ENGINEERING GRAPHICS (Code No. 046)
CLASS XII (2022-23)

The subject of 'Engineering Graphics' has become an indispensable tool for Engineers, Technocrats, Architects, Draftsmen, Surveyors, Designers and many other professionals in the recent times. It is used to convey the ideas and information necessary for the construction or analysis of machines, structures and system, graphically. It is expected that the knowledge gained through the study of different topics and the skills acquired through the prescribed practical work will make the learners to meet the challenges of academic, professional courses and daily life situations after studying the subject at Senior Secondary Stage.

Objectives:

The study of the subject of Engineering Graphics at Senior School Level aims at helping the learner to:

- Develop clear concept and perception of different objects.
- Develop a clear understanding of plane geometry, solid geometry and machine drawing so as to apply the same in relevant practical fields such as technology and industry.
- Develop the skill of expressing two-dimensional and three-dimensional objects into professional language and vice versa.
- Acquire speed and accuracy in use of drawing instruments.
- Acquire the ability to readily draw neat sketches, often needed in "On-job situations".
- Use technology (CAD) in developing isometric and orthographic projections of simple objects.

COURSE STRUCTURE
CLASS XII (2022-23)

One Paper (Theory): 3 Hours 70 Marks
One paper (Practical): 3 Hours 30 Marks

S.No.	Unit Name	Marks	Periods
I	Isometric Projections of Solids	25	40
II	**Machine Drawing** A. Drawing of Machine parts B. Assembly Drawing and Dis-assembly drawings 1. Bearings 2. Rod joints 3. Tie-rod and Pipe joint	45	75
	Practical	30	45
	Total Marks	**100**	**160**

THEORY

Unit I: Isometric Projection of Solids **40 Periods**

(i) Construction of isometric scale showing main divisions of 10mm and smaller divisions of 1mm, also showing the leading angles. Drawing helping view/s such as triangles, pentagon, hexagon, etc., using isometric scale.

(ii) Isometric projection (drawn to isometric scale) of solids such as cube; regular prisms and pyramids (triangular, square, pentagonal and hexagonal); cone; cylinder; sphere; hemisphere. The axis and the base side of the solid should be either perpendicular to HP / VP or parallel to HP and VP. (Indicate the direction of viewing).

(iii) Combination of any two above mentioned solids keeping the base side parallel or perpendicular to HP/VP and placed centrally together (Axis of both the solids should not be given parallel to HP).

Note: Hidden lines are not required in isometric projection.

Unit II: Machine Drawing (as per SP46: 2003) **75 Periods**

A. Drawing of machine parts

(i) Drawing to full size scale with instruments. 25 Periods

(Internal choice will be given between any two of the following).

Introduction of threads: Standard profiles of screw threads - Square, Knuckle, B.S.W., Metric (external and internal); Bolts – Square head, Hexagonal head; Nuts – Square head, Hexagonal head; Plain washer;

combination of nut and bolt with or without washer for assembling two parts together.

(ii) Free-hand sketches

(Internal choice will be given between any two of the following).

Conventional representation of external and internal threads; Types of studs – Plain stud, Square-neck stud, Collar stud; Types of rivets – Snap head, Pan head (without tapered neck), Flat head, 60^0 countersunk flat head.

B. Assembly drawings and Dis-Assembly drawings

(Internal choice will be given between an Assembly drawing and a Dis-Assembly drawing). 50 periods

1. Bearings
   - (i) Open-Bearing
   - (ii) Bush- Bearing
2. Rod-Joints
   - (i) Cotter-joints for round-rods (Sleeve and cotter joint)
   - (ii) Cotter-joints for square rods (Gib and cotter-joint)
3. Tie-rod and Pipe-joint
   - (i) Turnbuckle
   - **(ii)** Flange pipe joint

Note:

1. *In all Assembly drawings, half sectional front view will be asked. Side/End view or Top View/Plan will be drawn without section.*
2. *In all Dis-assembly drawings, only two orthographic views (one of the two views may be half in section or full in section) will be asked of any two parts only.*
3. *(a) In all sectional views, hidden lines/ edges are not to be shown.*

   (b) In all full views, hidden/edges are to be shown.

PRACTICALS **45 Periods**

(i) To perform the following tasks (for One only) from the given views of the prescribed ten machine blocks in **ANNEXURE-I**.

Value-Points

1. Copy the given views 1
2. Drawing the missing view with hidden lines 2
3. Sketching the Isometric view without hidden edges 5
4. To make the machine block of the above in three dimensions.
   (Not to scale but approximately proportionately drawn with

	Any medium i.e. thermocol, soap-cake, plasticine, clay, wax, orchsis (available with florists), etc.	7
(ii)	Computer Aided Design (CAD) – Project Project file to be submitted on the simple solids (Prism, Pyramids and Frustums of equilateral triangle, square, pentagon and hexagon) or machine blocks as prescribed in part-I by using the CAD software.	10
(iii)	(a) Sessional work relating to machine blocks as prescribed.	3
	(b) Viva-voce based on part-I and part-II	2
	Total Marks	**30**

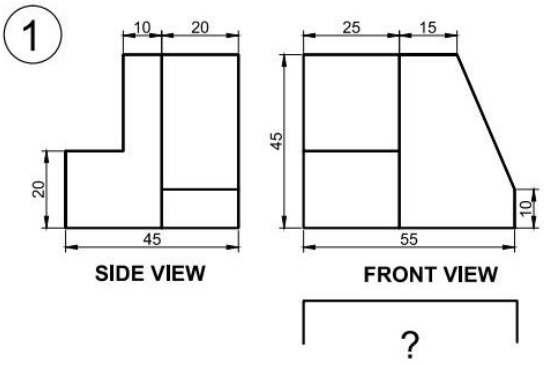
ACTIVITY

Industrial Visits (Two) to any industry/ manufacturing plant to acquaint the students with the present - day methods & technology for better conceptual understanding can be done by virtual tour of the factory/plant. The following links are given as an example for same:

Bolt Making Machine Manufacturer
https://www.youtube.com/watch?v=ARS87trb4u4
Machine Tools Manufacturing Process -2
https://www.youtube.com/watch?v=vlZjTEkGbN8
BMW Engine Factory
https://www.youtube.com/watch?v=0z6E_1KonbA
Hydroelectric Virtual Plant Tour
https://youtu.be/Ki8kSB1ThJQ

ANNEXURE -- 1

1



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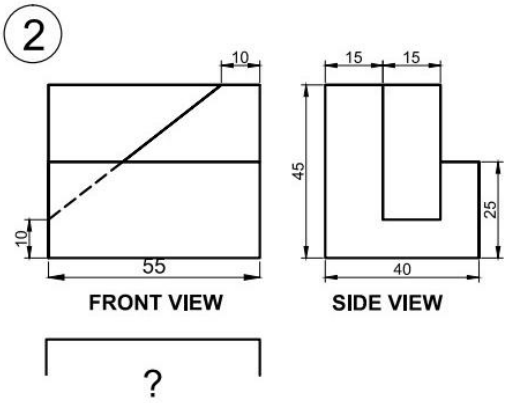

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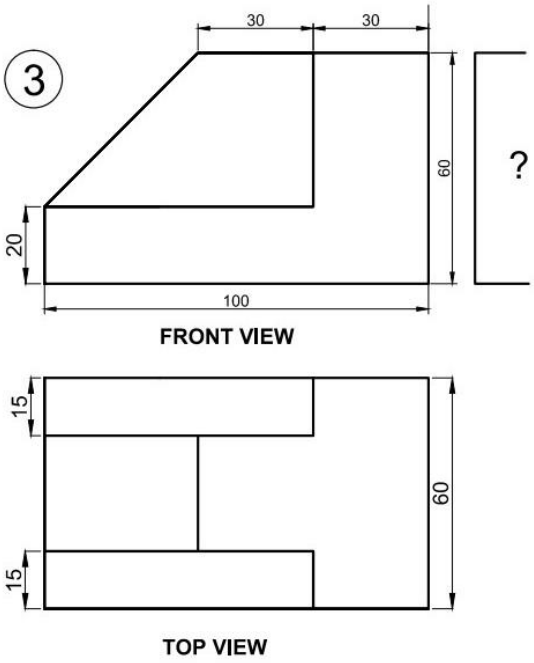

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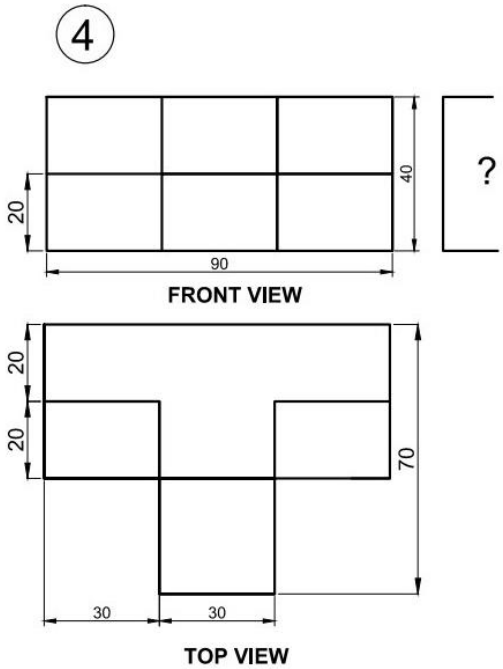

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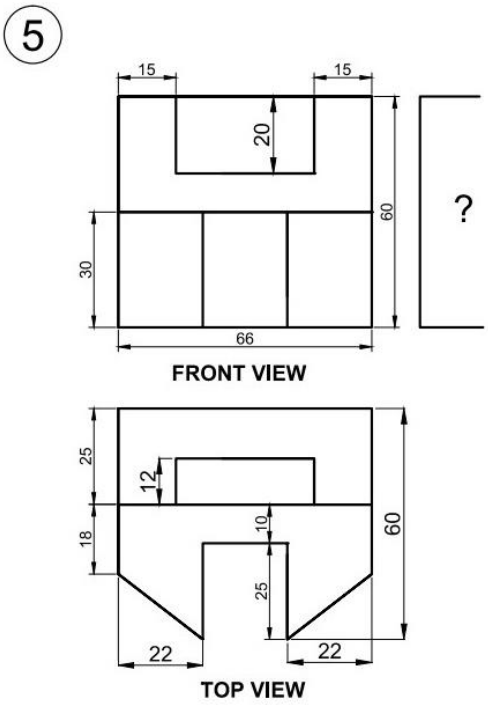

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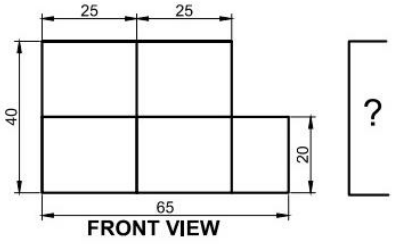
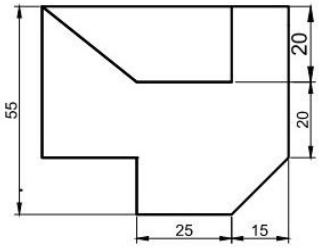
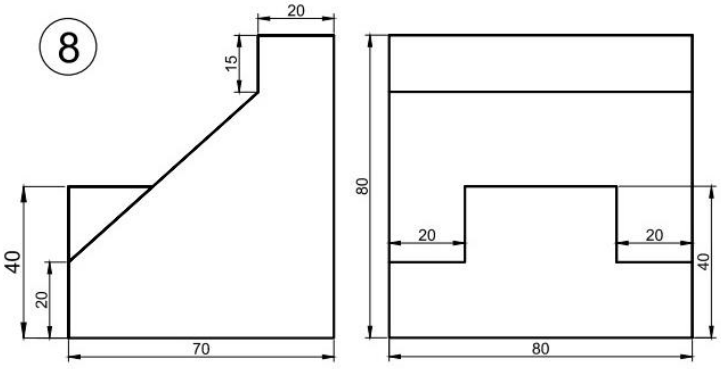


FRONT VIEW



TOP VIEW

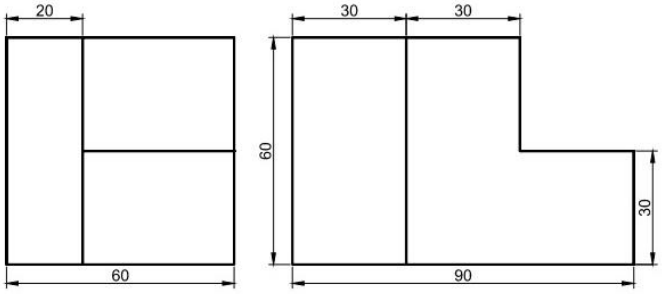
8



SIDE VIEW

FRONT VIEW

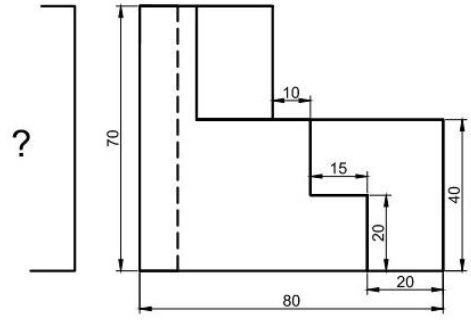
9



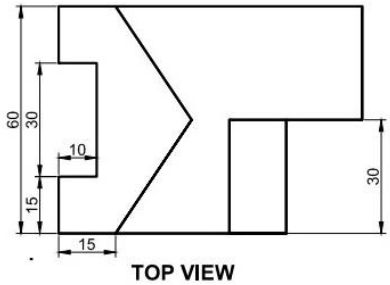
SIDE VIEW

FRONT VIEW

7

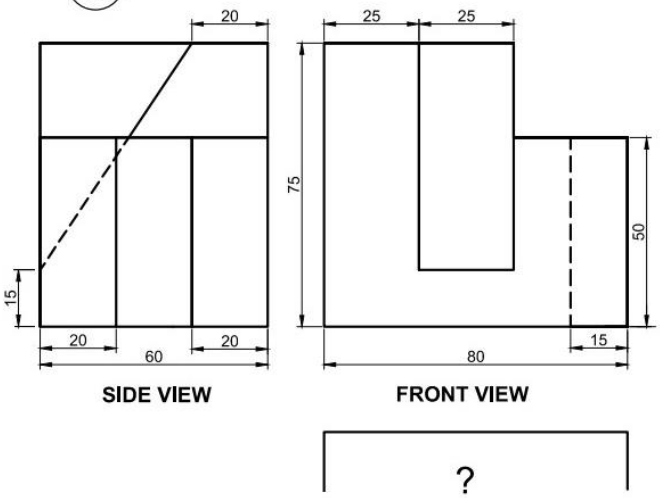


FRONT VIEW



TOP VIEW

10



SIDE VIEW

FRONT VIEW