ENGINEERING DRAWING

(NSQF)

1st YEAR

(For 2 Year Trades)

(As per Revised Syllabus July 2022)

Group 23

Group 23 CTS Trades Covered

Information and Communication Technology System Maintenance,
Information Technology

Directorate General of Training

DIRECTORATE GENERAL OF TRAINING
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
GOVERNMENTOF INDIA

NATIONAL INSTRUCTIONAL MEDIA INSTITUTE, CHENNAI

Post Box No. 3142, CTI Campus, Guindy, Chennai - 600 032

Engineering Drawing (NSQF) 1st Year (For 2 Year Trades)

Group 23 Engineering Trades

As per Revised syllabus July 2022 under CTS

Developed & Published by

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FOREWORD

The Government of India has set an ambitious target of imparting skills to 30 crores people, one out of every four Indians, by 2020 to help them secure jobs as part of the National Skills Development Policy. Industrial Training Institutes (ITIs) play a vital role in this process especially in terms of providing skilled manpower. Keeping this in mind, and for providing the current industry relevant skill training to Trainees, ITI syllabus has been recently updated with the help of comprising various stakeholder's viz. Industries, Entrepreneurs, Academicians and representatives from ITIs.

The National Instructional Media Institute (NIMI), Chennai, has now come up with instructional material to suit the revised curriculum for **Engineering Drawing 1st Year (For 2 Year Trades)** NSQF **Group 23 Engineering Trades (Revised 2022)** under CTS will help the trainees to get an international equivalency standard where their skill proficiency and competency will be duly recognized across the globe and this will also increase the scope of recognition of prior learning. NSQF trainees will also get the opportunities to promote life long learning and skill development. I have no doubt that with NSQF the trainers and trainees of ITIs, and all stakeholders will derive maximum benefits from these IMPs and that NIMI's effort will go a long way in improving the quality of Vocational training in the country.

The Executive Director & Staff of NIMI and members of Media Development Committee deserve appreciation for their contribution in bringing out this publication.

Jai Hind

SHRI. ATUL KUMAR TIWARI., I.A.S.,
Secretary
Ministry of Skill Development & Entrepreneurship,
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New Delhi - 110 001

PREFACE

The National Instructional Media Institute(NIMI) was set up at Chennai, by the Directorate General of Training, Ministry of skill Development and Entrepreneurship, Government of India, with the technical assistance from the Govt of the Federal Republic of Germany with the prime objective of developing and disseminating instructional Material for various trades as per prescribed syllabus and Craftsman Training Programme(CTS) under NSQF levels.

The Instructional materials are developed and produced in the form of Instructional Media Packages (IMPs), consisting of Trade Theory, Trade Practical, Test and Assignment Book, Instructor Guide, Wall charts, Transparencies and other supportive materials. The above material will enable to achieve overall improvement in the standard of training in ITIs.

A national multi-skill programme called SKILL INDIA, was launched by the Government of India, through a Gazette Notification from the Ministry of Finance (Dept of Economic Affairs), Govt of India, dated 27th December 2013, with a view to create opportunities, space and scope for the development of talents of Indian Youth, and to develop those sectors under Skill Development.

The emphasis is to skill the Youth in such a manner to enable them to get employment and also improve Entrepreneurship by providing training, support and guidance for all occupation that were of traditional types. The training programme would be in the lines of International level, so that youths of our Country can get employed within the Country or Overseas employment. The **National Skill Qualification Framework (NSQF)**, anchored at the National Skill Development Agency(NSDA), is a Nationally Integrated Education and competency-based framework, to organize all qualifications according to a series of **levels of Knowledge, Skill and Aptitude.** Under NSQF the learner can acquire the Certification for Competency needed at any level through formal, non-formal or informal learning.

The **Engineering Drawing** 1st Year (For 2 Year Trades) NSQF Group 23 - Engineering Trades (Revised 2022) under CTS is one of the book developed by the core group members as per the NSQF syllabus.

The **Engineering Drawing** 1st Year (For 2 Year Trades) NSQF Group 23 - Engineering Trades under (Revised 2022) CTS as per NSQF is the outcome of the collective efforts of experts from Field Institutes of DGT, Champion ITI's for each of the Sectors, and also Media Development Committee **(MDC)** members and Staff of **NIMI.** NIMI wishes that the above material will fulfill to satisfy the long needs of the trainees and instructors and shall help the trainees for their Employability in Vocational Training.

NIMI would like to take this opportunity to convey sincere thanks to all the Members and Media Development Committee (MDC) members.

Chennai - 600 032 **EXECUTIVE DIRECTOR**

ACKNOWLEDGEMENT

The National Instructional Media Institute (NIMI) sincerely acknowledge with thanks the co-operation and contribution of the following Media Developers to bring this IMP for the course **Engineering Drawing 1st Year (For 2 Year Trades) Group 23 - Engineering Trades** as per NSQF Revised 2022.

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NIMI records its appreciation of the **Data Entry, CAD, DTP Operators** for their excellent and devoted services in the process of development of this IMP.

NIMI also acknowledges with thanks, the efforts rendered by all other staff who have contributed for the development of this book.

INTRODUCTION

Theory and procedure along with the related exercises for further practice

This book on theory and procedure along with related exercises contains theoretical information on **1st Year Engineering drawing** NSQF (For 2 Year Revised syllabus July 2022 Group 23 - Engineering Trades) and procedure of drawing/ sketching different exercise for further practice are also available. Wherever required, BIS specification has been used.

Exercise for further practice

The practice exercise is given with Theory and procedure for 1st Year book made obsolete as it was felt that, it is very difficult to work in workbook using drawing instruments. It is well known fact that, any drawing is prepared on suitable standard size of drawing sheets only.

The instructor is herewith advised to go through the instructions given below and to follow them in view of imparting much drawing skill in the trainees.

Acquiring the above said ability and doing small drawings is not a simple task. These books will provide a good platform for achieving the said skills.

Time allotment:

Duration of 1st Year : 40 Hrs

Sl. No.	Topic	Exercise No.	Time Allotment
1	Introduction to Engineering Drawing and Drawing Instruments	1.1.01 - 1.1.05	2
2	Free hand drawing	1.2.06 - 1.2.08	6
3	Symbolic Representation	1.3.09	12
4	Reading of Hardware Component	1.4.10	20
			40 Hrs

Instructions to the Instructors

It is suggested to get the drawing prepared on A4/A3 sheets preferably on only one side. If separate table and chair facility is available for every trainee then it is preferred to use A3 sheets and if the drawing hall is provided with desks then A4 sheets may be used. However while preparing bigger drawings on A4 sheets suitable reduction scale to be used or multiple sheets may be used for detailed and assembly drawings.

First the border and the title block to be drawn only for the first sheet of the chapter. Eg. for conical sections only first sheet will have the title block whereas the rest of the sheets of that chapter will have only borders.

Serial number of sheet and total no. of sheets to be mentioned on each sheet.

The completed sheet to be punched and filled in a box file/ suitable files and preserved by the trainees carefully after the approval of instructor, VP and Principal of the Institute.

The file may be referred by the authority before granting the internal marks at the end of Year.

CONTENTS

LEARNING / ASSESSABLE OUTCOME

On completion of this book you shall be able to

- **Read and apply engineering drawing for different application in the field of work.**

SYLLABUS

1st Year **Group 23 - Revised syllabus July 2022** **Duration: 1 Year**

2 Year Engineering trades under CTS

CTS Trades Covered: Information and Communication Technology System Maintenance, Information Technology

S.no.	Syllabus	Time in Hrs
1	Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instruments	2
2	Free hand drawing of - • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the free hand sketches. • Free hand drawing of hand tools.	6
3	Symbolic representation - • Different symbols used in the related trades.	12
4	Reading of Hardware Component	20
	Total	**40**

Introduction to engineering drawing and drawing instruments

Communication

There are many different ways of communicating ideas, information, instructions, requests, etc. They can be transmitted by signs or gestures, by word of mouth, in writing, or graphically. In an industrial context the graphical method is commonly used with communication is achieved by means of engineering drawings.

If oral and written communication only were used when dealing with technical matters, misunderstandings could arise, particularly in relation to shape and size. The lack of a universal spoken language makes communication and understanding even more difficult because of the necessity to translate both words and meaning from one language to another.

However, the universally accepted methods used in graphical communication through engineering drawings eliminate many of these difficulties and make it possible for drawing prepared by a British designer to be correctly interpreted or "read" by, for example, his German, French or Dutch counterparts.

Equally important, the components shown on the drawings could be made by suitably skilled craftsmen of any nationality provided they can "read" an engineering drawing.

Conventionally prepared engineering drawings provide the main means of communication between the "ideas" men (the designers and draughtsman) and the craftsmen (machinists, fitters, assemblers, etc.). For the communication to be effective, everyone concerned must interpret the drawing in the same way. Only then will the finished product be exactly as the designer envisages it.

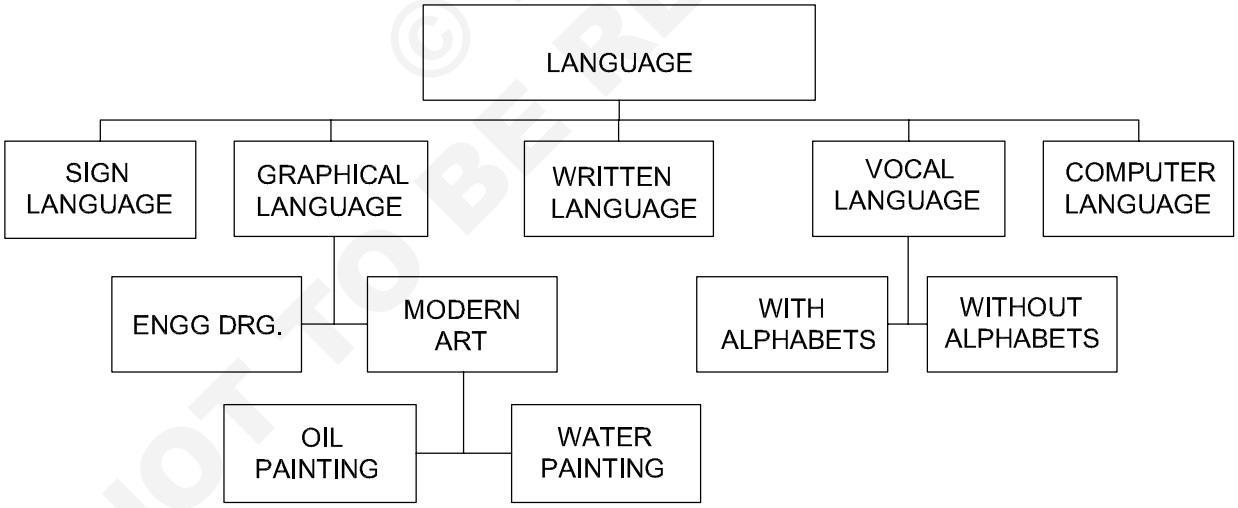
To ensure uniformity of interpretation, the British Standards Institution has prepared a booklet entitled BS 308:1972, Engineering Drawing Practice. Now in three parts, this publication recommends the methods which should be adopted for the preparation of drawing used in the engineering industry.

The standards and conventions in most common use and hence those required for a basic understanding of engineering drawing are illustrated and explained in this book.

Language

1 It is the media of communication (Fig 1)

Fig 1



Conclusion

Effective communication is possible when graphical language is supported by written language/vocal language and vice versa.

Engineering drawing is a language that uses both graphical language and written language for effective communication.

Engineering drawing is a graphical language that also uses written language for effective communication.

The importance of Engineering Drawing

The economic success of any country is mainly dependent on its industrial development. Due to globalization, any industry in our country is expected to be of a global market standard. For the above-mentioned reasons, our Indian products require very high quality for their size, dimension, fit, tolerance, and finish etc.

To produce the best standard product, all the technical personnel (Engineers to Craftsman) in an industry must have a sound knowledge of engineering drawing because engineering drawing is the language of engineers. Engineering drawing is a universal language. Different types of lines make up their alphabets. Technical personnel in any industry, including craftsman, are expected to communicate anything concerning a part or a component by means of drawings involving lines, symbols, conventions, abbreviations etc.

With our spoken languages, it is impossible to express the details of a job or a product. Engineering drawing knowledge and practise are a must for designing or producing a component or part. Even a small mistake in the drawing may reflect very badly on the product. Therefore, reading and doing engineering drawings are very essential for craftsmen and engineers.

A drawing is a graphical representation of an object, or part of it, and is the result of creative thought by an engineer or technician. When one person sketches a rough map in giving direction to another, this is graphic communication. Graphic communication involves using visual materials to relate ideas. Drawings, photographs, slides, transparencies, and sketches are all forms of graphic communication. Any medium that uses a graphic image to aid in conveying a message, instructions, or an idea is involved in graphic communication.

One of the most widely used forms of graphic communication is the drawing. Technically, it can be defined as **"a graphic representation of an idea, a concept or an entity which actually or potentially exists in life"**

Drawing is one of the oldest forms of communicating, dating back even farther than verbal communication. The drawing itself is a method of communicating necessary information about an abstract, such as an idea or concept or a graphic representation of some real entity, such as a machine part, house or tools. There are two basic types of drawings: Artistic and Technical drawings.

Technical drawings

Technical drawings allows efficient communication among engineers and can be kept as a record of the planning process. Since a picture is worth a thousand words, a technical drawing is a much more effective tool for engineers than a written plan.

The technical drawing, on the other hand is not subtle, or abstract. It does not require an understanding of its creator, only on understanding of technical drawings. A technical drawing is a means of clearly and concisely communicating all of the information necessary to transform an idea or a concept in to reality. Therefore, a technical drawing often contains more than just a graphic representation of its subject. It also contains dimensions, notes and specifications.

Fields of use

Technical drawing is the preferred method of drafting in all engineering fields, including, but not limited to, civil engineering, electrical engineering, mechanical engineering and architecture.

Purpose of studying engineering drawing

1 To develop the ability to produce simple engineering drawing and sketches based on current practice

2 To develop the skills to read manufacturing and construction drawings used in industry.

3 To develop a working knowledge of the layout of plant and equipment.

4 To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators.

Main types of Engineering drawing

Regardless of branch of engineering the engineering drawing is used. However based on the major engineering branches, engineering drawing can be classified as follows: (Fig 2)

Mechanical Engineering drawings

Some examples of mechanical engineering drawings are part and assembly drawings, riveted joints, welded joints, fabrication drawings, pneumatics and hydraulics drawings, pipeline diagrams, keys coupling drawings etc. (Fig 3&4)

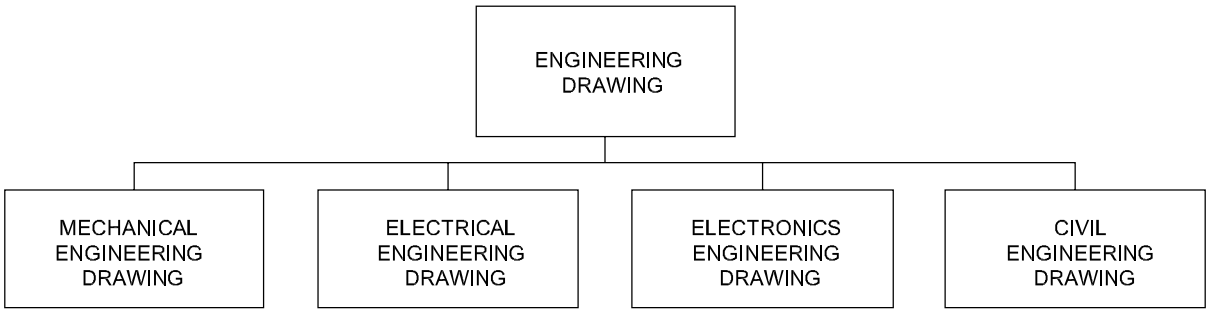
Electrical engineering drawing

Wiring diagrams of home and industries, circuit diagrams, electrical installation drawings etc.

Example

The voltage supply to a filament lamp is 10.8V. The voltage should be 12V. (Fig 5)

Fig 2



Mechanical Engineering Drawings (Fig 3&4)

Fig 3

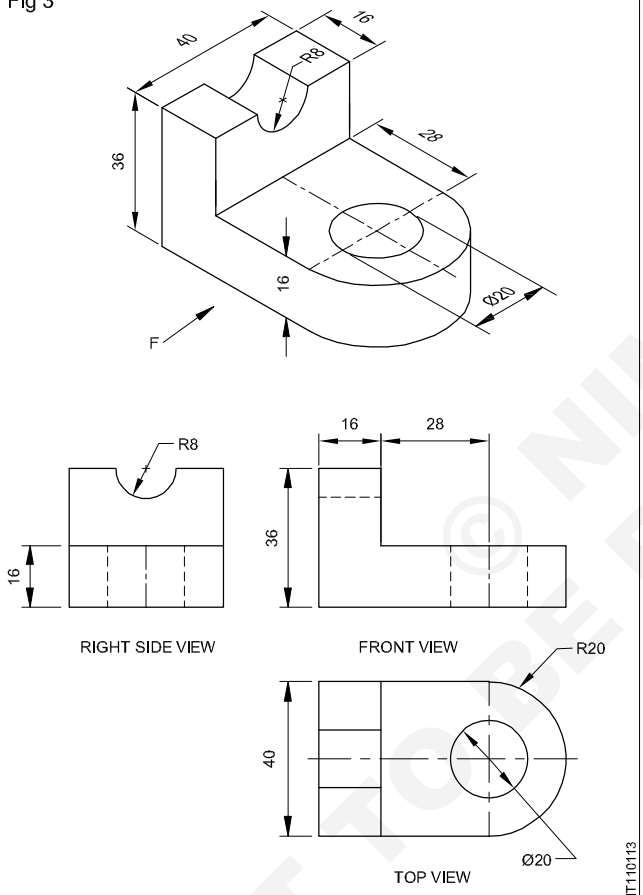
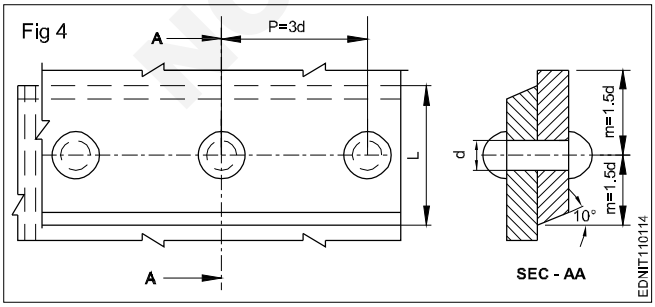
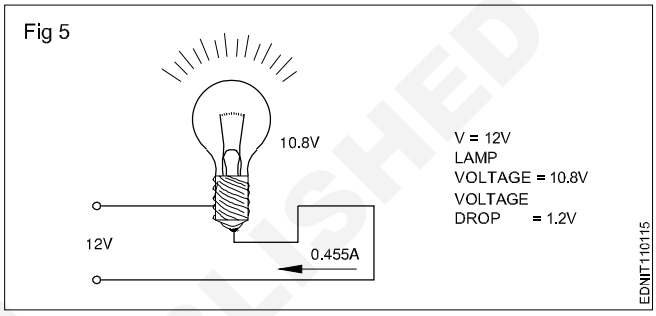


Fig 4



Electrical Engineering Drawing (Fig 5)

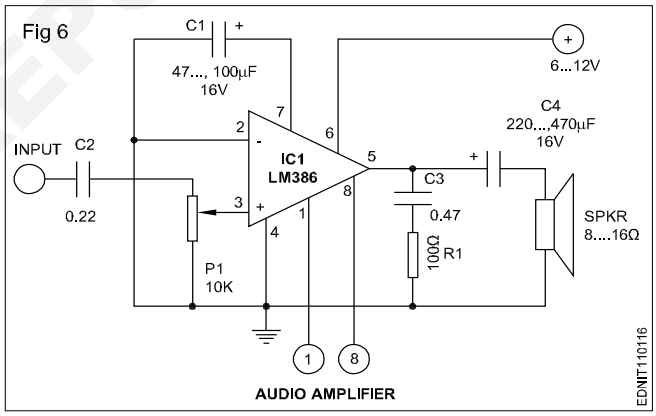
Fig 5



Electronics Engineering Drawing

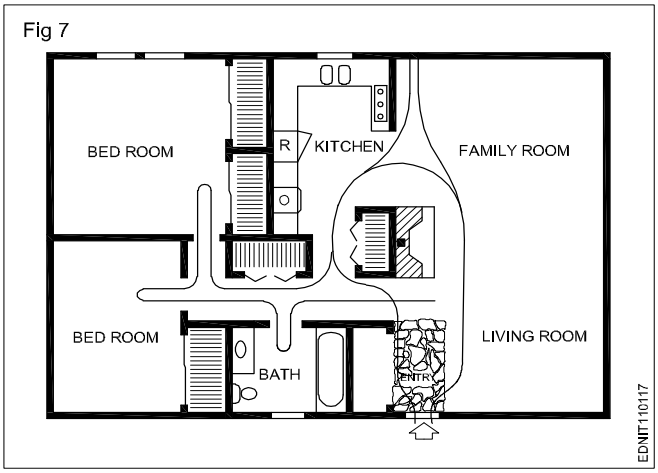
Audio amplifier (Fig 6)

Fig 6

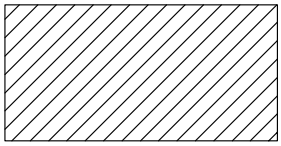
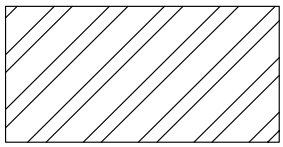
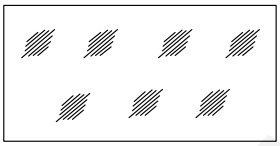
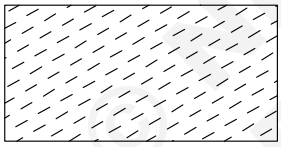
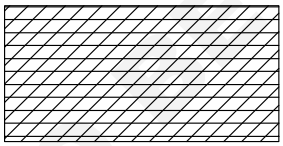
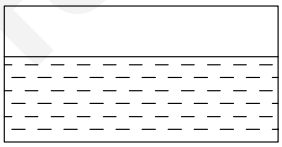
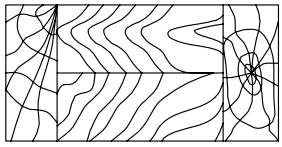
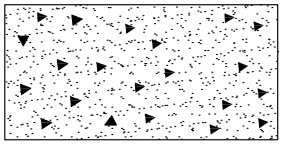


Civil Engineering Drawing (Fig 7)

Fig 7



Conventions

TYPE	CONVENTION	MATERIALS
Metals		Steel, Cast Iron, Copper and its Alloys, Aluminium and its alloy, 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 etc
Liquid		Water, Oil, Petrol, Kerosene etc
Wood		Wood, Plywood etc
Concrete		Concrete

Sizes and layout of drawing sheets

Size of drawing sheets (in mm): While being worked on or handled, the drawing sheets are prone to tear along the edges. So slightly larger(untrimmed) sheets are preferred. They are trimmed afterwards. IS:10811:1983 lays down such as designation of preferred trimmed and untrimmed sizes.

Designation of sheets: The drawing sheets are designated by symbols such as A0, A1, A2, A3, A4 and A5. A0 being the largest and A5 is smallest. Table 1 below gives the length and breadth of the above sizes of sheets. (Trimmed and untrimmed)

The relationship between two sides is same as that between a side of a square and its diagonal.

TABLE 1

Designation	Trimmed size	Untrimmed size
A0	841 x 1189	880 x 1230
A1	594 x 841	625 x 880
A2	420 x 594	450 x 625
A3	297 x 420	330 x 450
A4	210 x 297	240 x 330
A5	148 x 210	165 x 240

Special elongated series increasing its widths, double, treble etc. are denoted as follows A3 x 3, A3 x 4, A4 x 3, A4 x 4, A4 x 5. Please refer Table 2.

TABLE 2

Special elongated series

Designation	Size
A3 x 3	420 x 891
A3 x 4	420 x 1189
A4 x 3	297 x 630
A4 x 4	297 x 841
A4 x 5	297 x 1051

Fig 1 & 2 shows how the sheet sizes are formed by halving/ doubling and similarity of format.

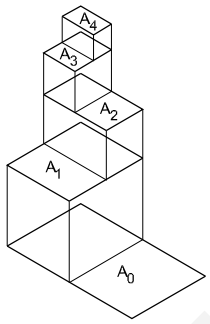
White drawing papers that do not turn yellow on exposure to air are used for finished drawings, maps, charts and drawings for photographic reproductions.

For pencil layouts and working drawings, cream-coloured papers are best suited.

Quality drawing paper: The drawing papers should have sufficient teeth or grain to take the pencil lines and withstand repeated erasing.

To get uniform lines, backing paper is to be placed on the drawing board before fixing drawing/tracing paper,. Before starting the drawing, the layout should be drawn. (Ref: IS:10711)

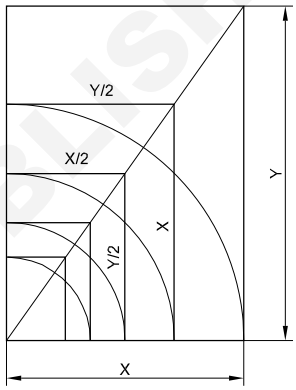
Fig 1



HALVING AND DOUBLING

EDNIT110311

Fig 2



SIMILARITY OF FORMATIONS

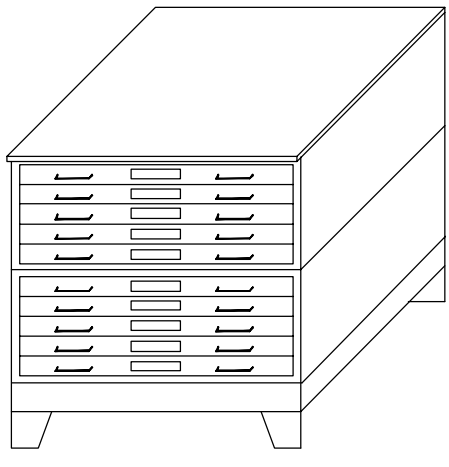
EDNIT110312

The following is the method of folding printed drawing sheets as recommended by BIS. (Fig 3)

Method of folding of printed drawing sheets as per BIS SP: 46-2003

When drawings sheets are in more numbers, they have to be folded and kept in order to save the trace required for preserving them (Fig 4).

Fig 4

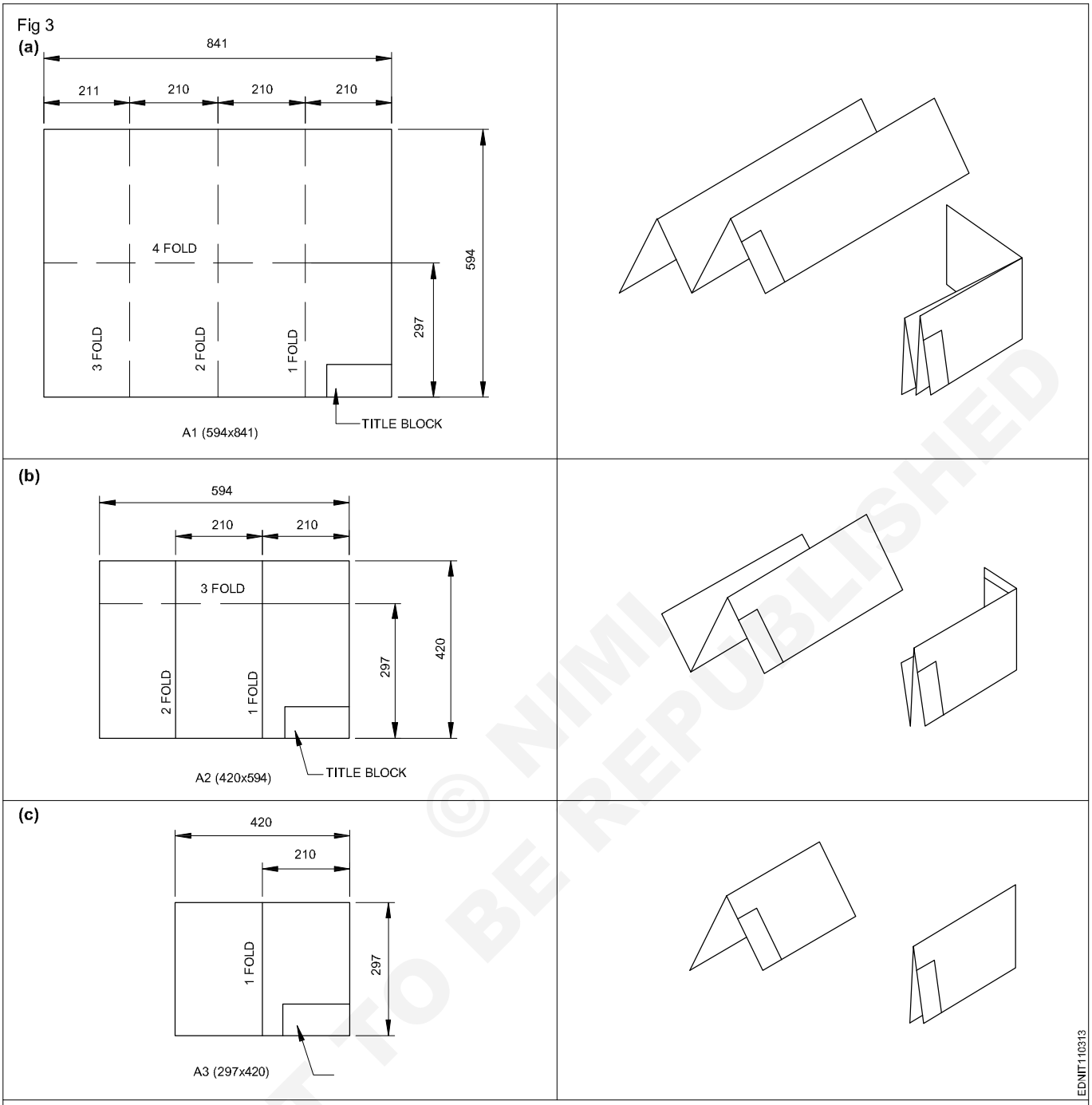


DRAWING CABINET

EDNIT110314

Method of folding printed drawing sheets (Fig 3)

Fig 3



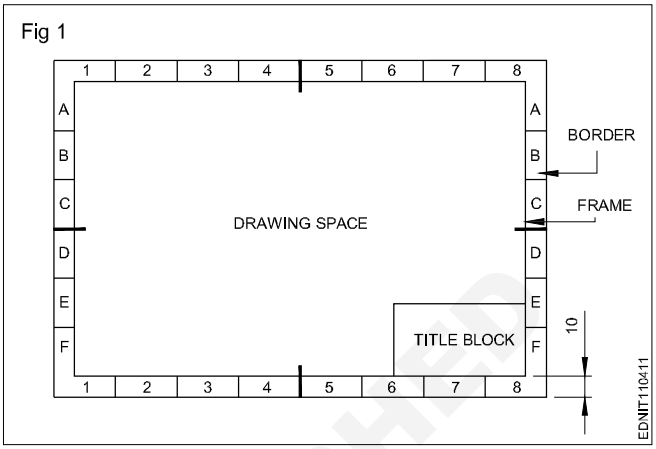
METHOD OF FOLDING OF PRINTED DRAWING SHEETS

Title block, its position and content

Layout of drawing sheet

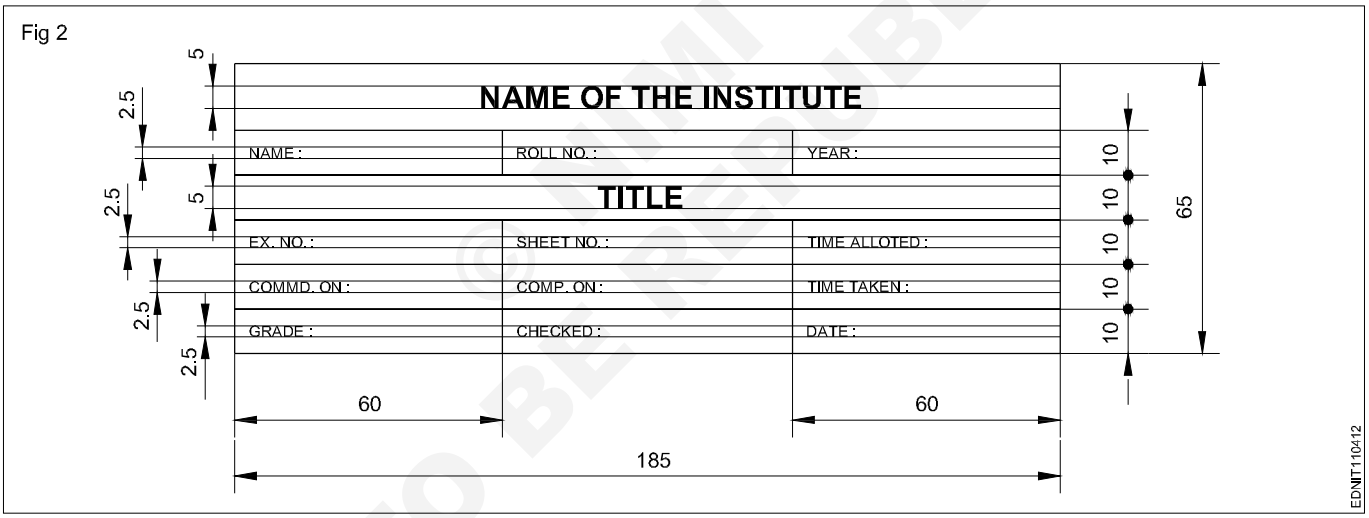
As a standard practice, sufficient margins are to be provided on all sides of the drawing sheet. The drawing sheet should have drawing space and title space. A typical layout of a drawing sheet is shown in the (Fig 1 & 2).

Fig 1



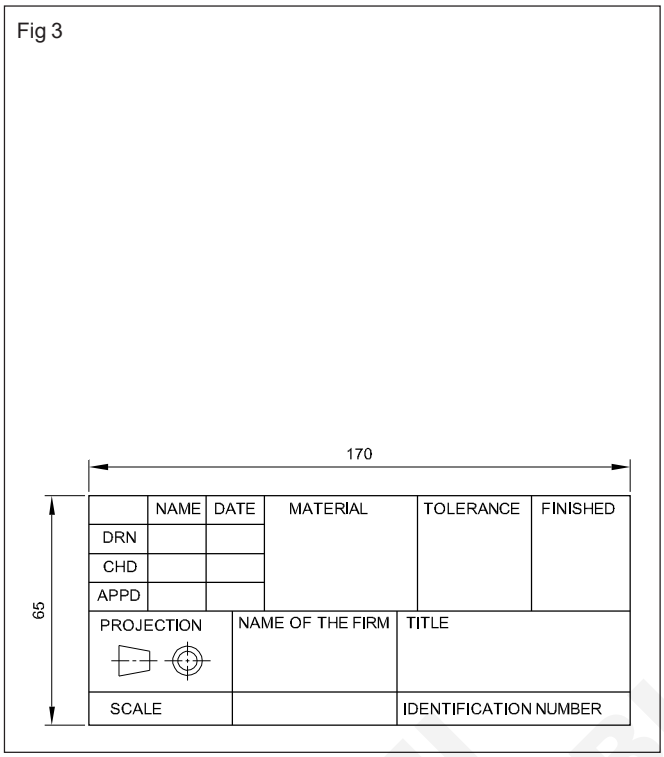
Title Block - 1

Fig 2



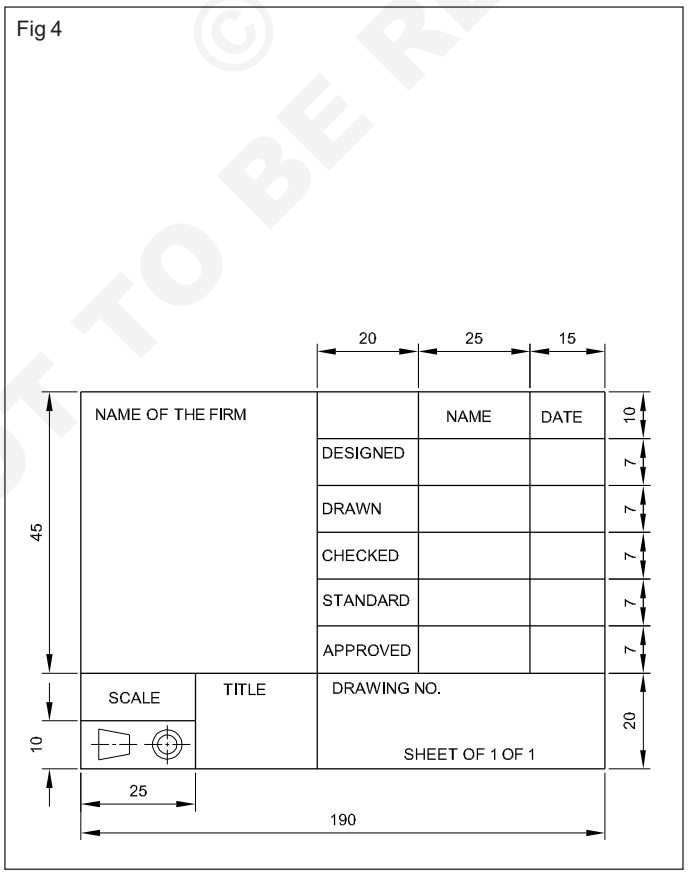
Title Block - 2

Fig 3



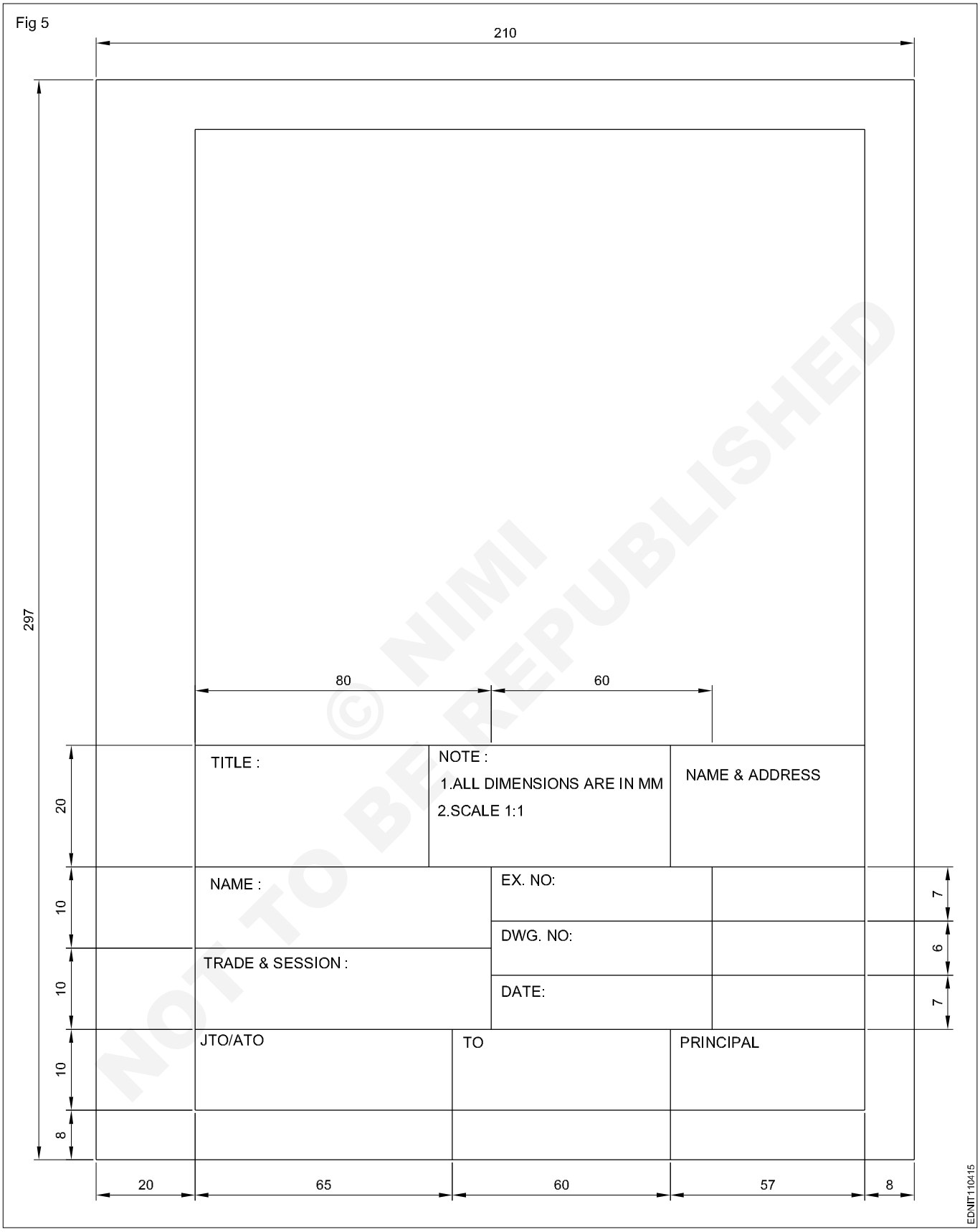
Title Block - 3

Fig 4



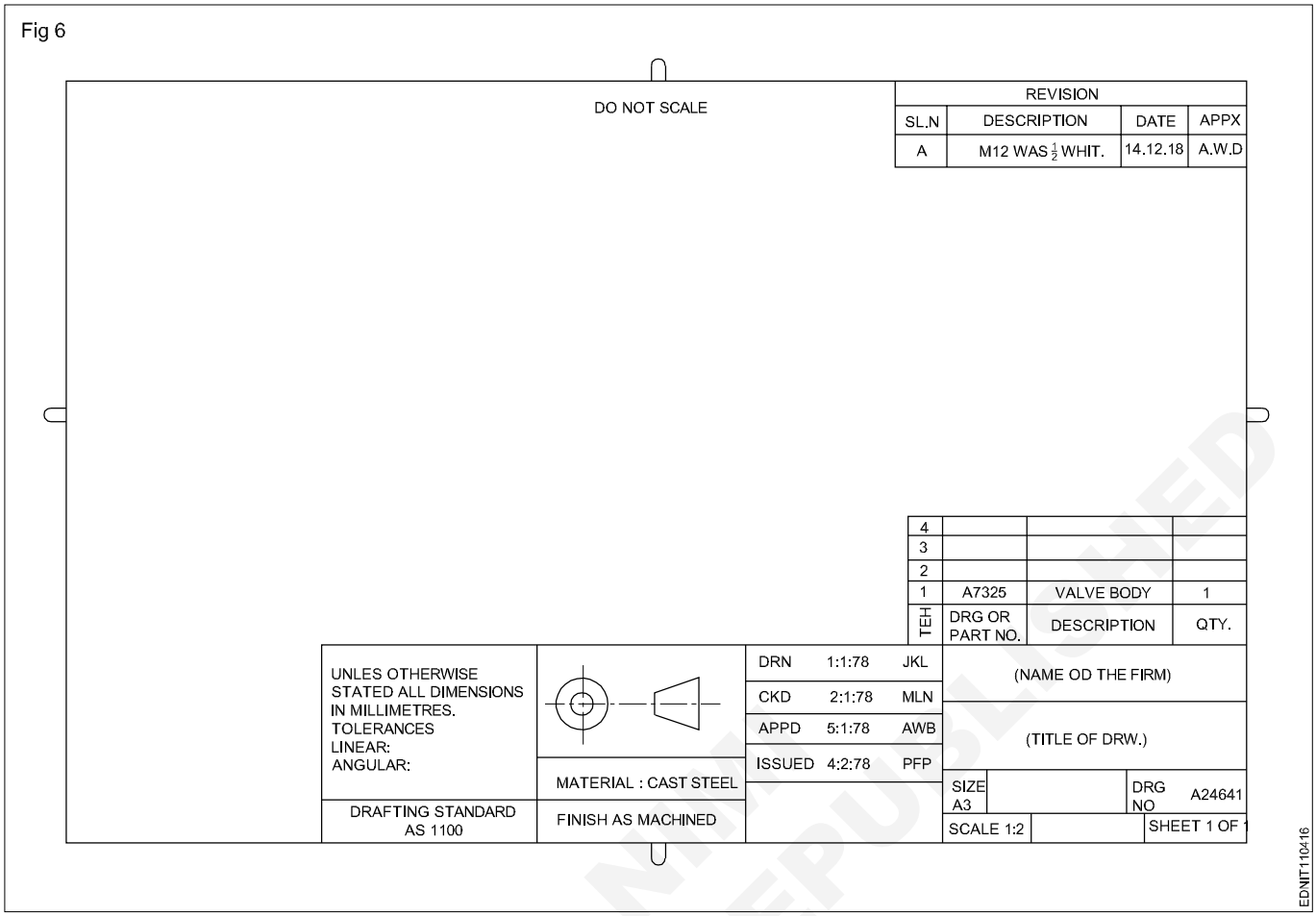
Title Block - Position and content - 1

Fig 5



Title Block - Position and content - 2

Fig 6



Item Reference on Drawing Sheet

05	TIGHTENING PIN	01	MILD STEEL	
04	WORK PIECE	01	ANY MATL.	
03	SCREW ROD	01	STD.	
02	"U" CLAMP	01	CAST IRON	
01	"V" BLOCK	01	CAST IRON	
PART NO	DESCRIPTION OF ITEM	QTY/ASSY	MATERIAL	REMARKS
BILL OF MATERIALS				

The drawing sheet on which the drawings to be prepared should be prepared first by following the procedure given below:

1 Take A4/A3 drawing sheet.

2 Mark the borders and draw the title block as mentioned.

3 Follow the same procedure for A3 drawing sheet where the title block is to be drawn right side bottom corner and the border dimensions remain same.

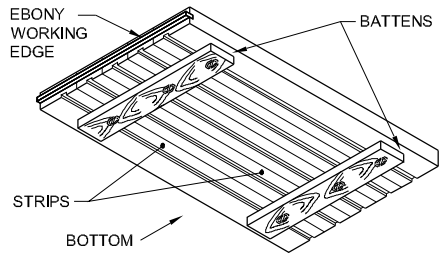
4 Title block to be drawn whenever the title of the drawing changes. Eg. for the geometrical construction chapter the title block may be drawn in the first sheet only where as on the remaining sheets borders to be drawn before they are used for preparing drawings.

Drawing instruments

The following are the commonly used equipment in a drawing office.

Drawing board (Fig 1): Drawing board is one of the main item of equipment for Draughtsman. It is used for supporting the drawing paper/tracing paper for making drawings. It is made of well-seasoned wood strips of about 25 mm thick or masonite, free from knots and warping. It should be softer enough to allow insertion and removal of drawing pins. Two battens are fastened to the board by screws, in slotted joints. They prevent warping and at the same time permit expansion and contraction of the strips due to the change of moisture in the atmosphere.

Fig 1



DRAWING BOARD

One of the shorter edges of the drawing board is provided with an "ebony edge" (hardwood) fitted perfectly straight.

Standard drawing boards are designated as follows as per IS:1444-1989.

Sl. No.	Designation	Size (mm)
1	D0	1500 x 1000 x 25
2	D1	1000 x 700 x 25
3	D2	700 x 500 x 15
4	D3	500 x 350 x 15

The working edge (ebony) must be straight.

Now-a-days drawing boards are available with laminated surfaces. The flatness can be checked by placing a straight edge on its surface. If no light passes between them, the surface is perfectly flat.

'T' Square: It is of 'T' shape, made of well-seasoned wood. It has two parts., head/stock and blade. One of the edges of the blade is the working edge. The blade is screwed to this head such that the working edge is at a right angle to the head. (Fig 2a)

The standard 'T' square is designated as follows with dimensions shown in mm; as per IS:1360-1989.

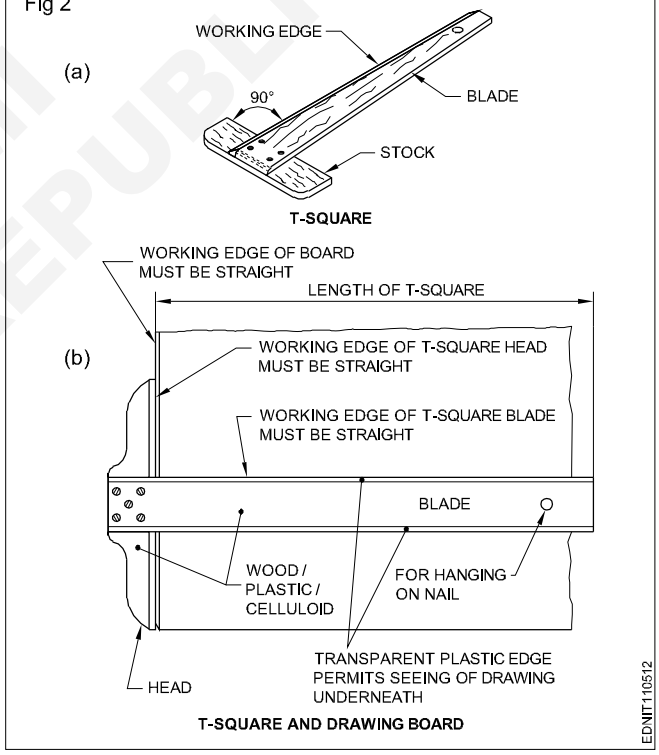
Sl. No.	Designation	Blade length
1	T0	1500
2	T1	1000
3	T2	700
4	T3	500

The 'T' square is used with its head against the ebony edge of the drawing board to draw horizontal lines, and parallel lines and to guide/hold the set squares, stencils etc.

Fig 2b shows how the 'T' square is used.

'T' square should never be used as a hammer or as a guide for trimming papers.

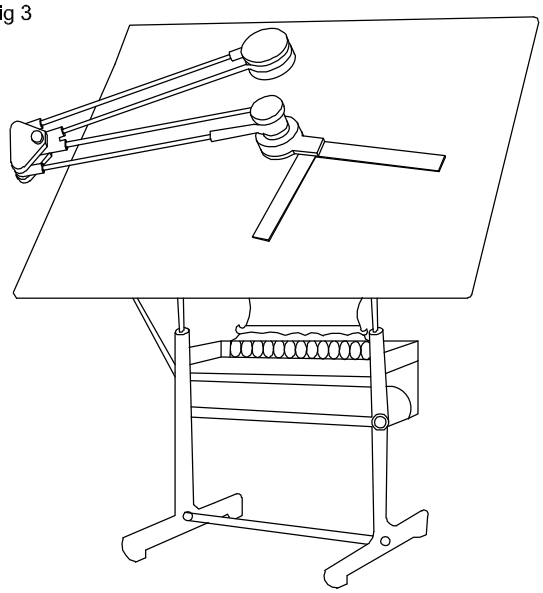
Fig 2



T-SQUARE AND DRAWING BOARD

Drafting in the machine (Fig 3): It serves the functions of a Tee square, set square, protractor and scale. They come in different sizes and have a pattern called the 'Pantograph' type. It is fitted on the top left side, edge of the drafting board, mounted on an adjustable frame or table. It requires a large area of working place. The angle of the drafting board can be adjusted by the pedal operating system. There are two counterweights to balance the angular position of the board and the drafting head. It is more suitable for the production drawing office.

Fig 3



DRAFTING TABLE

EDNIT110513

On the other end, a protractor head H with swivelling and locking arrangement is fitted with two scales at right angles.

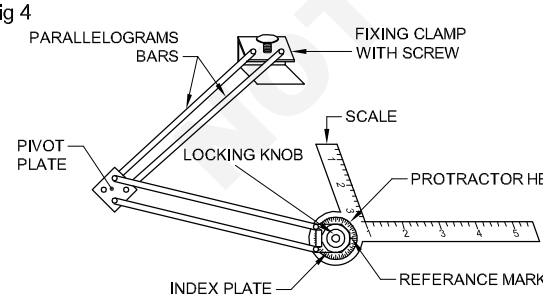
The protractor head has a spring-loaded clutch relieving handle, which rotates and locks at 15° intervals automatically. For setting any angle other than multiples of 15°, the clutch spring is released and by rotating the centre knob, the zero line is set to the required angle and the friction clutch knob is tightened. It is capable of rotating 180°, thereby any angle can be set.

The scales are bevelled on both sides, graduates to 1:1 & 1:2. They can be reversed with the help of dovetail slide fitting.

There is a fine adjusting mechanism on the drafting head to set the scale parallel to the edge of the board. The scales also can be adjusted if there is an error in measuring 90° between them.

The mini drafter is an important device used for making drawing quickly & accurately. This instrument has the combination of T-square, set square, protractor and scales, it helps to draw the drawings at a faster rate. (Fig 4,5 & 6)

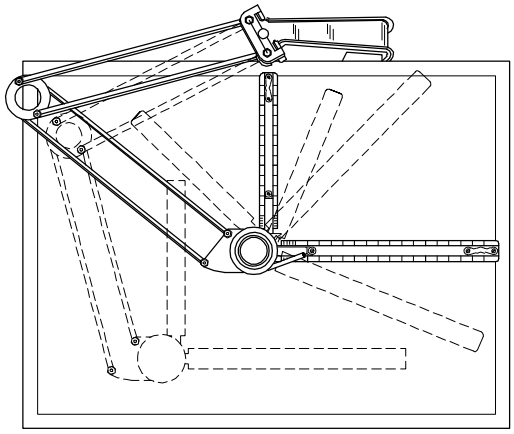
Fig 4



MINI DRAFTER PARTS

EDNIT110514

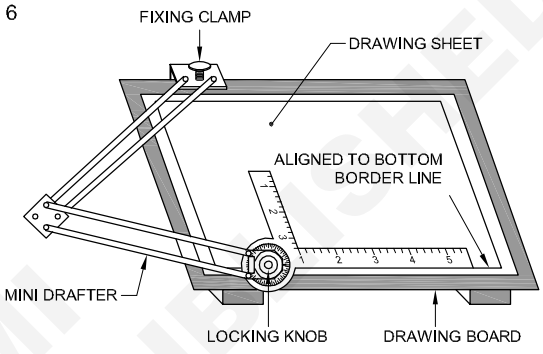
Fig 5



MINI DRAFTER ADJUSTMENT

EDNIT110515

Fig 6

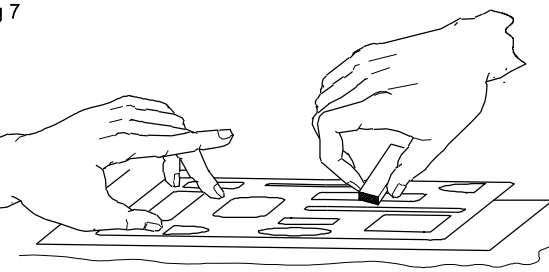


FIXING MINI DRAFTER

EDNIT110516

Erasing shield: When, on a drawing, if a part of a line or some lines among many other lines needs to be erased or modified, in a normal way erasing will damage the other nearby lines. In such a situation an erasing shield is effectively useful. It is a thin metallic sheet having small openings of different sizes and shapes. A suitable opening is aligned to the line to be erased and the line is removed by the eraser. (Fig 7)

Fig 7

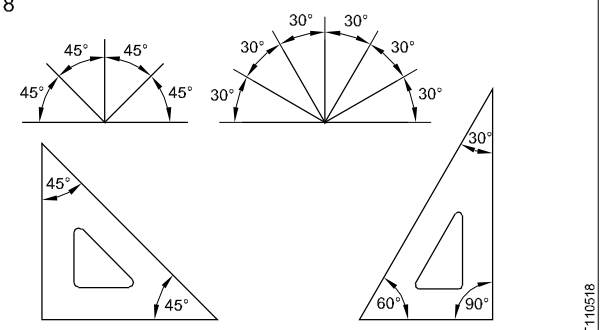


USE OF ERASER SHIELD

EDNIT110517

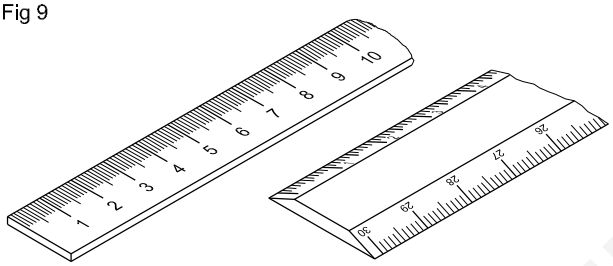
Set square (IS:1361-1988): Transparent celluloid /Plastic set squares are preferred and are commonly used rather than ebonite ones. They are two in number, each having one corner with 90°. The set square with 60° & 30° of 250 mm long and 45° of 200mm long is convenient for use. (Fig 8)

Fig 8



Scales: Scales are used to transfer and or measure the dimensions. They are made of wood, steel, ivory, celluloid or plastic, stainless steel scales are more durable. different types of scales used are shown in Fig 9. They are either flat, bevel-edged or triangular cross-sections. Scales of 15cm long, 2cm wide or 30cm long 3.5cm wide are in general use.

Fig 9

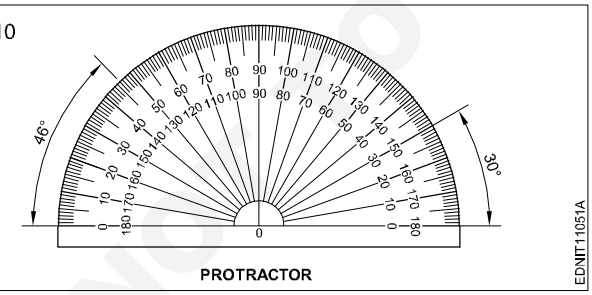


Protractor: A protractor is an instrument for measuring angles. It is semi-circular or circular and is made of a flat celluloid sheet.

The angles can be set or measured from both sides, aligning the reference line and point '0' with the corner point of the angle.

Figure 10 shows how to read or set the angle. A protractor can also be used to divide a circle or draw sectors.

Fig 10



French curves (Fig 11)

These are made in many different shapes, normally come in sets of 6,12,16 etc. French curves are best suited to draw smooth curves/ arcs (which cannot be drawn by a compass) with ease. To draw a smooth curve using a french curve first set it by trial against a part of the line to be drawn, then shift it to the next portions.

Fig 12 shows how to use the french curve and draw smooth curves. They are made of transparent celluloid (no bevel edge).

Fig 11

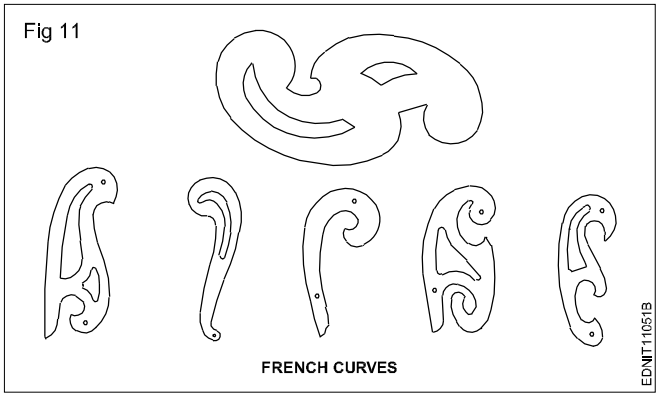
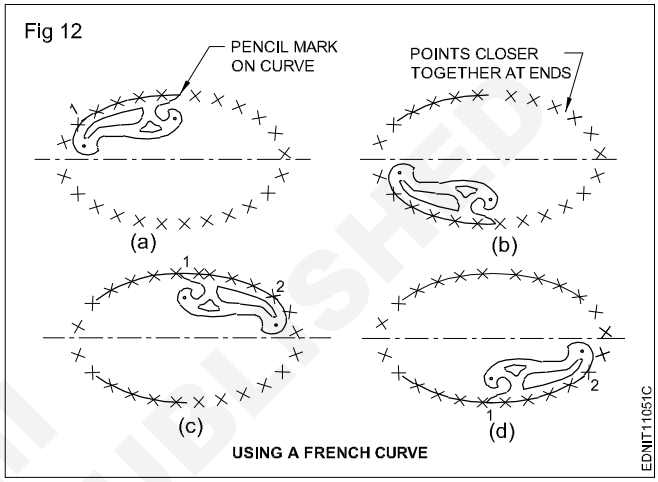


Fig 12

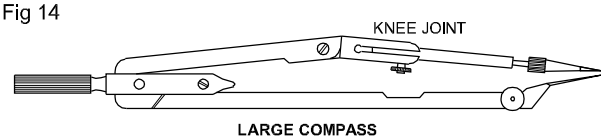


An instrument box contains the following: (Fig 13a to h)

- Large compass (with attachment facility) (a)
- Large divider (b)
- Bow compasses(pencil/ink), bow divider (c)
- Lengthening bar (d)
- Pen point for attachment (e)
- Screwdriver (f)
- Lead case (g)
- Liner (h)

Large compass (Fig 14): It has a knee joint in one leg that permits the insertion of a pen or pencil point or attaching a lengthening bar with a pen or pencil point attached to it. It is used for drawing large circles/arcs and also for taking large measurements.

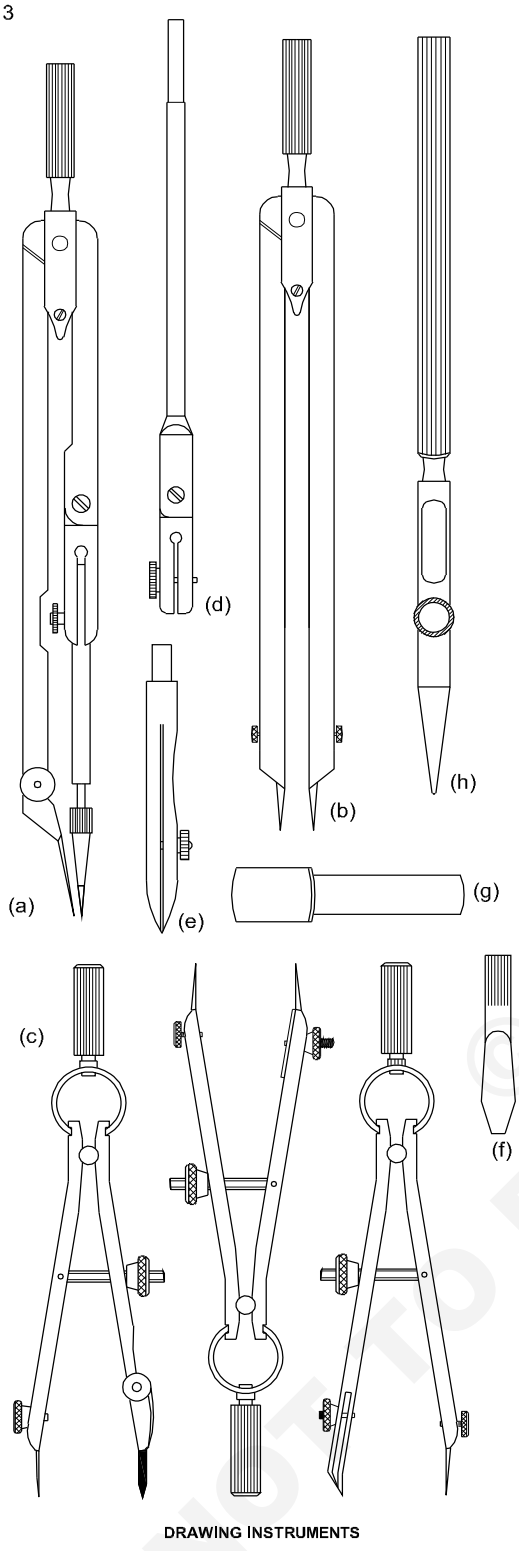
Fig 14



As a rule, while drawing concentric circles, small circles should be drawn first before the centre hole gets worn.

Large divider: It is used to transfer dimensions and divide lines into several equal parts. Divider with adjustable joints is preferable rather than plain legs. (Fig 15)

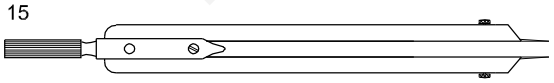
Fig 13



DRAWING INSTRUMENTS

EDNIT11051D

Fig 15



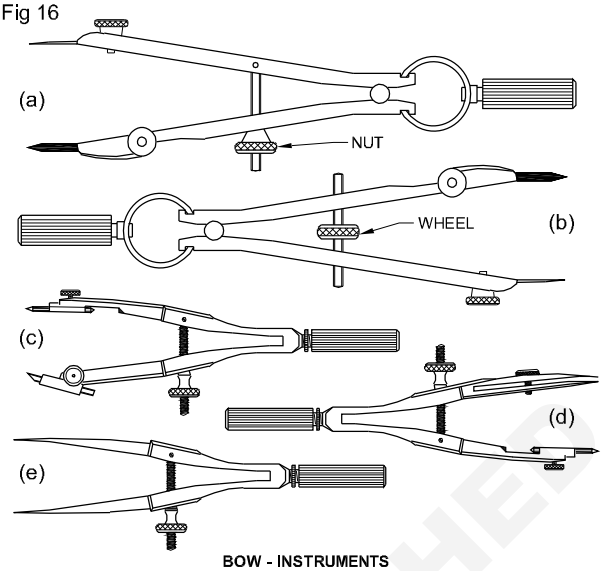
DIVIDER

EDNIT11051F

Bow instruments: Bow pencil and bow pen compass are used for drawing circles of approximately 25 mm radius. A bow divider is used for marking or dividing smaller spaces. There are two types (i) Integral legs with spring action (ii) two legs are held with a curved spring on top with a handle on it.

Fig 16 shows different types of bow instruments. Adjustments should be made with the thumb and middle finger.

Fig 16

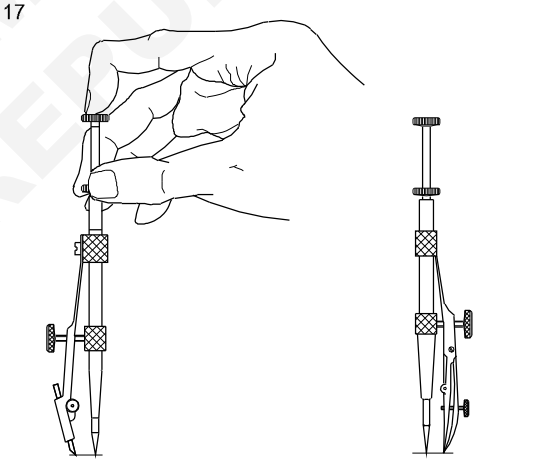


BOW - INSTRUMENTS

EDNIT11051G

Drop spring bow pencil and pen (Fig 17)**:** Drop spring bow pencil and pen are designed for drawing multiple identical small circles. Example: rivet holes, drilled/ reamed holes. The central pin is made to move freely up and down through the tube attached to the pen or pencil unit.

Fig 17

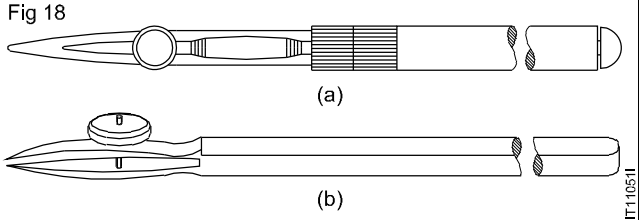


DROP SPRING BOW INSTRUMENT

EDNIT11051H

Inking pen or liner or ruling pen (Fig 18): It is used to ink the straight lines drawn with the instruments but never for freehand lines or lettering.

Fig 18

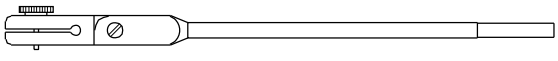


RULING PENS

EDNIT11051I

Lengthening bar (Fig 19): To draw larger circles, it is fitted to the compass. The pencil point or pen point is inserted into its end.

Fig 19



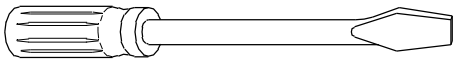
LENGTHENING BAR

EDNIT11051J

Replaceable spare pencils, pens and needle points for the compass are available in the instrument box.

Screwdriver (Fig 20): Used for adjusting the screws of the instruments.

Fig 20

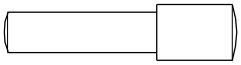


SCREW DRIVER

EDNIT11051K

Lead case (Fig 21): Lead case is the box for holding the pencil leads.

Fig 21

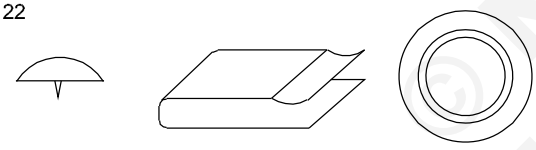


LEAD CASE

EDNIT11051L

Pin, Clip, Cello tape: Drawing sheet should be fastened onto the drawing board firmly temporarily so that it does not shake during preparing the drawing. For this purpose, the pins, clips and cello tapes are used (Fig 22)

Fig 22

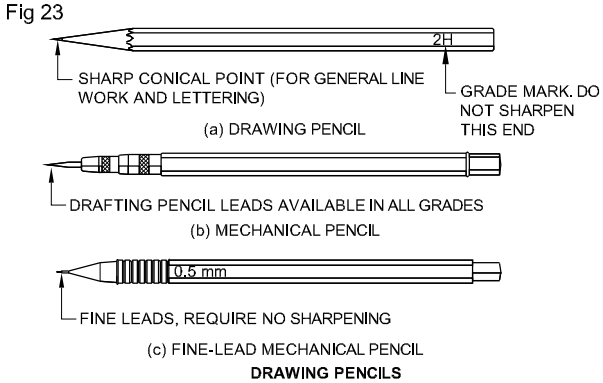


PIN,CLIP AND TAPE

EDNIT11051M

Pencils, Grade and Selection (Fig 23)

Fig 23



DRAWING PENCILS

EDNIT11051N

Grades of pencils: Pencils are graded according to the hardness or softness of the lead.

The hardest pencil is 9H grade and the softest pencil is 7B grade. The selection of the grade of pencils depends on the type of line work required and the paper on which it is used.

Softer lead pencils are used to produce thicker and darker line work, but they wear out quickly. Medium grades of H and 2H are used for general line work as well as for lettering.

Selection of pencils: Pencil grades vary from one brand to another brand. Select the grades of the pencil depending upon the type of line work. For construction lines, you can choose 2H or 3H, for lettering and object lines grade H pencils. In general H, HB and 2H are used.

H - medium-hard

HB - medium-soft

2H - hard

Now-a-days automatic (Mechanical) pencils or clutch pencils are available in different sizes (lead dia. 0.3, 0.5, 0.7 or 0.9). Leads can be replaced as per the required grade of hardness. They produce lines of uniform width without sharpening.

Free hand drawing of - Geometrical figures and blocks with dimension

Lines - Types and applications in drawing

Drawings are made up of different types of lines. Just a language with alphabet and grammar.

Lines of different thicknesses and features are used for specific use.

Technical drawings are drawn with different types of lines. By proper choice and application of lines, product features can be correctly defined in a drawing. Different types of lines recommended for specific applications are given in Table 1.

Table 1

Types of lines and their application

Lines	Description	General applications See figure and other relevant figure
A ——— 0.5	Continuous thick	A1 Visible outlines A2 Visible edges
B ——— 0.2	Continuous thin (straight)	B1 Imaginary lines of intersection B2 Dimension lines B3 projection lines or extension line B4 Leader lines B5 Hatching B6 Outlines of revolved sections in place B7 Short centre lines B8 Thread line B9 Diagonal line
C ~~~ 0.2	Continuous thin free hand	C1 Limits of partial or interrupted views & sections, if the limit is not a chain thin
D ⌇⌇⌇ 0.2	Continuous thin (Straight) with zig-zags	D1 Line (See figures)
E — — — — 0.3	Dashed thick	E1 Hidden outlines E2 Hidden edges
F — — — — 0.2	Dashed thin	F1 Hidden outlines F2 Hidden edges
G — · — · — 0.2	Chain thin	G1 Centre lines G2 Lines of symmetry G3 Trajectories
H — — — 0.3	Chain thin, thick at ends & changes of direction	H1 Cutting planes
J ——— 0.5	Chain thick	J1 Indication of lines or surfaces to which a special requirement applies
K — — — 0.2	Chain thin double-dashed	K1 Outlines of adjacent parts K2 Alternative and extreme positions of movable parts K3 Centroidal lines K4 Initial outlines prior to forming K5 Parts situated in front of the cutting plane

1 This type of line is suited for production of drawings by machines.
2 Although two alternatives are available, it is recommended that on any one drawing, only one type of line be used.

In the above range, for craftsmen, 0.5 is preferred. This table shows the 0.5 line range and other lines under this range.

The numbers on the right side of the lines refer to the line thickness in mm.

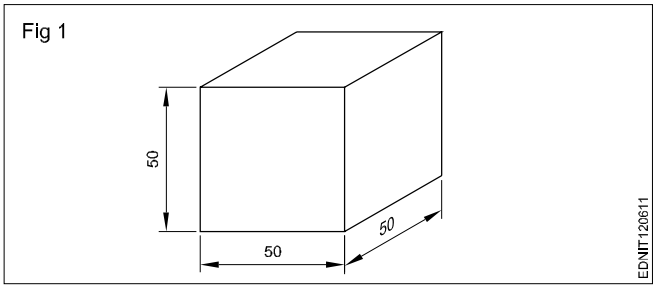
Geometrical figures and block with dimension

Freehand sketching: Apart from making drawing using instruments, often craftsmen will be required to make drawings with their free hand.

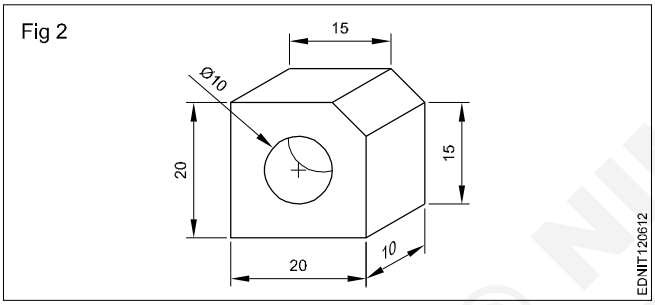
Freehand sketching is the easiest method to express the shape of a piece part or a component by an engineer or craftsman.

Freehand sketches are not usually made to scale. However, they should be as nearly to the proportions as possible.

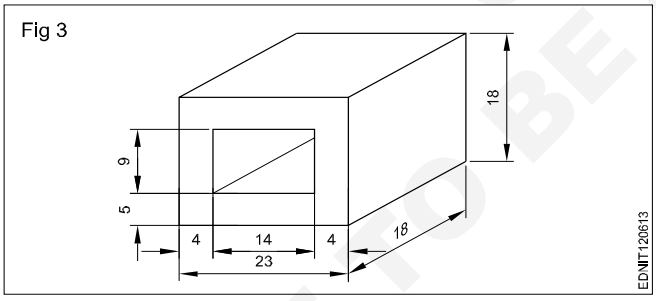
Cube (Fig 1)



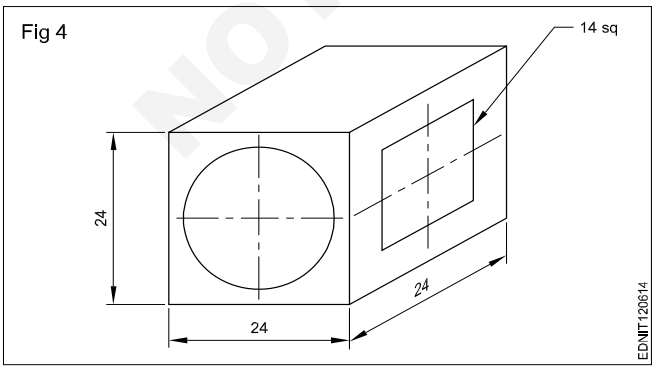
Square block (Fig 2)



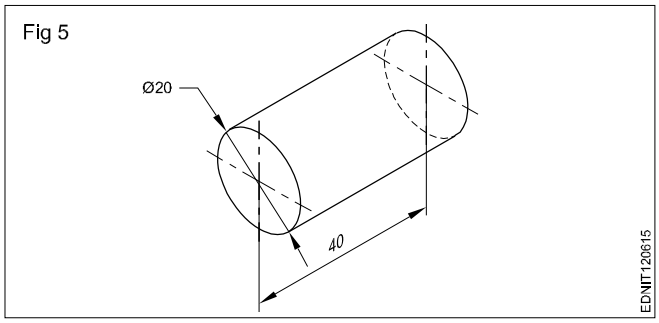
Rectangular block (Fig 3)



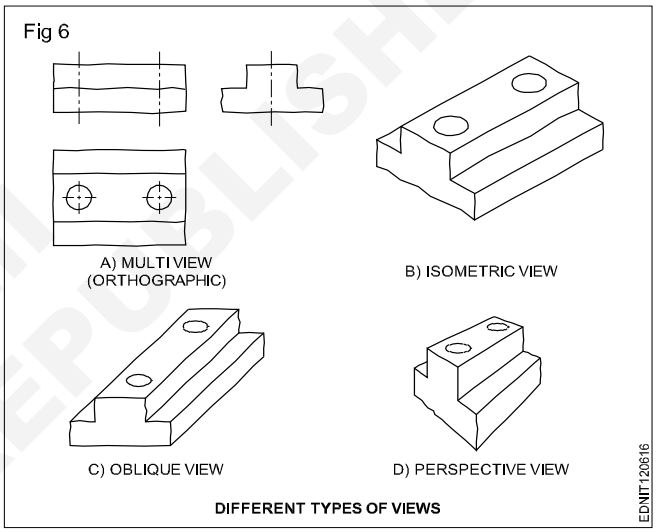
Cube block (Fig 4)



Cylinder (Fig 5)



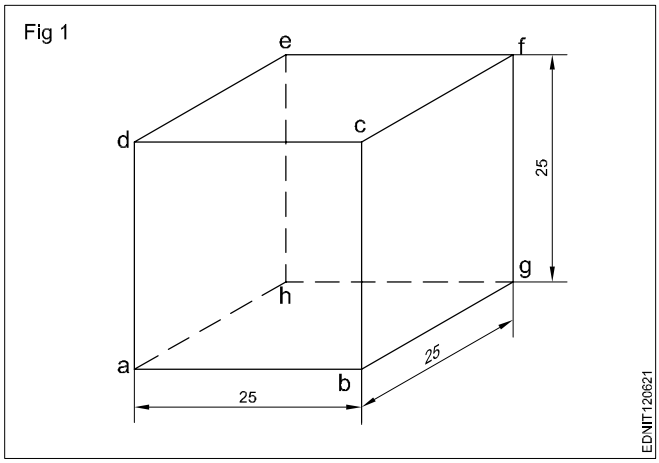
Materials for free hand sketching: A4 size sheet (preferably a pad instead of loose papers) pencils of soft grade. Example H, HB, and a good quality eraser are the only materials required. For drawing different darkness, the pencil points should be sharpened to a conical shape. Fig 6 shows some free hand sketches of different types of views.



Procedure

Freehand drawing of solid figures, cubes, cuboids, cone, prism, pyramid, frustum of a cone with dimensions

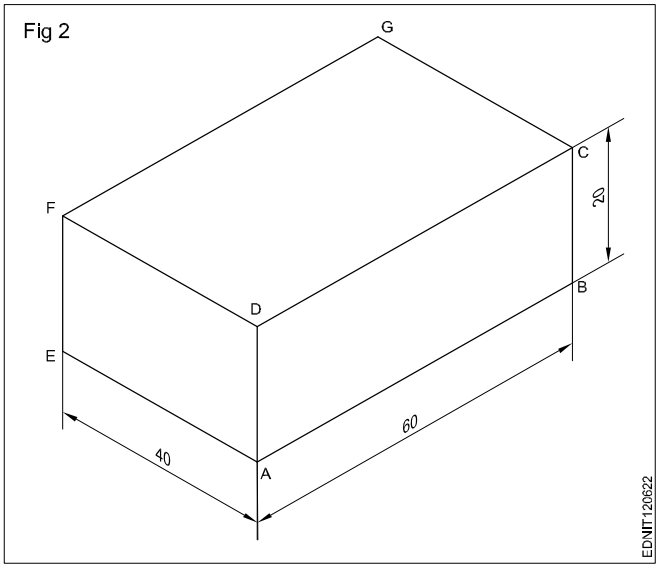
Cube (Fig 1)



- Draw squares of a, b, c and d.
- Draw 30° from points b, c and d for the length of 25mm.
- Mark point g from b, f from c and e from d as shown in the figure.
- Joint all points.

Cuboid (Fig 2)

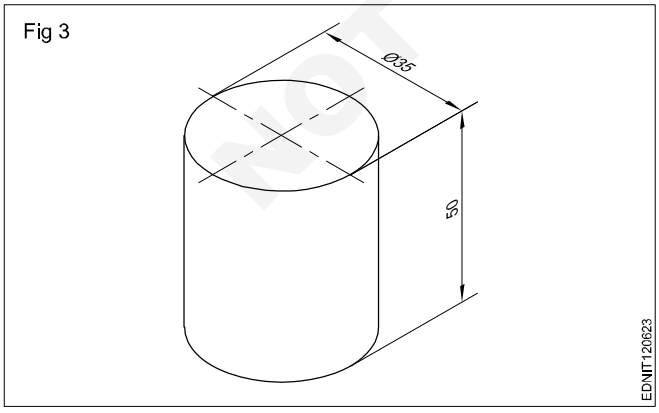
Draw the isometric drawing of a cuboid of base 60 mm x 40 mm and the height of 20 mm. (Fig 2)



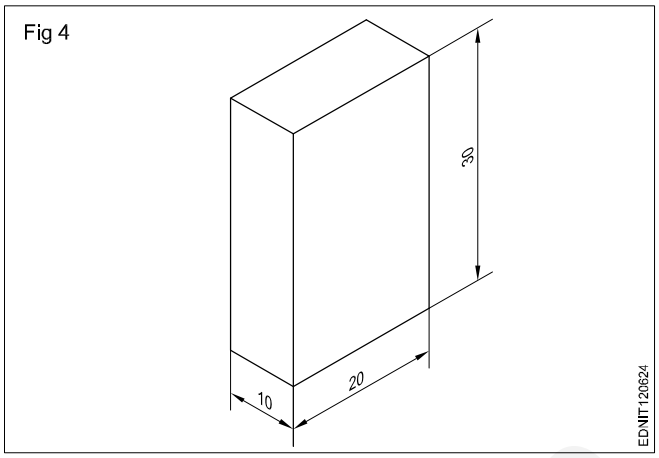
Draw the three isometric axes through the point 'A'.

- Mark AB = 60mm, AE = 40mm and AD= 20mm representing the three sides of cuboid.
- Draw two vertical lines EF and BC parallel to AD from points E and B respectively.
- Similarly, draw two more lines parallel to AB and AE to mark G's interesting point from F and C.
- Draw lines parallel to DC and FG Draw lines parallel to DF and GC.
- Join all the points.

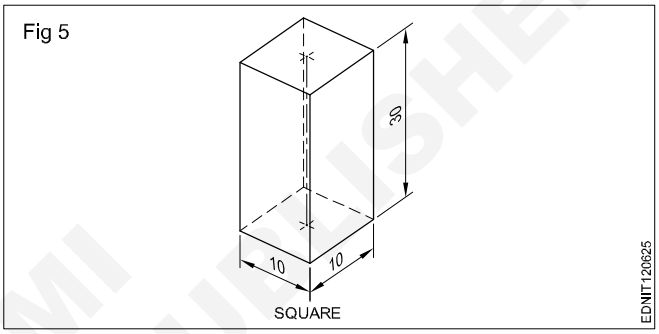
Cylinder (Fig 3)



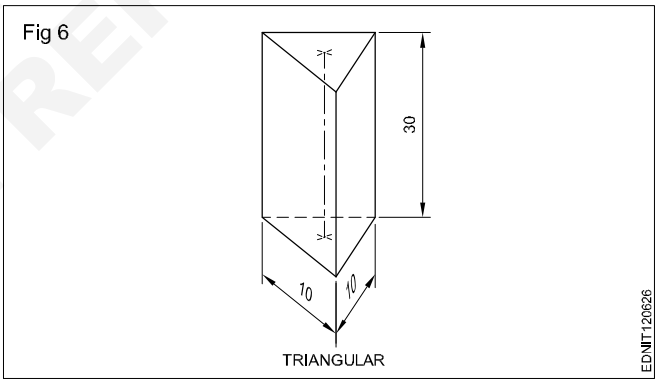
Rectangular prism (Fig 4)



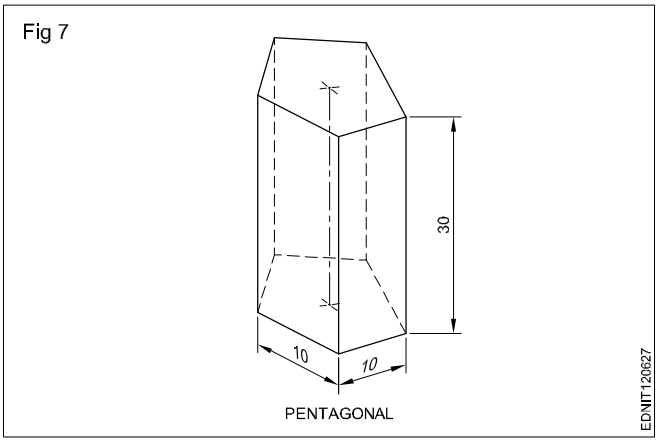
Square Prism (Fig 5)



Triangular Prism (Fig 6)

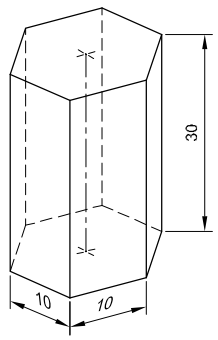


Pentagonal prism (Fig 7)



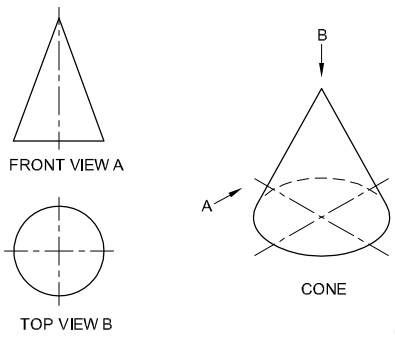
Hexagonal prism (Fig 8)

Fig 8



Cone: When a right-angled triangle revolves about one of its sides forming the right angle, a cone is generated. Cone forming has a circular face and a slant curved surface. (Fig 9)

Fig 9



Pyramids: Pyramids are polyhedron solids having a base surface whose shape may be triangular, square or polygon and as many slant triangular faces as there are sides in the base. All the slant triangular faces join at a common point called APEX.

Similar to prisms, pyramids also are known by the shape of their base viz triangular, square, rectangular, pentagonal, hexagonal etc. The imaginary line joining the centre of the base to the apex is called the AXIS.

Fig 10 shows some pyramids and their views.

When a semi-circle revolves about its diameter a sphere is generated. A sphere has no flat surface. (Fig 11D)

Frustums: Pyramid/cone is cut parallel to the base and the top portion is removed. The remaining bottom portion is called the frustum of a pyramid/cone.

If the cutting plane is at an angle to the axis/base, the pyramids or cones are called "Truncated pyramids or cones".

Fig 10

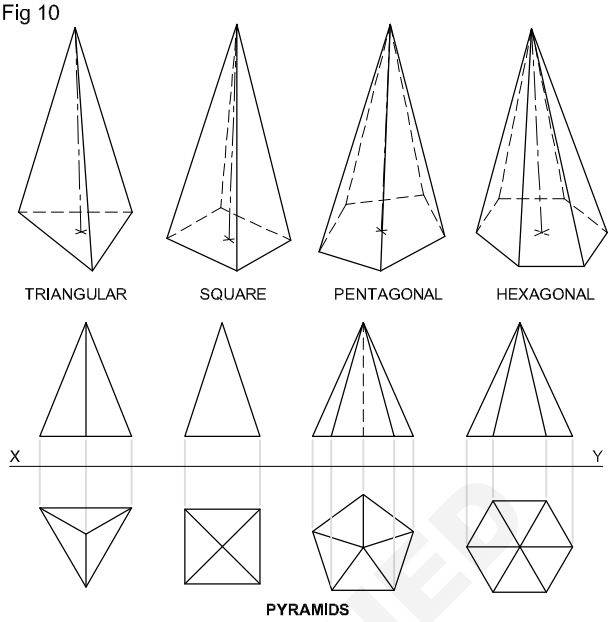


Fig 11

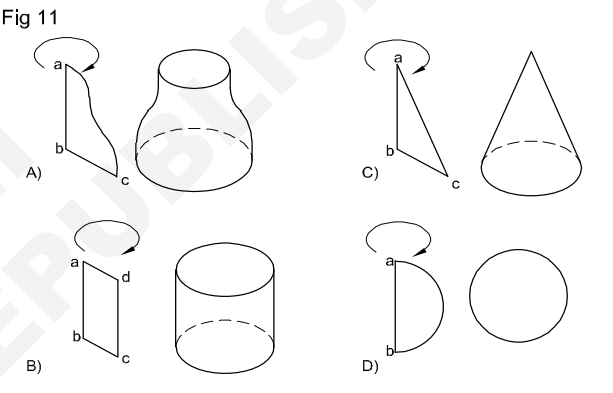
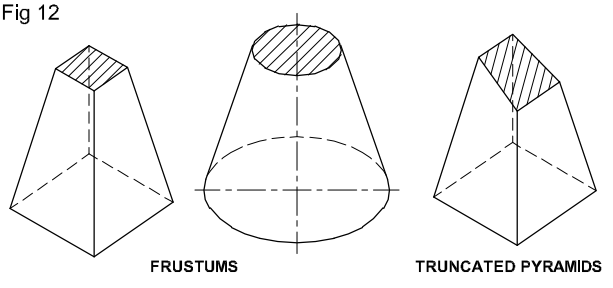


Fig 12 shows frustums and truncated pyramids.

All items we use are solids. Their shapes may confirm individual geometrical solids like prisms, cones or other combinations.

Fig 12



Free hand drawing of - Transferring measurement from the given object to the free hand sketches

Fig 1

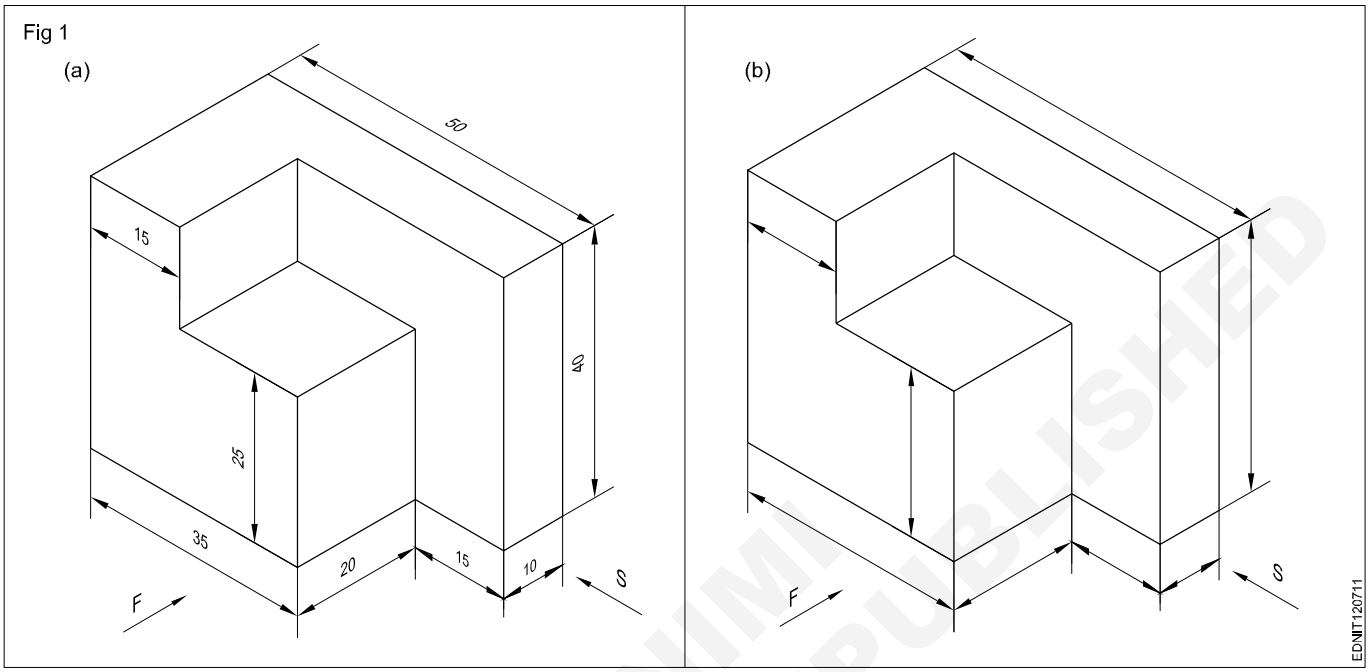


Fig 2

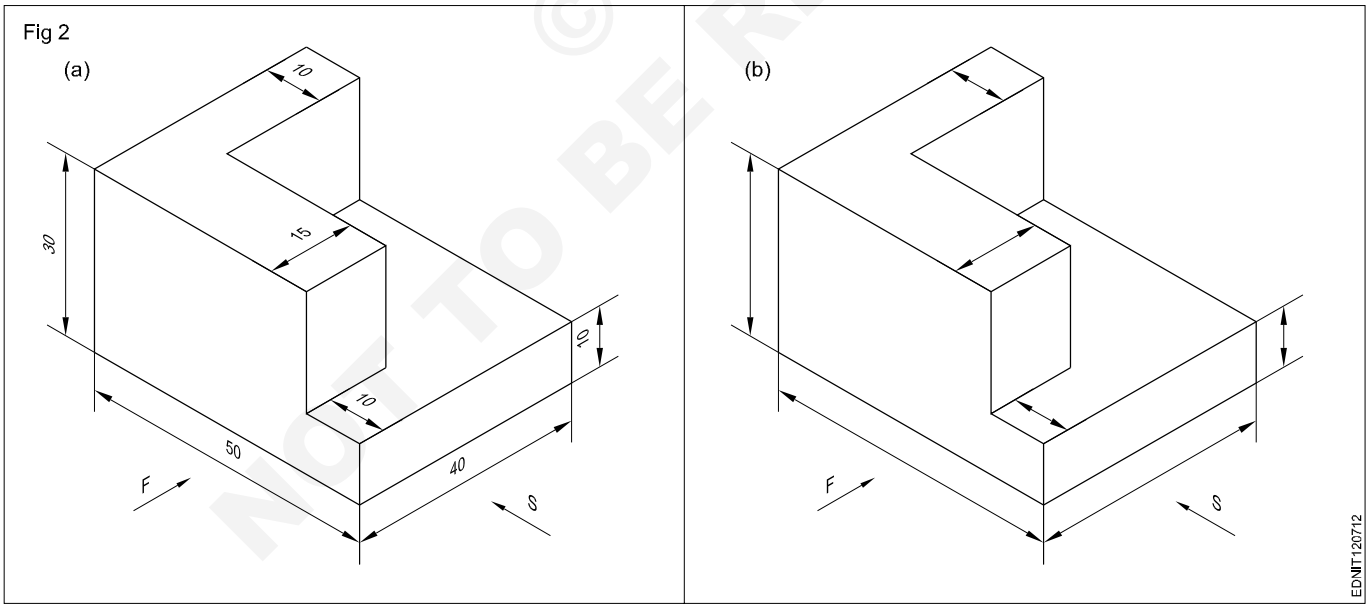
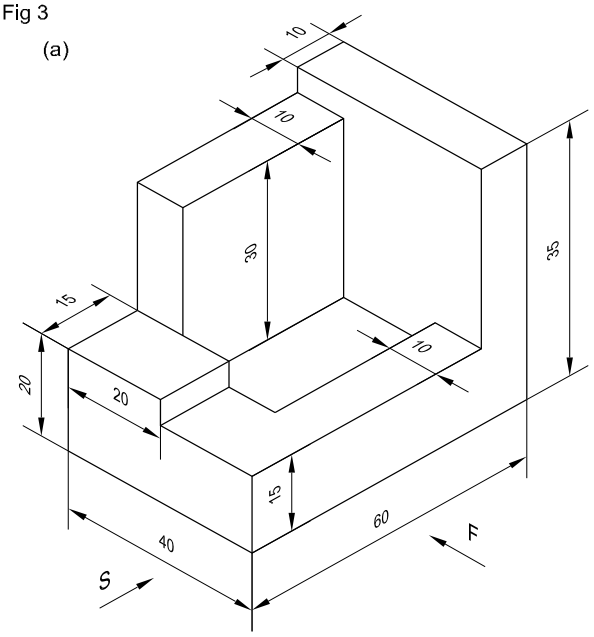
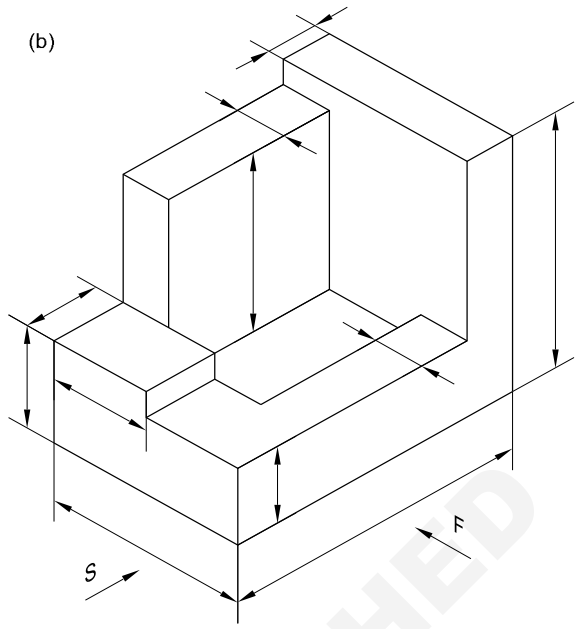


Fig 3

(a)



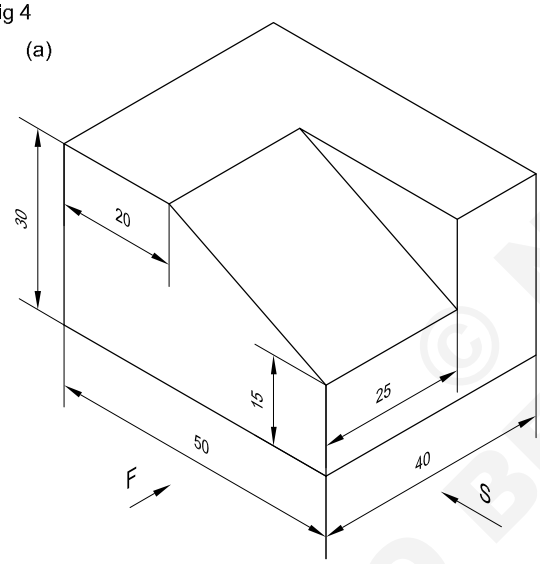
(b)



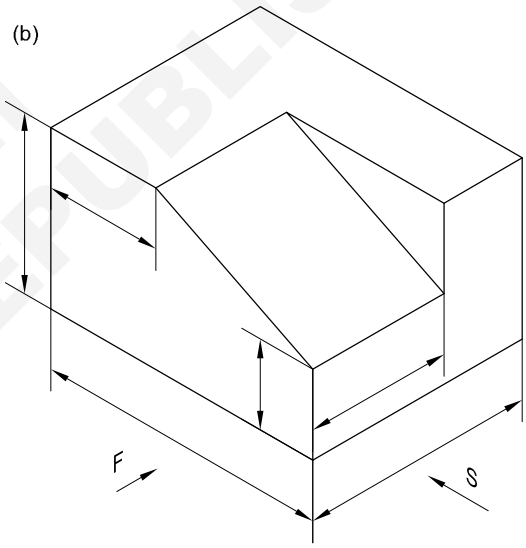
EDNIT120713

Fig 4

(a)



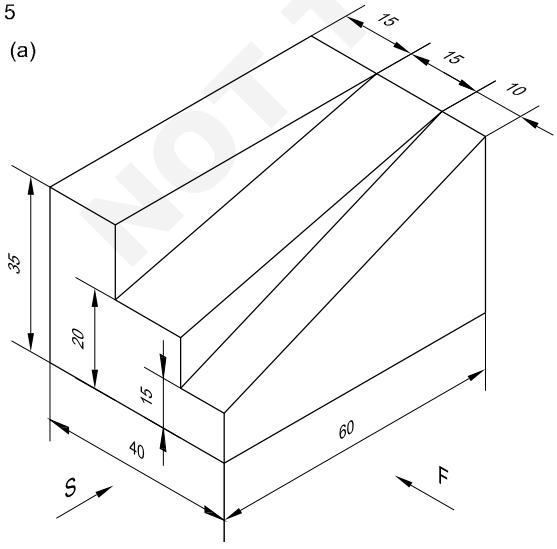
(b)



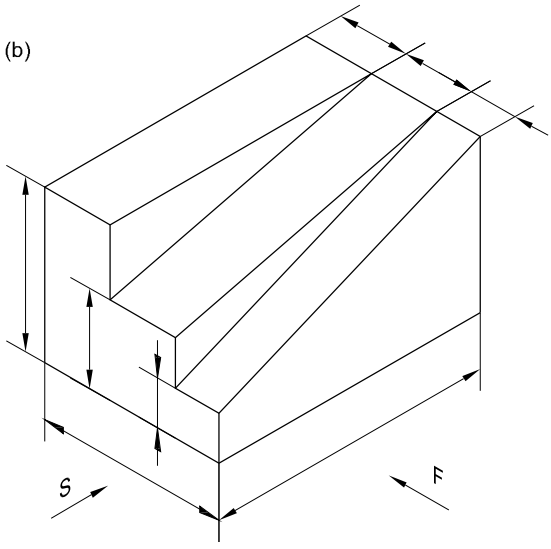
EDNIT120714

Fig 5

(a)



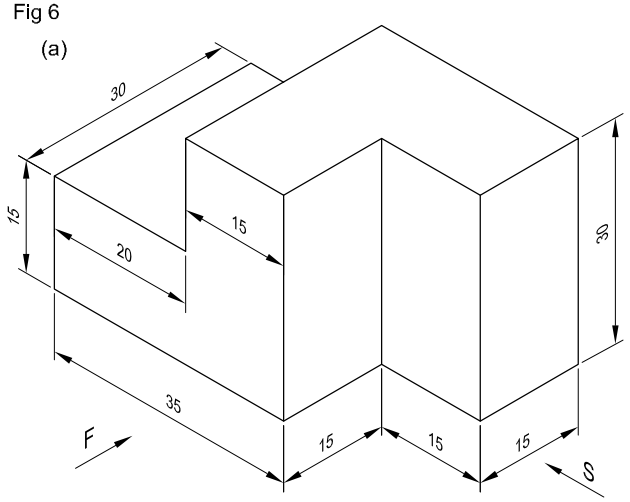
(b)



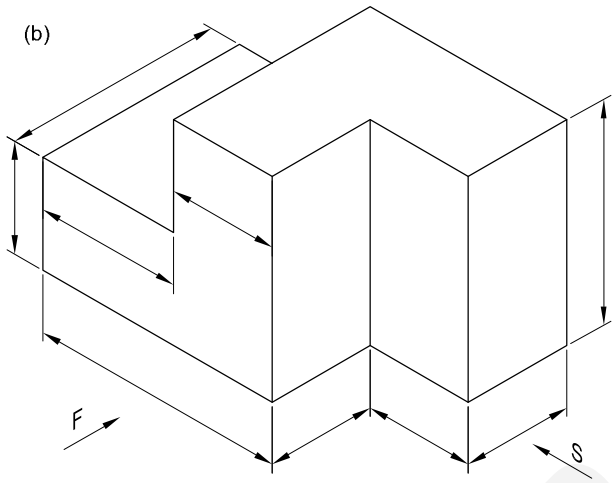
EDNIT120715

Fig 6

(a)



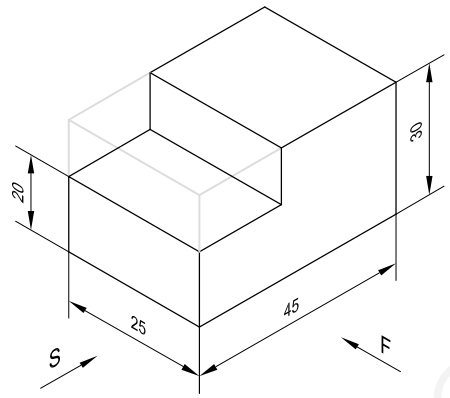
(b)



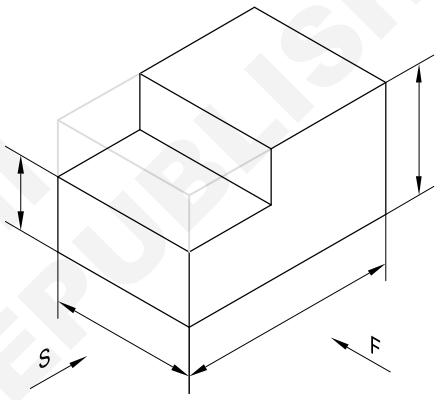
EDNIT120716

Fig 7

(a)



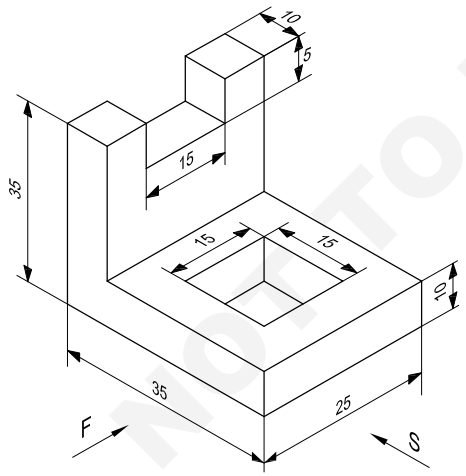
(b)



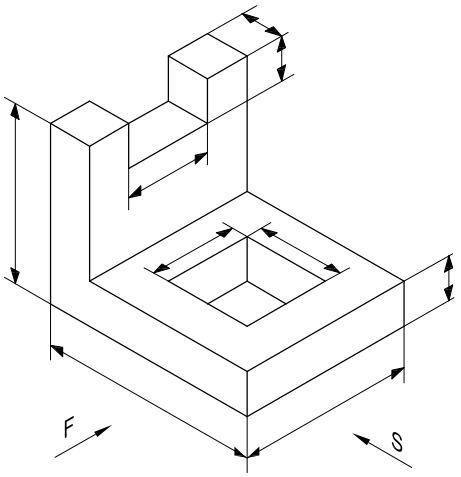
EDNIT120717

Fig 8

(a)



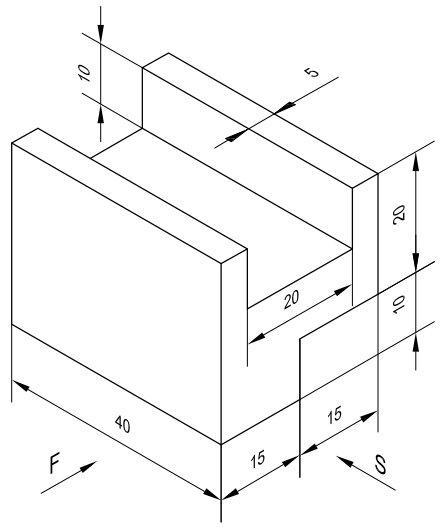
(b)



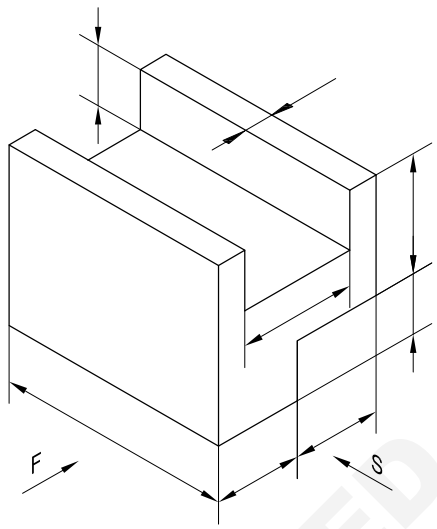
EDNIT120718

Fig 9

(a)



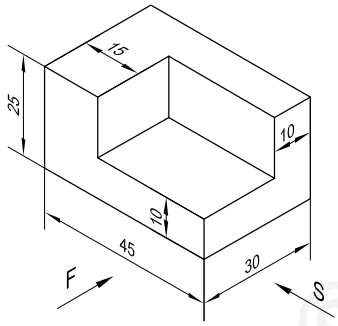
(b)



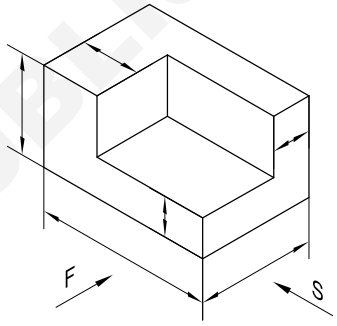
EDNIT120719

Fig 10

(a)



(b)



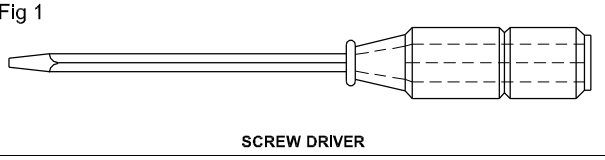
EDNIT12071A

Freehand drawing of hand tools

Hand Tools

Screw driver (Fig 1)

Fig 1

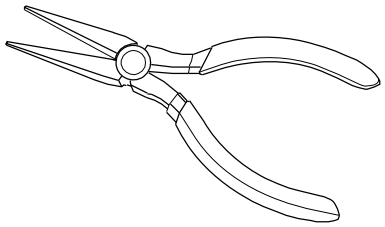


SCREW DRIVER

EDNIT120811

Mini needle-nose pliers (Fig 2)

Fig 2

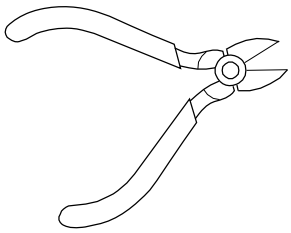


MINI NEEDLE-NOSE PLIERS

EDNIT120812

Mini diagonal cutting pliers (Fig 3)

Fig 3



MINI DIAGONAL CUTTING PLIERS

EDNIT120813

Cross screw driver (Fig 4)

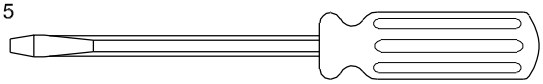
Fig 4

CROSS SCREW DRIVER

EDNIT120814

Straight screw driver (Fig 5)

Fig 5

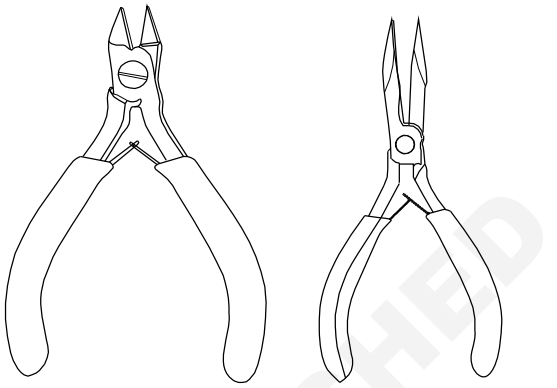


STRAIGHT SCREW DRIVER

EDNIT120815

Snip set (Fig 6)

Fig 6

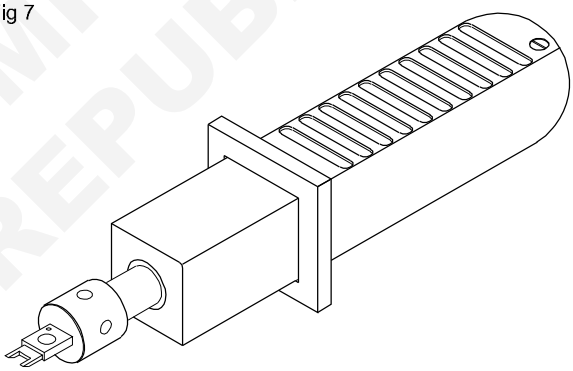


SNIP SET

EDNIT120816

Crimping tool (Fig 7)

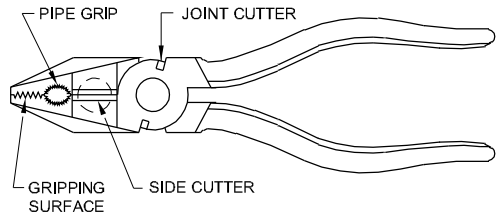
Fig 7



EDNIT120817

Cutting plier (Fig 8)

Fig 8



CUTTING PLIER

EDNIT120818

RJ45 Ethernet crimp tool (Fig 9)

Fig 9

RJ45 ETHERNET CRIMP TOOL

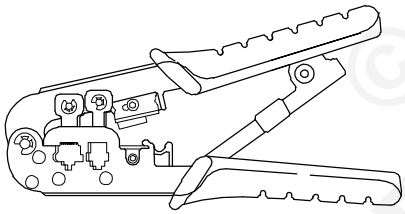
Network LAN crimping tool (Fig 10)

Fig 10

NETWORK LAN CRIMPING TOOL

Cable crimper tool (Fig 11)

Fig 11

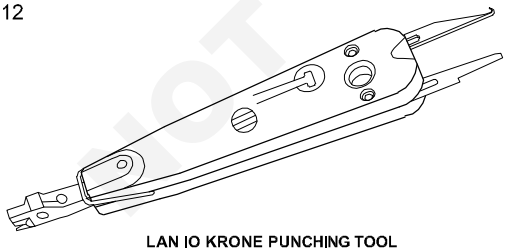


CABLE CRIMPER TOOL

EDNIT12081B

LAN IO Krone Punching Tool (Fig 12)

Fig 12



LAN IO KRONE PUNCHING TOOL

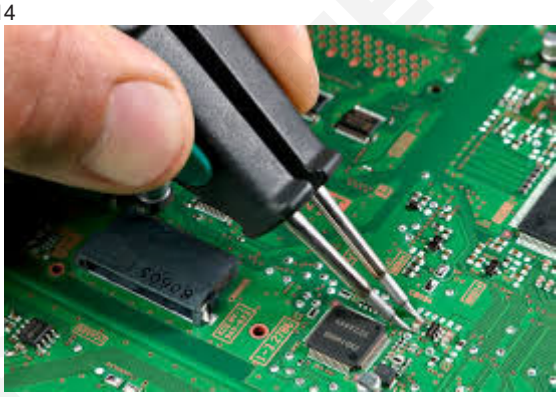
EDNIT12081C

Soldering iron (Fig 13)

Fig 13

Soldering tweezers (Fig 14)

Fig 14



SOLDERING TWEEZERS

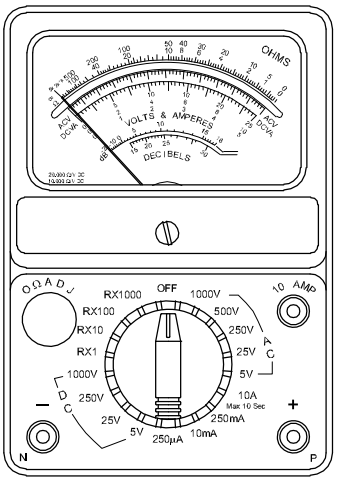
Temperature controlled soldering station (Fig 15)

Fig 15

TEMPERATURE CONTROLLED SOLDERING STATION

Analog multimeter (Fig 16)

Fig 16

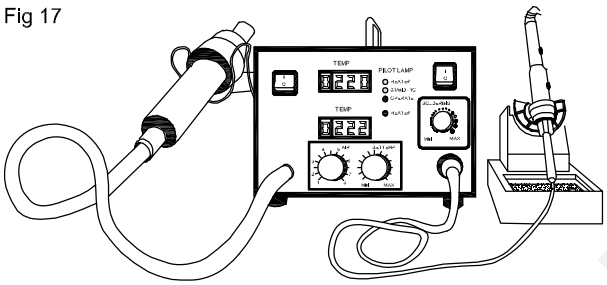


EDNIT12081G

ANALOG MULTIMETER

Hot air station solder blower (Fig 17)

Fig 17



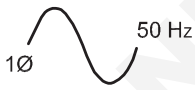
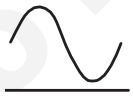
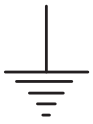
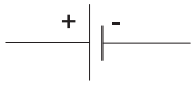
EDNIT12081H

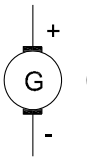
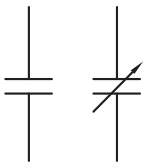
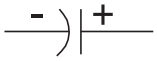
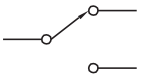
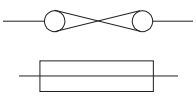
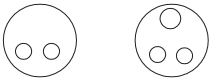
Digital multimeter (Fig 18)

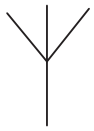
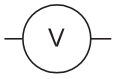
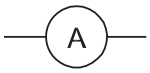
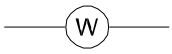
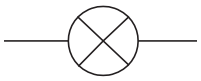
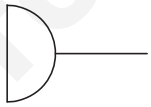
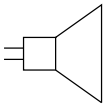
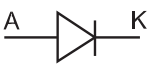
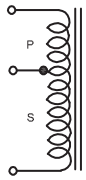
Fig 18

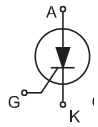
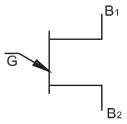
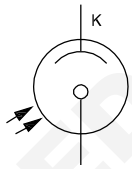
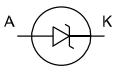
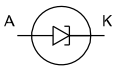
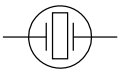
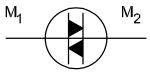
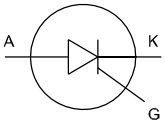
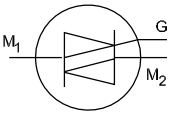
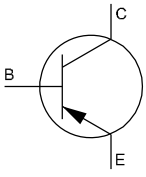
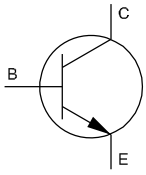
DIGITAL MULTIMETER

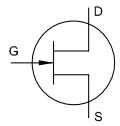
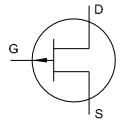
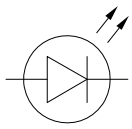
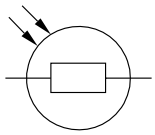
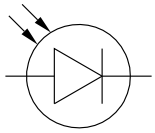
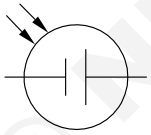
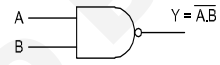
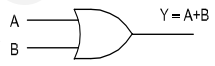
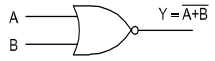
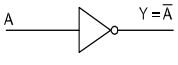
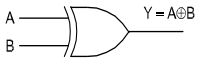
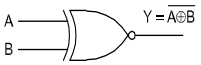
Symbolic representation - Different symbols used in the related trades

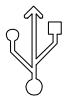
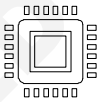
S.No.	Description	Symbol
1	Power	
2	A.C.	
3	Positive	
4	Negative	
5	Single Phase A.C. 50 Hz	
6	Three Phase A.C., 50 Hz	
7	A.C. / D.C.	
8	Earth	
9	Cell	
10	Battery	

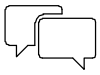
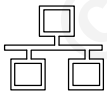
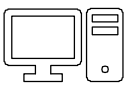
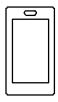
S.No.	Description	Symbol
11	Single pole single throw switch	
12	Alternator	
13	Generator	
14	D.C. Motor	
15	Capacitor: Fixed, variable	
16	Electrolytic Capacitor	
17	Two-way switch	
18	Fuse: ordinary catridge	
19	Socket 2 pin, 3 pin	

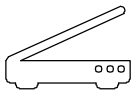
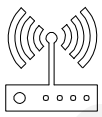
S.No.	Description	Symbol
20	Aerial / Antenna	
21	Voltmeter	
22	Ammeter	
23	Ohm Meter	
24	Watt Meter	
25	Lamp	
26	Buzzer	
27	Choke	
28	Transformers	
29	Carbon microphone	
30	Loudspeaker	
31	Diode	
32	Auto transformer	

S.No.	Description	Symbol
33	SCR	
34	UJT	
35	Photo diode	
36	Semi-conductor diode	
37	Zener diode	
38	Tunnel diode	
39	Piezoelectric crystal	
40	Diac	
41	SCR	
42	TRIAC	
43	PNP transistor	
44	NPN transistor	

S.No.	Description	Symbol
45	FET N-channel	
46	FET P-channel	
47	Light Emitting Diode	
48	LDR	
49	LED Photo diode	
50	Photo voltaic cell	
51	AND Gate	
52	NAND Gate	
53	OR Gate	
54	NOR Gate	
55	NOT Gate	
56	EX-OR Gate	
57	EX-NOR Gate	

S.No.	Description	Symbol
58	Power	
59	Reboot	
60	USB	
61	Chip	
62	Download	
63	Play	
64	Pause	
65	Previous / Reverse	
66	Next / Forward	
67	Hub	
68	WIFI signal	
69	Cloud Sync	
70	Cloud download	

S.No.	Description	Symbol
71	Mute	
72	Speaker	
73	Webcam	
74	Printer	
75	Disk	
76	Chat	
77	Bluetooth	
78	Network	
79	Mail	
80	MIC	
81	Desktop	
82	Laptop	
83	Mobile	

S.No.	Description	Symbol
84	Scanner	
85	Floppy	
86	WIFI Router	
87	Network Tower	
88	Cloud	
89	Firewall	
90	Terminal	
91	Switch	
91	Bridge	
93	Server	
94	Router	
95	Mainframe	

Reading of hardware component

Read and write the following. (Fig 1)

1 What are the main functions of motherboard?

2 State the process of North Bridge?

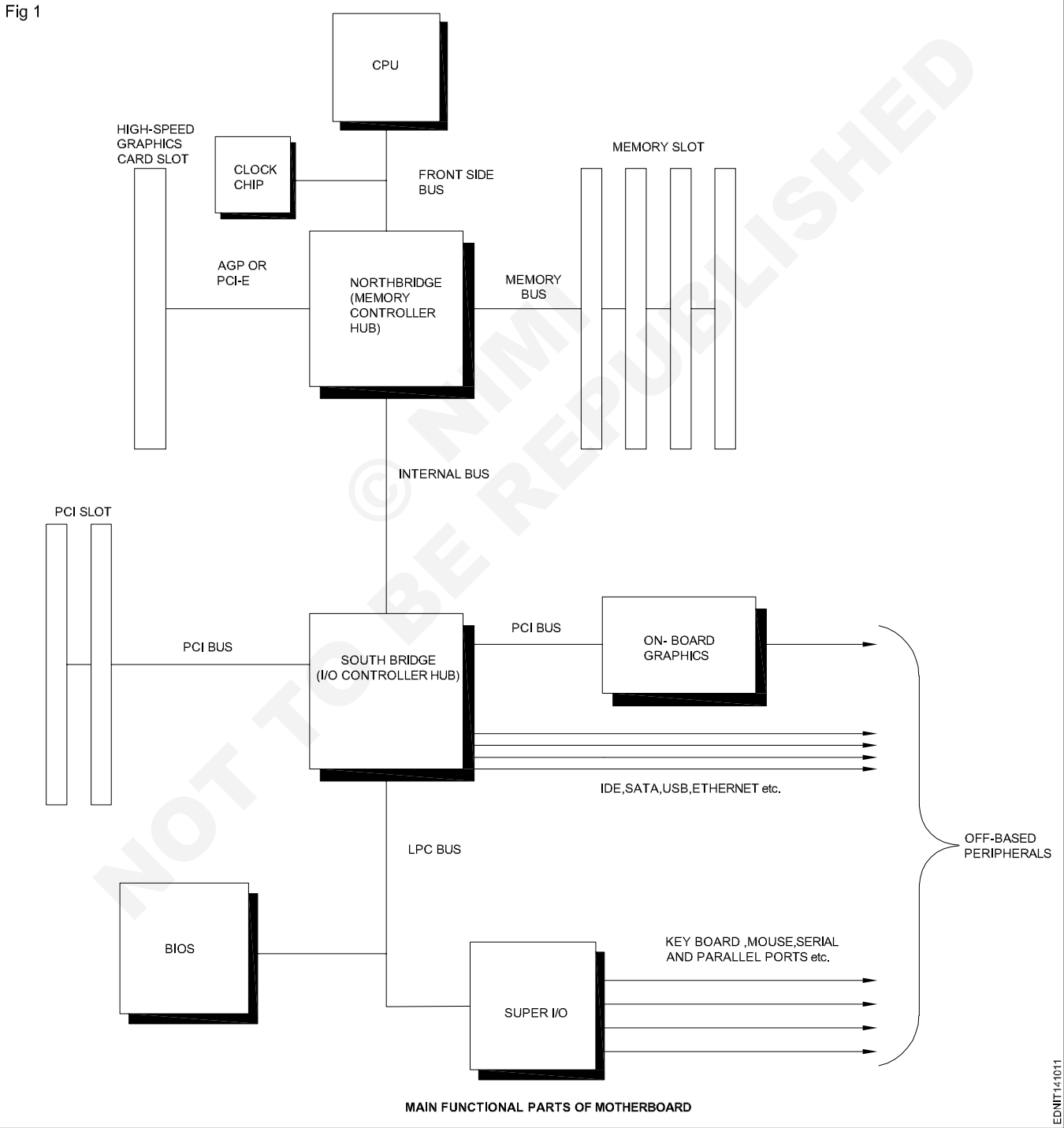
3 State the process of South Bridge?

4 State the CPU?

5 List the IO Ports?

6 Read and understand BIOS?

Fig 1



MAIN FUNCTIONAL PARTS OF MOTHERBOARD

Read and write the following. (Fig 2)

1 What are the main functions of SMPS?

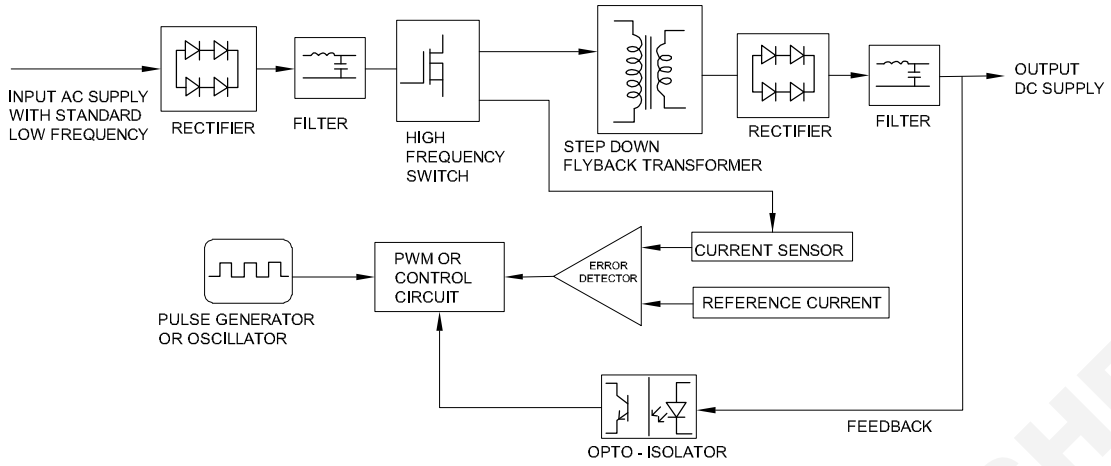
2 State the process of Bridge Rectifier?

3 State the process of Transformer?

4 State the PWM?

5 State the function of High Frequency Switch?

Fig 2



BLOCK DIAGRAM OF SMPS

EDNIT141012

Read and write the following. (Fig 3)

1 State the function of PWM sinewave invertor?

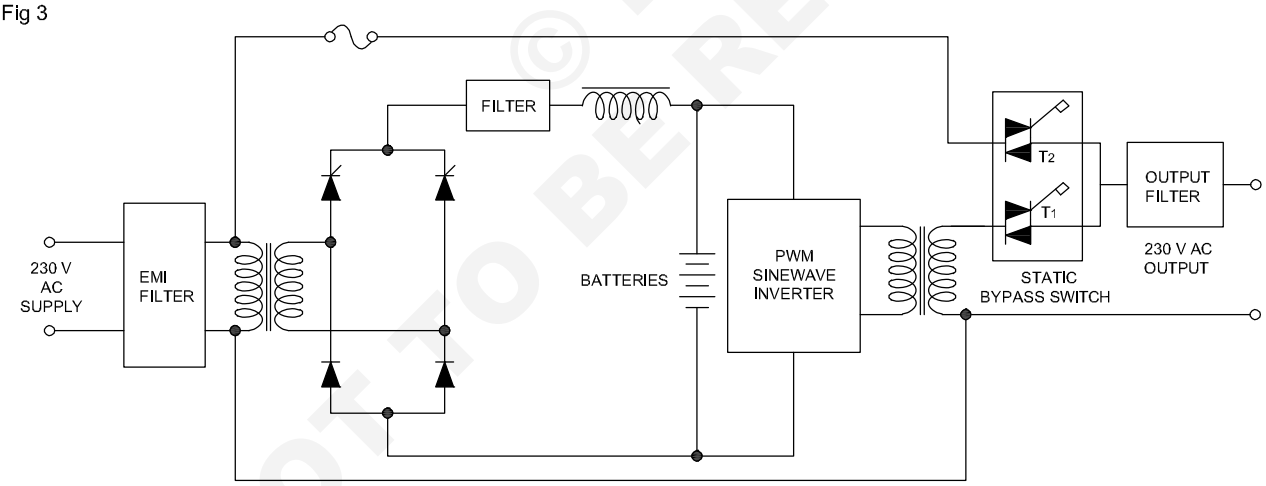
2 What is the use of filter?

3 Which type of rectifier circuit is used?

4 Name the component of T1 and T2?

5 How does On-line ups works?

Fig 3



BLOCK DIAGRAM OF ON - LINE UPS

EDNIT141013

Read and write the following. (Fig 4)

1 Read and understand the block diagram of basic invertor?

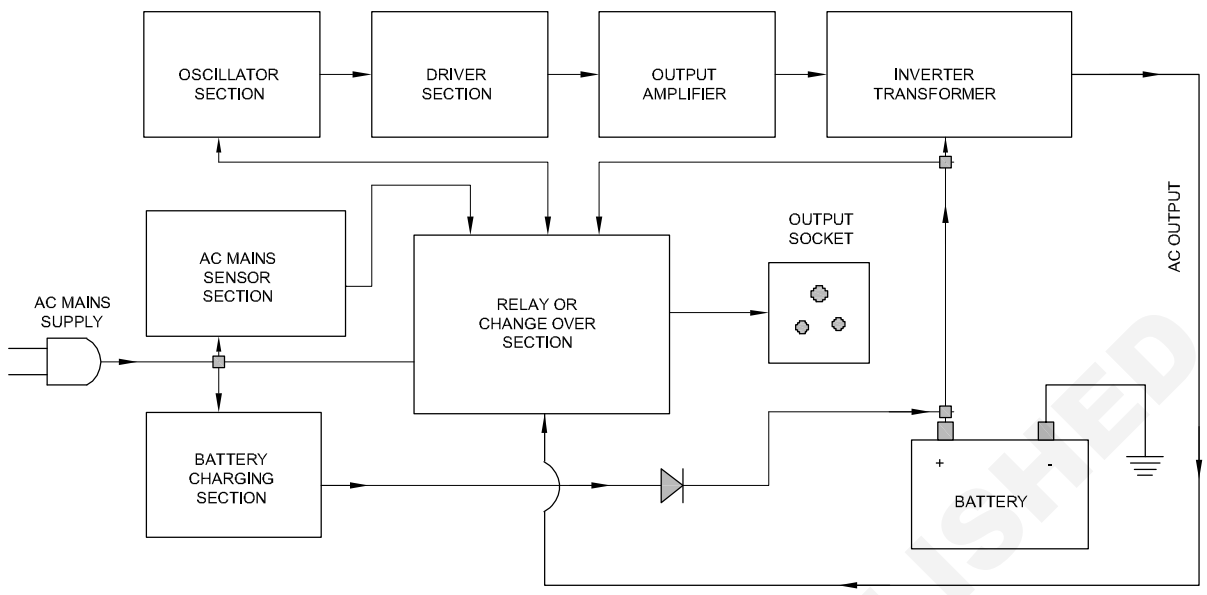
2 What is oscillator?

3 What is the function of relay?

4 What is the use of inverter transformer?

5 What is the difference between UPS and inverter?

Fig 4



BLOCK DIAGRAM OF A BASIC INVERTER

EDNIT141014

Read and write the following. (Fig 5,6&7)

1 Read and understand the Serial pin layout diagram?

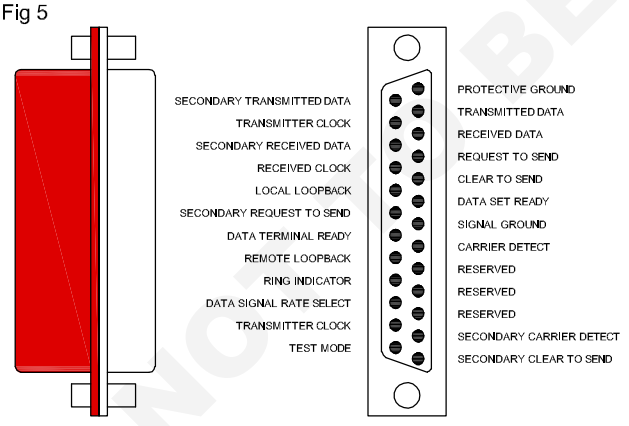
2 Read and understand the Printer pin layout diagram?

3 How much voltage is applied in this port?

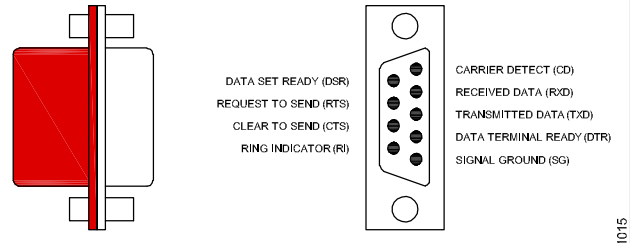
4 Draw the pin layout diagram of serial COM Port?

5 What is the Use of Serial and Parallel Port?

Fig 5



DB-25 SERIAL CONNECTOR (EIA-232)

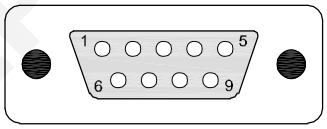


DB-9 SERIAL CONNECTOR (EIA-574)

RS-232 PIN ASSIGNMENTS

EDNIT141015

Fig 6

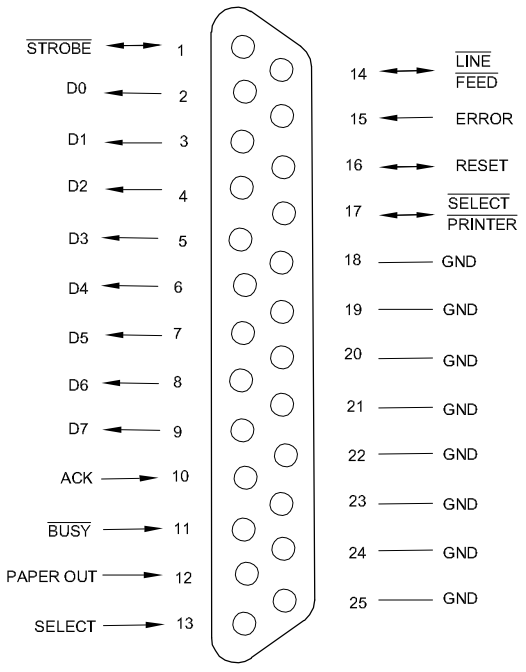


PIN #	SIGNAL
1	DCD
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

DB9M CONNECTOR

EDNIT141016

Fig 7



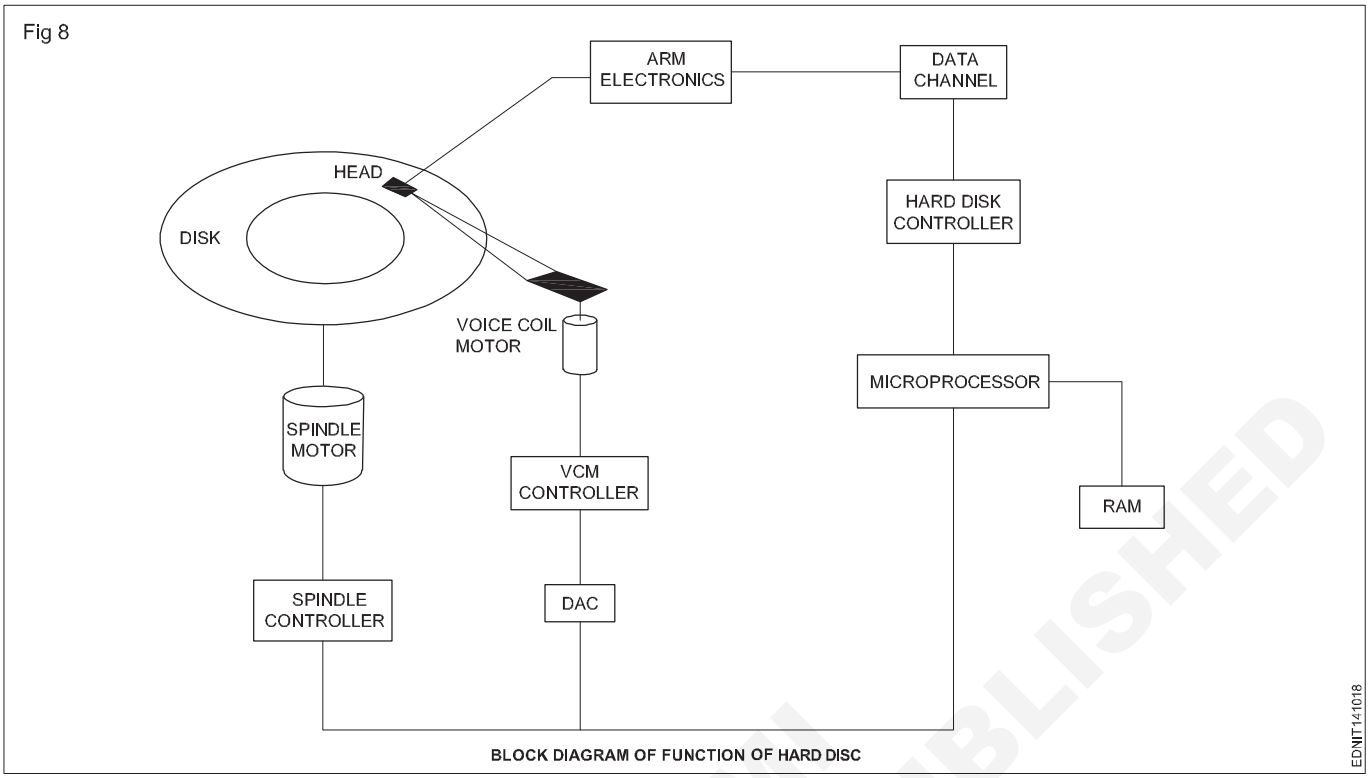
SERIAL & PARALLEL

EDNIT141017

Read and Write the following. (Fig 8)

1 Read and understand the Function of Hard disk?

Fig 8



BLOCK DIAGRAM OF FUNCTION OF HARD DISC

Read and Write the following. (Fig 9)

1 What is the function of ALU?

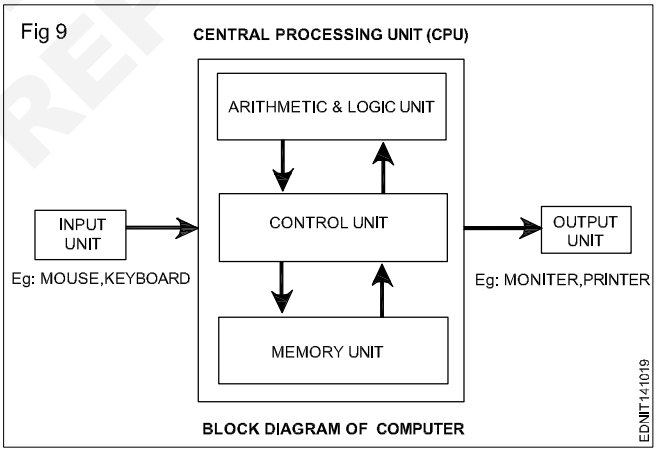
2 What is the function of Control unit?

3 What is the use of Memory unit?

4 Give some examples of Input devices?

5 Give some examples of Output devices?

Fig 9



BLOCK DIAGRAM OF COMPUTER

Read and Write the following. (Fig 10)

1 Identify the parts name of the Motherboard?

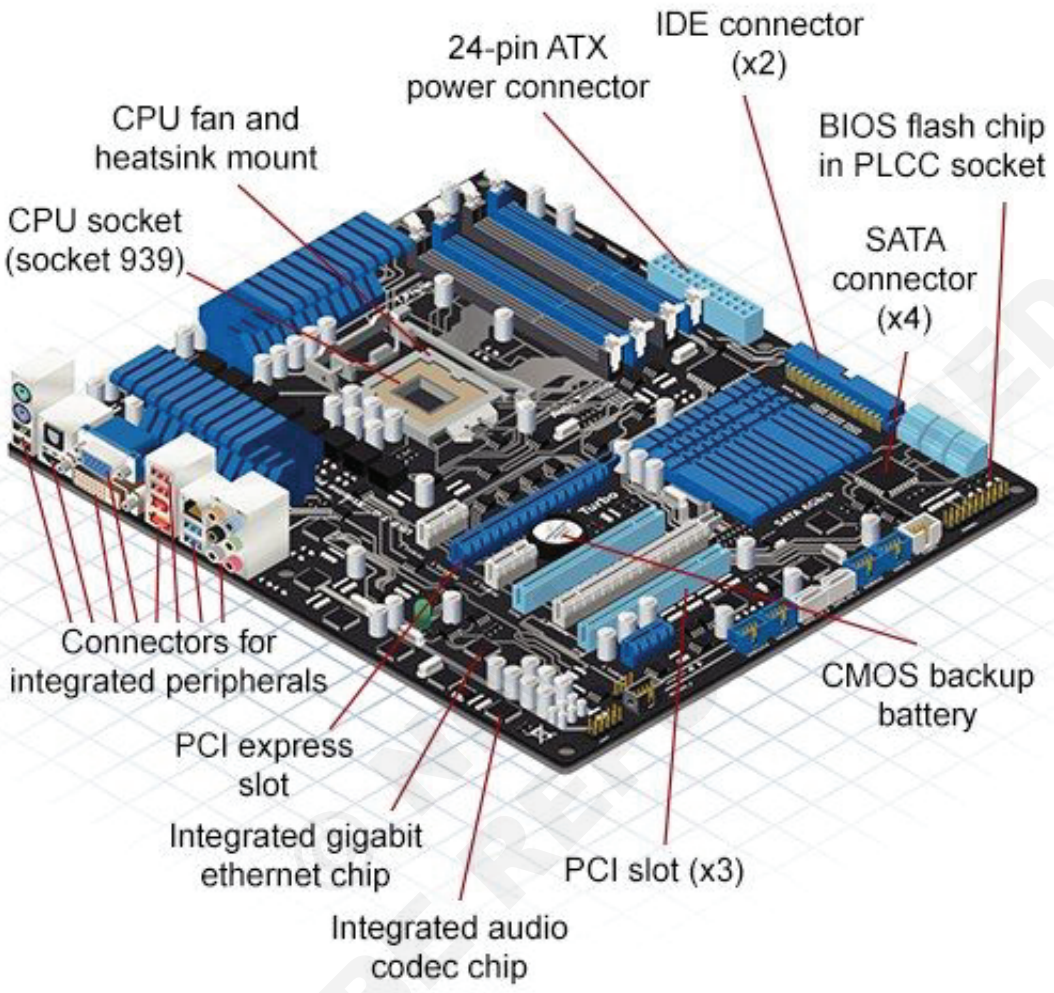
2 What are the different types of PC Motherboard?

3 What is the function of RAM?

4 What is the function of Processor?

5 What are the different slots in PC Motherboard?

Fig 10



DESKTOP MOTHERBOARD

Read and Write the following. (Fig 11)

1 What are the internal parts of Laptop Motherboard?

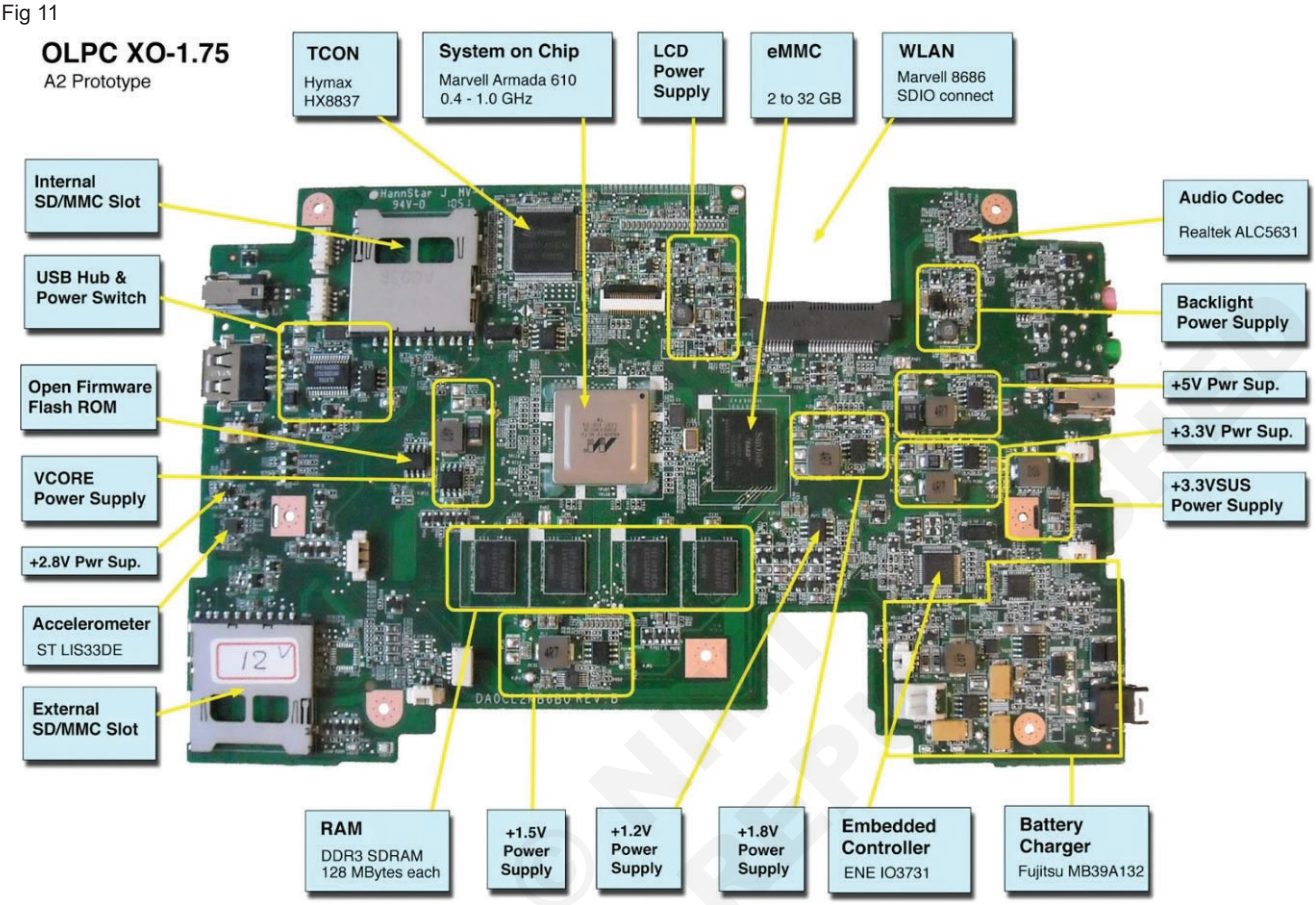
2 Why Laptop Motherboard fails often?

3 What will happen if Laptop motherboard damaged?

4 What is the lifespan of Motherboard?

5 What are the signs for Motherboard failure?

Fig 11



LAPTOP MOTHERBOARD

Read and Write the following. (Fig 12)

1 Identify the different types of storage devices?

2 What is the use of Hard disk?

3 What is the difference between RAM and ROM?

4 What is the difference between CD and DVD?

5 Write the storage capacity of storage devices?

Fig 12

COMPUTER STORAGE OR MEMORY DEVICES

Read and Write the following. (Fig 13)

1 What is the other name of back panel of CPU?

2 What are the parts of the back panel?

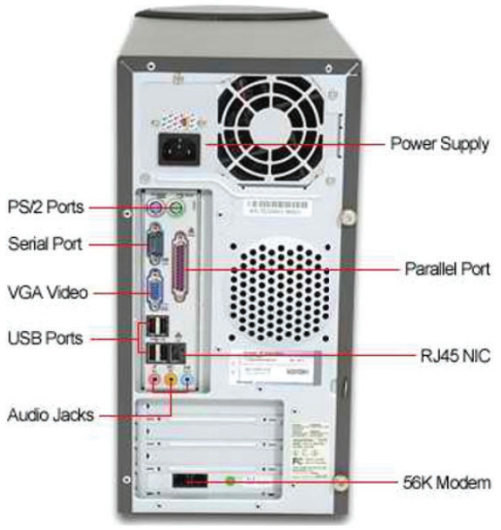
3 What is back panel I/O connectors?

4 What is the use of RJ45 port (or) Ethernet port?

5 What is the use of PS/2 port?

6 How many pins are available in serial and parallel port?

Fig 13



CPU - REAR PANEL

Read and Write the following. (Fig 14)

1 How do you connect the front panel of CPU?

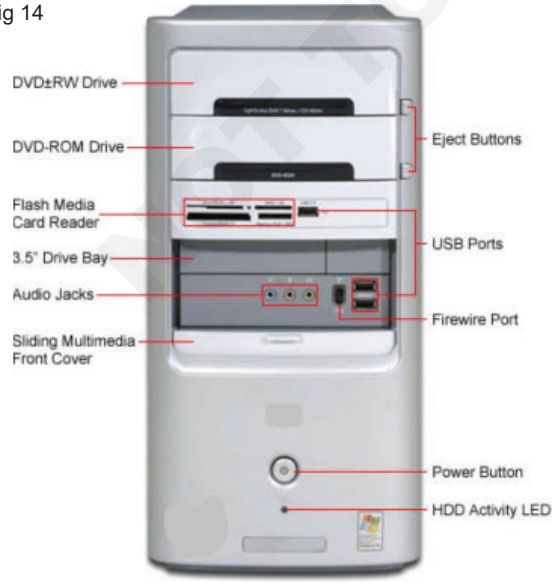
2 Which is PC front panel?

3 How many types of front panel connectors and write their names?

4 Front panel connector are necessary?

5 How to connect front panel connector to the motherboard?

Fig 14



CPU - FRONT PANEL

Read and Write the following. (Fig 15)

1 What is the use of SMPS?

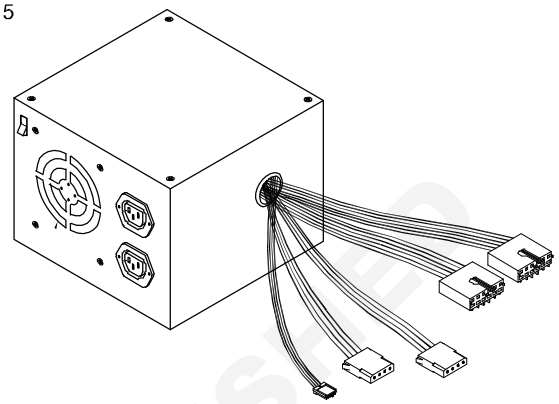
2 What are the main functions of SMPS?

3 Why SMPS is required?

4 Where is SMPS used?

5 What are the output voltage of SMPS?

Fig 15



SMPS

Read and Write the following. (Fig 16)

1 What is the difference between NIC and Ethernet?

2 Where is Network card used?

3 Does Network card affect internet speed?

4 List the types of NIC?

5 Why NIC is in motherboard?

Fig 16

NETWORK INTERFACE CARD

Read and Write the following. (Fig 17)

1 How to install a USB card?

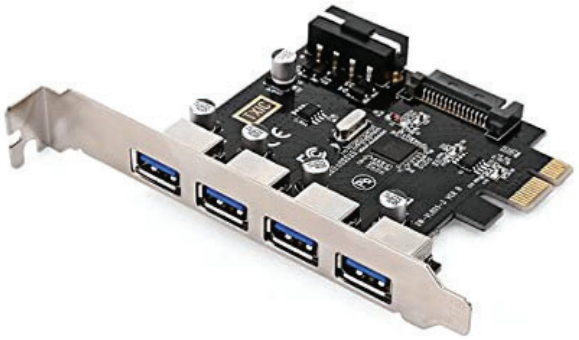
2 Is USB is a PCI slot?

3 List out types of USB and their pins?

4 How can you differenciate USB 2.0 and USB 3.0 ports?

5 Is it possible to increase USB port on laptop?

Fig 17



USB CARD

Read and Write the following. (Fig 18)

1 What is the use of sound card?

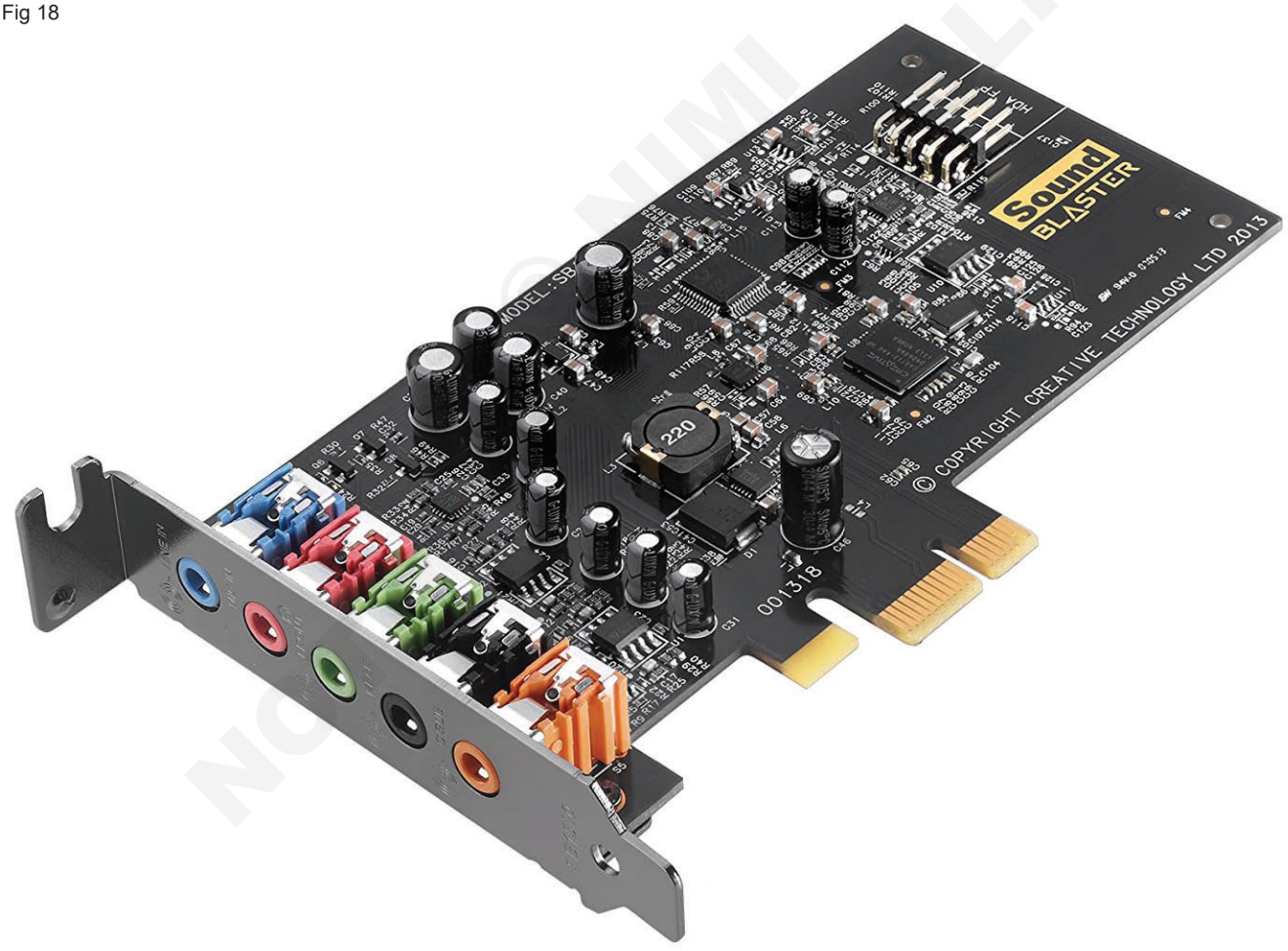
2 How to install sound card in PC?

3 Which sound card is best for PC?

4 Why sound card is necessary?

5 How to improve sound quality?

Fig 18



SOUND CARD

Read and Write the following. (Fig 19)

1 What is the purpose of video card?

2 What are the two types of video card?

3 Why video card important?

4 Why graphic card is required in laptop?

5 Which graphics card is fastest?

Fig 19

VIDEO CARD

Read and Write the following. (Fig 20)

1 What is the use of processor fan?

2 How to fix CPU fan?

3 What will cause if the processor fan is not working?

4 When CPU fan to be replaced?

5 Is it require more fan to cool CPU?

Fig 20

PROCESSOR FAN

Read and Write the following. (Fig 21)

1 What are the four types of computers?

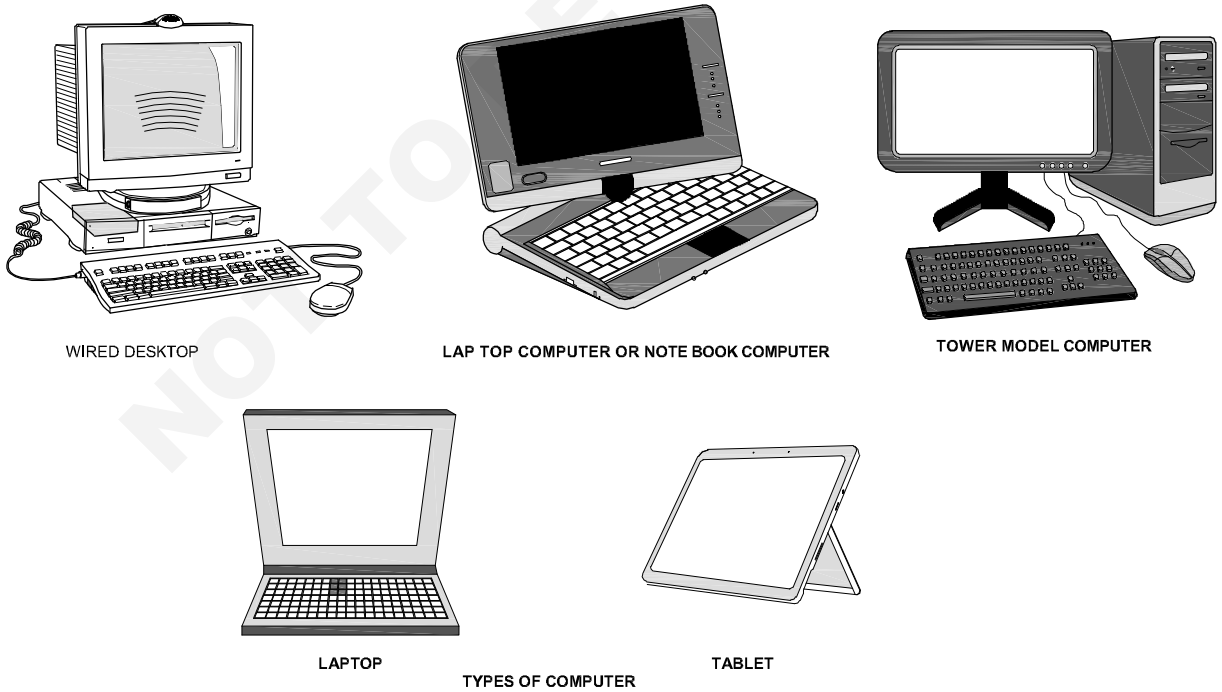
2 Whether tablet is a computer?

3 What type of computer is a smartphone?

4 What is the name of 1st computer?

5 How many types of computers available. Explain with example?

Fig 21



TYPES OF COMPUTER

EDNIT14101L