centre line of a hole		1. Dimensions are given form the mid-line of the object. 2. Dimensions of holes are shown inside the figure. 3. Dimensions are shown in vertical line. 4. Smaller dimensions (25 mm) precedes the larger dimensions (30 mm). 5. Fillet radius is not shown.
(iv)			1. Dimension lines are used as extension. 2. Dimensions are placed inside the view. 3. Dimension 27 and 50 not written according to aligned system.
(v)			Section overlap the dimension 21.
(vi)			The outlines of the object are used as the extension lines.
(vii)			1. Smaller circle is designated with radius. 2. Convention 'Ø' for diameter is placed after dimension. 3. Leader has arrow and it is drawn horizontal.

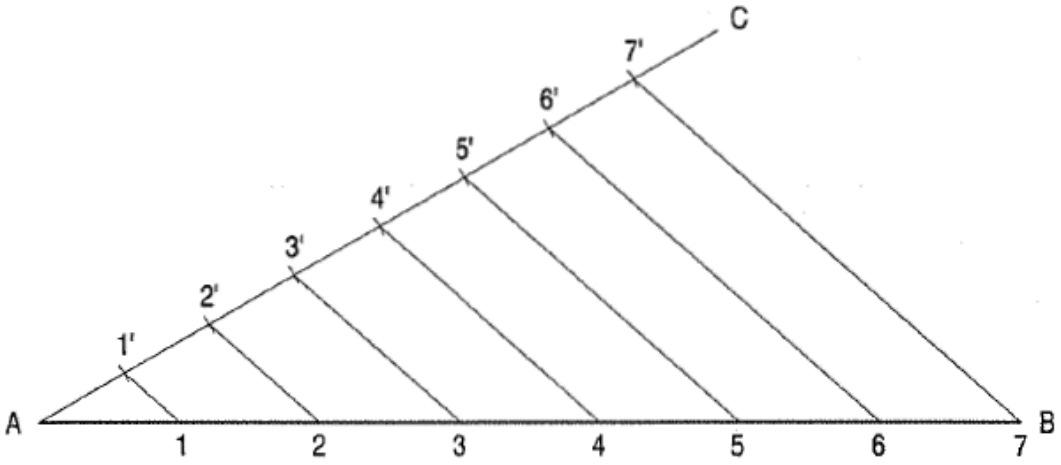
5. Bisecting a Geometry



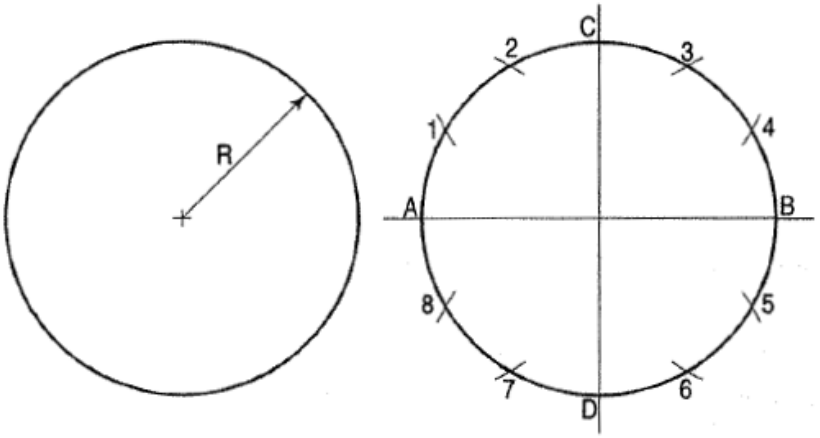
a. Bisect a Straight Line



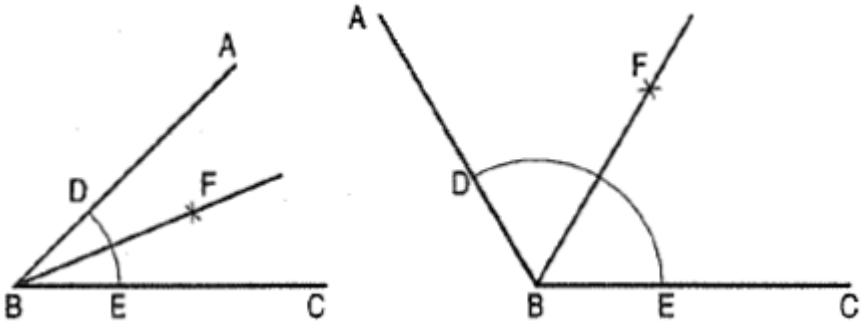
b. Draw a Perpendicular



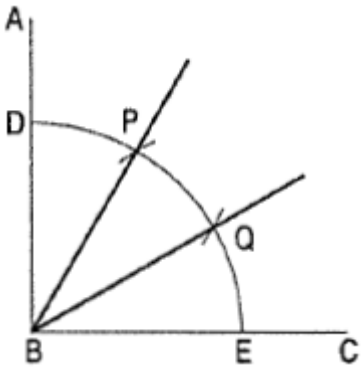
C. Divide a Line in N Equal Parts (Here, N=7)



d. Divide a Circle into 12 Equal Parts

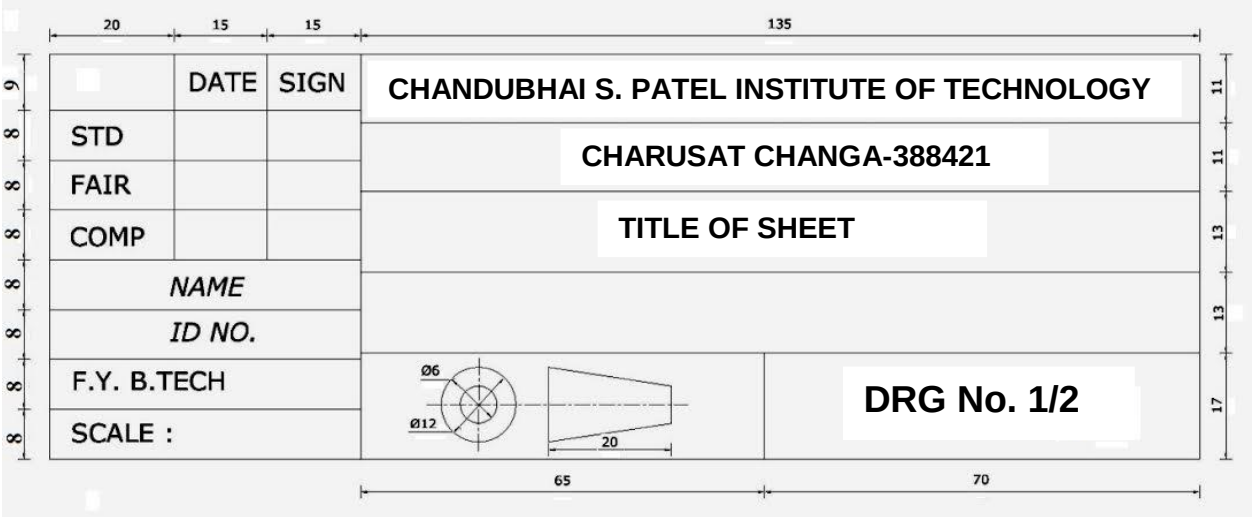


e. Bisect an Angle



f. Trisect a Right Angle

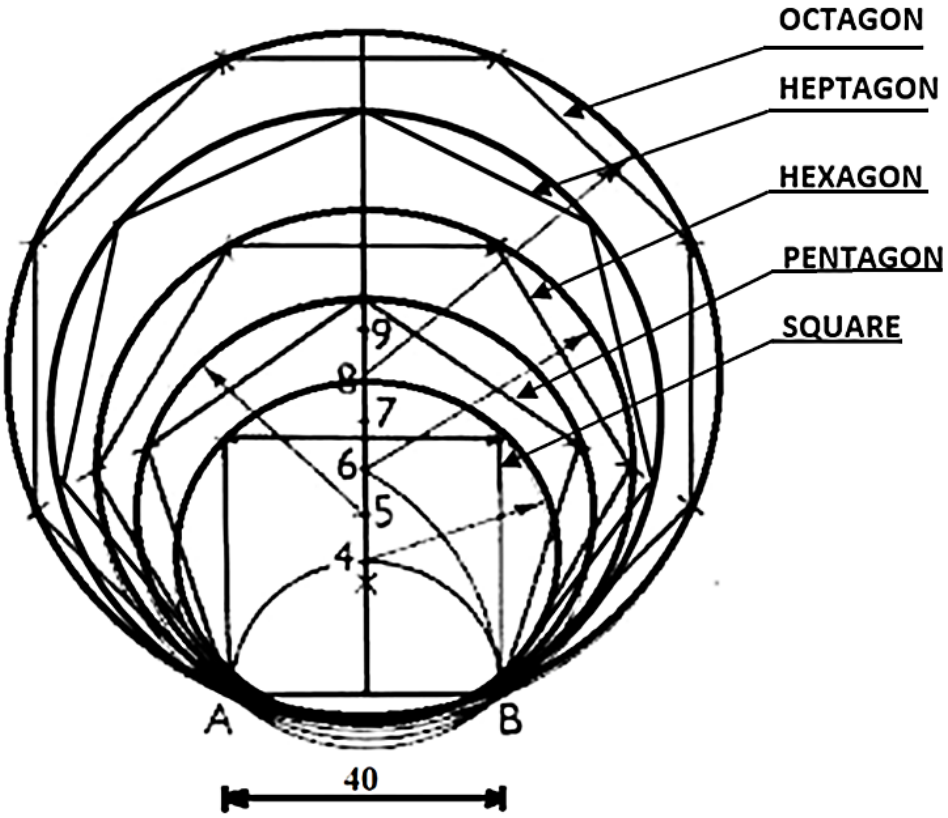
1. TITLE BLOCK:



2. TYPES OF LINES:

Line	*Description*	*General Applications*
A ———	Continuous thick	A1 Visible outlines
B ———	Continuous thin (straight or curved)	B1 Imaginary lines of intersection B2 Dimension lines B3 Projection lines B4 Leader lines B5 Hatching lines B6 Outlines of revolved sections in place B7 Short centre lines
C ~~~	Continuous thin, free-hand	C1 Limits of partial or interrupted views and sections, if the limit is not a chain thin
D —/\/\/\—	Continuous thin (straight) with zigzags	D1 Line (see Fig. 2.5)
E — — — — — —	Dashed thick	E1 Hidden outlines
G —— – —— – ——	Chain thin	G1 Centre lines G2 Lines of symmetry G8 Trajectories
H —·—	Chain thin, thick at ends and changes of direction	H1 Cutting planes
J —— – —— – ——	Chain thick	J1 Indication of lines or surfaces to which a special requirement applies
K —— – – —— – – ——	Chain thin, double-dashed	K1 Outlines of adjacent parts K2 Alternative and extreme positions of movable parts K3 Centroidal lines

3. Geometric Construction:



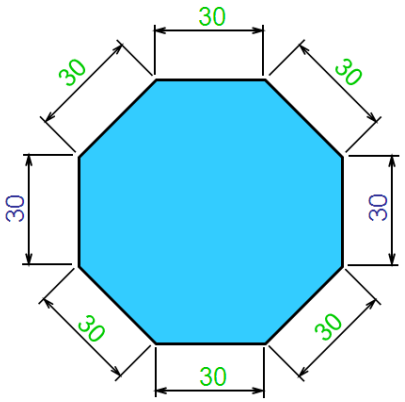
4. Dimensioning System:

General Principles:

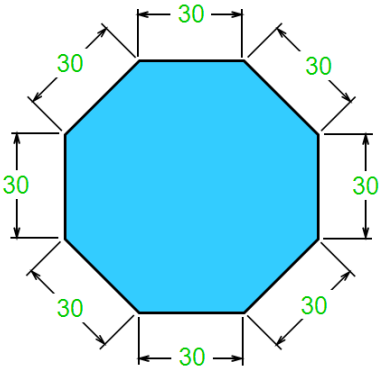
- All dimensions should be detailed on a drawing.
- No single dimension should be repeated except where unavoidable.
- Mark the dimensions outside the drawing as far as possible.
- Avoid dimensioning to hidden lines wherever possible.
- The longer dimensions should be placed outside all intermediate dimensions, so that dimension lines will not cross extension lines.

Elements of dimensioning:

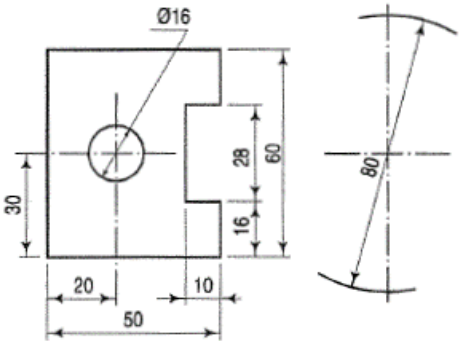
1. Students should identify and know the correct drawing of the following dimensioning elements like Dimension lines, Extension lines, Leader lines, Arrowheads.
2. Draw the figure in both, Aligned system & unidirectional system.

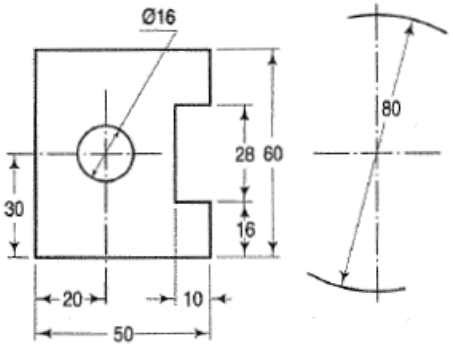


Aligned System



Unidirectional System





Conversion of Units for Reference:

1 centimetre (cm)	=	10 millimeter(mm)
1 decimeter (dm)	=	10 centimeter(cm)
1 meter (m)	=	10 decimeter (dm) 100 centimeter(cm) 1000 millimeter(mm)
1 decameter (dam)	=	10 meter(m) 100 decimeter(dm)
1 hectometer (hm)	=	10 decameter 100 meter
1 kilometer (km)	=	10 hectometer 1000 meter

Other important conversions:

1 inch	=	2.54 cm
1 foot	=	12 inches
1 yard	=	3 feet 36 inches
1 mile	=	1760 yards 5280 feet 1.609 km

Sheet 1: Orthographic Projections & Isometric View

BATCH A

1. Draw the following View for **Figure 1**
   a) Front View
   b) Top View
   c) Right hand side View

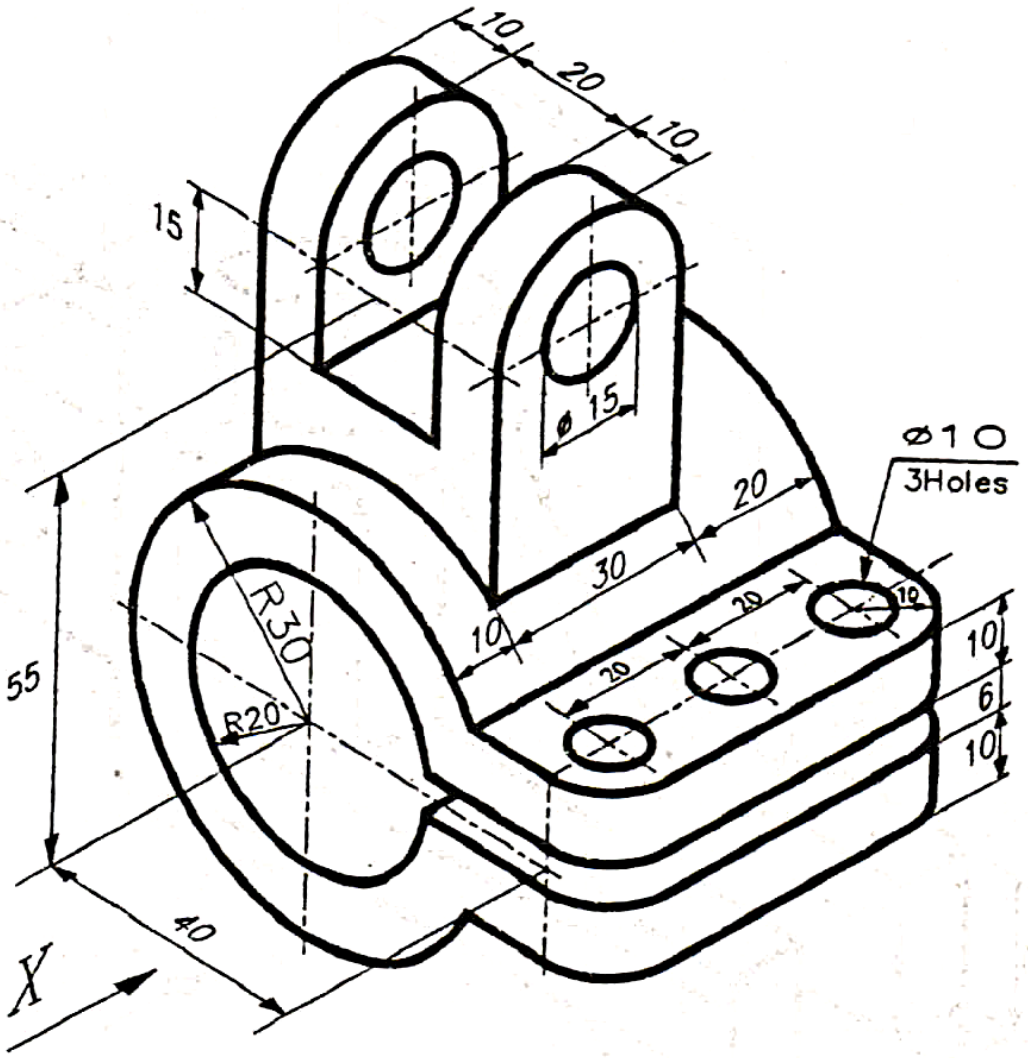


Figure 1

2. Draw the following View for **Figure 2**
   a) Right hand side view
   b) Top View
   c) Sectional FV

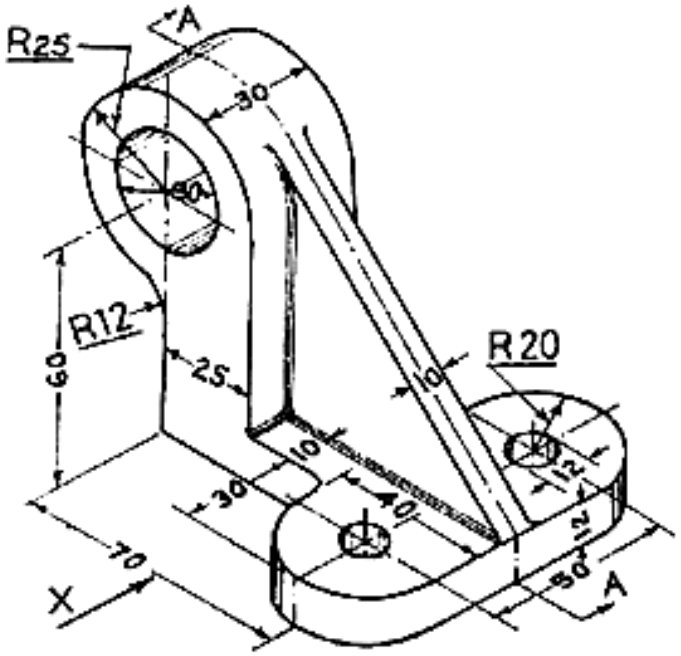


Figure 2

3. Draw Isometric View for **Figure 3**

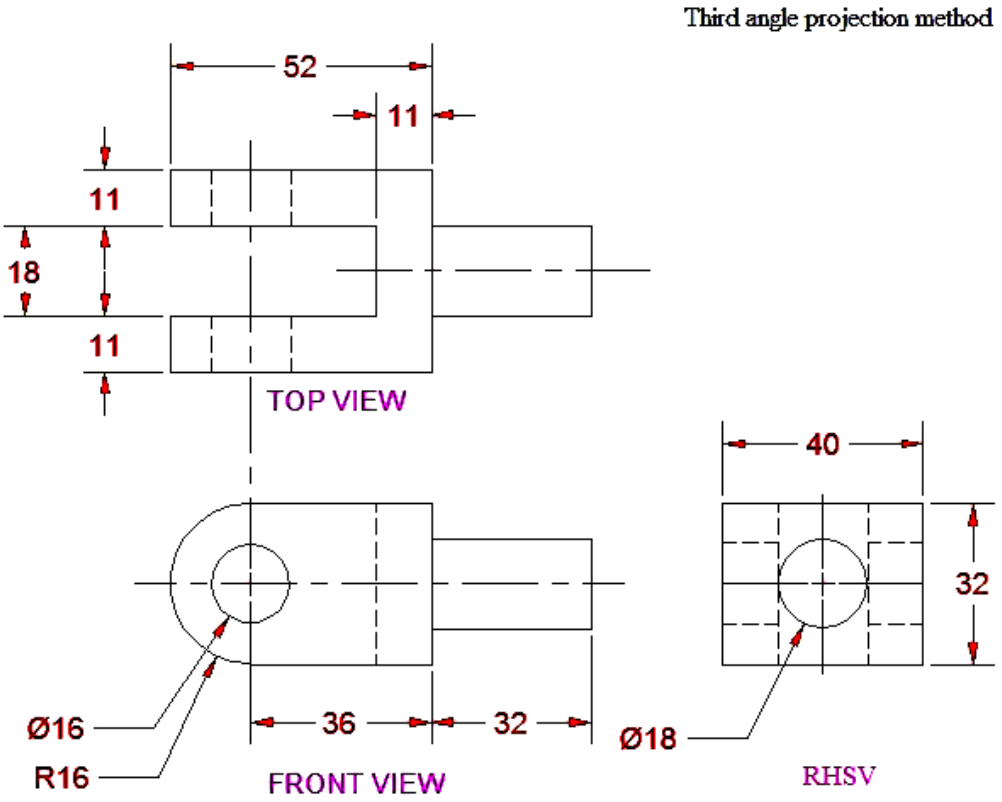


Figure 3

BATCH B

1. Draw the following View for **Figure 4**
a) Front View
b) Top View
c) Left hand side View

2. Draw the following View for **Figure 5**
a) Front View
b) Top View
c) Sectional LHSV

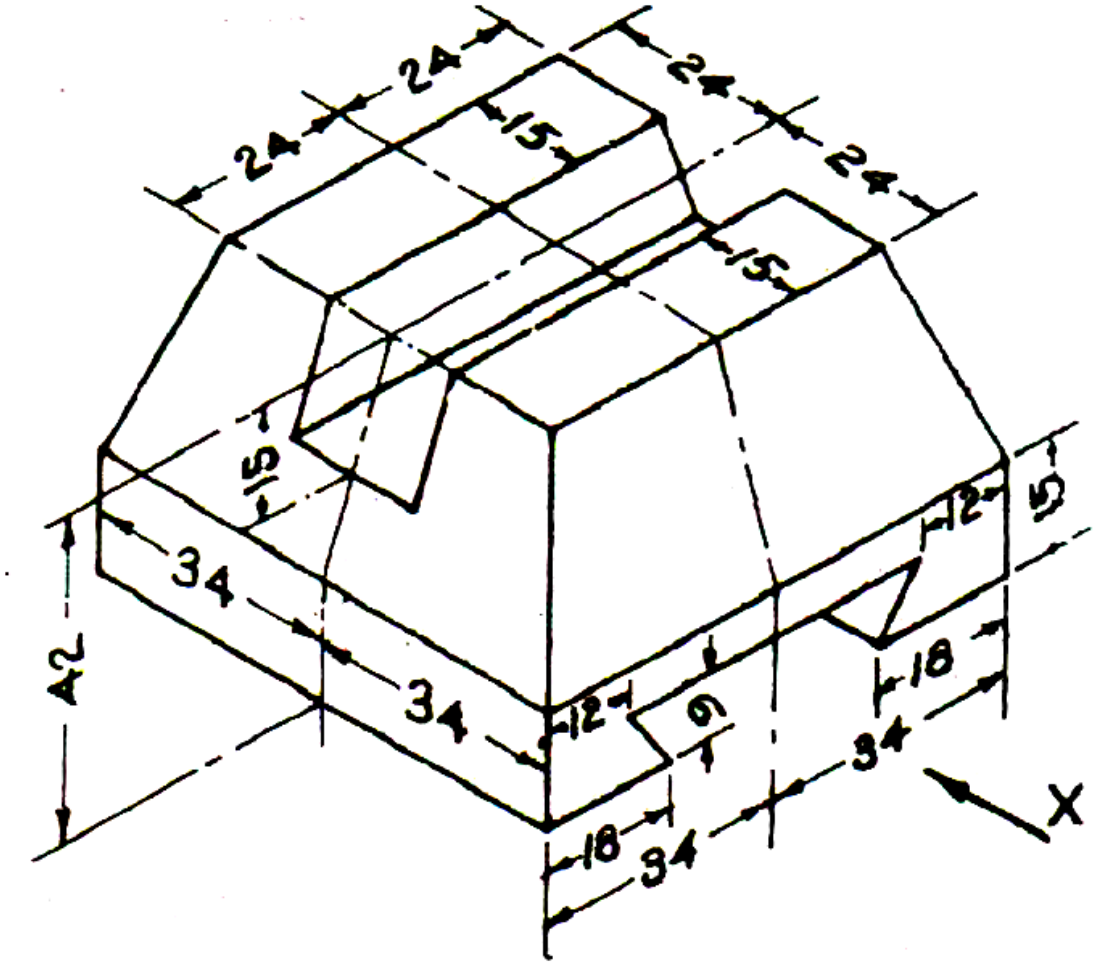


Figure 4

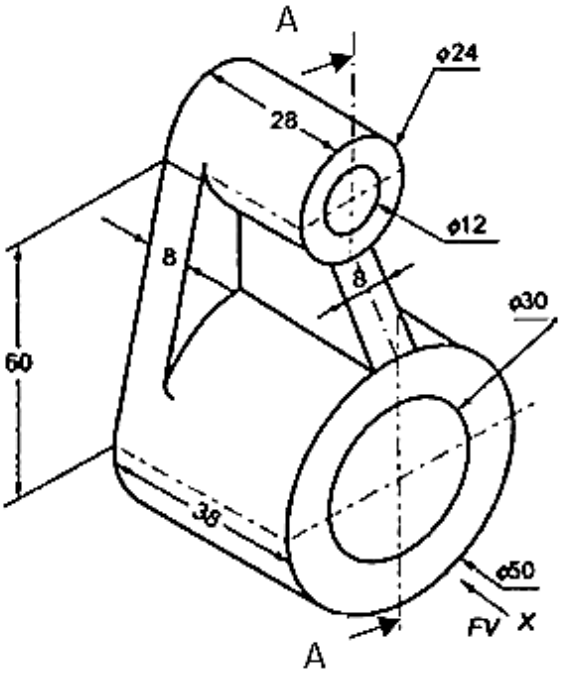


Figure 5

3. Draw Isometric View for **Figure 6**

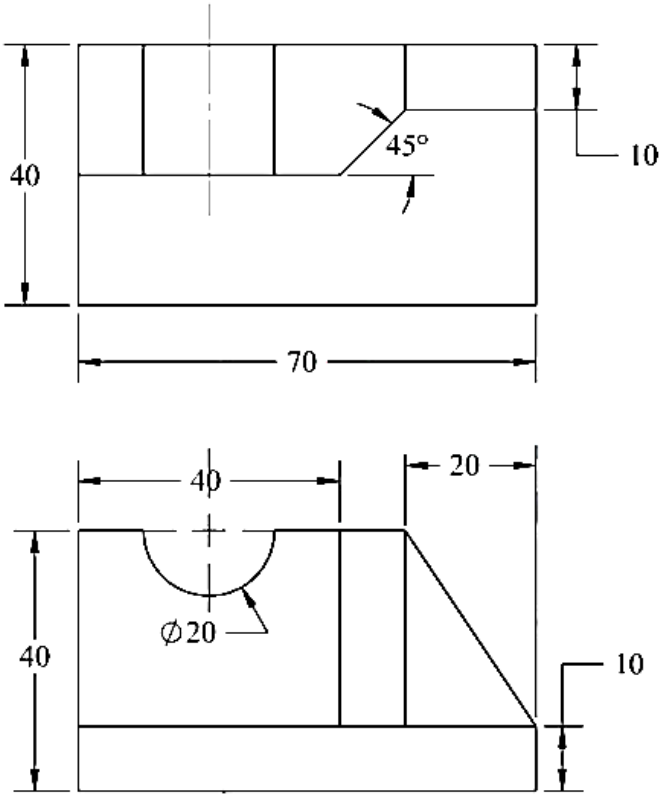


Figure 6

BATCH C

1. Draw the following View for **Figure 7**
a) Front View
b) Top View
c) Right hand side View

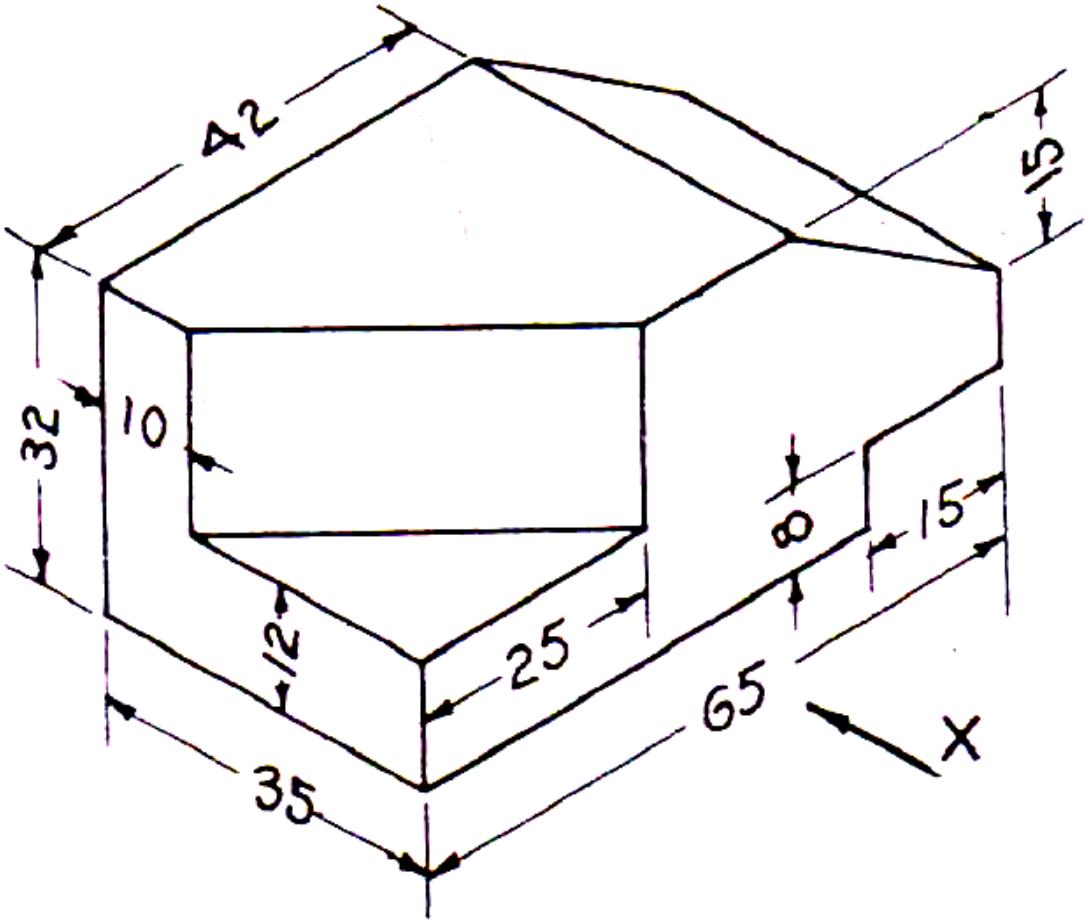


Figure 7

2. Draw the following View for **Figure 8**
a) Sectional Front View
b) Top View
c) LHSV

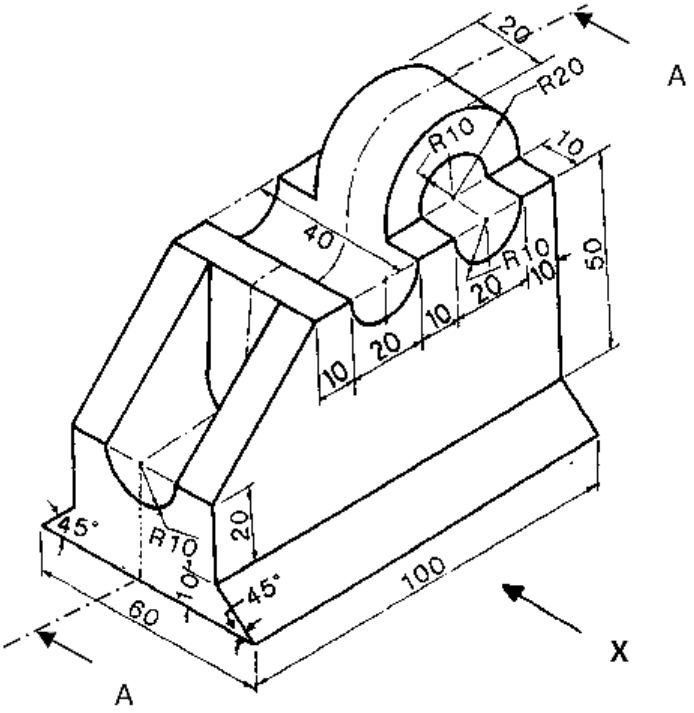


Figure 8

3. Draw Isometric View for **Figure 9**

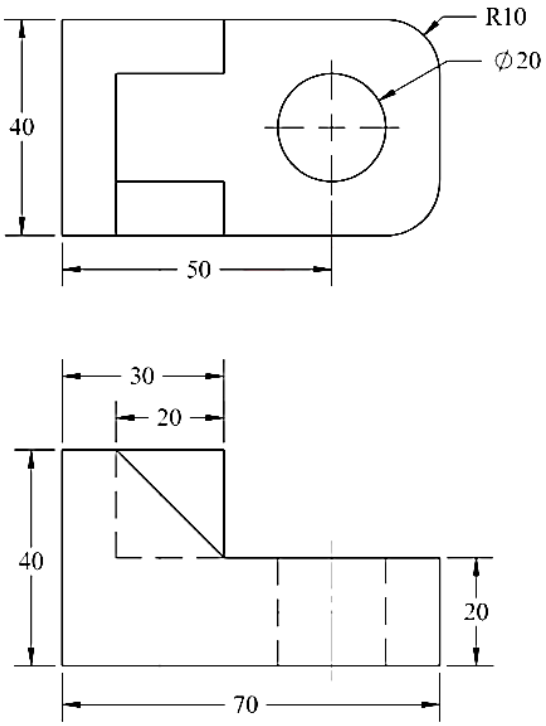


Figure 9

Sheet 2: Computer Aided Drafting and Modeling

BATCH A

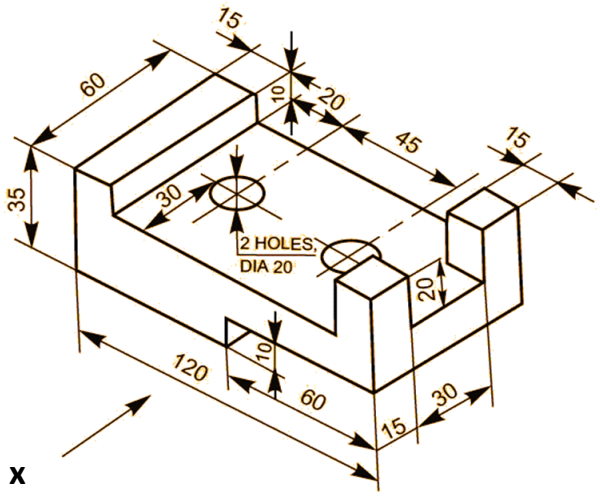


Figure 10

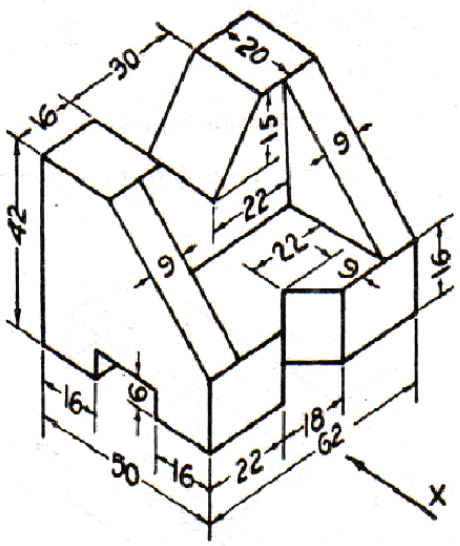


Figure 11

1. Draw the following View for Figure 10
   a) Front View
   b) Top View
   c) Right hand side View

2. Draw the following View for Figure 11
   a) Front View
   b) Top View
   c) Left hand side View

Note: Use any CAD software: Autocad /Creo /Autodesk fusion 360 to prepare the sheet.

BATCH B

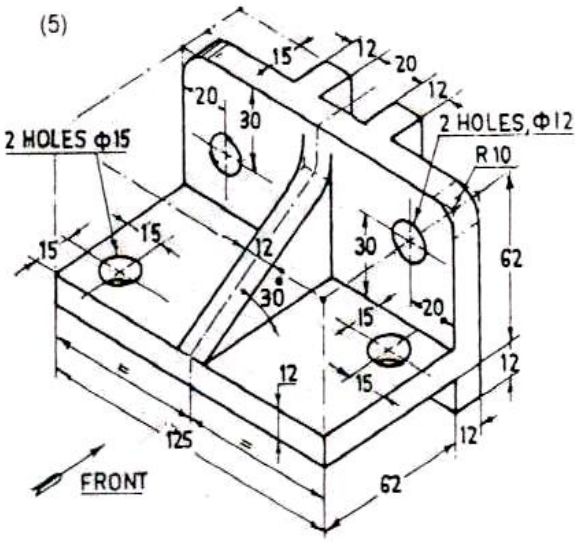


Figure 12

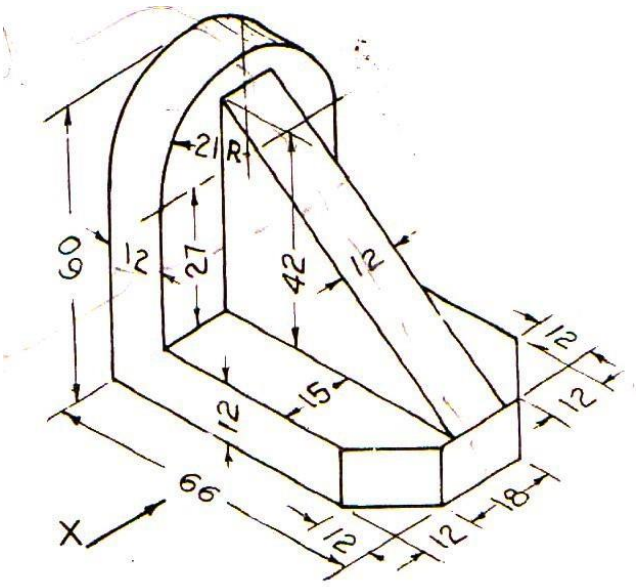


Figure 13

1. Draw the following View for Figure 12
   a) Front View
   b) Top View
   c) Right hand side View

2. Draw the following View for Figure 13
   a) Front View
   b) Top View
   c) Right hand side View

Note: Use any CAD software: Autocad /Creo /Autodesk fusion 360 to prepare the sheet.

BATCH C

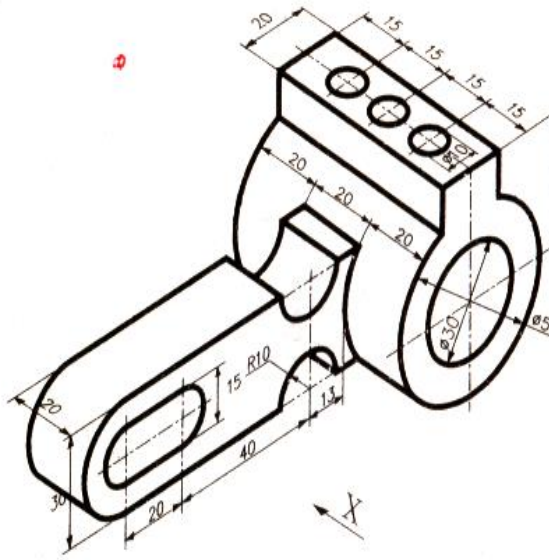


Figure 14

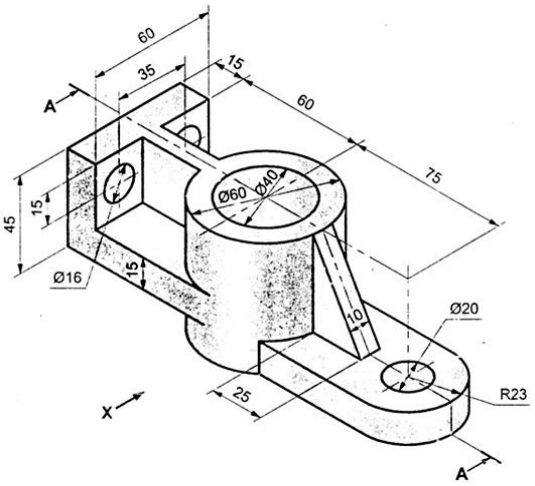


Figure 15

1.Draw the following View for Figure 14
a) Front View
b) Top View
c) Left hand side View

2. Draw the following View for Figure 15
a) Left hand side View
b) Top View
c) Sectional FV

Note: Use any CAD software: Autocad /Creo /Autodesk fusion 360 to prepare the sheet.

EXPERIMENT NO: 3

SCOPE OF CIVIL ENGINEERING

1. Explain role of civil engineers.
2. Define civil engineering.
3. Enlist various branches of civil engineering.
4. Explain geotechnical engineering and structural engineering.
5. Enlist various branches of civil engineering. Explain any two branches in details.
6. Brief the scope of civil engineering based on filed work.

Marks Obtained:	Signature of Faculty:	Date:

EXPERIMENT NO: 4

INTRODUCTION TO SURVEYING-1

1. Draw the conventional symbols of following.

Sr. No.	Object	Symbol
1.	North Line	
2.	Main stations	
3.	Traverse stations or sub stations	
4.	Chain line	
5.	River	
6.	Canal	
7.	Open Well	
8.	Tube Well	
9.	Railway Line (single)	
10.	Railway line (Double)	
11.	Road Bridge or culvert	
12.	Railway Bridge or culvert	
13.	Road & Rail level Crossing	
14.	Wall with gate	

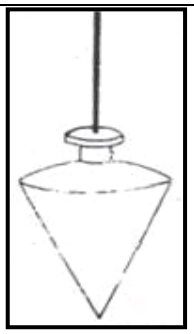
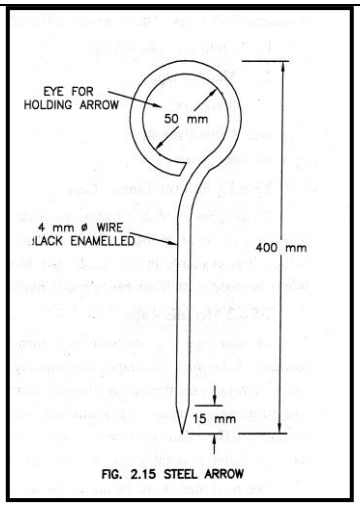
Sr. No.	Object	Symbol
15.	Building (Pakka)	
16.	Building (Katcha)	
17.	Temple	
18.	Bench Mark	
19.	Tree	
20.	Cultivated Road	
21.	Embankment	
22.	Cutting	
23.	Telephone Line	
24.	Telegraph Post	
25.	Electric Line	
26.	Electric Post	
27.	Burial Ground or Cemetery	

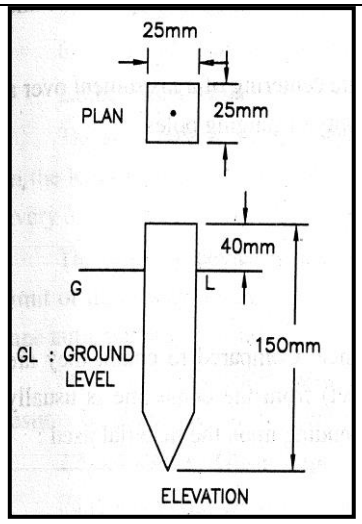
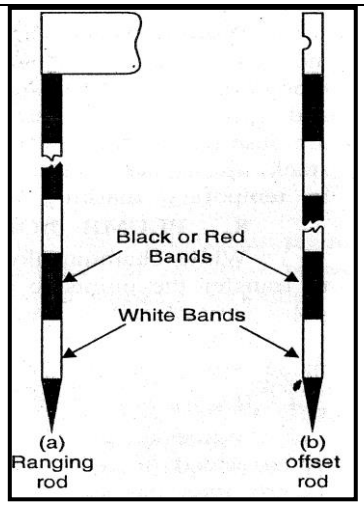
Marks Obtained:	Signature of Faculty:	Date:

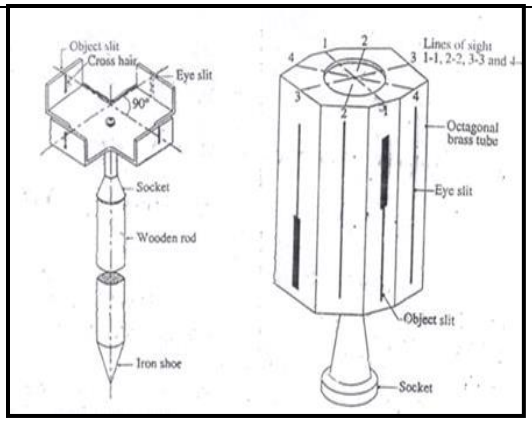
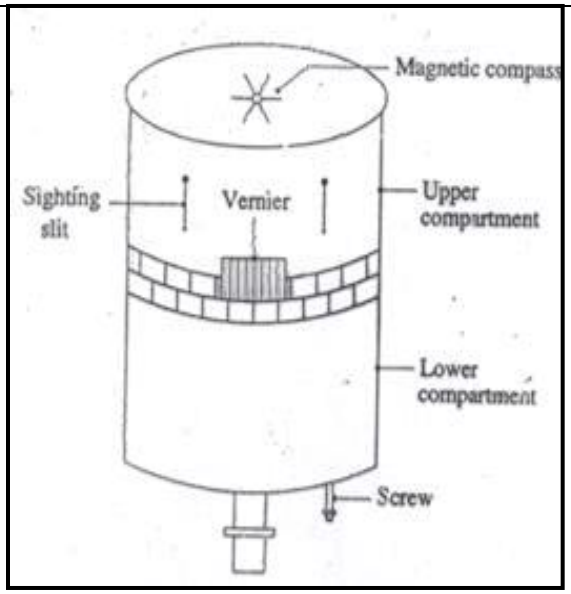
EXPERIMENT NO: 5

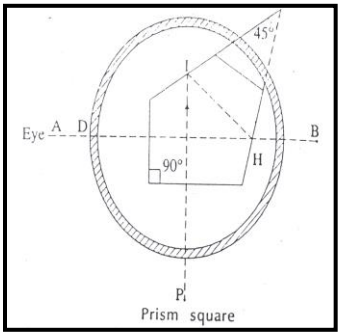
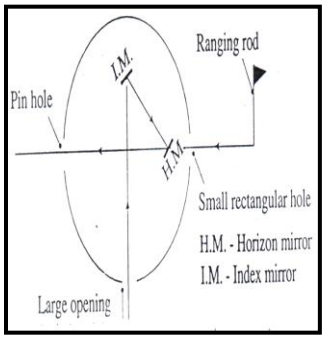
INTRODUCTION TO SURVEYING-2

1. Give the label of below mentioned instruments.

Sr. No.	Instrument	Label
1		
2	 FIG. 2.15 STEEL ARROW	

3	 25mm PLAN 25mm 40mm G L GL : GROUND LEVEL 150mm ELEVATION		
4	 Black or Red Bands White Bands (a) Ranging rod (b) offset rod		

5	 Object slit Cross hair Eye slit 90° Socket Wooden rod Iron shoe Lines of sight 1-1, 2-2, 3-3 and 4-4 Octagonal brass tube Eye slit Object slit Socket	
6	 Magnetic compass Sighting slit Vernier Upper compartment Lower compartment Screw	

7	 45° Eye A D B 90° H P Prism square  I.M. Ranging rod Pin hole H.M. Small rectangular hole H.M. - Horizon mirror I.M. - Index mirror Large opening	
8		
9		

10		
11		

2. Multiple choice questions

1	Plan is a small-scale representation of a large area. a) True b) false
2	Plane and geodetic surveying are classifications of surveying based on: a) Methodology b) Earth's curvature c) Object of survey d) Instrument
3	EDM stands for a) Errorless Distance Measurement b) Electronic Direct Measurement c) Electronic Distance Measurement d) Errorless Direct Measurement
4	Which of the below is not a classification of surveying? a) Marine b) Basement c) Astronomical d) Land
5	In the triangulation method, the whole area is divided into: a) Scale triangles b) Triangles c) Obtuse triangles d) Well-conditioned triangles
6	Hydrographic surveys deal with the mapping of large water bodies a) Heavenly bodies b) Mountaineous region c) Canal system d) Movement of clouds

7. Define Surveying and state the objective of surveying.

8. Define levelling.

9. Distinguish between plane survey and Geodetic survey.

10. What are the fundamental principles of surveying? Explain in briefly.

11. Give the classification of surveying.

12. Explain the classification of surveying based on method used.

13. Explain the classification of surveying based on nature of field.

14. Give the difference between plan and map.

15. Define representative fraction.

16. An area of 49 cm^2 of a map represents an area of 2401 km^2. Find the scale and R.F. of Map?

17. A 10 km long road is indicated in a map by 10cm straight line. Calculate the scale and RF

Marks Obtained:	**Signature of Faculty:**	**Date:**

EXPERIMENT NO: 6

BUILDING COMPONENTS DRAWING-1

1. Classify building based on occupancy.

2. Classify building based on structure. Explain any one in detail.

3. Differentiate Load bearing structure and Frame structure

4. Write down the definitions of following building components.

a) Foundation

b) Plinth

c) Lintel

d) Sill

e) Beam

f) Column

5. Write down the functions of following building components.

a) Foundation

b) Plinth

c) Beam

d) Sill

e) Weather shed (Chajja)

f) Damp proof course

6. What is the width of footing when the thickness of the wall is 40cm.

7. Match the following building type with correct example.

Residential building	a. Stationary shop
Institutional building	b. Godowns
Assembly building	c. Dormitories

Mercantile Building

Industrial Building

d. Mills
e. Temple
f. Old age home

Marks Obtained:	**Signature of Faculty:**	**Date:**

EXPERIMENT NO: 7

BUILDING COMPONENTS DRAWING-2

1. Draw the building components of section of a 30 cm thick masonry wall.
2. Draw cross section of 20 cm thick wall footing.
3. Draw cross section of 30 cm thick wall footing.
4. Draw cross section of 40 cm thick wall footing.

Marks Obtained:	Signature of Faculty:	Date:

EXPERIMENT NO: 8

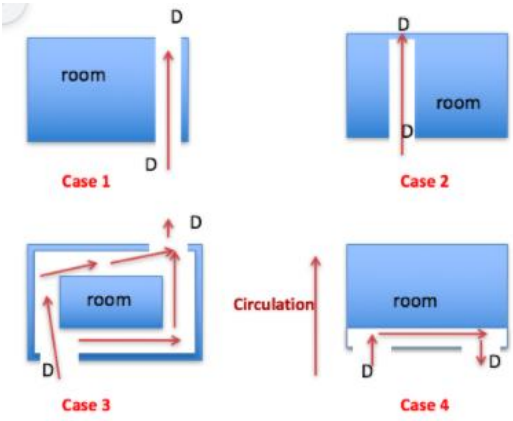
PRINCIPLES OF BUILDING PLANNING

1. Descriptive questions

1. Enlist principles of building planning and explain any two in details.
2. Explain the basic requirements of building planning.

2. Multiple choice questions

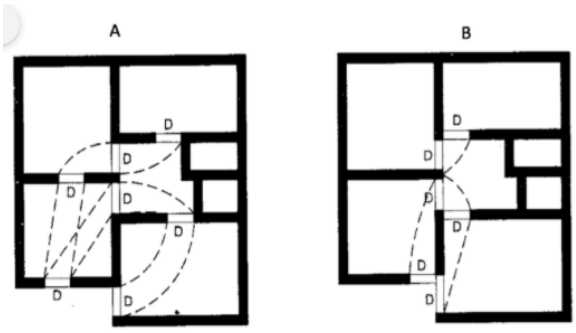
1. Principle of surveying which deals with the direction of wind and light is _____
   a) Aspect
   b) Prospect
   c) Privacy
   d) Circulation
2. Following image shows position of Doors in a roo1.m and the direction of circulation. Match the following.



	Case Number from figure
Best case	

Poor case	
Waste is less but less usefull space	
Better but not practical	

3. Which one of the planning is better?



a) A
b) B
c) Both are equally good
d) Both are equally bad

4. If house in figure A is said to be better than Figure B, which principle of planning is considered?

Figure A

Figure B

a) Circulation
b) Roominess
c) Elegance
d) Circulation

5. Which of the following is not a good grouping ?
   a) Bed room, toilet and dressing room grouped together
   b) Dining room close to kitchen
   c) W/C close to dining
   d) Verandah adjacent to drawing room
6. The term used to refer the effect derived from space of a room, ie. its length , width and height is _____
   a) Aspect
   b) Prospect
   c) Roominess
   d) Elegance

Marks Obtained:	**Signature of Faculty:**	**Date:**