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Computer and Drawing

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Technical and Vocational Stream
Learning Resource Material

Computer and Drawing

(Grade 9)
Civil Engineering

Government of Nepal
Ministry of Education, Science and Technology
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Preface

The curriculum and curricular materials have been developed and revised on a regular basis with the aim of making education objective-oriented, practical, relevant and job oriented. It is necessary to instill the feelings of nationalism, national integrity and democratic spirit in students and equip them with morality, discipline, self-reliance, creativity and thoughtfulness. It is essential to develop linguistic and mathematical skills, knowledge of science, information and communication technology, environment, health and population and life skills in students. It is also necessary to bring the feeling of preserving and promoting arts and aesthetics, humanistic norms, values and ideals. It has become the need of the present time to make them aware of respect for ethnicity, gender, disabilities, languages, religions, cultures, regional diversity, human rights and social values to make them capable of playing the role of responsible citizens with applied technical and vocational knowledge and skills. This learning resource material for civil engineering has been developed in line with the Secondary Level civil engineering Curriculum with an aim to facilitate the students in their study and learning on the subject by incorporating the recommendations and feedback obtained from various schools, workshops, seminars and interaction programs attended by teachers, students, parents and concerned stakeholders.

In bringing out the learning resource material in this form, the contribution of the Director General of CDC Mr. Yubaraj Paudel and members of the subject committee Dr. Jagat Kumar Shrestha, Dr. Bhim Kumar Dahal, Er. Anisha Lamsal, Er. Gita Lamichhane, Er. Durga Bahadur Pun is highly acknowledged. This learning resource material is compiled and prepared by Er. Jagadishchandra Karki, Er. Kedarnath Dahal, and Er. Ashish Sharma Ghimire. The subject matter of this material is edited by Mr. Badrinath Timsina and Mr. Khilanath Dhamala. Similarly, the language is edited by Mr. Narendra Bahadur Bogati. CDC extends sincere thanks to all those who have contributed to developing this material in this form.

This learning resource material contains a wide coverage of subject matters and sample exercises which will help the learners to achieve the competencies and learning outcomes set in the curriculum. Each chapter in the material clearly and concisely deals with the subject matters required for the accomplishment of the learning outcomes. The Curriculum Development Centre always welcomes creative and constructive feedback for the further improvement of the material.

2082 BS

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Sanothimi, Bhaktapur

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Guidelines to Teachers

A. Facilitation Methods

The goal of this course is to combine the theoretical and practical aspects of the contents needed for the subject. The nature of contents included in this course demands the use of practical or learner focused facilitation processes. Therefore, the practical side of the facilitation process has been focused much. The instructor is expected to design and conduct a variety of practical methods, strategies or techniques which encourage students engage in the process of reflection, sharing, collaboration, exploration and innovation new ideas or learning. For this, the following teaching methods, strategies or techniques are suggested to adopt as per the course content nature and context.

Brainstorming

Brainstorming is a technique of teaching which is creative thinking process. In this technique, students freely speak or share their ideas on a given topic. The instructor does not judge students' ideas as being right or wrong, but rather encourages them to think and speak creatively and innovatively. In brainstorming time, the instructor expects students to generate their tentative and rough ideas on a given topic which are not judgmental. It is, therefore, brainstorming is free-wheeling, non-judgmental and unstructured in nature. Students or participants are encouraged to freely express their ideas throughout the brainstorming time. Whiteboard and other visual aids can be used to help organize the ideas as they are developed. Following the brainstorming session, concepts are examined and ranked in order of importance, opening the door for more development and execution. Brainstorming is an effective technique for problem-solving, invention, and decision-making because it taps into the group's combined knowledge and creative ideas.

Demonstration

Demonstration is a practical method of teaching in which the instructor shows or demonstrates the actions, materials, or processes. While demonstrating something the students in the class see, observe, discuss and share ideas on a given topic. Most importantly, abstract and complicated concepts can be presented into visible form through demonstration. Visualization bridges the gap between abstract ideas and concrete manifestations by utilizing the innate human ability to think visually. This enables students to make better decisions, develop their creative potential, and obtain deeper insights across a variety of subject areas.

Peer Discussion

Peer conversation is a cooperative process where students converse with their peers to exchange viewpoints, share ideas, and jointly investigate subjects that are relevant or of mutual interest. Peer discussion is an effective teaching strategy used in the classroom to encourage critical thinking, active learning, and knowledge development. Peer discussions encourage students to express their ideas clearly, listen to opposing points of view, and participate in debate or dialogue, all of which contribute to a deeper comprehension and memory of the course material. Peer discussions also help participants develop critical communication and teamwork skills by teaching them how to effectively articulate their views, persuasively defend their positions, and constructively respond to criticism.

Peer conversation is essential for professional growth and community building outside of the classroom because it allows practitioners to share best practices, work together, and solve problems as a group. In addition to expanding their knowledge horizon and deepening their understanding, peer discussions help students build lasting relationships and a feeling of community within their peer networks.

Group Work

Group work is a technique of teaching where more than two students or participants work together to complete a task, solve a problem or discuss on a given topic collaboratively. Group work is also a cooperative working process where students join and share their perspectives, abilities, and knowledge to take on challenging job or project. Group work in academic contexts promotes active learning, peer teaching, and the development of collaboration and communication skills. Group work helps individuals to do more together than they might individually do or achieve.

Gallery Walk

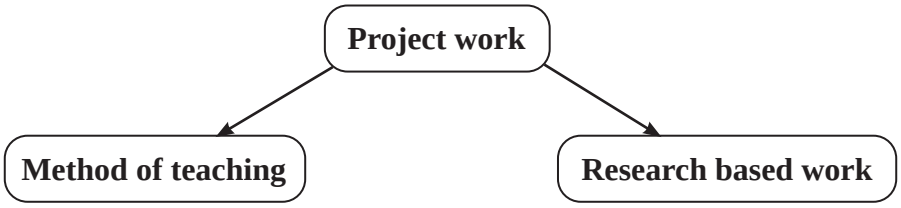
Gallery walk is a critical thinking strategy. It creates interactive learning environment in the classroom. It offers participants or students a structured way to observe exhibition or presentation and also provides opportunity to share ideas. It promotes peer-to-peer or group-to-group engagement by encouraging participants to observe, evaluate and comment on each other's work or ideas. Students who engage in this process improve their communication and critical thinking abilities in addition to their comprehension of the subject matter, which leads to a deeper and more sophisticated investigation of the subjects at hand.

Interaction

The dynamic sharing of ideas, knowledge, and experiences between people or things is referred to as interaction, and it frequently takes place in social, academic, or professional settings. It includes a broad range of activities such as dialogue, collaboration or team work, negotiation, problem solving, etc. Mutual understanding, knowledge sharing, and interpersonal relationships are all facilitated by effective interaction. Interaction is essential for building relationships, encouraging learning, and stimulating creativity in both in-person and virtual contexts. Students can broaden their viewpoints, hone their abilities, and jointly achieve solutions to difficult problems by actively interacting with others.

Project Work

Project work is a special kind of work that consists of a problematic situation which requires systematic investigation to explore innovative ideas and solutions. Project work can be used in two senses. First, it is a method of teaching in regular class. The next is: it is a research work that requires planned investigation to explore something new. This concept can be presented in the following figure.



Project work entails individuals or teams working together to achieve particular educational objectives. It consists of a number of organized tasks, activities, and deliverables. The end product is important for project work. Generally, project work will be carried out in three stages. They are:

- Planning
- Investigation
- Reporting

B. Instructional Materials

Instructional materials are the tools and resources that teachers use to help students. These resources/materials engage students, strengthen learning, and improve conceptual comprehension while supporting the educational goals of a course or program. Different learning styles and preferences can be accommodated by the variety of instructional

resources available. Here are a few examples of typical educational resource types:

- Daily used materials
- Related Pictures
- Reference books
- **Slides and Presentation:** PowerPoint slides, keynote presentations, or other visual aids that help convey information in a visually appealing and organized manner.
- **Audiovisual Materials:** Videos, animations, podcasts, and other multimedia resources that bring concepts to life and cater to auditory and visual learners.
- **Online Resources:** Websites, online articles, e-books, and other web-based materials that can be accessed for further reading and research.

Maps, Charts, and Graphs: Visual representations that help learners understand relationships, patterns, and trends in different subjects.

Real-life Examples and Case Studies: Stories, examples, or case studies that illustrate the practical application of theoretical concepts and principles.

C. Assessment

Formative Test

Classroom discussions: Engage students in discussions to assess their understanding of concepts.

Quizzes and polls: Use short quizzes or polls to check comprehension during or after a lesson.

Homework exercises: Assign tasks that provide ongoing feedback on individual progress.

Peer review: Have students review and provide feedback on each other's work.

Summative Test

Exams: Conduct comprehensive exams at the end of a unit or semester.

Final projects: Assign projects that demonstrate overall understanding of the subject.

Peer Assessment

Group projects: Evaluate individual contributions within a group project.

Peer feedback forms: Provide structured forms for students to assess their peers.

Classroom presentations: Have students assess each other's presentations.

Objective Test

Multiple-choice tests: Use multiple-choice questions to assess knowledge.

True/False questions: Assess factual understanding with true/false questions.

Matching exercises: Evaluate associations between concepts or terms.

Portfolio Assessment

Compilation of work: Collect and assess a variety of student work samples.

Reflection statements: Ask students to write reflective statements about their work.

Showcase events: Organize events where students present their portfolios to peers or instructors.

Observational Assessment

Classroom observations: Observe students' behavior and engagement during class.

Performance observations: Assess practical skills through direct observation.

Field trips: Evaluate students' ability to apply knowledge in real-world settings.

Unit 1 : Introduction to Computer

1.1. The Concept of Computer

Computer is an advanced electronic device that takes raw data as an input from the user and processes it under the control of a set of instructions (called program), produces a result (output), and saves it for future use. This unit explains the foundational concepts of computer hardware, software, operating systems, peripherals, etc. along with how to get the most value and impact from computer technology.

A computer is an electronic data processing device, which accepts and stores data input, processes the data input and generates the output in a required format. Moreover, a computer is an electronic machine that accepts the data and instructions from the user, processes the data according to the given set of instructions, stores and gives the information (result).

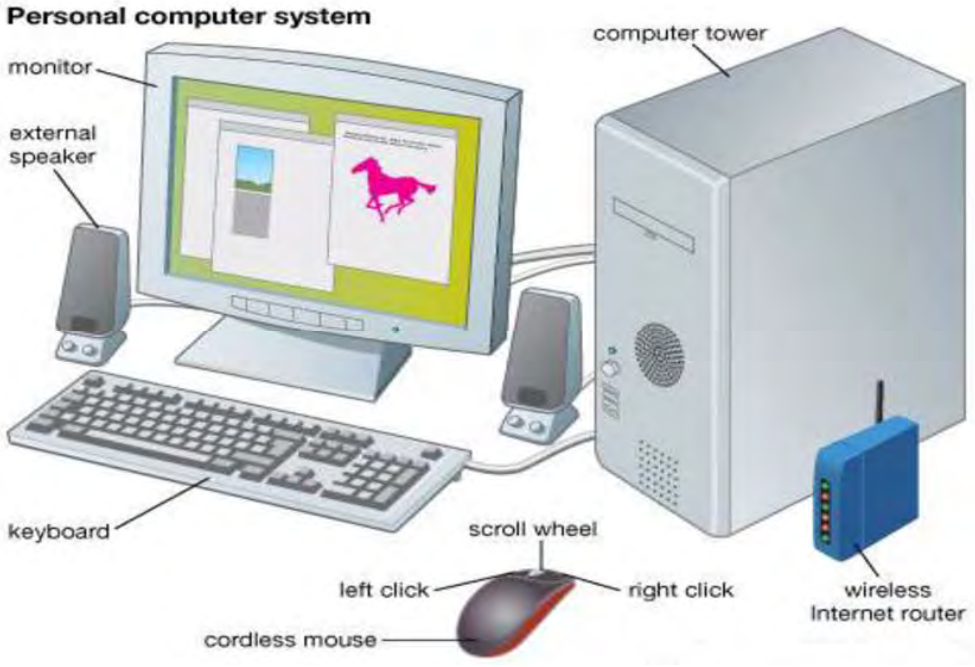


Fig: Computer system

Functionalities of a Computer

If we look at it in a very broad sense, any digital computer carries out the following five functions −

Step 1 − Takes data as input.

Step 2 − Stores the data/instructions in its memory and uses them as required.

Step 3 − Processes the data and converts it into useful information.

Step 4 − Generates the output.

Step 5 − Controls all the above four steps.

1.2. History of Computers

If we see the computer from the past to present, we can see that they don't have similar technology, shape, size, functionality etc. So, the present computer that we use differs from the past computer. The origin of computer starts from counting. A short description about the development process of computer is described below:

Mechanical Devices

Abacus

Many centuries ago when men started to count the numbers, they thought of a device which can trace the numbers and thus came the existence of ABACUS. It was the first counting device developed in which was China more than 3000 years ago. The name Abacus was obtained from Greek word Abax which means slab. This device basically consists of a rectangular wooden frame and beads. The frame is divided into two parts and beam separates these parts. The upper part is called heaven and the lower part is called earth.

The frame contains horizontal rods and the beads which have holes are passed through the rods. Counting was done by moving the beads from one end of the frame to the other.

Fig: Abacus

Napier's Bones

It is a device which contains a set of rods made of bones. It was developed by John Napier in 1617, a Scottish mathematician and hence the device was named as Napier's bones. The device was mainly developed for performing multiplication and division. In 1614, he also introduced logarithms.

Slide Rule

Slide rule was an analog device invented by William Oughtred in 1620. The slide rule is used mainly for multiplication and division, and also for "scientific" functions such as roots, logarithms and trigonometry, but usually not for addition or subtraction. The slide rule is based on the work on logarithm. A simple slide rule consists of two movable marked scales in which one scale slips upon the other.

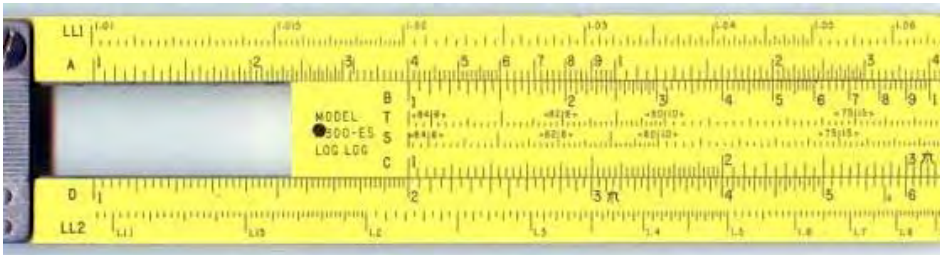


Fig: Slide Rule

Pascaline

Pascaline is a calculating machine developed by Blaise Pascal in 1642, a French mathematician. It was the first device with an ability to perform additions and subtractions on whole numbers. The device is made up of interlocked cog wheels which contains numbers 0 to 9 on its circumference. When one wheel completes its rotation the other wheel moves by one segment. Pascal patented this device in 1647 and produced it on mass scale and earned a handful of money.

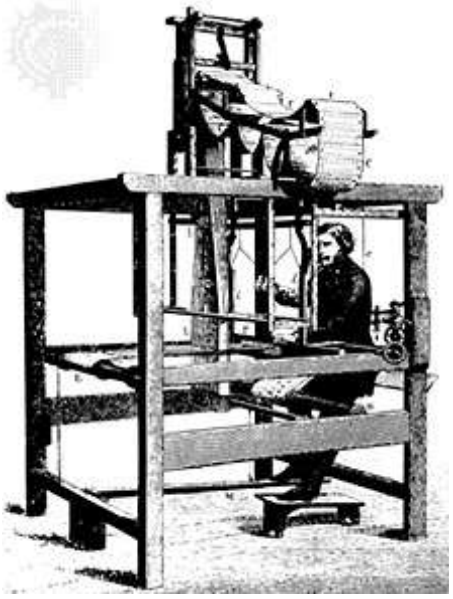
Fig: Pascaline

Stepped Reckoner

Stepped Reckoner a calculating machine designed (1671) and built (1673) by the German mathematician-philosopher Gottfried Wilhelm von Leibniz. The Stepped Reckoner expanded on the French mathematician-philosopher Blaise Pascal's ideas and did multiplication by repeated addition and shifting. It was the first calculator that could perform- addition, subtraction, multiplication and division. Even square roots could be calculated by series of stepped additions.

Jacquard's Loom

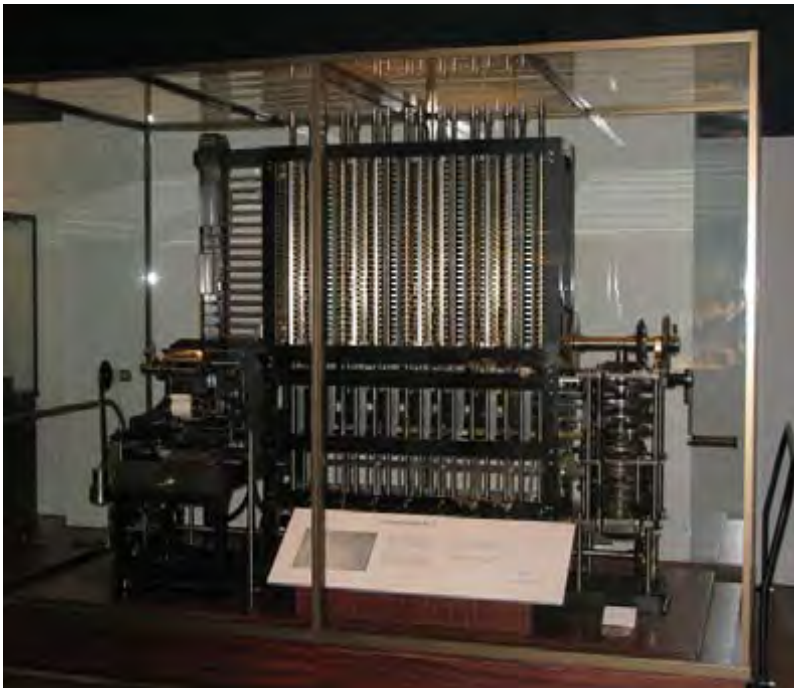
Jacquard's Loom was invented by Joseph Jacquard and first demonstrated in 1801. This device is an attachment for powered looms that uses a chain of punch cards to instruct the loom on how to make intricate textiles. For example, a loom could have hundreds of cards with holes in each of them that correspond to hooks that can be raised or lowered to make a textile brocade. Below is an illustration of the Jacquard Loom attachment on top of a textile loom.



Charles Babbage and his Engines

Charles Babbage was born on December 26, 1791 in London, England. He designed the first mechanical computer, which he called the "Difference Engine" — a machine that could solve polynomial equations without using multiplication or division. He began developing the machine in 1822, and worked on it for over ten years, but its construction was never completed. He also invented and developed his Analytical Engine in the late 1833. This was the first general purpose fully programmable mechanical machine. This device could perform complex calculations and store the result. This analytical engine was based on input, process and output principle since the modern computers are based on Babbage's idea and principle. Therefore,

Charles Babbage is also known as the father of modern computer science.



Lady Augusta Ada Lovelace

Lady Augusta Ada Lovelace was an English writer as well daughter of famous English poet Lord Byron. She suggested Charsles Babbage to use binary number system for programs and data to be fed into the Analytical Engine. That was the first programming concept. So, she is regarded as the world's first computer programmer. In 1979, the US Department of Defense developed a programming language and named 'ADA' in her honor.

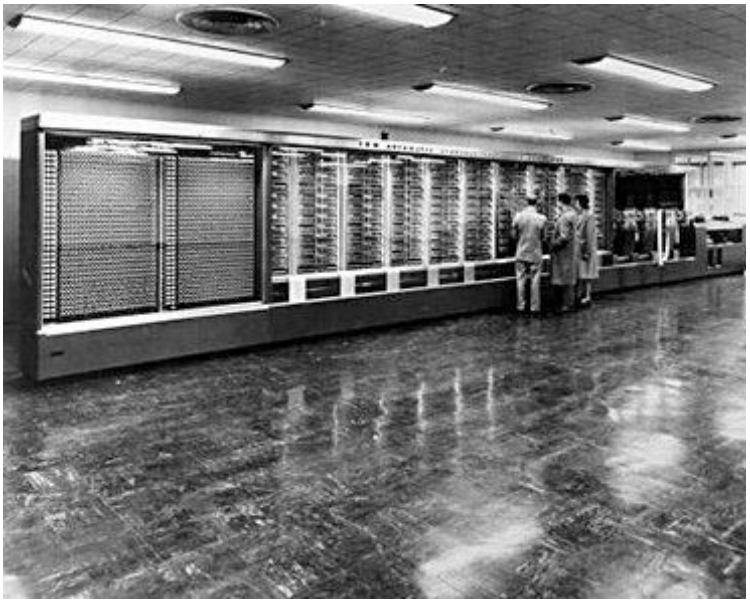
Tabulating Machine

The Hollerith tabulating machine, also known as the tabulating machine, was an electrical counting machine invented by Herman Hollerith. It was first described in his doctoral thesis, which he presented at Columbia University in 1889. The machine was proof of his concept that data could be encoded by holes punched in a card and thereby counted and sorted electronically. It was successful, and Hollerith went on to found the Tabulating Machine Company, which later merged to become a company called IBM.

Electromechanical Computer (Devices)

Mark I

Mark I was designed by a Harvard graduate student, Howard H. Aiken in 1937 to solve advanced mathematical physics problems encountered in his research. The IBM Automatic Sequence Controlled Calculator (ASCC) called Mark I, uses 18000 vacuum tubes to store data in the memory. The machine weighed 35 tones, 500 miles of wire, 8 feet tall and 51 feet long etc.



Atanasoff-Berry Computer

Atanasoff-Berry Computer (the ABC) is considered as the first electronic digital computer and was the first machine to use vacuum tubes (over 300 vacuum tubes). Professor John Vincent Atanasoff and graduate student Cliff Berry developed the ABC in 1937 and continued development until 1942 at the Iowa State College (now Iowa State University). On October 19, 1973, Judge Earl R. Larson signed his conclusion that the ENIAC, patent by Eckert and Mauchly was invalid and named Atanasoff the inventor of the first electronic digital computer.

Electronic Computers (Devices)

ENIAC

Electronic Numerical Integrator and Calculator (the ENIAC) was the first electronic computer used for general purposes, such as solving numerical problems. It was invented by J. Presper Eckert and John Mauchly at the University of Pennsylvania to calculate artillery firing tables for the United States Army's Ballistic Research Laboratory.

Its construction began in 1943 and was not completed until 1946. Although it was not completed until the end of World War II, the ENIAC was created to help with the war effort against German forces.

In 1956, the end of its operation, the (ENIAC) occupied about 1,800 square feet and consisted of almost 20,000 vacuum tubes, 1,500 relays, 10,000 capacitors, and 70,000 resistors. It also used 200 kilowatts of electricity, weighed over 30 tons, and cost about $487,000.

EDSAC

Electronic Delay Storage Automatic Calculator (EDSAC) is an early British computer considered to be the first stored program electronic computer. It was created at the

University of Cambridge in England, performed its first calculation on May 6, 1949, and was the computer that ran the first graphical computer game, nicknamed "Baby."

The simulator simulates the EDSAC computer as it existed between 1949-1951.

UNIVAC I

Universal Automatic Computer, the UNIVAC I was released in 1951 and 1952 when first developed by J. Presper Eckert and John Mauchly. The UNIVAC is an electrical computer containing thousands of vacuum tubes that utilizes punch cards and switches for inputting data and punch cards for outputting and storing data. The UNIVAC was later released the UNIVAC II, and III with various models, such as the 418, 490, 491, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, and 1108. Many of these models were only owned by a few companies or government agencies. This is a room-sized computer and often required multiple people to operate.

History of Computer in Nepal

There is not a long history of computers in Nepal. Nepal hired some types of calculators and computers for its census calculation. Following list shows its history in Nepal.· In 2018 BS an electronic calculator called "Facit" was used for census.· In 2028 BS census IBM 1401 a second generation mainframe computer was used.· In 2031 BS a center for Electronic Data Processing, later renamed to National Computer Center (NCC), was established for national data processing and computer training. In 2038 BS ICL 2950/10 a second generation mainframe computer was used for census. Now-a-days probably each and every institution, business organizations, communication centers, ticket counters etc. are using computers. After 2039 B.S., microcomputer s such as Sirus, Vector, IBM, Apple etc were imported by private companies and individuals in Nepal. Today there are thousands of computer training institutes, computer sales and repair centers in Nepal. Different universities are opening IT colleges in Nepal. Computer subject has been included in the curriculum of school education and universities.

1.3. The Computer System Characteristics

1. High Speed

1. Computer is a very fast device.
2. It is capable of performing calculation of very large amount of data in a short time.
3. The computer has units of speed in microsecond, nanosecond, and even the picosecond.

4. It can perform millions of calculations in a few seconds as compared to man who will spend many months to perform the same task.

2. Accuracy

1. In addition to being very fast, computers are very accurate.
2. The calculations are 100% error free.
3. Computers perform all jobs with 100% accuracy if the input is correct.

3. Storage Capability

1. Memory is a very important characteristic of computers.
2. A computer has much more storage capacity than human beings.
3. It can store large amount of data.
4. It can store any type of data such as images, videos, text, audio, etc.

4. Diligence

1. Unlike human beings, a computer is free from monotony, tiredness, and lack of concentration.
2. It can work continuously without any error and boredom.
3. It can perform repeated tasks with the same speed and accuracy.

5. Versatility

1. A computer is a very versatile machine.
2. It is very flexible in performing the jobs to be done.
3. This machine can be used to solve the problems related to various fields.
4. At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

6. Reliability

1. A computer is a reliable machine.
2. Modern electronic components have long lives.
3. Computers are designed to make maintenance easy.

7. Automation

1. Computer is an automatic machine.
2. Automation is the ability to perform a given task automatically. Once the

computer receives a program i.e., the program is stored in the computer memory, then the program and instruction can control the program execution without human interaction.

8. Reduction in Paper Work and Cost

1. The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up the process.
2. As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.
3. Though the initial investment for installing a computer is high, it substantially reduces the cost of each of its transaction.

1.4. The Capabilities and Limitation of Computer

Computer - Applications

The application of computers in various fields are given as below:

1. Business

A computer has high speed of calculation, diligence, accuracy, reliability, or versatility. It is an integrated part in all business organizations. It is used in business organizations for Payroll calculations, Budgeting, Sales analysis, Financial forecasting, Managing employee database, Maintenance of stocks, etc.

2. Banking

Computer is used dominantly in banking. Banks provide the following facilities with the help of computers.

1. Online accounting facility, which includes checking current balance, making deposits and overdrafts, checking interest charges, shares, and trustee records.
2. ATM machines which are completely automated are making it even easier for customers to deal with banks.

3. Insurance

Insurance companies are keeping all records up-to-date with the help of computers. Insurance companies, finance houses, and stock broking firms are widely using computers for their concerns. Insurance companies are maintaining a database of all clients with information showing Procedure to continue with policies, Starting

date of the policies, Next due installment of a policy, Maturity date, Interests due, Survival benefits, Bonus etc.

4. Education

The computer helps to provide following facilities in the field of education.

1. The computer provides a tool in the education system known as CBE (Computer Based Education).
2. CBE involves control, delivery, and evaluation of learning.
3. Computer education is rapidly increasing the graph of number of computer students.
4. There are a number of methods in which educational institutions can use a computer to educate the students.
5. It is used to prepare a database about the performance of a student and analysis is carried out on this basis.

5. Marketing

In marketing, uses of the computer are following –

6. Advertising − With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.

7. Home Shopping − Home shopping has been made possible through the use of computerized catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

8. Healthcare

Computers have become an important part in hospitals, labs, and dispensaries. They are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, ultrasounds and CT scans, etc. are also done by computerized machines.

9. Engineering Design

Computers are widely used for engineering purpose. One of the major areas is CAD (Computer Aided Design) that provides creation and modification of images. Some of the fields are Structural Engineering, Industrial Engineering, Architectural Engineering, etc.

10. Military

Computers are largely used in defense. Military also employs computerized control systems. Some military areas where a computer has been used are Missile Control, Military Communication, Military Operation and Planning, Smart Weapons etc.

11. Communication

Communication is to convey a message, an idea, a picture, or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are E-mail, Chatting, Usenet, FTP, Telnet, Videoconferencing, etc.

12. Government

Computers play an important role in government services. Some major fields in this category are budgets, Sales tax department, Income tax department, Computation of male/female ratio, Computerization of voters lists, Computerization of PAN card, Weather forecasting etc.

Disadvantages of Computers

Following are certain disadvantages of computers:

1. A computer is a machine that has no intelligence to perform any task.
2. Each instruction has to be given to the computer.
3. A computer cannot take any decision on its own.
4. Computers have no feelings or emotions.

1.5 The Types of Computer

There are different types of computer having different features. Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality.

According to purpose, computers are either general purpose or specific purpose.

a. Special Purpose Computers

b. General Purpose Computers

a. Special Purpose Computers

A special purpose computer is designed only to meet the requirements of a particular task or application. The instructions needed to perform a particular

task are permanently stored into the internal memory, so that it can perform the given task on a single command. It therefore doesn't possess unnecessary options and is less expensive.

b. General Purpose Computers

A General Purpose computers are designed to meet the needs of many different applications. In these computers, the instructions needed to perform a particular task are wired permanently into the internal memory. When one job is over, instructions for another job can be loaded into the internal memory for processing. This, a general purpose machine can be used to prepare pay-bills, manage inventories, print sales report and so on.

Based on the operating principles, computers can be classified into the following types:

a. Analog Computers

b. Digital Computers

c. Hybrid Computers

a. Analog Computers

An analog computer is a form of computer that uses the continuously changeable aspects of physical phenomena such as electrical, mechanical, or hydraulic quantities to model problem being solved. In contrast, digital computers represent varying quantities symbolically, as their numerical values change.

b. Digital Computers

Operate essentially by counting. All quantities are expressed as discrete or numbers. Digital computers are useful for evaluating arithmetic expressions and manipulations of data (such as preparation of bills, ledgers, solution of simultaneous equations etc)

c. Hybrid Computers

Hybrid Computers are computers that exhibit features of analog computers and digital computers. The digital component normally serves as the controller and provides logical operations, while the analog component normally serves as a solver of differential equations.

Classification of digital Computer based on size and Capability

Based on size and capability, computers are broadly classified into

a. Microcomputers (Personal Computer)

A microcomputer is the smallest general purpose processing system.

Microcomputer can be classified into two types:

1. Desktops
2. Portables

The difference is portables can be used while travelling whereas desktops computers cannot be carried around.

The different portable computers are:

1) Laptop
2) Notebooks
3) Palmtop (hand held)
4) Wearable computers

b. Minicomputer

A minicomputer is a medium-sized computer. That is more powerful than a microcomputer. These computers are usually designed to serve multiple users simultaneously (Parallel Processing). They are more expensive than microcomputers.

Examples: Digital Alpha, Sun Ultra.

c. Mainframe Computers

Computers with large storage capacities and very high speed of processing (compared to mini- or microcomputers) are known as mainframe computers. They support a large number of terminals for simultaneous use by a number of users like ATM transactions. They are also used as central host computers in distributed data processing system. Examples: - IBM 370, S/390.

d. Supercomputer

Supercomputers which have extremely large storage capacity and computing speeds are many times faster than other computers. A supercomputer is measured in terms of tens of millions instructions per second (mips), an operation is made up of numerous instructions. The supercomputer is mainly used for large scale numerical problems in scientific and engineering disciplines such as weather analysis.

Examples: IBM Deep Blue

1.6. The Generations of Computers and their Features

Computer generation is the classification of computers into different groups according to their manufacturing date, other hardware and software technology used inside those computers.

There are five computer generations known till date. Each generation has been discussed in detail along with their time period and characteristics. In the following table, an approximate date against each generation has been mentioned, which are normally accepted.

Following are the main five generations of computers:

Generations of computers	Generations timeline	Evolving hardware
First generation	1940s-1950s	Vacuum tube based
Second generation	1950s-1960s	Transistor based
Third generation	1960s-1970s	Integrated circuit based
Fourth generation	1970s-present	Microprocessor based
Fifth generation	The present and the future	Artificial intelligence based

Exercises

Choose the correct answer from the given alternatives.

1. Who is the father of Computers?

   a. James Gosling
   b. Charles Babbage
   c. Dennis Ritchie
   d. Bjarne Stroustrup

2. Which of the following is the correct abbreviation of COMPUTER?

   a. Commonly Occupied Machines Used in Technical and Educational Research
   b. Commonly Operated Machines Used in Technical and Environmental Research
   c. Commonly Oriented Machines Used in Technical and Educational Research
   d. Commonly Operated Machines Used in Technical and Educational Research

3. Which of the following is the correct definition of Computer?

   a. Computer is a machine or device that can be programmed to perform arithmetical or logic operation sequences automatically
   b. Computer understands only binary language which is written in the form of 0s & 1s
   c. Computer is a programmable electronic device that stores, retrieves, and processes the data
   d. All of the mentioned

4. What is the full form of CPU?

   a. Computer Processing Unit
   b. Computer Principle Unit
   c. Central Processing Unit
   d. Control Processing Unit

5. Which of the following language does the computer understand?

   a. Computer understands only C Language
   b. Computer understands only Assembly Language
   c. Computer understands only Binary Language
   d. Computer understands only BASIC

6. Which of the following computer language is written in binary codes only?

   a. Pascal
   b. Machine language
   c. C
   d. C#

7. Which of the following is the brain of the computer?

   a. Central Processing Unit b. Memory

   c. Arithmetic and Logic unit d. Control unit

8. Which of the following is not a characteristic of a computer?

   a. Versatility b. Accuracy

   c. Diligence d. I.Q.

9. Which of the following is the smallest unit of data in a computer?

   a. Bit b. KB

   c. Nibble d. Byte

10. Which of the following unit is responsible for converting the data received from the user into a computer understandable format?

    a. Output Unit b. Input Unit

    c. Memory Unit d. Arithmetic & Logic Unit

Write short answer to the following questions.

1. What is computer? How is it used in business and banking?
2. Why is data processing done in computer?
3. List any five features of computer.
4. Why is computer called a versatile machine?
5. Why is Charles Babbage known as father of computer science?
6. Draw the figure of Abacus showing its parts.
7. Write the feature of Mark-I.
8. How are computer generations classified?

Write long answer to the following questions.

1. Explain the working principle of computer with suitable diagram.
2. Discuss any five features of computer.
3. Explain the history of computing device of mechanical era.
4. Compare and discuss between electromechanical and electrical era of computer.
5. Describe the history of computer in Nepal in your own words.

6. What is computer generation? Discuss different generation of computer with technologies used in each generation.
7. Classify the types of digital computer with short description.

Project works

1. Demo of computer system in computer lab with brief introduction.

Unit 2 : Computer Components

2.1 Concept of Computer Organization

The computer along with various hardware units and software that makes the computer function and perform the different tasks is collectively known as computer system. Computer system covers different categories some of them are given below:

1. Hardware
2. Software
3. Data or information
4. Procedure (data which the computer converts)
5. User
6. Communication

1. Hardware

Hardware refers to the part of computer. Hardware are observable and we can touch them. It refers to the physical devices of the computer. It consists of interconnected electronic equipment that controls everything the computer does. It includes input devices, input devices, output devices, processing devices and storage devices.

Example of hardware are keyboard, monitor, CPU, hard disk and RAM.

2. Software

The software is the term used to describe the instruction that tells the hardware, what and how to perform a task. Without software, the hardware is useless. Examples of software are Window 7, MS office, Internet explorer, etc.

3. Data/Information

The function of a computer system is to convert data into information. Data can be considered as the raw facts whether in a paper, electronic or the other form that is processed by the computer. In other words, data consist of the raw facts and figures that are processed to form information. Information is summarized or manipulated or processed data.

4. People

People constitute the most important parts of the computer system. People operate the computer hardware and create the computer software. They also follow a certain procedure when using the hardware and software.

5. Procedure

The procedure is a description of how things are done, step for accomplishing a result. Procedure for a computer system appears in documentation manual, also known as reference manual which contains instruction, rules, and guidelines to follow when using hardware and software. When you buy a microcomputer or software package, it comes with one or more documentation manuals.

6. Communication

When one computer system is set up to share data and information electronically with another computer system, communication becomes a system element. In other words, the manner on which the various individual system are connected by wires, cables, phone lines, microwave, Wi-Fi or satellite is an element of the total computer system.

2.2 Types of Computer Hardware

The computer is a device that is operated upon information or data. It is an electronic device which accepts inputs data, stores the data, carries out arithmetic, logic operations and provides the outputs in the desired format. The computer receives data, processes it, produces output and stores it for further references. So, a computer should have at least four major components to perform these tasks. A block diagram of the basic computer organization has the following functional **input unit**

The input unit is formed by the input devices attached to the computer. Input devices are to interact with a computer system or used enter data and instructions to the computer. These devices convert input data and instructions into a suitable binary form such as ASCII, which can be acceptable by the computer. In brief, an input unit performs the following functions:

a) It accepts data and instruction from the outside worlds.

b) It converts these data and instruction into computer understandable from a binary form.

c) It supplies the converted data and instructions to the computer system for further processing.

The examples of input devices are keyboard, mouse, scanner etc.

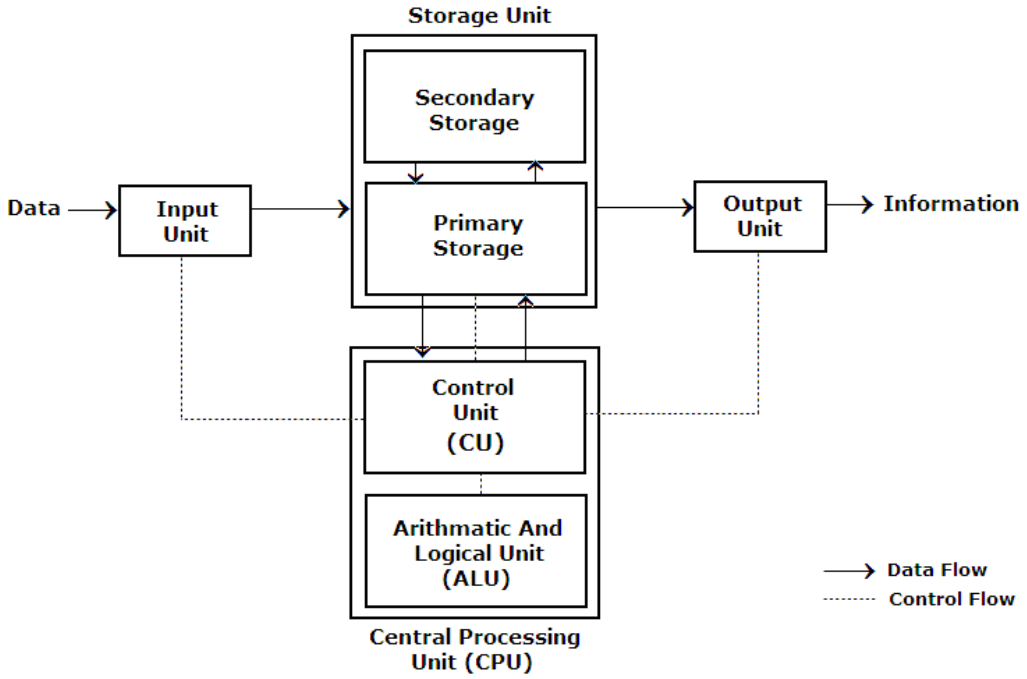


Fig: Components of CPU

1. Central Processing Unit (CPU)

CPU is the component that actually responsible for interpreting and executing most of the commands from the computer hardware and software and also controling the operation of all other components such as memory unit, input and output devices. It simply accepts binary data as input and processes data according to those instructions and provides the result as output. It is the logic machine. So, its main function is run the program by fetching instructions from the RAM, evaluating and executing them in sequence. In summary, the function of CPU are as follow:

a. Reading instruction from memory
b. Communicating with all peripherals using the system bus.
c. Controlling the sequence of instructions.
d. Controlling the flow of data from one component to another component.
e. Performing the computing task specified in the program.

The CPU has three components responsible for different function, these components are Control units, arithmetic-logical unit (ALU) and Register.

2. Control Unit

The control unit provides the necessary timing and control signals to all the operations on the computer. It controls the flow of data between the CPU, memory and peripherals. It also controls the entire operation of a computer. It obtains the instructions from the program stored in the main memory, interprets the instructions and issues the signals which cause the other units of the system to execute them. So, it is considered as a central nervous system of a computer that provides status, control and timing signals necessary for the operation of other parts of CPU, memory and I/O devices. The main functions of control units are given below:

1 It performs the data processing operations with the aid of program prepared by the user and sends control signals to various parts of the computer system.

2 It gives commands to transfer data from the input devices to the memory to an arithmetic logic unit.

3 It also transfers the results from ALU to the memory and then to the output devices.

4 It stores a program in the memory.

5 It fetches the required instruction from the main storage and decodes each instruction; and hence executes them in sequence.

3 Arithmetic Logic Unit

This is the area of CPU where various computing functions are performed on data. The ALU performs arithmetic operations such as addition, subtraction, multiplication and division and logical operation such as comparison AND, OR and Exclusive OR. The result of an operation is stored in Accumulator or in some register. The main functions of ALU are as follow:

1 It accepts operands from registers.

2 It performs arithmetic and logic operations.

3 It returns a result to register or a memory.

The logical operations of ALU give the computer the decision-making ability.

4 Registers

Registers are the high-speed temporary storage locations in the CPU made from electronic devices such as transistors, flip-flops, etc. So, registers can be thought as

CPU's working memory. Register are primarily used to store data temporarily during the execution of a program and are accessible to the user through instructions. These are the part of Control unit and ALU rather than of memory

5 Output Unit

The output unit is formed by the output devices attached to the computer. Output devices are used to present result produced by the computer to the users. The output from the computer is in the form electric signals, which is then converted into human understandable form into human readable form.

The examples of output devices are the monitor, printer and speaker.

The main functions of the output unit are as follow:

1 It accepts the result produced by the computer which is in electric binary signals.

2 It then converts the result into human readable form.

3 Finally, it supplies the converted results to the outside word.

2.3 Memory and Storage Devices

Memory Unit

This unit is also called storage unit. The data and instructions which are entered through an input unit must be stored on the computer before the actual processing starts. The result produces by the computer after processing is also kept somewhere before passing to the output units. If intermediate results are produced during processing, it should be stored in somewhere in memory. The storage unit of a computer performs all these needs. In brief, the specific functions performed by the storage unit are as follow:

1 It stores data and instructions, which are entered through input devices.

2 It stores an intermediate result of processing.

3 It stores the final result of processing before these results are passed to an output device.

The storage unit of computers consists of two types of memory or storage: primary and secondary storage:

A. Primary Storage

Memory storage that communicates directly with CPU is called main memory. It enables the computer to store, at least temporarily data and instruction. It is mainly used to hold data and instructions and as well as the intermediate result of processing which the computer system is currently working on. Primary memory is volatile, that is, it loses its content when power supply is off. There are two types of primary memory. They are RAM and ROM.

1. Random Access Memory (RAM)

a. It is also called as read write memory or the main memory or the primary memory.

b. The programs and data that the CPU requires during execution of a program are stored in this memory.

c. It is a volatile memory as the data loses when the power is turned off.

d. RAM is further classified into two types- SRAM (Static Random Access Memory) and DRAM (Dynamic Random Access Memory).

2. Read Only Memory (ROM)

The functions of ROM are given below;

a. Stores crucial information essential to operate the system, like the program essential to boot the computer

b. It is not volatile.

c. It is used in embedded systems or where the programming needs no change.

d. It is used in calculators and peripheral devices.

e. ROM is further classified into 4 types- ROM, PROM, EPROM, and EEPROM.

Difference Between RAM and ROM

RAM	ROM
1. Temporary Storage	1. Permanent storage
2. Store data in MBs.	2. Store data in GBs.
3. Volatile.	3. Non-volatile.
4. Used in normal operations.	4. Used for startup process of computer.
5. Writing data is faster.	5. Writing data is slower.

Cache Memory

As CPU has to fetch instruction from main memory speed of CPU depending on fetching speed from main memory. Cache is cheaper so we can access cache. Cache memory is a very high speed memory that is placed between the CPU and main memory, to operate at the speed of the CPU. It is used to reduce the average time to access data from the main memory. ***The cache is a smaller and faster memory which stores copies of the data from frequently used main memory locations.***

B. Secondary Storage

Auxiliary storage is also known as secondary storage. It is the memory that supplements the main memory. These are a non-volatile memory. It is mainly used to transfer data to program from one computer to another computer. There are high capacity storage devices used to store data and program permanently. These are also used as backup devices which allow to store the valuable information as backup on which you are working on. The examples of secondary memory are Magnetic Tape, Magnetic Disk, Optical disk, etc.

Various Storage Devices

1) Magnetic Tape

Magnetic tape is a type of physical storage media for different kinds of data. It is considered an analog solution, in contrast to more recent types of storage media, such as solid state disk (SSD) drives. Magnetic tape has been a major vehicle for audio and binary data storage for several decades, and is still part of data storage for some systems. Magnetic tape was used in many of the larger and less complex mainframe computers that predated today's personal computers (PC).

Magnetic Storage Devices

Magnetic storage or magnetic recording is the storage of data on a magnetized medium. Magnetic storage uses different patterns of magnetization in a magnetisable material to store data and is a form of non-volatile memory. The information is accessed using one or more read/write heads.

2) Floppy Disks

A floppy disk, also called a floppy, diskette, or just disk, is a type of disk storage composed of a disk of thin and flexible magnetic storage medium, sealed in a rectangular plastic enclosure lined with fabric that removes dust particles. Floppy

disks are read and written by a floppy disk drive (FDD).

3) Hard Disks

A hard disk drive (HDD), hard disk, hard drive, or fixed disk is an electromechanical data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks (platters) coated with magnetic material. The platters are paired with magnetic heads, usually arranged on a moving actuator arm, which read and write data to the platter surfaces. Data is accessed in a random-access manner, meaning that individual blocks of data can be stored or retrieved in any order and not only sequentially. HDDs are a type of non-volatile storage, retaining stored data even when powered off.

4) Optical Disks

An optical disc (OD) is a flat, usually circular disc which encodes binary data (bits) in the form of pits (binary value of 0 or off, due to lack of reflection when read) and lands (binary value of 1 or on, due to a reflection when read) on a special material (often aluminum) on one of its flat surfaces. The encoding material sits a top a thicker substrate (usually polycarbonate) which makes up the bulk of the disc and forms a dust defocusing layer. The encoding pattern follows a continuous, spiral path covering the entire disc surface and extending from the innermost track to the outermost track. The data is stored on the disc with a laser or stamping machine, and can be accessed when the data path is illuminated with a laser diode in an optical disc

drive which spins the disc at speeds of about 200 to 4,000 RPM or more, depending on the drive type, disc format, and the distance of the read head from the center of the disc (inner tracks are read at a higher disc speed).

1) DVD ROM.
2) VCD
3) CD-ROM
4) Blue ray disc
5) WORM
6) Flash drive
7) SD cards

MMC Memory Cards

Multimedia Card (MMC) is a memory-card standard used for solid-state storage. MMC operates as a storage medium for a portable device, in a form that can easily be removed for access by a PC. For example, a digital camera would use an MMC for storing image files. MMCs are available in sizes up to and including 512 GB.

Physical structure of floppy and Hard Disk, Drive Naming Conventions in PC

Physical Structure of Floppy Disk

A floppy disk is basically a circular sheet of plastic, coated with magnetic material. A hard disk is made of a stack of circular metal platters, also coated with magnetic material. Before a disk can be used it must be formatted. The surface of the disk is divided up into a number of concentric **tracks**, each of which is subdivided into **sectors**.

Floppy disks have 80 tracks on each side and each track is split into 18 sectors. A 3.5" floppy disk with 80 tracks and 18 sectors will have 80 x 18 = 1,440 storage units, each uniquely identified by its track and sector position. Each storage unit can hold 512 bytes of data, so the disk has a capacity of 1,440 x 512 = 737,280 bytes (720 KBytes) per side, or 1,400 KBytes (1.4 MBytes) per disk.

A hard disk is a sealed unit containing a stack of circular platters mounted on a common spindle. Electromagnetic read/write heads are located above and below each platter. The platters rotate at a constant speed, eg: 7200 rpm. While they are spinning the heads can move in towards the centre or out towards the edge. This The above picture is the physical structure of a hard disk; the hard disk consists of several discs. How to locate a position on a hard disk? There are three words you should learn: cylinder, head and sector.

Cylinder

The disc that makes up the hard disk is divided into tracks; tracks of all discs which have same track value are called a cylinder, so the cylinder is a pile of tracks with same track value of a hard disk.

Head

Normally, a disc has two heads for reading or writing data, one is for the top and the other one is for the opposite side; the head value means the disc location and side.

Sector

A track is composed of sectors and the number of sectors of all tracks on the hard disk is the same. Sector is the minimal storage unit of a hard disk; the size of one sector is always 512 bytes (rarely, it might be 1024, 2048 or 4096 bytes in some special hard disks).

2.4 Input Device

An input device is a piece of computer hardware equipment used to provide data and control signals to an information processing system such as a computer or information

appliance. Examples of input devices include keyboards, mouse, trackball, joystick, digitizing tablet, scanners, digital cameras, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen etc.

1) Keyboard

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

2) Mouse

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

3) Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer,

instead of a mouse. This is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button, or a square.

4) Joystick

Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions. The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

5) Digitizer

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.

6) Scanner

Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation. Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

7) Digital Camera

A digital camera is a camera that takes video or photographs and input to the computer in the digital format. At first, the photographs are stored in the camera's memory and then transferred to a computer through a cable. Then, we can edit that photograph according to our requirement. Most of the camera we use today are digital.

8) Magnetic Ink Card Reader (MICR)

MICR input device is generally used in banks as there are large number of cheques to be processed every day. The bank's code number and cheque number are printed

on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

9) Optical Character Reader (OCR)

OCR is an input device used to read a printed text. OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.

10) Optical Mark Reader (OMR)

OMR is a special type of optical scanner used to recognize the type of mark made

by pen or pencil. It is used where one out of a few alternatives is to be selected and marked.

It is specially used for checking the answer sheets of examinations having multiple choice questions.

11) Bar Code Readers (BCR)

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labeling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

12) Voice Recognition

Voice or speaker recognition is the ability of a machine or program to receive and interpret dictation or to understand and carry out spoken commands. Voice recognition has gained prominence and use with the rise of AI and intelligent assistants, such as Amazon's Alexa, Apple's Siri and Microsoft's Cortana. Voice recognition systems enable consumers to interact with technology simply by speaking to it, enabling hands-free requests, reminders and other simple tasks. Voice recognition is a computer software program or hardware device with the ability to decode the human voice.

13) Light Pen

Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.

When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

14) Microphone

Microphone is an input device to input sound that is then stored in a digital form. The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

15) Touch Screen

A touch screen is a display device that allows the user to interact with a computer by

using their finger. They can be quite useful as an alternative to a mouse or keyboard for navigating a graphical user interface (GUI). Touch screens are used on a variety of devices such as computer and laptop monitors, smart phones, tablets, cash registers, and information kiosks. Some touch screens use a grid of infrared beams to sense the presence of a finger instead of utilizing touch-sensitive input.

2.5 Output devices

Following are some of the important output devices used in a computer.

1) Monitors
2) Graphic Plotter
3) Printer

1) Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

a. Cathode-Ray Tube (CRT)
b. Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help. There are some disadvantages of CRT Large in Size and High power consumption.

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

Characteristics of a Monitor

Following are the characteristics of a monitor:

a) **Size:** The most important aspect of a monitor is its size. Screen sizes are measured in diagonal inches, the distance from one corner to another opposite corner diagonally.

b) **Resolution:** The resolution of a monitor indicates how density the pixels are packed. Pixel is short short for picture element. A pixel is a single point in a graphic image.

c) **Band Width:** The amount of data that can be transmitted in a fixed amount of time.

d) **Refresh Rate:** Display monitors must be refresh many times per second. The refresh rate determines how many times per seconds the screen is to be red drawn. The refresh rate of a monitor is measured in Hertz.

e) **Interlacing:** It is a technique in which instead of scanning the image one line at a time, it scans alternately i.e. alternate lines are scanned at each pass.

2) **Printers**

Printer is an output device, which is used to print information on paper.

There are two types of printers:

a) Impact Printers

b) Non-Impact Printers

a) Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

Characteristics of Impact Printers are the following:

1 Very low consumable costs

2 Very noisy

3 Useful for bulk printing due to low cost

4 There is physical contact with the paper to produce an image

These printers are of two types:

a. Character printers, and

b. Line printers

1. Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

i. Dot Matrix Printer(DMP)

ii. Daisy Wheel

i. Dot Matrix Printer

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character which is why it is called Dot Matrix Printer.

Advantages

1 Inexpensive

2 Widely Used

3 Other language characters can be printed

Disadvantages

1 Slow Speed

2 Poor Quality

ii. Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices that require a few letters to be sent here and there with very nice quality.

Advantages

a) More reliable than DMP

b) Better quality

c) Fonts of character can be easily changed

Disadvantages

a) Slower than DMP

b) Noisy

c) More expensive than DMP

b. Line Printers

Line printers are the printers which print one line at a time.

These are of two types:

a) Drum Printer

b) Chain Printer

b) Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

These printers are of two types:

i. Laser Printers

ii. Inkjet Printers

Characteristics of Non-Impact Printers

1 Faster than impact printers

2 They are not noisy

3 High quality

4 Supports many fonts and different character size

i. Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Advantages

1 Very high speed

2 Very high quality output

3 Good graphics quality

4 Supports many fonts and different character size

Disadvantages

1 Expensive

2 Cannot be used to produce multiple copies of a document in a single printing

ii. Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers

produce high quality output with presentable features. They make less noise because no hammering is done and these have many styles of printing modes available. Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

1 High quality printing

2 More reliable

Disadvantages

1 Expensive as the cost per page is high

2 Slow as compared to laser printer

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following is not a characteristic of a computer?

   a. Versatility b. Accuracy

   c. Diligence d. I.Q.

2. Which of the following is the smallest unit of data in a computer?

   a. Bit b. KB c. Nibble d. Byte

3. Which of the following unit is responsible for converting the data received from the user into a computer understandable format?

   a. Output Unit b. Input Unit

   c. Memory Unit d. Arithmetic & Logic Unit

4. Which of the following monitor looks like a television and are normally used with non-portable computer systems?

   a. LED b. LCD

   c. CRT d. Flat Panel Monitors

5. Which of the following is not a type of computer code?

   a. EDIC b. ASCII

   c. BCD d. EBCDIC

6. Which of the following part of a processor contains the hardware necessary to perform all the operations required by a computer?

   a. Controller b. Registers

   c. Cache d. Data path

7. Which of the following is designed to control the operations of a computer?

   a. User b. Application Software

   c. System Software d. Utility Software

8. Which of the following device use positional notation to represent a decimal number?

   a. Pascaline b. Abacus

   c. Computer d. Calculator

9. Which of the following is used in EBCDIC?

a. Super Computers
b. Mainframes
c. Machine Codes
d. Programming

10. Which of the following are physical devices of a computer?

a. Hardware
b. Software
c. System Software
d. Package

11. Which of the following defines the assigned ordering among the characters used by the computer?

a. Accumulation
b. Sorting
c. Collating Sequence
d. Unicode

12. Which of the following storage is a system where a robotic arm will connect or disconnect off-line mass storage media according to the computer operating system demands?

a. Magnetic
b. Secondary
c. Virtual
d. Tertiary

13. Which of the following is known as the interval between the instant a computer makes a request for the transfer of data from a disk system to the primary storage and the instance the operation is completed?

a. Disk utilization time
b. Drive utilization time
c. Disk access time
d. Disk arrival time

14. Which of the following devices provides the communication between a computer and the outer world?

a. Compact
b. I/O
c. Drivers
d. Storage

15. Which of the following are the input devices that enable direct data entry into a computer system from source documents?

a. System Access devices
b. Data acquiring devices
c. Data retrieving devices
d. Data Scanning devices

16. Which of the following is the device used for converting maps, pictures, and drawings

into digital form for storage in computers?

a. Image Scanner b. Digitizer

c. MICR d. Scanner

17. Which of the following can access the server?

a. Web Client b. User

c. Web Browser d. Web Server

18. Which of the following is known as the language made up of binary-coded instructions?

a. High level b. BASIC c. C d. Machine

19. Which of the following package allows individuals to use personal computers for storing and retrieving their personal information?

a. Personal assistance package b. Graphics package

c. Spreadsheet package d. Animation package

20. Which of the following is created when a user opens an account in the computer system?

a. SFD b. MFD c. Subdirectory d. RFD

21 Which of the following is a technique that marked the beginning of computer communications?

a. User Environment b. Batch Environment

c. Time Sharing d. Message passing

22. Which of the following is a type of technique in which dumb terminals are connected to a central computer system?

a. Time Sharing b. Message passing

c. Batch environment d. User environment

23. Which of the following service allows a user to log in to another computer somewhere on the Internet?

a. e-mail b. UseNet c. Telnet d. FTP

24. Which of the following is not a type of computer on the basis of operation?

a. Digital b) Analog

c. Hybrid d) Remote

25. Which of the following type of computer is mostly used for automatic operations?

a. Analog b. Digital

c. Hybrid d. Remote

Write short answer to the following questions.

1. What is computer system?
2. Differentiate between primary and secondary data.
3. Draw physical structure of hard disk.
4. Define computer hardware with some examples.
5. What is CPU ? Write its major parts.
6. Write the importance of software in computer.
7. Write the function of CU and ALU.
8. Differentiate between input device and output device.
9. List the main unit of computer system.
10. What is primary memory? List its major types.
11. What are the necessities of computer software?

Write long answer to the following questions.

1. Explain different types of hardware devices that make computer system.
2. What is software? Discuss types of software with example and explain also.
3. Draw and explain the block diagram of computer system.
4. What is a printer? Differentiate between impact and non-impact printer.
5. What is a monitor? Explain its types.
6. What is an input device? Explain its types.

Project works

1. Computer lab: Introduction to different input, output, storage and processing devices.

Unit 3 : Operating System

3.1 Introduction of Operating System

An operating system is a kind of system software that controls and co-ordinates the overall operations of the computer system. The Operating System is a program with the following features:

a. An operating system is a program that acts as an interface between the software and the computer hardware.

b. It is specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Characteristics of Operating System

Here is a list of some of the most prominent characteristic features of operating systems:

- Memory Management
- Processor Management
- Device Management
- File Management Security
- Job Accounting Control
- Over System Performance
- Interaction with the Operators
- Coordination Between Other Software and Users

3.2 Types of Operating System

An Operating System performs all the basic tasks like managing file, process, and memory. Thus operating system acts as manager of all the resources, i.e. resource manager. Thus operating system becomes an interface between user and machine.

Some of the widely used operating systems are as follows:

1. Batch Operating System

The users of a batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to

the computer operator. To speed up processing, jobs with similar needs are batched together and run as a group. The programmers leave their programs with the operator and the operator then sorts the programs with similar requirements into batches.

The problems with Batch Systems are as follows:

a) Lack of interaction between the user and the job.

b) CPU is often idle because the speed of the mechanical I/O devices is slower than the CPU

c) Difficult to provide the desired priority.

i. Single-user, Single-tasking Operating System

As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time. The Palm OS for Palm handheld computers is a good example of a modern single-user, single-task operating system.

ii. Single-user, Multi-tasking Operating System

This is the type of operating system most people use on their desktop and laptop computers today. Microsoft's Windows and Apple's Mac OS platforms are both examples of operating systems that will let a single user have several programs in operation at the same time. For example, it's entirely possible for a Windows user to be writing a note in a word processor while downloading a file from the Internet while printing the text of an e-mail message.

2. Multiprogramming Operating System

In a multiprogramming system there are one or more programs loaded in main memory which are ready to execute. Only one program at a time is able to get the CPU for executing its instructions (i.e., there is at most one process running on the system) while all the others are waiting their turn.

3. Multi-user Operating System

Multi-user operating system allows many different users to take advantage of the computer's resources simultaneously. UNIX, VMS and mainframe operating systems, such as MVS, are examples of multi-user operating systems.

4. Multiprocessing Operating System

Multiprocessing sometimes refers to executing multiple processes (programs) at the same time. Multiprocessing refers tote *hardware* (i.e., the CPU units) rather than the

software (i.e., running processes). If the underlying hardware provides more than one processor, then that is multiprocessing.

5. Multitasking Operating System

Multitasking has the same meaning of multiprogramming but in a more general sense, as it refers to having multiple (programs, processes, tasks, threads) running at the same time.

6. Multithreading Operating System

Multitasking refers to multiple tasks running (apparently) simultaneously by sharing the CPU time. Finally, multiprocessing describes systems having multiple CPUs. Multithreading is an execution model that allows a single process to have multiple code segments (i.e., *threads*) run concurrently within the "context" of that process. Multiple threads of a single process can share the CPU in a single CPU system or (purely) run in parallel in a multiprocessing system.

7. Time-sharing Operating Systems

Time-sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time. Time-sharing or multitasking is a logical extension of multiprogramming. Processor's time which is shared among multiple users simultaneously is termed as time-sharing.

8. Real-time Operating System (RTOS)

Real-time operating systems are used to control machinery, scientific instruments and industrial systems.

9. Distributed Operating System

Distributed operating systems use multiple central processors to serve multiple real-time applications and multiple users. Data processing jobs are distributed among the processors accordingly.

10. Network Operating System

Network Operating System runs on a server and provides the server the capability to manage data, users, groups, security, applications, and other networking functions. The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), and a private network or to other networks. Examples of network operating

systems include Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

3.3 Windows Operating System

In windows operating system, we can give commands to the computer by clicking on icons, menus and buttons by using a mouse. We do not need to remember commands to perform any tasks in the computer like MS-DOS.

Graphical User Interface (GUI) With advancement of technology, computer system has become quicker and cheaper. Operating environment has also changed. This lead the development of graphical user interface where users can interact with the computer using picture and graphs, rather than character and commands. It displays the icon, buttons, dialog box etc. Popular GUI based operating system is Microsoft Windows.

Advantages of Graphical User Interface

1. Easiness for non-technical people
2. Drag and drop feature
3. Looks nicer than text interface
4. Hotkeys usage
5. User-friendly
6. Disabled people

Disadvantages of Graphical User Interface

1. Difficult to develop and high cost
2. Slower than command line tools
3. Extra attention required
4. Using flat screen
5. Time consumption
6. Memory resources
7. Implementation

Examples of GUI

1 Microsoft Windows, Mac OS

Command or Character Based User Interface (CUI)

CUI is a traditional user interface. It provides the interactive terminal where user can enter the command to interpret. It is the only one common place where the program and the user communicate with each other. MS-DOS and Novell NetWare are some example of CUI based operating system. In CUI, user has to interact with the applications by making use of commands. In CUI, only one task can run at atime. **CLI** or **CUI advantages** and **disadvantages**

The advantages of a command line interface are:

1. granular control of an OS or application
2. faster management of a large number of operating systems
3. ability to store scripts to automate regular tasks; and
4. basic command line interface knowledge to help with troubleshooting, such as network connection issues.

The disadvantages of a command line interface are :

1. GUI is more user-friendly;
2. steeper learning curve associated with memorizing commands and complex syntax/ arguments; and different commands used in different shells.

Working with a Windows Environment and Windows Application Program

Desktop

The desktop is the background displayed on your computer screen. It is the total visible area

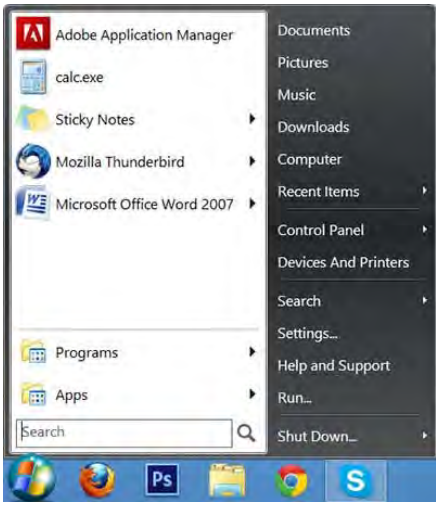
on the screen which users get immediately after turning on the computer. Files, folders, and program icons can be displayed on the desktop for easy access to users.

Desktop

On the desktop, files, folders and programs are displayed on window frame. The desktop may contain many items such as Computer, Network, Recycle Bin, User, etc. The desktop can be customized with themes and backgrounds to personalize the look of the computer.

Start Menu

The start menu provides access to the most useful items on your computer including all programs, most recent documents, help and support and other items on your computer. Present Windows includes more Start menu customization options. This menu appears by clicking on the start button.



Icons

Icons are the small graphical image used in GUI OS environment. It represents the symbolic meaning of the command, file, program, web page, etc. Icons help to execute commands, open programs or documents quickly. To execute a command by using an icon, click or double-click on the icon. An icon is a group of images of various formats (size and colors).

Window

Windows are frames on the desktop that contains the contents of opened files, folders, and programs. In other words, it is usually a rectangular portion of the display on a computer monitor that presents its contents (e.g. the contents of a directory, a text file or an image) on the screen. Windows are one of the elements that comprise a graphical user interface (GUI).

Task Bar

The taskbar displays opened files, folders, and programs. When multiple windows are open, you can click on the file, folder or program buttons in the taskbar to switch between windows.

List of components of tasks bar

1. Start button
2. Quick launch bar
3. System trays with some programs
4. Time bar

For example, all documents using the same extension have the same icon. Some folders can have a customized icon applied to them. The name of file, folder or program is displayed under the icon.

Computer

Computer folder displays all hard disk drives and removable storage devices connected to your computer. Double-clicking on a drive or removable storage device displays its contents.

Documents

Documents folder provides a place to store all of your files. When you save a document, the default save location is the Documents folder:

Fig. Documents

Networks

The Networks folder display all the shared resources connected to your computer by a network.

Recycle Bin

Music

Pictures

Folder

Folders on a computer provide a storage system similar to folders in a filing cabinet. Folders can contain files and other subfolders. Windows provides a number of personal folders to start your computer filing system. A folder is typically represented by a folder icon. The folder name is the icon. The folder in Windows is also known as a directory in DOS.

Display

This option is to customize the Desktop environment.

Keyboard

We can set keyboard settings like its character repetition and cursor blinking rate, a width of the cursor.

Program and Features

This option allows the user to do following things;

Allows users to uninstall and change existing software packages, as well as indicating how much space individual programs take and how frequently they are used.

1. Allows users to manually install software and install add-ons from Windows Update.
2. Allows users to change which Windows components are installed.

Administrative Tools

This option contains tools for system administration, including security, performance, and service configuration. These are the links to various configurations of the Microsoft Management Console such as the local services list and the Even Viewer.

Windows Update

This option is used to specify how the automatic updates client should download updates from Microsoft update website, by default this is set to download and install daily.

Windows Keyboard Shortcuts

Use shortcut keys as an alternative to the mouse when working Windows. You can open, close and navigate the Start menu, desktop, menus dialogue boxes and Web pages using keyboard shortcuts. It makes users use Windows easy.

3.4 Open Sources Operating System

Open-source software (OSS) is a type of computer software whose source code is released under a license in which the copyright holder grants users the rights to study, change, and distribute the software to anyone and for any purpose. Open source software may be developed in a collaborative public manner. According to scientists who have studied it, open-source software is a prominent example of open collaboration. The term is often written without a hyphen as "open source software".

Open-source software development, or collaborative development between multiple

independent contributors, generates an increasingly more diverse scope of design perspective than any one company is capable of developing and sustaining long term.

Advantages of Open Source Software

1. This software are freely available and no license is required to use them.
2. Source code of these software is freely available in the internet and it can be easily downloaded.
3. It has freedom at work. Everyone is free to modify the software according to the requirement from its source code.
4. The OSS allows to take our own security ownership.
5. There is no restriction of law to use them.
6. By adopting open source software, we become part of a community of users and developers.

Introduction to Linux

Linux is a free open-source operating system based on UNIX. Linux was originally created by Linus Torvalds with the assistance of developers from around the globe.

Linux is free to download, edit and distribute. Linux is a very powerful operating System and it is gradually becoming popular throughout the world.

Advantages of Linux

Low cost: There is no need to spend time and huge amount money to obtain licenses since Linux and much of its software come with the GNU General Public License.

Stability: Linux has high stability compared with other operating systems. There is no need to reboot the Linux system to maintain performance levels.

Performance: Linux provides high performance on various networks. It has the ability to handle large numbers of users simultaneously.

Networking: Linux provides a strong support for network functionality; client and server systems can be easily set up on any computer running Linux. It can perform tasks like network backup faster than other operating systems.

Flexibility: Linux is very flexible. Linux can be used for high performance server applications, desktop applications, and embedded systems.

Compatibility: It runs all common UNIX software packages and can process all common file formats.

Fast and Easy Installation: Linux distributions come with user-friendly installation.

Security: Linux is one of the most secure operating systems. File ownership and permissions make Linux more secure.

Open Source: Linux is an Open source operating systems. You can easily get the source code for Linux and edit it to develop your personal operating system. Today, Linux is widely used for both basic home and office uses. It is the main operating system used for high performance business and in web servers. Linux has made a high impact in this world.

Introduction to UNIX

The UNIX operating system is a set of programs that act as a link between the computer and the user. The computer programs that allocate the system resources and coordinate all the details of the computer's internals is called the **operating system** or the **kernel**. Users communicate with the kernel through a program known as the **shell**. The shell is a command line interpreter; it translates commands entered by the user and converts them into a language that is understood by the kernel. UNIX was originally developed in 1969 by a group of AT&T employees Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna at Bell Labs.Thereare various UNIX variants available in the market. Solaris UNIX, AIX, HP UNIX andBSD are a few examples. Linux is also a flavor of UNIX which is freely available.

a. Several people can use a UNIX computer at the same time; hence UNIX is called a multiuser system.
b. A user can also run multiple programs at the same time; hence UNIX is a multitasking environment.

Exercises

Choose the correct answer from the given alternatives.

1. What is an operating system?
   a. Interface between the hardware and application programs
   b. Collection of programs that manages hardware resources
   c. System service provider to the application programs
   d. All of the mentioned

2. What is the main function of the command interpreter?
   a. To provide the interface between the API and application program
   b. To handle the files in the operating system
   c. To get and execute the next user-specified command
   d. None of the mentioned

3. In Operating Systems, which of the following is/are CPU scheduling algorithms?
   a. Priority
   b. Round Robin
   c. Shortest Job First
   d. All of the mentioned

4. In Services of the operating system, the interface is provided by the _____
   a. Library
   b. System calls
   c. Assembly instructions
   d. API

5. CPU scheduling is the basis of _____
   a. Multiprogramming operating systems
   b. Larger memory sized systems
   c. Multiprocessor systems
   d. None of the mentioned

6. Which one of the following errors will be handle by the operating system?
   a. Lack of paper in printer
   b. Connection failure in the network
   c. Power failure
   d. All of the mentioned

7. Where is the operating system placed in the memory?
   a. Either low or high memory (depending on the location of interrupt vector)

b. In the low memory

c. In the high memory

d. None of the mentioned

8. In operating system, each process has its own _____

a. Open files

b. Pending alarms, signals, and signal handlers

c. Address space and global variables

d. All of the mentioned

9. The main memory accommodates _____

a. Cpu

b. User processes

c. Operating system

d. All of the mentioned

10. The operating system is responsible for?

a. Bad-block recovery

b. Booting from disk

c. Disk initialization

d. All of the mentioned

11. In real time operating system _____

a. Process scheduling can be done only once

b. All processes have the same priority

c. Kernel is not required

d. A task must be serviced by its deadline period

12. To recover from failures in the network operations _____ information may be maintained.

a. Operating system

b. Ip address

c. Stateless

d. State

13. Whenever a process needs I/O to or from a disk it issues a _____

a. System call to the operating system

b. A special procedure

c. System call to the CPU

d. All of the mentioned

14. Network operating system runs on _____

a. Every system in the network

b. Server

c. Both server and every system in the network

d. None of the mentioned

15. What are the types of distributed operating systems?

a. Zone based Operating system

b. Level based Operating system

c. Network Operating system

d. All of the mentioned

Write short answer to the following questions.

1. Write the features of OSS.
2. What is an operating system? Write two examples.
3. What are the basic functions of an operating system? List any four of them.
4. What is single user operating system? Write two examples.
5. What is MS DOS? Write its two features.
6. What are wild cards? Write some wildcard characters.
7. Distinguish between GUI and CUI?
8. What is Linux? Write its advantages.

Write long answer to the following questions.

1. Explain the types of operating system.
2. Why is GUI operating software more popular than CUI give reasons these days? Discuss.
3. What is windows operating system? Explain.

Project works

1. Demonstration of types of OS and working with windows OS in computer laboratory in group of 4-5 students.

Unit 4 : Multimedia

4.1. Introduction to Multimedia

Multimedia means that computer information can be represented through audio, video, and animation in addition to traditional media (i.e., text, graphics/drawings, images).

General Definition A good general working definition for this module is: Multimedia is the field concerned with the computer controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.

Multimedia Application: A Multimedia Application is an application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video.

4.2 Components of Multimedia

1) **Text-** All multimedia productions contain some amount of text. The text can have various types of fonts and sizes to suit the profession presentation of the multimedia software.

2) **Graphics-** Graphics make the multimedia application attractive. In many cases people do not like reading large amount of textual matter on the screen. Therefore, graphics are used more often than text to explain a concept, present background information etc. There are two types of Graphics:

   a. **Bitmap images-** Bitmap images are real images that can be captured from devices such as digital cameras or scanners.

   b. **Vector Graphics-** Vector graphics are drawn on the computer and only require a small amount of memory. These graphics are editable.

3) **Audio-** A multimedia application may require the use of speech, music and sound effects. These are called audio or sound element of multimedia. Speech is also a perfect way for teaching. Audio are of analog and digital types.

Analog audio or sound refers to the original sound signal. Computer stores the sound in digital form. Therefore, the sound used in multimedia application is digital audio.

4) **Video-** The term video refers to the moving picture, accompanied by sound such as a picture in television. Video element of multimedia application gives a lot of information in small duration of time. Digital video is useful in multimedia application for showing real life objects. Video have highest performance demand on the computer memory and on the bandwidth if placed on the internet. Digital video files can be stored like any other files in the computer and the quality of the video can still be maintained. The digital video files can be transferred within a computer network. The digital video clips can be edited easily.

5) **Animation-** Animation is a process of making a static image look like it is moving. An animation is just a continuous series of still images that are displayed in a sequence. The animation can be used effectively for attracting attention. Animation also makes a presentation light and attractive. Animation is very popular in multimedia application

4.3. Application of Multimedia

Following are the common areas of applications of multimedia.

a. **Multimedia in Business:** Multimedia can be used in many applications in a business. The multimedia technology along with communication technology has opened the door for information of global wok groups. Today the team members may be working anywhere and can work for various companies. Thus the work place will become global. The multimedia network should support the following facilities:

I. Voice Mail

II. Electronic Mail

III. Multimedia based FAX

IV. Office Needs

V. Employee Training

VI. Sales and Other types of Group Presentation

VII. Records Management

b. **Multimedia in Marketing and Advertising-** By using multimedia marketing of new products can be greatly enhanced. Multimedia boost communication on an affordable cost opened the way for the marketing and advertising personnel.

c. **Multimedia in Entertainment -** Multimedia has revolutionized the entertainment industry by combining elements like text, graphics, sound, video, and animation to create engaging and interactive experiences. It plays a vital role in movies, video games, music, and social media by enhancing storytelling and visual appeal. Technologies like virtual reality (VR), augmented reality (AR), and computer-generated imagery (CGI) have brought realism and immersion to a new level, making entertainment more dynamic and personalized. From animated films to live-streamed concerts and interactive games, multimedia continues to shape the way audiences enjoy and interact with content across various platforms.

d. **Multimedia in Education-** Many computer games with focus on education are now available. Consider an example of an educational game which plays various rhymes for kids. The child can paint the pictures, increase reduce size of various objects etc. apart from just playing the rhymes. Several other multimedia packages are available in the market which provide a lot of detailed information and playing capabilities to kids.

e. **Multimedia in Bank-** Bank is another public place where multimedia is finding more and more application in recent times. People go to bank to open saving/current accounts, deposit funds, withdraw money, know various financial schemes of the bank, obtain loans etc. Every bank has a lot of information which it wants to impart to in customers. For this purpose, it can use multimedia in many ways. Bank also displays information about its various schemes on a PC monitor placed in the rest area for customers. Today on-line and internet banking have become very popular. These use multimedia extensively. Multimedia is thus helping banks give service to their customers and also in educating them about banks attractive finance schemes.

f. **Multimedia in Hospital-** Multimedia best use in hospitals is for real time monitoring of conditions of patients in critical illness or accident. The conditions are displayed continuously on a computer screen and can alert the doctor/nurse on duty if any changes are observed on the screen. Multimedia

makes it possible to consult a surgeon or an expert who can watch an ongoing surgery line on his PC monitor and give online advice at any crucial juncture.

In hospitals multimedia can also be used to diagnose an illness with CD-ROMs/ Cassettes/ DVDs full of multimedia based information about various diseases and their treatment. Some hospitals extensively use multimedia presentations in training their junior staff of doctors and nurses. Multimedia displays are now extensively used during critical surgeries.

g. **Multimedia Pedagogues-** Pedagogues are useful teaching aids only if they stimulate and motivate the students. The audio-visual support to a pedagogue can actually help in doing so. A multimedia tutor can provide multiple numbers of challenges to the student to stimulate his interest in a topic. The instruction provided by pedagogue have moved beyond providing only button level control to intelligent simulations, dynamic creation of links, composition and collaboration and system testing of the user interactions.

h. **Communication Technology and Multimedia Services-** The advancement of high computing abilities, communication ways and relevant standards has started the beginning of an era where you will be provided with multimedia facilities at home. These services may include:

i. Basic Television Services
ii. Interactive entertainment
iii. Digital Audio
iv. Video on demand
v. Home shopping
vi. Financial Transactions
vii. Interactive multiplayer or single player games
viii. Digital multimedia libraries
ix. E-Newspapers, e-magazines

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following multimedia element places the highest performance demand on the computer?

   a. Animation b. Sound c. Text d. Video

2. Multimedia is also used for ___ communications and presentations.

   a. Corporate b.Company c. Communal d. Commercial

1. What is multimedia file?

   a. Is same as any other regular file

   b. Must be accessed at specific rate

   c. Stored on remote server cannot be delivered to its client

   d. None of the mentioned

3. Which one of the following is the characteristic of a multimedia system?

   a. High storage

   b. High data rates

   c. Both high storage and high data rates

   d. None of the mentioned

Write short answer to the following questions.

1. What are the extensions used for text, audio, image and video?

Write long answer to the following questions.

1. Explain the application of media in detail.
2. Write short notes on:
   a. Text
   b. audio
   c. image
   d. video
   e. animation

Project works

1. Demo of multimedia with their features, uses and assist the students in application of multimedia for various uses like text, audio, video, animation etc.

Unit 5 : Network and Internet

6 .1. Introduction of Computer Network

Data Communication

The process of transferring data or information between among computers called data communications.

Telecommunication

It refer to all types of data transmission like characters, numerical, photos, audios and videos etc using electronic or light emitting media.

Computer Network

A computer network is a logical or physical inter connection between two or more computers in such a way that people could communicate with each other. It is used to provide users with the access to share resources. These shared resources include data files, application software and hardware.

Components of Computer Network

1) Computer
2) Transmission media
3) Network software.
4) Protocols.
5) Networking cables. (Transmission media)

Advantages of Computer Network

1) It ensures resources data software and hardware can be shared.
2) It provides faster & cheaper communication and data transmission.
3) It provides as the tools for e-mail, teleconferencing, and videoconferencing for communication.
4) Flexible working condition.
5) Office automation can be made very effective well managed.

Disadvantages of Computer Network

1) High installation and administrative cost.
2) Attack on the privacy of the people.
3) Computer virus spread most easily through network.
4) Technologically very complicated.
5) If the server is out of order, then all workstations are hang up.
6) Well trained technical support is required.

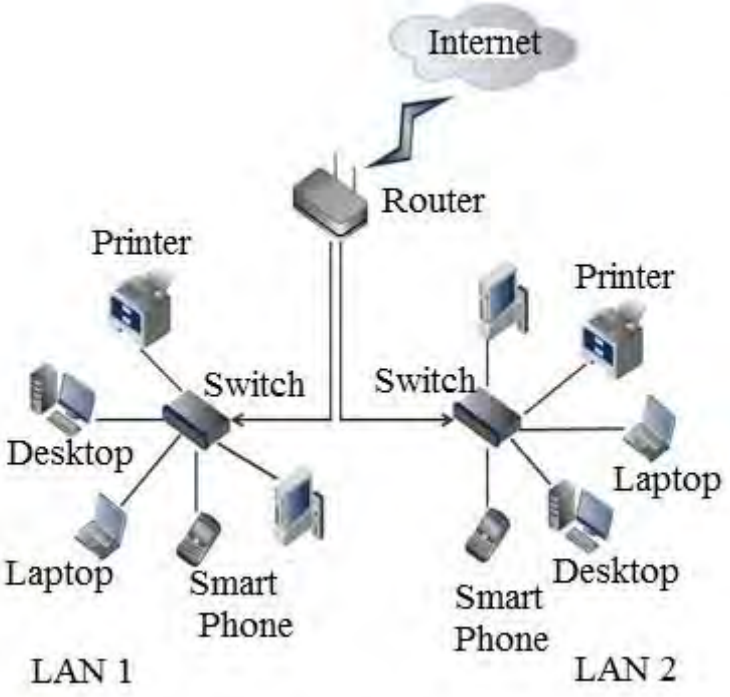
6.2. Types of Network

On the basis of size, physical and geographical division, computer network can be categorized into three types. They are:

1) Local Area Network

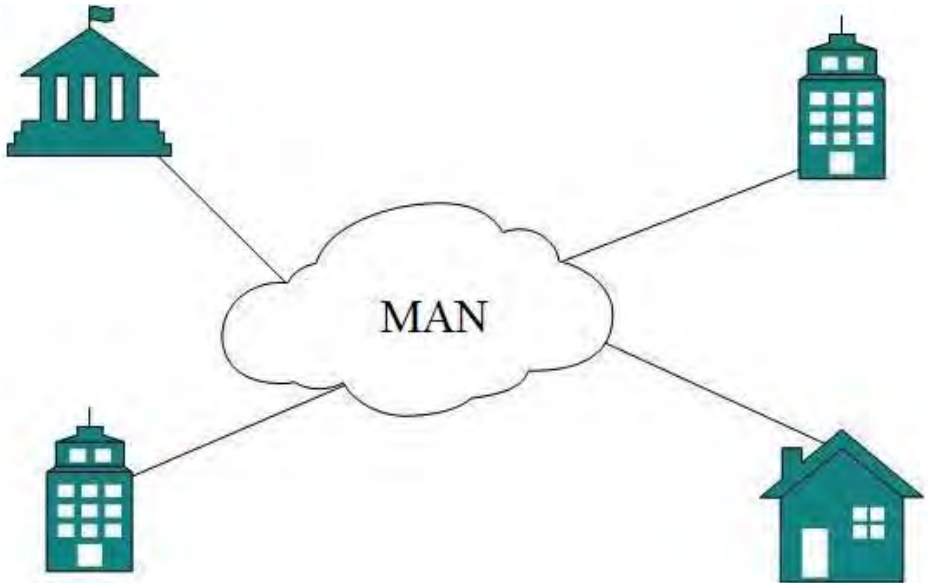
The way of connecting two or more computers in a very limited area (about 100 to 300 meters) or within a same building or a group of adjacent building is called LAN.

It enables very high speed communication through wire connection or wireless connection some times. Small organizations prefer it because of less expensive and faster communication.



2) Metropolitan Area Network

The way of connecting computers inside a metropolitan area is called MAN. The Area may be a part of city, whole part of city, district, zone or country. Radio wave is used to transmit the data for communication between the workstation and server in the system. Many different systems of networking and computing are brought together to form a MAN.



3) Wide Area Network

The connection of computers of networks covering more distance or the world by the help of wave, frequency and satellite is called WAN. Different types of LAN and MAN are connected to form a WAN. It covers more area but it is slower than LAN and MAN. Examples - satellite communication, internet etc.

4) Internet

The internet is worldwide collection of computer networks and gateways that use TCP/IP suite of protocols to communicate with one another using telephone lines modems or satellites. Internet is network of networks. At the heart of the internet is a backbone of high speed data communication lines between major nodes or host computers, consisting of thousands of commercial governmental, educational and other computer system, that route data and messages.

Different Network Component

1. **MODEM:** Modem is a device that directly converts digital signal from a computer or other digital devices into analog form for transmission over analog link i.e. telephone line and vice versa. MODEM stands for Modulation and Demodulation. There are two types of modem used in computer they are as follows:

   a. Internal modem b. External modem.

2. **NIC:** It is a Network Interface Card, which connects each computer to the wiring to the network. A NIC is a circuit board that fits in one of the computer's expansion slots. It provides a port on the back of the computer to connect in the network.

3. **Hub:** Hubs are connectivity devices, which contain multiple ports for connecting to network components. Hubs connect the computers in a star topology. It lies between server and clients computers.

4. **Connector:** Bridge and Gateway are the two different connectors, which play role to link between two network systems.

   a. **Bridge:** Bridge connects networks using same communications protocols or similar networks so that information can be passed from one to the other.

   b. **Gateway:** Gateway connects networks using different communications protocols or dissimilar networks so that information can be passed from one to the other.

5. **Switch:** A device that is capable of forwarding packets directly to the ports associated with particular network addresses. Hubs and switches are almost same but switch is new technology and intelligent compare to hub.

6. **Repeater:** A device used on communications circuits that decrees distortion by amplifying or regenerating a signals so that it can be transmitted onward in its original strength and form as they pass through a network cable.

7. **Protocols:** Protocols are the set of rules and formats for sending and receiving data. It works as guidelines to govern the exchange between equipments. There are different types of protocols that we can use. Some of popular protocols are *TCP/IP, HTTP, FTP, IPX/SPX*.

8. **Router:** A router is a device that is used to connect different LAN in the network. It receives transmitted messages and forwards them their correct destinations over most efficient available route.

NOS: The operating, which can support network environment, is called Network Operating System. For example Windows XP, 2000, server, UNIX, Linux, Novel Netware etc.

Network architectures or (Types of Network Architecture) or LAN Architecture:

Client server: This is old model of computer network. In this kind of network model one main computer equipped with very powerful processor, large memory and network operating system works as a main computer or service provider. Other computers connected with server, which are also called workstation or node or terminals can use the hardware and software resources of server computer. There are different types of server such as file server, print server, network server or email server.

Advantages of Client Server Network

1) It works with any size or physical layout of LAN.
2) It does not tend to slow down with heavy use.
3) The network can be expanded to any size as we wish.
4) It provides very high level security
5) It reduces software installation time and cost to all computers.

Disadvantages of Client Server Network

It is very difficult to setup and well trained technicians are required to handle and setup.

1) It is expensive compared to peer to peer network.
2) All software and operating systems are installed in server computer so that other client computer has to depend on it.

Use of Communication in Daily Life:

It is an exchange of ideas. Communication is the process through which an exchange of information takes place. It is the sharing of information, ideas, concepts and messages.

2. Two Parties are Involved in It

In communication, the exchange of information takes place between two or more persons. This implies that there are minimum two people involved in the communication process at any given time.

The one who initiates the exchange is the sender of the message (speaker/writer) and the one who receives and interprets it is the receiver of the message (listener/reader).

3. It is a Two-way Process

Communication is a two-way process of exchanging ideas or information. One person alone cannot carry out communication. When you communicate, there has to be a receiver or an audience that would reciprocate. Then only your communication can be complete.

Thus, communication is a process of transmitting and receiving verbal and nonverbal messages. It is considered effective only when it achieves the desired reaction or response from the receiver. The response may be positive or negative.

In case of absence of any response, communication is incomplete.

Thus, communication is effective only when a concise and clear message is delivered well, received successfully, understood fully, and responded to promptly.

Exercises

Choose the correct answer from the given alternatives.

1. What is a computer network?

   a. A device used to display information on a computer screen

   b. A collection of interconnected computers and devices that can communicate and share resources

   c. A type of software used to create documents and presentations

   d. The physical casing that protects a computer's internal components

2. What is internet?

   a. A network of interconnected local area networks

   b. A collection of unrelated computers

   c. Interconnection of wide area networks

   d. A single network

3. Which of the following is an example of Bluetooth?

   a. Wide area network b. Virtual private network

   c. Local area network d. Personal area network

4. Which of the following computer networks is built on the top of another network?

   a. Overlay network b. Prime network

   c. Prior network d. Chief network

5. What is the full form of OSI?

   a. Optical service implementation b. Open service Internet

   c. Open system interconnection d. Operating system interface

6. When a collection of various computers appears as a single coherent system to its clients, what is this called?

   a. Mail system b. Networking system

   c. Computer network d. Distributed system

7. How many layers are there in the ISO OSI reference model?

   a. 7 b. 5 c. 4 d. 6

8. What are nodes in a computer network?

   a. The computer that routes the data

   b. The computer that terminates the data

   c. The computer that originates the data

   d. all of the mentioned

9. Which one of the following is not a function of network layer?

   a. Congestion control b. Error control

   c. Routing d. Inter-networking

10. How is a single channel shared by multiple signals in a computer network?

    a. Multiplexing b. Phase modulation

    c. Analog modulation d. Digital modulation

11. Which of the following devices forwards packets between networks by processing the routing information included in the packet?

    a. Firewall b. Bridge c. Hub d. Router

12. What is the term for an endpoint of an inter-process communication flow across a computer network?

    a. Port b. Machine c. Socket d. Pipe

Write short answer to the following questions.

1. What are the advantages of computer network?
2. What is meant by network topology?
3. List types of topology and briefly explain.
4. Draw and explain about star topology.
5. Differentiate between star and ring topology.
6. List components of data communication.
7. What is data transmission mode? List different types of data transmission modes.
8. Differentiate between simplex and duplex mode of communication.
9. What are the differences between wired or wireless media with example?
10. What is Local Area Network? Write its features.
11. What is Metropolitan Area Network? Write its importance.

12. What is WAN? Write its properties.
13. What is modem with working?
14. Explain the use of communication in our daily life.

Write long answer to the following questions.

1. What is computer network? Explain the types of computer networks.
2. Explain different services provided by computer network.
3. What is network architecture or model? List its types.
4. Explain different types of topologies with their merits and demerits.
5. Differentiate between LAN and WAN.

Project Work

1. Demonstration of Network, types and their components in computer lab.

Unit 6 : Introduction of Drawing

Introduction

An engineering drawing is also as called technical drawing which is graphic method of representing objects or forms on a surface chiefly by means of lines, using any of a wide variety of tools and techniques. It is universal language of engineering used in the design process for solving problems, quickly and accurately visualizing objects, and conducting analysis. Engineering drawing is a two dimensional representation of three dimensional objects. In general, it provides necessary information about the shape, size, surface quality, material, and manufacturing processed of the object. It is the graphic language from which a trained person can visualize objects. Drawings prepared in one country may be utilized in any other country irrespective of the language spoken. Hence, engineering drawing is called the universal language of engineers. Any language to be communicative should follow certain rules so that it conveys the same meaning to everyone. Similarly, drawing practice must follow certain rules, if it is to serve as a means of communication. For this purpose, Bureau of Indian Standards (BIS) adapted the International Standards on code of practice for drawing. The other foreign standards are: DIN of Germany, BS of Britain and ANSI of America.

6.1 Types of Drawing

1) Architecture drawing

Architectural drawing is a technical drawing of building that falls within the definition of architectural. It is a process and product of planning, designing and construction building and other physical structures.

2) Technical Drawing

The act or process of producing a technical drawing or drafting. - The art of Producing technical drawing.

3) Drawing with scale

All most all drawing are drawn in the engineering with the scale. With the Help of the scale drawing can be drawn in its true scale that it on field and in Drawing.

4) Free hand Drawing (free sketch)

A style of drawing made without the use of guiding or measure instrument, as distinguished from mechanical or geometrical drawing also.

6.2 Engineering Drawing as Universal Language of Engineering Technical Persons

The ability to read drawing is the most important requirement of all technical people In any profession. As compared to verbal or written description, this method is brief And. Some of the applications are: building drawing for civil engineers, machine drawing for mechanical engineers, circuit diagrams for electrical and electronics Engineers, computer graphics for one and all. The subject in general is designed to impart the following skills. Ability to read and prepare engineering drawings.

- Ability to make free - hand sketching of objects.
- Power to imagine analysis and communicate, and
- Capacity to understand other subjects.

Merits of engineering drawing

It will give the following information:

Geometry - the shape of the object; represented as views; how the object will look when it is viewed from various angles, such as front, top, side, etc.

Dimensions - the size of the object is captured in accepted units.

Tolerances - the allowable variations for each dimension.

Material - represents what the item is made of.

Finish - specifies the surface quality of the item, functional or cosmetic. For example, a mass-marketed product usually requires a much higher surface quality than, say, a component that goes inside industrial machinery.

6.3 Introduction of Drawing Materials

1. Drawing Sheet

Drawing sheet is the medium on which drawings are prepared by means of pencils or pen. Drawing sheets are available in standard sizes as shown in Table 1.2. A standard A0 size sheet is the one with an area of 1 m-2 and having dimensions of 1189 x 841. Each higher number sheet (A1, A2, A3, etc. in order) is half the size of the immediately lower numbered sheet. For drawing

practice for first year engineering students A2 size is the preferred drawing sheet. The recommended sizes obtained for various drawing sheets are shown in figure 1

Table 1.2 Standard Sizes of Drawing sheets as per BIS

Designation	Size (mm)
A0	841 x 1189
A1	594 x 841
A2	420 x 594
A3	297 x 420
A4	210 x 297

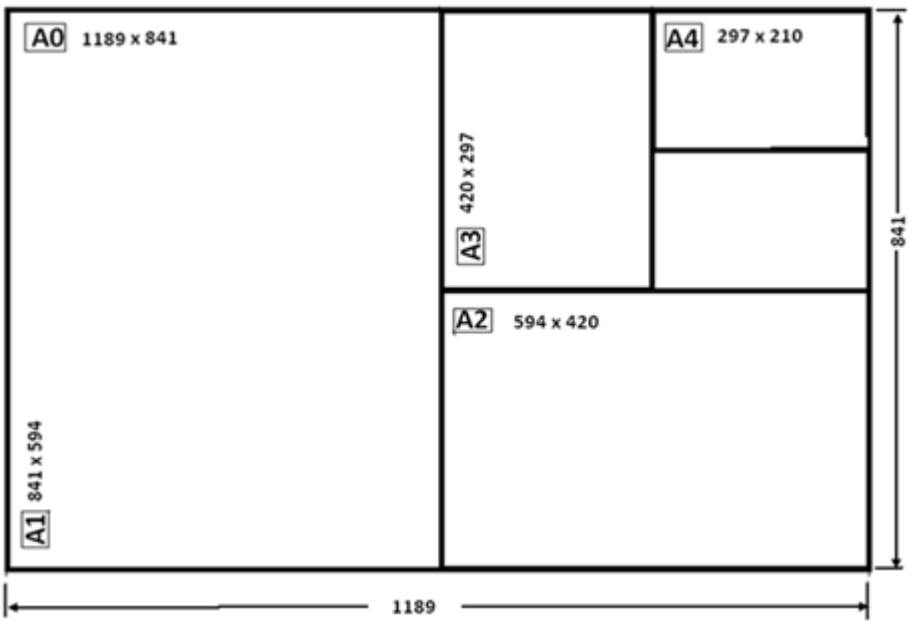


Figure 1. Recommended sizes obtained for various drawing sheets

Drawing Instrument and Aids

The Instruments and other aids used in drafting work are listed below:

1. Drawing board
2. Geometry box
3. Mini drafting
4. Set squares

5. Protractor
6. Set of scales
7. French curves
8. Drawing sheets
9. Pencils
10. Templates
11. Masking tape
12. Base paper
13. T-square
14. Set square

Drawing Boards

Recently drawing boards used are made of well-seasoned softwood of about 25 mm thick with a working edge for T-square. Nowadays mini-drafting's used instead of T-squares which can be fixed on any board. The standard size of board depends on the size of drawing sheet size required.

6.4 Introduction of Drawing Tools

Geometry Box

For completion of engineering drawing the instrument Box is required and it contains the following

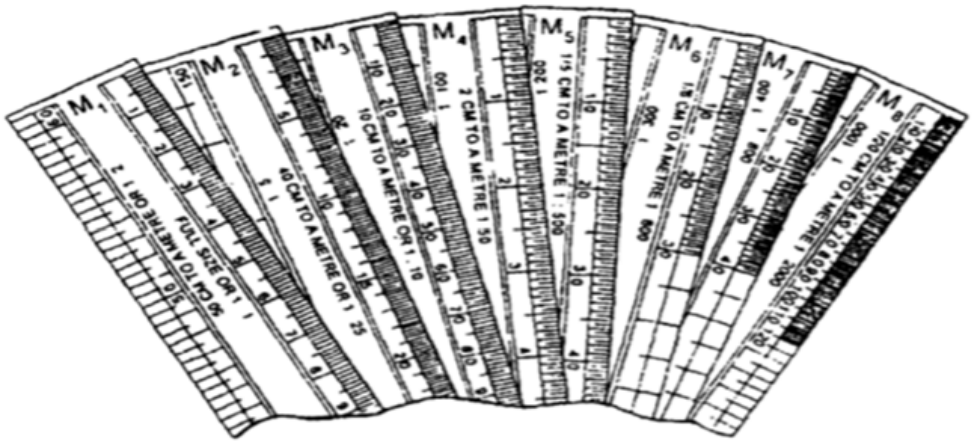
1. Compass
2. Dividers and
3. Inking pens

Mini-Drafting

Mini-drafting consists of an angle formed by two arms with scales marked and rigidly hinged to each other. It combines the functions off-square, set-squares, scales and protractor. It is used for drawing horizontal, vertical and inclined lines, parallel and perpendicular lines and for measuring lines and angles.

Set of Scales

Scales are used to make drawing of the objects to proportionate size desired. These are made of wood; steel or plastic .BIS recommends eight set-scales in plastic cardboard with designations MI, M2 and soon set of scales.



Scales for use on technical drawings (IS : 46-1988)			
Category	**Recommended scales**		
Enlargement scales	50 : 1 5 : 1	20 : 1 2 : 1	10 : 1
Full size	1 : 1		
Reduction scales	1 : 2 1 : 20 1 : 200 1 . 2000	1 : 5 1 : 50 1 : 500 1 · 5000	1 : 10 1 : 100 1 . 1000 1 10000

Set Square

There are two type of set square, they are used to produce angle at 30º, 45º, 60º and 90º.

a) With 2-45º angle

b) With 30º and 60º angle.

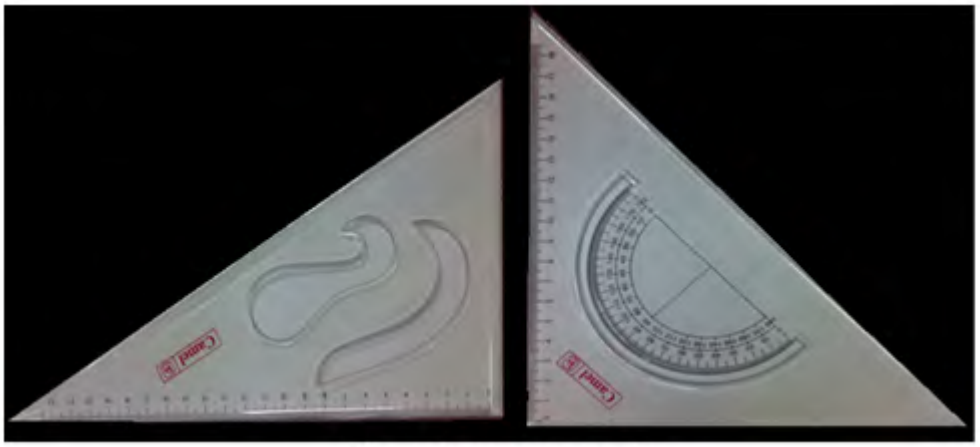


Figure 3. Set Square set

T Square

T scale is a long scale and also called as T scale used as base for set square and to produce horizontal and vertical line.

Base paper

Base paper is for support to drawing paper on the just below the drawing paper and on the table. It is thicker than drawing paper and for fairness work.

Masking Tape

The tape to stick base paper on the board and drawing paper on the base paper.

French Curves

French curves are available in different shapes Fig. First a series of points are plotted along the desired path and then the most suitable curve is made along the edge of the curve. A flexible curve consists of a lead bar inside rubber which bends conveniently to draw a smooth curve through any set of points

(a) French curves

(b) Flexible curve

Figure. A typical French Curve.

Templates

These are aids used for drawing small features such as circles, arcs, triangular, square and other shapes and symbols used in various science and engineering fields

Pencils

Pencils with leads of different degrees of hardness or grades are available in the market. The hardness or softness of the lead is indicated by 3H, 2H, H, HB, B, 2B, 3B, etc. The grade HB denotes medium hardness of lead used for general purpose. The lead becomes softer, as the value of the numeral before B increases.

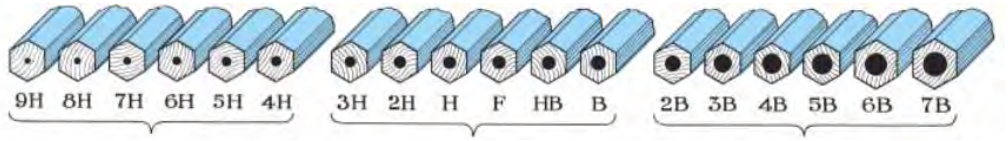


Fig:-Pencils

The selection of the grade depends on the line quality desired for the drawing. Pencils of grades H or 2H may be used for finishing a pencil drawing as these give sharp black line. Softer grade pencils are used for sketching work. HB grade is recommended for lettering and dimensioning. Nowadays mechanical pencils are widely used in place of wooden pencils. When these are used, much of the sharpening time can be saved. The number 0.5, 0.70 of the pen indicates the thickness of the line obtained with the lead and the size of the lead diameter. Microtippencils with 0.5 mm thick leads with the following grades are recommended. **Mechanical Pencil** Soft grade for Border lines and lettering and free sketching H Medium grade for visible outlines, visible edges and boundary lines 2H Hard grade for construction lines, Dimension lines, Leader lines, Extension lines, Centre lines, Hatching lines and Hidden lines.

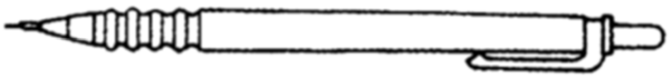


Fig: Mechanical pencil

Layout of Drawing Sheets

Any engineering drawing has to follow a standard format. The drawing sheet consist of drawing space, title block and sufficient margins. After fixing the drawing sheet on the drawing board, margins should be drawn. The layout should facilitate quick reading of important particulars. Drawings are prepared at various locations and shared and quick references should be located easily. A typical drawing sheet is shown in figure 4 and consist of the following:

a. Borders – space left all around in between the trimmed edges of the sheet. A minimum of 10 mm

b. Filling margin – 20 mm minimum on left hand side with border included. This is provided for taking perforations.

c. Grid reference system – For all sizes of drawing sheets for easy location of drawing within the frame. The length and the width of the frames are divided into even number of divisions. Number of divisions for a particular sheet depends on complexity of the drawing. The length of the grids lies between 25 mm to 75mm depending on the Drawing sheet size. The grids along vertical edges are named by capital letters where as grids along the horizontal edges are by numerals. Numbering and lettering start from the corner of the sheet opposite to the title box and are repeated on the opposite sides. The numbers and letters are written upright. Repetition of letters or numbers like AA, BB, etc. are practiced in case they exceed that of the alphabets.

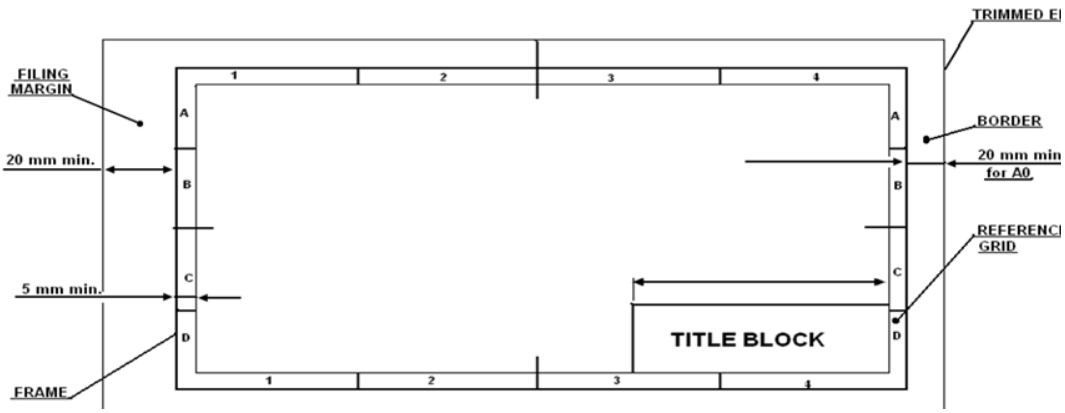


Figure 7. Typical drawing layout showing the margins, location of title block and grids.

d. Title box – An important feature which is a must in every drawing sheet. The title box is drawn at the bottom right hand corner of every drawing sheet and provides technical and administrative details regarding the drawing/component. Though there

are various dimensions for the title box, for Engineering students it is advisable to use a title box of size 170 mm x 65 mm.

The title box is divided in to two zones: (a) part identification zone and (b) additional information zone. In the part identification zone, information like the component identification number , name of the part, the legal owner of the drawing (i.e. the name of firm/component/etc will be highlighted where as in the additional information zone, technical information like symbols indicating the system of projection, scale of drawing, method of indicating surface texture, geometric tolerances, etc. will be highlighted.

Exercises

Choose the correct answer from the given alternatives.

1. How many battens will be there for a Drawing board?

   a. 1 b. 2 c. 3 d. 4

2. The part that doesn't belong to T-square is _____

   a. Working edge b. Blade c. Stock d. Ebony

3. The angle which we can't make using a single Set-square is _____

   a. 45^o b. 60^o c. 30^o d. 75^o

4. The angle which we can't make using both the Set-squares is _____

   a. 15^o b. 105^o c. 165^o d. 125^o

5. Small bow compass can draw circles less than _____ mm radius.

   a. 25mm b. 30mm c. 35mm d. 40mm

6. Which is not the use of divider?

   a. To divide curved or straight lines into the desired number of equal parts

   b. To draw circles

   c. To transfer dimensions from one part of the drawing to another part

   d. To set-off given distances from the scale to the drawing

7. The cardboard scales are available in a set of _____ scales.

   a. Six b. Ten c. Eight d. Rwelve

8. _____ is used to draw curves which are not circular.

   a. Compass b. Protractor c. French curves d. Pro circle

9. The areas of the two subsequent sizes of drawing sheet are in the ratio ____

   a. 1:5 b. 1:4 c. 1:2 d. 1:10

10. The sizes from A0 to A5 increases.

    a. True b. False

11. The increase in hardness is shown by the value of the figure put in front of the letter H, 2H, 3H, and 4H etc.

    a. True b. False

12. What is the next size of 210 mm x 297 mm in drawing papers?

a. 148 mm x 210 mm b. 297 mm x 420 mm

c. 420 mm x 594 mm d. 105 mm x 148 mm

13. The Grade becomes _____ according to the figure placed in front of the letter B, 2B, 3B, 4B etc.

a. Harder b. Lighter c. Darker d. Softer

Write short answer to the following questions.

1. Name different types of drawing instruments.
2. What are the standard sizes of the drawing boards according to B.I.S.?
3. Which size of drawing board is suitable for the practices of engineering students for A2 size ofdrawing sheet? Explain the procedure for clamping a mini-drafter on the drawing board.
4. What are the standard sizes of the drawing sheets according to B.I.S.? Which size issuitable for the technical drawing?
5. How pencils are graded? Give the various shapes of the pencil lead along with theirfield of applications.
6. Write the precautions in using compass.

Write long answer to the following questions.

1. What is the maximum size of circle that can be drawn by a bow compass?
2. State three functions that a divider can perform.
3. What is the use of Engineer's scale? List the types of engineer's scale asrecommended by B.I.S.
4. What is the use of french curves? Explain its working in brief.
5. State the angles that can be made with the help of a pair of set-squares.
6. How parallel lines are drawn with the help of a set-square? Explain with a neatsketch.
7. Distinguish between the use of an art gum eraser and a kneaded eraser.
8. Distinguish between the use of an eraser shield and a template.
9. Why should a sharpener be avoided for preparing the print of pencils?
10. What precautions would you maintain to keep your sheet neat and tidy?
11. Explain the need of the following for the layout of a drawing sheet.

a. Grid references,

b. Metric reference graduation, and

c. Orientation mark.

12. What information should be contained in the title block of a drawing sheet?
13. What information may be included in the space for text?
14. What is a revision table? What information should be contained by it?
15. When an item references is required? How the item list is prepared?

Project Work

1. Introduction class on drawing lab about drawing tools and materials and show how to use them to students making group.

Unit 7 : Introduction of Line and Geometrical Shape

7.1 Definition of Line and Its Type, Line Weight and Their Uses

Lines

A line that is bounded by two distinct end points just as in English textbook the correct words are used for making correct sentences .In engineering lettering the details of various objects are drawn by different types of lines. Each line has a definite meaning and sense to convey.IS 10714 (Pint 20): 2001 (General principles of presentation on technical drawings) and SP 46:200 specify the following types of lines and their applications:

1) **Visible Outlines, Visible .Edges:** Type 01.2 (Continuous wide lines) the lines drawn to represent the visible outlines/ visible edges / surface boundary lines of objects should be outstanding in appearance.

2) **Dimension Lines:** Type 01.1 (Continuous narrow lines) Dimension Lines are drawn to mark dimension.

3) **Extension Lines:** Type 01.1 (Continuous narrow Lines). There are extended slightly beyond the respective dimension lines.

4) **Construction Lines:** Type 01.1 (Continuous narrow Lines) Construction Lines are drawn for constructing drawings and should not be erased after completion of the drawing.

5) **Hatching/Section Lines:** Type 01.1 (Continuous Narrow Lines) Hatching Lines are drawn for the sectioned portion of an object. These are drawn inclined at an angle of 45^0 to the axis or to the main outline of the section.

6) **Guide Lines:** Type 01.1 (Continuous Narrow Lines) Guide Lines are drawn for lettering and should not be erased after lettering.

7) **Break Lines:** Type 01.1 (Continuous Narrow Freehand Lines) Wavy continuous narrow line drawn freehand is used to represent break of an object.

8) **Break Lines:** Type 01.1 (Continuous Narrow Lines with Zigzags) Straight continuous ~arrow line with zigzags is used to represent break of an object.

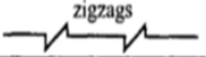
9) **Dashed Narrow Lines:** Type 02.1 (Dashed Narrow Lines) Hidden edges /Hidden outlines of objects are shown by dashed lines of short dashes of equal lengths of about 3 mm, spaced at equal distances of about 1 mm. the points of intersection of these lines with the outlines / another hidden line should be clearly shown.

10) **Center Lines:** Type 04.1 (Long-Dashed Dotted Narrow Lines) Center Lines are drawn at the center of the drawings symmetrical about an axis or both the axes. These are extended by a short distance beyond the outline of the drawing.

11) **"Cutting Plane Lines:** Type 04.1 and Type 04.2 Cutting Plane Line is drawn to show the location of a cutting plane. It is long-dashed dotted narrow line, made wide at the ends, bends and change of direction. The direction of viewing is shown by means of arrows resting on the cutting plane line.

12) **Border Lines:** Border Lines are continuous wide lines of minimum thickness0.7 mm Understanding the various types of lines used in drawing (i.e.,) their thickness, style of construction and appearance as per BIS and following them meticulously maybe considered as the foundation of good drawing skills. Table below shows various types of lines with the recommended applications

No.	Line description and Representation	Applications
01.1	Continuous narrow line B ———	Dimension lines, Extension lines
		Leader lines, Reference lines
		Short centre lines
		Projection lines
		Hatching
		Construction lines, Guide lines
		Outlines of revolved sections
		Imaginary lines of intersection
01.1	Continuous narrow freehand line C ~~~	Preferably manually represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[4].
01.1	Continuous narrow line with zigzags A —/\/\—	Preferably mechanically represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[a].

		Outlines of revolved sections
		Imaginary lines of intersection
01.1	Continuous narrow freehand line C 	Preferably manually represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[4].
01.1	Continuous narrow line with zigzags A 	Preferably mechanically represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[a].

7.2 Introduction of Geometrical Shape

Shape Types

Rectangle: Opposite sides Parallel and all side angle @ 90º.

Square: All sides equal, opposite side parallel and all the angle is 90º.

Triangle: With three sides and 3 angles triangle are isosceles, scalene and equilateral.

Parallelogram: Opposite sides parallel and opposite side equal but not 90º

Rhombus: opposite sides equal and parallel and opposite angle equal but not 90ºand diagonal are intersect at 90º.

Polygon: having angle and sides of various numbers,

i. Triangle

ii. Rectangle

iii. Pentagon

iv. Hexagon etc.

Introduction of Geometric Shape

Triangles

Triangles are closed figures contained by three straight lines. A triangle which has all its sides equal is called equilateral. Such a triangle will always have its three angles equal, and therefore will also be equiangular. A triangle which has two sides (and therefore two angles) equal is called isosceles (isosceles equal; skills, a leg).A scalene triangle has none of its sides equal. A triangle which has a right angle is called right-angled. The side opposite to the right angle is called the hypotenuse.

In a scalene triangle, all sides and angles are different from one another.

A triangle which has an obtuse angle is called obtuse-angled. A triangle which has three acute angles is called acute angled. The base of a triangle is its lowest side. The vertex is the

point opposite the base. The altitude or perpendicular height is alien drawn from the vertex at right angles to its base. The median is a line drawn from the vertex to the middle point of the base. If two corresponding internal angles of two triangles have the same measure, the triangles are similar. If three corresponding sides of two triangles are in proportion, then the triangles are similar. Two triangles that are congruent have exactly the same size and shape: all pairs of corresponding interior angles are equal in measure, and all pairs of corresponding sides have the same length.

The circum center is the center of a circle passing through the three vertices of the triangle. The three perpendicular bisectors meet in a single point, the triangle'scircum center; this point is the center of the circum circle, the circle passing through all three vertices. The diameter of this circle can be found from the law of sines. If the circum center is located on one side of the triangle, then the opposite angle Isa right one. More is true: if the circum center is located inside the triangle, then the triangle is acute; if the circum center is located outside the triangle, then the triangles obtuse.

Quadrilateral Figures

Quadrilateral figures are such as are bounded by four straight lines. The word quadrilateral is made of the words quad and lateral. Quad means four and lateral means sides. The interior angles of a quadrilateral add up to 360 degrees of arc. Quadrilateral figure whose opposites are parallel is called a parallelogram. The opposite sides and angles of parallelograms are equal. A parallelogram whose angles are right angles is called a rectangle. A rectangle which has its sides equal called a square. A parallelogram whose angles are not right angles called a rhombus, if its sides are all equal or a rhomboid if the opposite sides alone are equal. All other quadrilaterals are called trapeziums. A line joining two opposite angles of a quadrilateral figure is called a diagonal.

Parallelograms

Parallelogram is a quadrilateral with two sets of parallel sides. Equivalent conditions are: t opposite sides is of equal length; that opposite angles are equal; or that the diagonals bisect each other. Parallelograms also include the square, rectangle, rhombus and rhomboid.

- Rhombus or rhomb: all four sides arc of equal length. Equivalent conditions are that opposite sides are parallel and opposite angles are equal, or that the diagonals perpendicularly bisect each other.
- Rhomboid: a parallelogram in which adjacent sides are of unequal lengths and angles are oblique (not right angles).

- Rectangle: all four angles are right angles. An equivalent condition is that the diagonals bisect each other and are equal in length.

Square (regular quadrilateral)

All four sides are of equal length (equilateral), and all four angles are right angles. An equivalent condition is that opposite sides are parallel (a square is parallelogram), that the diagonals perpendicularly bisect each other, and are of equal length. A quadrilateral is a square if and only if it is both a rhombus and a rectangle. The diagonals of a square are equal bisect each other. Some properties of square are; the diagonals of a square bisect its angles, the diagonals of a square are perpendicular, opposite sides of a square are both parallel and equal, all four angles of a square are equal. (Each is 360/4 = 90 degrees, so every angle of a square is a right angle.)Rhombus (four equal sides) + Rectangle (four equal angles) = Square (four equal sides and four equal angles) Square

- Rhombus
- Parallelogram (opposite sides are parallel)
- Quadrilateral (four sided polygon) isosceles trapezium (Brit.) or isosceles trapezoid two opposite sides are parallel and the base angles are equal in measure. This implies that the other two sides are of equal length, and that the diagonals are of equal length. Trapezium no sides are parallel. (In British English this would be called an irregular quadrilateral, and was once called a trapezoid.)
- Cyclic quadrilateral: the four vertices lie on a circumscribed circle.
- Tangential quadrilateral: the four edges are tangential to an inscribed circle.
- Bi-centric quadrilateral: both cyclic and tangential.

Polygons

Polygon means "many-angled". A polygon is a plane figure which has more than four angles. A polygon which is both equilateral and equiangular is called regular. A skew polygon does not lie in a flat plane, but zigzags in three (or more) dimensions. A spherical polygon is a circuit of sides and corners on the surface ofa sphere. A polygon is an infinite sequence of sides and angles, which is not closed but it has no ends because it extends infinitely. Individual polygons are named (and sometimes classified) according to the number of sides, combining a Greek-derived numerical prefix with the suffix -gon, e.g. Pentagon, hexagon. The sum of interior:-. Angles of polygon (n sides) is equals (n– 2) πradians or (n - 2)180 degrees or (2n - 4) 90 degrees. The sum of exterior angles of polygon (n sides) is equals 360°.**A polygon of**

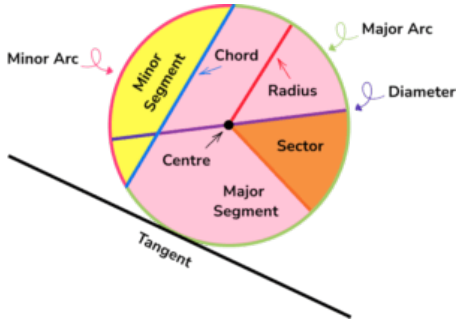
- Five sides are called a pentagon.
- Six side hexagon.
- Seven side heptagon.
- Eight side an octagon.
- Nine side nonagon
- Ten side decagon
- Eleven side hendecagon
- Twelve side dodecagon, etc.

Solids

Solid has length, breadth, and thickness. A solid bounded wholly by planes is called a polyhedron {polyA many; hedraA a side). A solid bounded by six planes or faces, whereof the opposite ones are parallel, is called a parallelepiped. Aparallelepiped whose angles are all right angles is called a rectangular parallelepiped or orthohedron. An orthohedron with six equal faces is called a cube {kudos, a die). A polyhedron, all but one of whose faces meet in a point is called a pyramid. Pyramids are often named, after the shape of their bases, triangular, square, etc. A polyhedron, all but two of whose faces are parallel to one straight-line, is called a prism. If the ends of a prism are at right angles to the straight line to which the other faces are parallel it is called a right prism. Prisms are often named, after the shape of their ends, triangular, hexagonal, etc. cylinder is a solid described by the revolution of a rectangle about one of its sides which remains fixed. This fixed line is called the axis of the cylinder. A right circular cone generally spoken of simply as a cone is a solid described by the revolution of a right- angled triangle about one of the sides containing the right-angle, which side remains fixed. This fixed line is called the axis of the cone; the base is a circle, and the point opposite the base is called the vertex. A solid bounded by a closed surface, such that all straight lines drawn to it from ascertain point are equal, is called a sphere. The point referred to is called the center of the sphere.

7.3 Circle and Its Parts Name

Circle: A round plane figure whose boundary consists of points equidistant from a fixed point.



Circle and its Parts

Exercise

Choose the correct answer from the given alternatives.

1. Medium thickness, line-group of 2mm are not used for _____

   a. Out lines
   b. Dotted lines
   c. Cutting plane-lines
   d. Dimension lines

2. Initial work and construction lines are drawn using __ pencil.

   a. 3H
   b. 4H
   c. H
   d. 2H

3. Centre lines, section lines are drawn using __ pencil.

   a. H
   b. 2H
   c. 3H or 4H
   d. HB

4. The line given below is used for_____

   The line given below is used for long-break line at the ends & at changing of position

   a. Long-break line
   b. Cutting planes
   c. Centroidal lines
   d. Out lines of adjacent parts

5. In engineering drawing, which type of line indicates that there is a change of plane?

   a. Continuous thin wavy
   b. Long chain thin
   c. Continuous thick
   d. Medium thick short dashes

6. Which of the following lines are used to show that the object is cut and then viewed?

   a. Hidden lines
   b. Leader lines
   c. Centre lines
   d. Hatching Lines

7. What do hidden lines in orthographic projections denote?

   a. Holes or slots
   b. Change of Plane
   c. Position of cut
   d. Centre of a circle or cylinder

8. From the below figure, what is the name of the line X?

   The name of the line X is hidden line with dashes equaling 2mm & the gap 1mm

   a. Outline
   b. Section line
   c. Hidden line
   d. Hatching

9. What is the type of line used for line a?

   Type of line used for line a is continuous thin straight used to denote dimensions

   a. Continuous thick
   b. Continuous thin straight
   c. Medium thick short dashes
   d. Continuous thin wavy

10. The axis of the cylinder or sphere is denoted by which of the following line?

   a. Section line
   b. Centre line
   c. Hidden line
   d. Leader line

Write short answer to the following questions.

1. Distinguish between dimension line, projection lines and leaders with the help of a neat sketch.
2. Draw basic types of lines recommended by BIS.
3. Give five applications of following lines in Mechanical Engineering drawing. (a) Continuous narrow lines (b) Continuous wide lines

Write long answer to the following questions.

1. Draw suitable lines recommended by BIS for the following applications. (a Visible outlines (b) hidden lines (c) center lines (d) cutting plane line (e) projection lines.

Project Work

1. Draw different line , geometrical shapes and circle.

Unit 8 : Scale

8.1 Knowledge of Scale and Its Use

Introduction

Small objects are sometimes drawn larger than actual size, while large components and assemblies, of necessity, are drawn to a reduced size. It is not possible always to make drawings of an object to its actual size. If the actual linear dimensions of an object are shown in its drawing, the scale used is said to be a full size scale. Wherever possible, it is desirable to make drawings to full size.

8.2 Full Scale

Drawing of small objects can be prepared of the same size as the objects they represent. A 50 mm long pencil may be shown by a drawing of 50 mm length. Drawings drawn of the same size as the objects are called full-size drawings. The scales generally used for general engineering drawings are shown in table below. Drawings of very small objects such as parts of wrist watch are drawn in enlarging scale.

8.3 Reduced Scale

Objects which are very big in size cannot be represented in drawing to full size. In such cases the object is represented in reduced size by making use of reducing scales. Reducing scales are used to represent objects such as large machine parts, buildings, town plans etc. A reducing scale, say 1: 10 means that 10 unit's length on the object is represented by 1 unit length on the drawing.

8.4 Enlarge Scale

Similarly, for drawing small objects such as watch parts, instrument components etc. And use scale may not be useful to represent the object clearly. In those cases enlarging scales are used. An enlarging scale, say 10: 1 means one unit length on the object is represented by 10 units on the drawing. The designation of a scale consists of the word. SCALE, followed by the indication of its ratio as follows. (Standard scales are shown in Fig. 3.1) Scale 1: 1 for full size scale 1: x for reducing scales (x = 10, 20 ..... etc.,) Scale x: 1 for enlarging scales.

8.5 Scale Construction (Reducing and enlarging scale)

Representative Fraction

The ratio of the dimension of the object shown on the drawing to its actual size is called the Representative Fraction (RF). If the desired scale is not available in the set of scales it may be constructed and then used.

Types of Scale

a) Full scale: 1:1 for full size

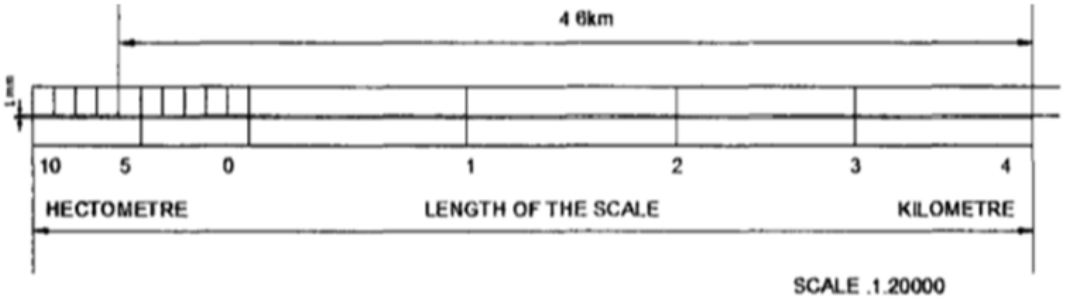
b) Reducing scale: 1: X for reduction 1:2, 1:50, E100, 1:500 etc.

c) Enlarging scale: X: l for enlarging 2:1, 5:1, 10:1 etc.

8.6 Practicing the Drawing of Various Length Line Using the Scale

Problem 1: On a survey map the distance between two places 1 km apart is 5 cm. Construct the scale to read 4.6 km.

Solution:



S cm 1 RF= =-- 1 x 1000 x 100cm 20000

1 If x is the drawing size required x = 5(1000) (100) x 20000

Therefore, x = 25 cm Note: If 4.6 km itself were to be taken x = 23 cm. To get 1 km divisions this length has to be divided into 4.6 parts which is difficult. Therefore, the nearest round figure 5 km is considered. When this length is divided into 5 equal parts each part will be 1 km.

1. Draw a line of length 25 cm.
2. Divide this into 5 equal parts. Now each part is 1 km.
3. Divide the first part into 10 equal divisions. Each division is 0.1 km.
4. Mark on the scale the required distance 4.6 km.

Exercise

Choose the correct answer from the given alternatives.

1. What is the type of scale in which the representative fraction is 1:1?
   a. Enlarged scale
   b. Reduced scale
   c. Full size scale
   d. Graphical scale

2. Which of the following representative fraction depicts an enlarging scale?
   a. 1:0.2
   b. 1:2
   c. 1:3
   d. 1:1

3. Which of the following scales is a reducing scale?
   a. 3:2
   b. 1:3
   c. 1:1
   d. 1:0.4

4. Which of the following is not an enlarging scale?
   a. 2:1
   b. 4:3
   c. 3:5
   d. 6:1

5. Which of the following scales is neither an enlarging nor a reducing scale?
   a. 3:2
   b. 1:4
   c. 1:0.5
   d. 1:1

6. A scale which is numerically represented on the drawing sheet is called as _____
   a. Graphical scale
   b. Engineer's scale
   c. Reducing scale
   d. Full size scale

7. Which of the following scale is used in survey maps?
   a. Engineer's scale
   b. Diagonal scale
   c. Graphical scale
   d. Vernier scale

8. What is the formula for calculating the length of the scale?
   a. Minimum length to be measured x R.F.
   b. Minimum length to be measured ÷ R.F.
   c. Maximum length to be measured ÷ R.F.
   d. Maximum length to be measured x R.F.

9. Units of the measurements must be shown in the scale drawn.
   a. True
   b. False

10. The minimum length to be shown must be known for drawing an unusual scale.

    a. True b. False

Write short answer to the following questions.

1. Distinguish between a full size, a reduced size and an enlarged sized drawing.
2. Give two practical applications of an enlarged scale.
3. What are the advantages of using graphical scale over an engineering scale?
4. What is a representative fraction?
5. Enlist types of scales used in engineering practices.

Write long answer to the following questions.

1. What is the principle used for measuring lengths from diagonal scale? What are the advantages of using a diagonal scale over a plain scale?
2. What is a comparative scale? What is the difference between a direct and a retrograde Vernier?
3. What is the difference between a diagonal and a Vernier scale? What are the applications of the scale of chords?

Project Work

1. Practicing the drawing of various length line using the scale

Unit 9 : Lettering

9.1 Introduction of Single and Double Stroke Letter

Lettering is defined as writing of titles, sub-titles, dimensions, etc., on a drawing.

Importance of Lettering

To undertake production work of an engineering component as per the drawing, the size and other details are indicated on the drawing. This is done in the front of notes and dimensions.

Single Stroke Letters

The word single-stroke should not be taken to mean that the lettering should be made in one stroke without lifting the pencil. It means that the thickness of the letter should be uniform as if it is obtained in one stroke of the pencil.

Types of Single Stroke Letters

1. Lettering Type A: (i) Vertical and (ii) Sloped (30º t0 75 º to the horizontal)
2. Lettering Type B: (i) Vertical and (ii) Sloped (45º at 75º to the horizontal)

(Type B Preferred)

In Type A, height of the capital letter is divided into 14 equal parts, while in Type B; height of the capital letter is divided into 10 equal parts. Type B is preferred for easy and fast execution, because of the division of height into 10 equal parts.

(Vertical Letters Preferred

Vertical letters are preferred for easy and fast execution, instead of sloped letters.)

(Note: Lettering in drawing should be in CAPITALS (i.e., Upper-case letters).

Lower-case (small) letters are used for abbreviations like mm, cm, etc.

Size of Letters

Size of Letters is measured by the height h of the CAPITAL letters as well as numerals.

Standard heights for CAPITAL letters and numerals recommended by BIS are given below:

1.8, 2.5, 3.5, 5, 6, 10, 14 and 20 mm

(Note: Size of the letters may be selected based upon the size of drawing.)

Guide Lines

In order to obtain correct and uniform height of letters and numerals, guide lines are drawn, using 2H pencil with light pressure. HB grade conical end pencil is used for lettering.

Procedure for Lettering

1. Thin horizontal guide lines are drawn first at a distance 'h' apart.
2. Lettering Technique: Horizontal lines of the letters are drawn from left to right. Vertical, inclined and curved lines are drawn from top to bottom.
3. After lettering has been completed, the guidelines are not erased.

Dimensioning of Type B Letters

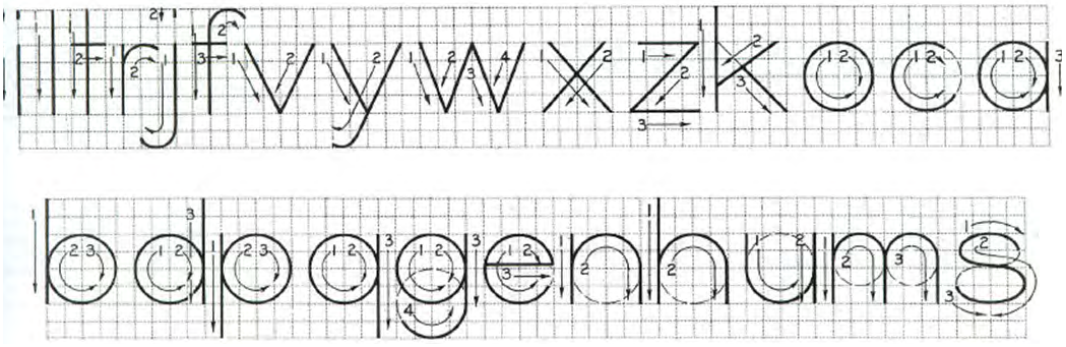
BIS denotes the characteristics of lettering as:

h (height of capita) letters), ci (height of lower-case letters), c 2 (tail of lower-case letters), c 3 (stem of lower-case letters), a (spacing between characters), bl & b2 (spacing between baselines), e (spacing between words) and d (line thickness).

Double stroke letter

Double stroke lettering in double stroke lettering the line width is greater than that of single stroke lettering. Double stroke lettering is further divided into: a) double stroke vertical and b) double stroke inclined lettering.

9.2 Vertical and Inclined Letter



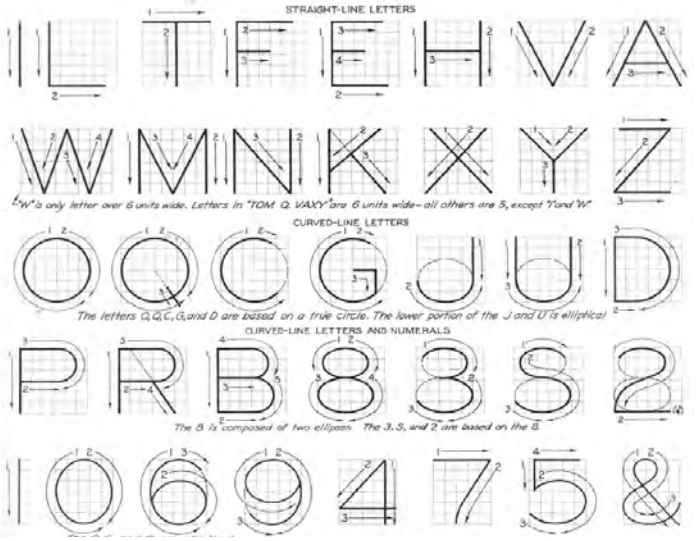


Fig: Vertical letters

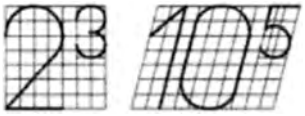


Fig: Inclined letters

9.3 Height and Width Ratio of the Letter

Lettering Proportions

Recommended Size (height h) of Letters I Numerals

Main Title 5 mm, 7 mm, 10 mm

Sub-Titles 3.5 mm, 5 mm

Dimensions, Notes, etc. 2.5 mm, 3.5 mm, 5 mm

Recommended Size (height h) of Letters / Numerals	
Main Title	5 mm, 7 mm, 10 mm
Sub-Titles	3.5 mm, 5 mm
Dimensions, Notes, etc.	2.5 mm, 3.5 mm, 5 mm

9.4 Practice of Letter Writing of Upper Case and Lower Case Letter

Practice of lettering capital and lower case letters and numerals of type B

The following are some of the guide lines for lettering:

1. Drawing numbers, title block and letters denoting cutting planes, sections are written in 10 mm size.
2. Drawing title is written in 7 mm size.
3. Hatching, sub-titles, materials, dimensions, notes, etc., are written in 3.5 mm size.
4. Space between lines = h.
5. Space between words may be equal to the width of alphabet M or 3/5 h.
6. Space between letters should be approximately equal to 115 h. Poor spacing will affect the visual effect.
7. The spacing between two characters may be reduced by half if the is gives a better visual effect, as for example LA, TV; over lapped in case of say LT, TA etc., and the space is increased for letters with adjoining stems

Capital Letter

1 Ratio of height to width for most of the CAPITAL letters is approximately =10:6

2 However, for M and W, the ratio = 10:8 for I the ratio = 10:2

3 Lower-case Letters Height of lower-case letters with stem tail (b, d, f, g, h, j, k, I, p, q, t, y)

4 Ratio of height to width for lower-case letters with stem or tail = 10:5

5 Height of lower-case letters without stems or tail c

(a)

NIGHT NUMBERS

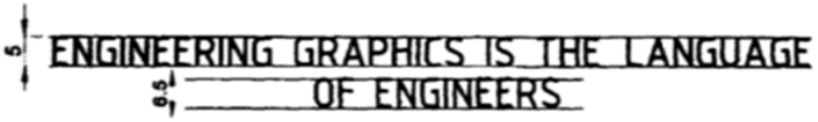
Letters with adjoining stems require more spacing

VITAL ALTAR

Letter combinations with over lapping letters

EXAMPLE IN LETTERING PRACTICE

Write freehand the following, using single stroke vertical CAPITAL letters of 5 mm (h) size



4.5 Practice of Devanagari Letter

Devanagari is the Nepali lettering which is Nepalese language.

Fig: Devanagari

Exercise

Choose the correct answer from the given alternatives.

1. Which grade of pencil is used for drawing arrowheads?

   a. 2H b. 2B c. 7H d. H

2. What does the “Single-Stroke” lettering mean?

   a. Cursive writing

   b. Uniformity in letters as obtained in one stroke of the pencil

   c. Writing in one stroke without lifting the pencil

   d. Writing only with hard, small diameter lead-pencil

3. Which line is drawn to make the section evident?

   a. Long-break line b. Chain thick

   c. Border line d. Hatching line

4. What is the slope of inclined letters with the horizontal?

   a. 75 degree b. 65 degree

   c. 45 degree d. 85 degree

5. In lettering ‘A’ the height of capital letter is divided in how many parts?

   a. 10 b. 14 c. 16 d. 8

Write short answer to the following questions.

1. Write all the alphabets and numerals of 12 mm height using single stroke vertical capital letters according to Indian standards
2. Write the name of your institute of 10 mm height using single stroke vertical capital letters according to Indian standards.

Write long answer to the following questions.

1. Write "the quick brown fox jumps over the lazy dog" of 12 mm height using single stroke vertical capital letters recommended by Bureau of Indian standard

Project Work

1. Demonstration of different types of lettering technique and explanation in classroom in group of 4-5 students.

Unit 10 : Dimensioning

10.1 Dimension System

Drawing of a component, in addition to providing complete shape description, must also furnish information regarding the size description. These are provided through the distances between the surfaces, location of holes, nature of surface finish, type of material, etc. The expression of these features on a drawing, using lines, symbols, figures and notes is called dimensioning.

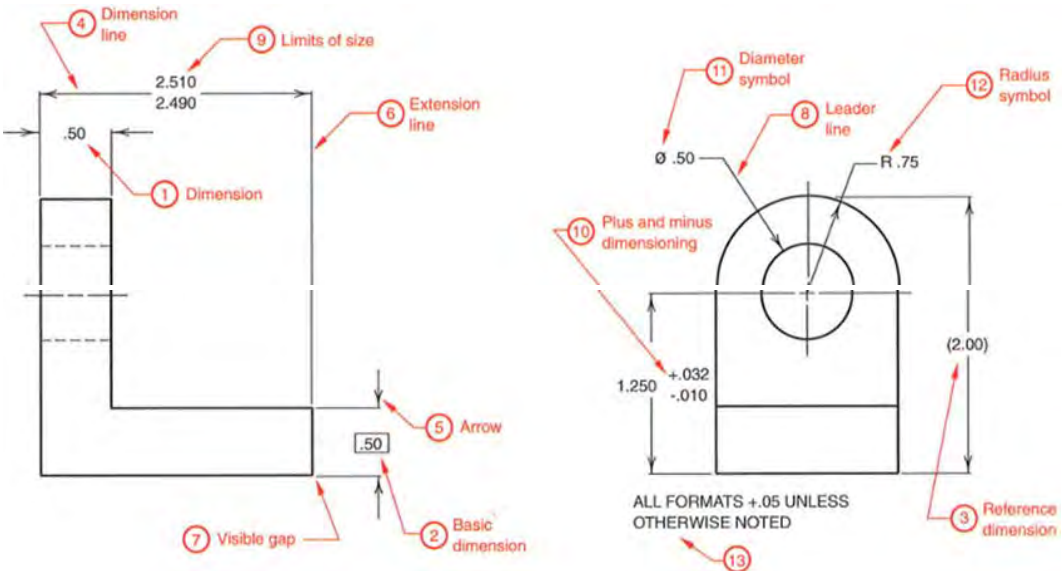


Fig: Elements of dimensioning

Dimensioning Principles

A drawing should provide a complete specification of the component to ensure that the design intent can be met at all stages of manufacture. Dimensions specifying features of size, position, location, geometric control and surface texture must be defined and appear on the drawing once only. With linear dimensions, two parallel lines, called "extension lines," spaced at the distance between two features, are shown at each of the features. A line perpendicular to the extension lines, called a “dimension line," with arrows at its endpoints, is shown between, and terminating at, the extension lines. The distance is indicated numerically at the midpoint of the dimension line, either adjacent to it, or in a gap provided for it. Remember the

following points:

a) Dimension and extension lines are narrow continuous lines 0.35 mm thick, if possible, clearly placed outside the outline of the drawing.

b) The extension lines should not touch the drawing but a small gap should be left, about 2 to 3 mm, depending on the size of the drawing.

c) Arrowheads should be approximately triangular, must be of uniform size and shape and in every case touch the dimension line to which they refer.

d) Centre lines must never be used as dimension lines but must be left clear and distinct. They can be extended, however, when used in the role of projection lines.

e) Dimensions are quoted in millimeters to the minimum number of significant figures.

f) To enable dimensions to be read clearly, figures are placed so that they can be read from the bottom of the drawing, or by turning the drawing in a clockwise direction, so that they can be read from the right hand side.

g) Leader lines are used to indicate where specific indications apply. The leader line to the hole is directed towards the center point but terminates at the circumference in an arrow.

1 **Dimension Line:** A thin, solid line that shows the extent and direction of a dimension. Dimension lines shall terminate in arrowheads at each end. Dimension lines are broken for insertion of the dimension numbers.

2 **Extension Line:** a thin, solid line perpendicular to a dimension line, indicating which feature is associated with the dimension.

3 **Visible Gap:** there should be a visible gap of 1.5 mm between the feature's corners and the end of the extension line.

Types of Dimensioning

Based upon the dimensioning lines dimensioning is divided into Chain/parallel/ running/combined dimensioning.

1 **Parallel Dimensioning:** The selected datum is the left hand side of the stand.

2 **Running Dimensioning:** It is a simplified method of parallel dimensioning having the advantage that the indication requires less space.

3 **Combined Dimensions:** A combined dimension uses both chain and parallel dimensioning.

Dimensioning System

Unidirectional and aligned dimensioning methods are in common use. Unidirectional dimensions are drawn parallel with the bottom of the drawing sheet, also any notes which refer to the drawing use this method. Aligned dimensions are shown in parallel with the related dimension line and positioned so that they can be read from the bottom of the drawing or from the right hand side. **Do not** use both systems on the same drawing or on the same series of drawing. Some of the basic principles of dimensioning are given below.

1. All dimensional information necessary to describe a component clearly and completely shall be written directly on a drawing.
2. Each feature shall be dimensioned once only on a drawing, i.e., dimension marked in one view need not be repeated in another view.
3. Dimension should be placed on the view where the shape is best seen.
4. As far as possible, dimensions should be expressed in one unit only preferably in millimeters, without showing the unit symbol (mm).
5. As far as possible dimensions should be placed outside the view.
6. Dimensions should be taken from visible outlines rather than from hidden lines.

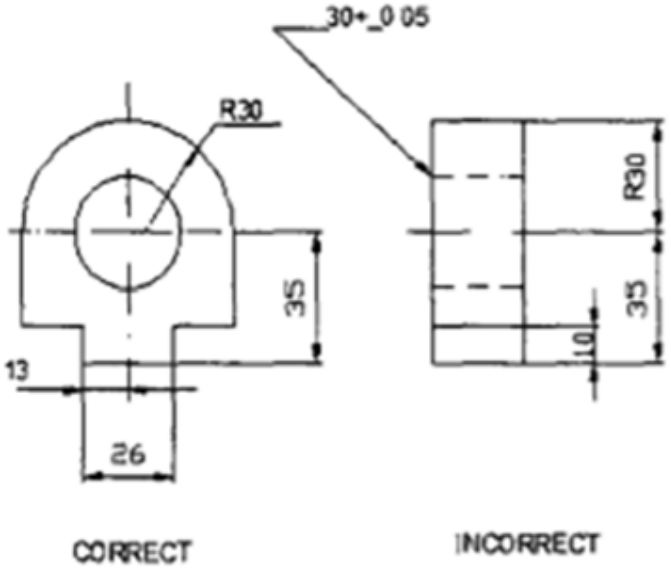


Fig: placing the dimension where the shape is best shown

10.2 Chain and Size Dimension

Chain Dimensions

Chain dimensioning also known as point-to-point dimensioning, is a method of dimensioning from one feature to the next. Each dimension is dependent upon the previous dimension or dimensions.

Size Dimension

Size dimensioning is used for exact dimensioning of part of the object.

10.3 Dimension and Extension Line Placement of Dimension Text

Execution of Dimensions

1. Projection and dimension lines should be drawn as thin continuous lines. Projection lines should extend slightly beyond the respective dimension line.

Projection lines should be drawn Perpendicular to the feature being dimensioned. If the space for dimensioning is insufficient, the arrow heads may be reversed and the adjacent arrow heads may be replaced by a dot.

However, they may be drawn obliquely, but parallel to each other in special cases, such as on tapered feature.

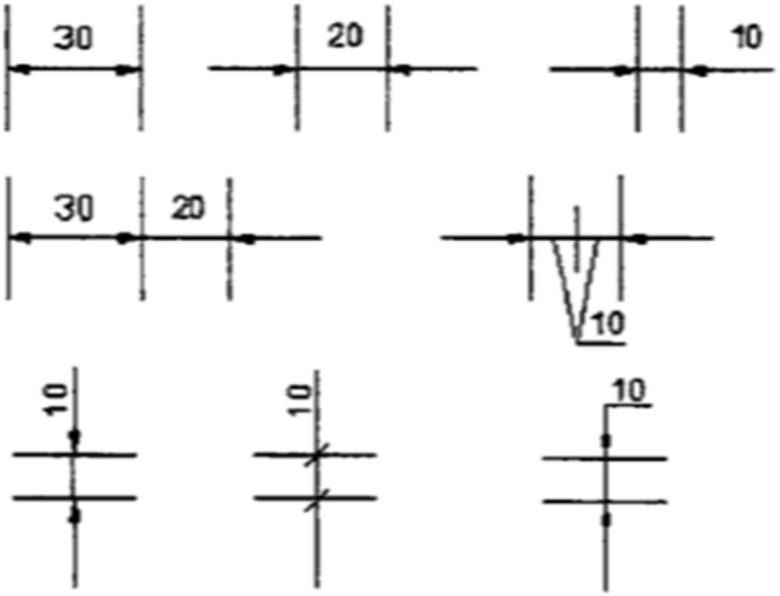


Fig: Making the dimension from the visible outlines

2. A leader line is a line referring to a feature (object, outline, and dimension).

Leader lines should be inclined to the horizontal at an angle greater than 30°. Leader line should terminate,

(a) With a dot, if they end within the outline of an object.

(b) With an arrow head, if they end on outside of the object.

(c) Without a dot or arrow head, if they end on dimension line

10.4 Uses of Arrow Head, Dot and Slash in Dimension

Dimension lines should show distinct termination in the front of arrow heads or oblique strokes or where applicable an origin indication. The arrow head included angle is 15°. The origin indication is drawn as a small open circle of approximately 2mm in diameter. The proportion length to depth 3: 1 of arrow head is shown in.

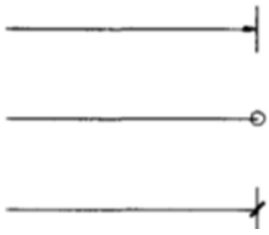


Fig: Termination of Dimension line

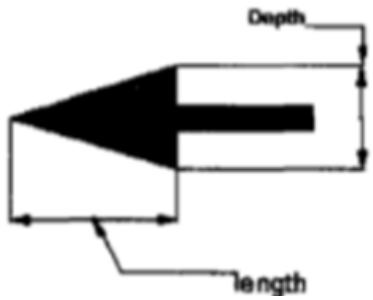


Fig: proportions of an Arrow Head

When a radius is dimensioned only one arrow head, with its point on the arc end of the dimension line should be used. The arrow head termination may be either on the inside or outside of the feature outline, depending on the size of the feature

Methods of Indicating Dimensions: The dimensions are indicated on the drawings according to one of the following two methods.

Method -1 (Aligned method)

Dimensions should be placed parallel to and above their dimension lines and preferably at

the middle, and clear of the line.

Dimensions may be written so that they can be read from the bottom or from the right side of the drawing. Dimensions on oblique dimension lines should be oriented except where unavoidable, they shall not be placed in the 30°zone.

Angular dimensions are oriented as shown in Fig. Dimensions should be indicated so that they can be read from the bottom of the drawing only. Non horizontal dimension lines are interrupted, preferably in the middle for insertion of the dimension. Angular dimensions may be oriented as in Fig. **Note:** Horizontal dimensional lines are not broken to place the dimension in both Cases

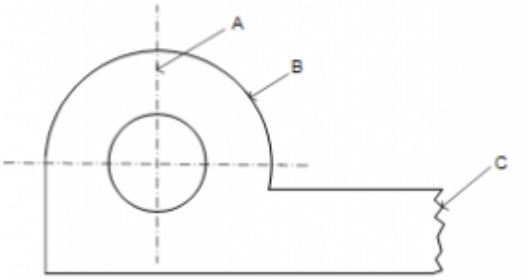
Exercises

Choose the correct answer from the given alternatives.

1. Which grade of pencil is used for drawing arrowheads?

   a. 2H b. 2B c. 7H d. H

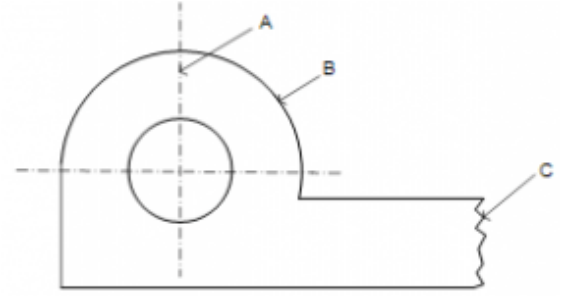
2. Which type is the line A in the following figure?



   a. Dimension line b. Extension line

   c. Centre line d. Short-break line

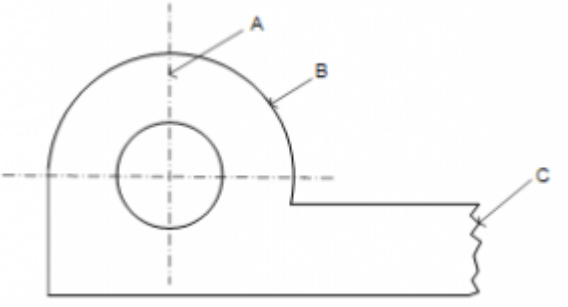
3. In n the following figure line C is used for irregular boundaries, what is its name?



   a. Construction line b. Long-break lines

   c. Short-break line d. Irregular line

4. What type of line is B in the following figure?



a. Inner line
b. Outline
c. Outer line
d. Boundary line

Write short answer to the following questions.

1. Distinguish between dimension line, projection lines and leaders with the help of aneat sketch.
2. Show various dimension line terminations (arrowheads) as recommended BIS.
3. Differentiate between aligned and unidirectional systems of linear dimensioning.
4. Explain (a) chain dimensioning and (b) parallel dimensioning.

Write long answer to the following questions.

1. Show various dimension line terminations (arrowheads) as recommended BIS.
2. Differentiate between aligned and unidirectional systems of linear dimensioning.
3. Explain (a) chain dimensioning and (b) parallel dimensioning.

Project Work

1. Demonstration of different types of dimensioning systems and make students practice on the systems.

Unit 11 : Geometrical Construction

11.1. Know about the Geometrical Shape and Their Name

Shape types

1 **Rectangle:** Opposite sides Parallel and all side angle @ 90º.

2 **Square:** All sides equal, opposite side parallel and all the angle is 90º.

3 **Triangle:** With three sides and 3 angles triangle are isosceles, scalene and

4 equilateral.

5 **Parallelogram:** Opposite sides parallel and opposite side equal but not 90º

6 **Rhombus:** opposite sides equal and parallel and opposite angle equal but not 90º

7 and diagonal are intersecting at 90º.

8 **Circle:** A circle is round structure having its diameter as (d) and side as

9 circumference (c= 2.77*d).

10 **Polygon:** having angle and sides of various numbers,

i. Triangle

ii. Rectangle

iii. Pentagon

iv. Hexagon etc.

Introduction of Geometric Shape

Triangles

Triangles are closed figures contained by three straight lines. A triangle which has all its sides equal is called equilateral. Such a triangle will always have its three angles equal, and therefore will also be equiangular. A triangle which has two sides (and therefore two angles) equal is called isosceles (isosceles equal; skills, a leg).A scalene triangle has none of its sides equal. A triangle which has a right angle is called right-angled. The side opposite to the right angle is called the hypotenuse. Ina scalene triangle, all sides and angles are different from one another. A triangle which has an obtuse angle is called obtuse-angled. A triangle which has three acute angles is called acute angled. The base of a triangle is its lowest side. The vertex is the point opposite the base. The altitude or perpendicular height

is a line drawn from the vertex at right angles to its base. The median is a line drawn from the vertex to the middle point of the base.

Quadrilateral Figures

Quadrilateral figures are such as are bounded by four straight lines. The word quadrilateral is made of the words quad and lateral. Quad means four and lateral means sides. The interior angles of a quadrilateral add up to 360 degrees of arc. A quadrilateral figure whose opposites are parallel is called a parallelogram. The opposite sides and angles of parallelograms are equal. A parallelogram whose angles are right angles is called a rectangle. A rectangle which has its side's equal called a square. A parallelogram whose angles are not right angles called a rhombus, if its sides are all equal or a rhomboid if the opposite sides alone are equal. All other quadrilaterals are called trapeziums. A line joining two opposite angles of quadrilateral figure is called a diagonal.

Parallelograms

Parallelogram is a quadrilateral with two sets of parallel sides. Equivalent conditions are: t opposite sides is of equal length; that opposite angles are equal; or that the diagonals bisect each other. Parallelograms also include the square, rectangle, rhombus and rhomboid.

Rhombus or Rhomb: all four sides arc of equal length. Equivalent conditions are that opposite sides are parallel and opposite angles are equal, or that the diagonals perpendicularly bisect each other.

Rhomboid: a parallelogram in which adjacent sides are of unequal lengths and angles are oblique (not right angles).

Rectangle: all four angles are right angles. An equivalent condition is that the diagonals bisect each other and are equal in length.

Square (regular quadrilateral)

All four sides are of equal length (equilateral), and all four angles are right angles. An equivalent condition is that opposite sides are parallel (a square is parallelogram), that the diagonals perpendicularly bisect each other, and are of equal length. A quadrilateral is a square if and only if it is both a rhombus and a rectangle. The diagonals of a square are equal bisect each other. Some properties of square are; the diagonals of a square bisect its angles, the diagonals of a square are perpendicular, opposite sides of a square are both parallel and equal, all four angles of a square are equal. (Each is 360/4 = 90 degrees, so every angle of a square is a right angle.) Rhombus (four equal sides) + Rectangle (four

equal angles) = Square (four equal Sides and four equal angles)

Polygons

Polygon means "many-angled". A polygon is a plane figure which has more than four angles. A polygon which is both equilateral and equiangular is called regular. A skew polygon does not lie in a flat plane, but zigzags in three (or more) dimensions. A spherical polygon is a circuit of sides and corners on the surface of a sphere. A polygon is an infinite sequence of sides and angles, which is not closed but it has no ends because it extends infinitely. Individual polygons are named (and sometimes classified) according to the number of sides, combining a Greek-derived numerical prefix with the suffix -gon, e.g. pentagon, hexagon. The sum of interior:-. Angles of polygon (n sides) is equals (n– 2) πradians or (n - 2)180 degrees or (2n - 4) 90 degrees. The sum of exterior angles of polygon (n sides) is equals 360°.

A polygon of

1. Five sides are called a pentagon.
2. Six side hexagon.
3. Seven side heptagon.
4. Eight side an octagon.
5. Nine side nonagon
6. Ten side decagon
7. Eleven side hendecagon
8. Twelve side dodecagon, etc.

Solids

A solid has length, breadth, and thickness. A solid bounded wholly by planes is called a polyhedron {polyA many; hedraA a side). A solid bounded by six planes or faces, whereof the opposite ones are parallel, is called a parallelepiped. Aparallelepiped whose angles are all right angles is called a rectangular parallelepiped or orthohedron. An orthohedron with six equal faces is called a cube {kudos, a die). A polyhedron, all but one of whose faces meet in a point is called pyramid. Pyramids are often named, after the shape of their bases, triangular, square, etc. A polyhedron, all but two of whose faces are parallel to one straight-line, is called a prism. If the ends of a prism are at right angles to the straight line to which the other faces are parallel it is called a right prism. Prisms are often named, after the shape of their ends, triangular, hexagonal, etc. cylinder is a solid described by the revolution of a

rectangle about one of its sides which remains fixed. This fixed line is called the axis of the cylinder. A right circular cone generally spoken of simply as a cone is a solid described by the revolution of a right- angled triangle about one of the sides containing the right-angle, which side remains fixed. This fixed line is called the axis of the cone; the base is a circle, and the point opposite the base is called the vertex. A solid bounded by a closed surface, such that all straight lines drawn to it from ascertain point are equal, is called a sphere. The point referred to is called the center of the sphere.

11.2 Construction of 90-, 60-degree Angle and Given Angles

1. Construction of an Angle of 60° by using Compass

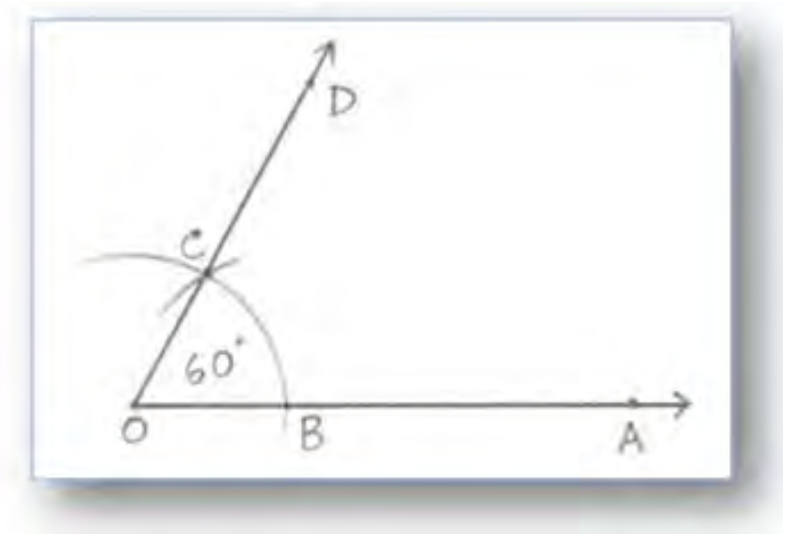
Step of Construction:

(i) Draw a ray OA.

(ii) With O as center and any suitable radius draw an arc above OA cutting it at a point B.

(iii) With B as center and the same radius as before, draw another arc to cut the previous arc atC.

(iv) Join OC and produce it to D.



Then ∠AOD=60°.

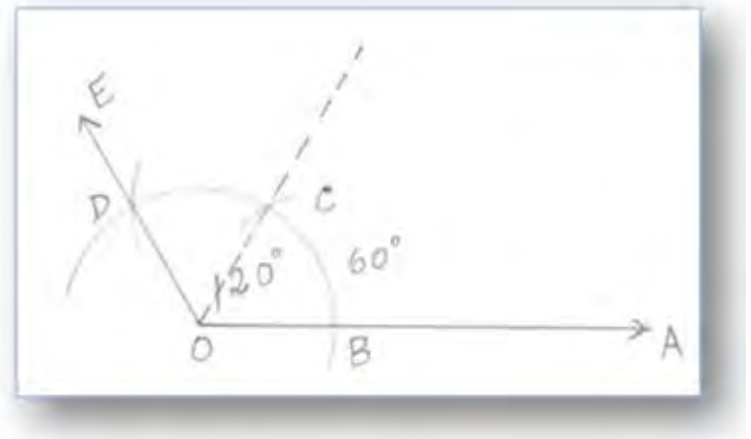
2. Construction of an Angle of 120° by using Compass

Step of Construction:

(i) Draw a ray OA.

(ii) With O as center and any suitable radius draw an arc cutting OA at B.

(iii) With B as center and the same radius cut the arc at C, then with C as centre and same radius cut the arc at D. Join OD and produce it to E.



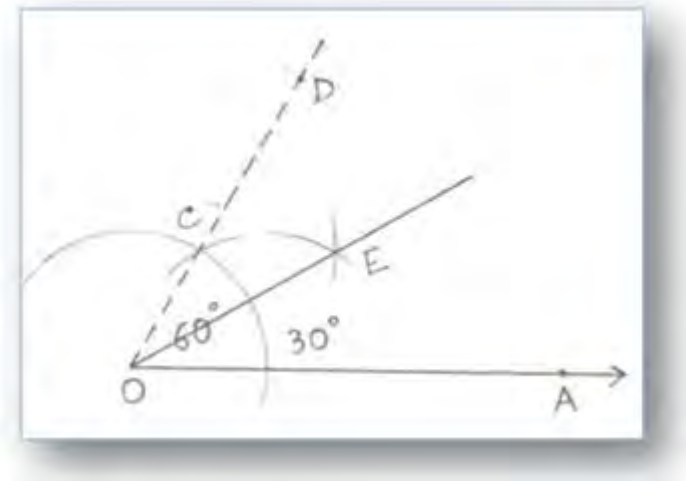
Then, ∠AOE= 120°.

3. Construction of an Angle of 30° by using Compass

Step of Construction:

(i) Construction an angle ∠AOD = 60° as shown.

(ii) Draw the bisector OE of ∠AOD.



Then, ∠AOD = 30°.

4. Construction of an Angle of 90° by using Compass

Step of Construction:

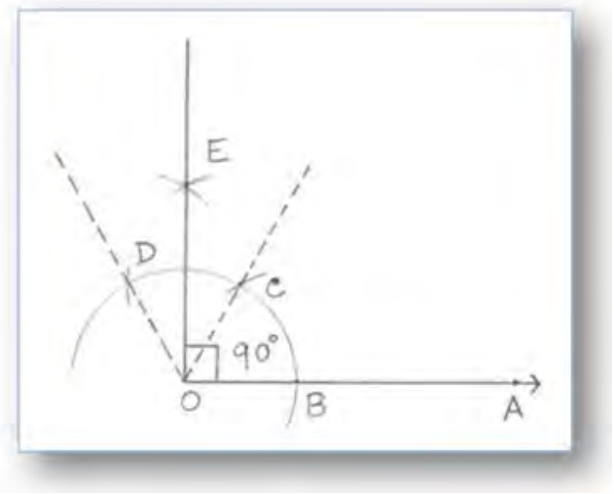
(i) Take any ray OA.

(ii) With O as center and any convenient radius, draw an arc cutting OA at B.

(iii) With B as centre and the same radius, draw an cutting the first arc at C.

(iv) With C as centre and the same radius, cut off an arc cutting again the first arc at D.

(v) With C and D as centre and radius of more than half of CD, draw two arcs cutting each other at E, join OE.



Then, ∠EOA = 90°.

5. Construction of an Angle of 75° by using Compass

Step of Construction

(i) Take a ray OA.

(ii) With O as centre and any convenient radius, draw an arc cutting OA at C.

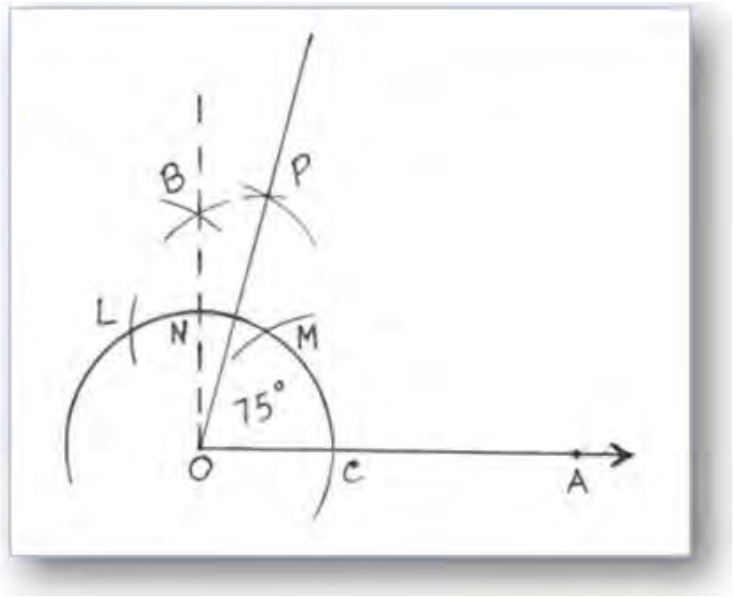
(iii) With C as centre and the same radius, draw an cutting the first arc at M.

(iv) With M as centre and the same radius, cut off an arc cutting again the first arc at L.

(v) With L and M as centre and radius of more than half of LM, draw two arcs cutting each other at B, join OB which is making 90°.

(vi) Now with N and M as centers again draw two arcs cutting each other at P.

(vii) Join OP.



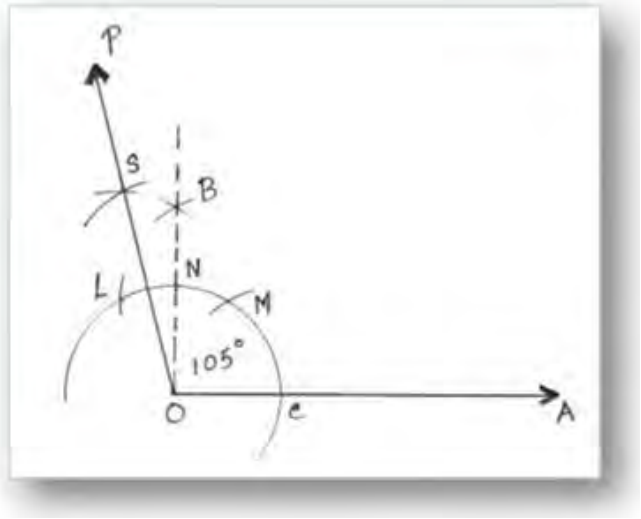
Then, ∠POA = 75°.

6. Construction of an Angle of 105° by using Compass

Step of Construction

(i) After making 90° angle take L and N as centre and draw two arcs cutting each other at S.

(ii) Join SO.



Then, ∠SOA = 105°.

7. Construction of an Angle of 135° by using Compass

Step of Construction:

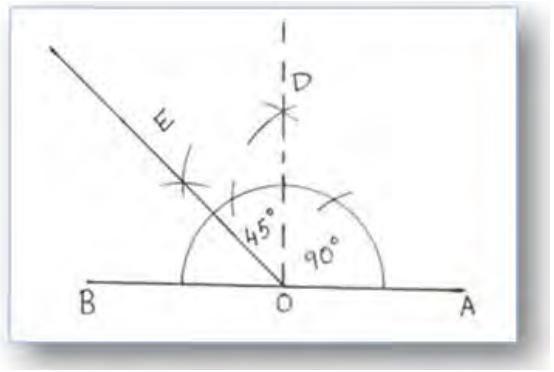
(i) Construct ∠AOD = 90°

(ii) Produce ∠AO to B.

(iii) Draw OE to bisect ∠DOB.

∠DOE = 45°

∠EOA = 45° + 90° = 135°



Then, ∠EOA = 135°.

8. Construction of an Angle of 150° by using Compass

Step of Construction:

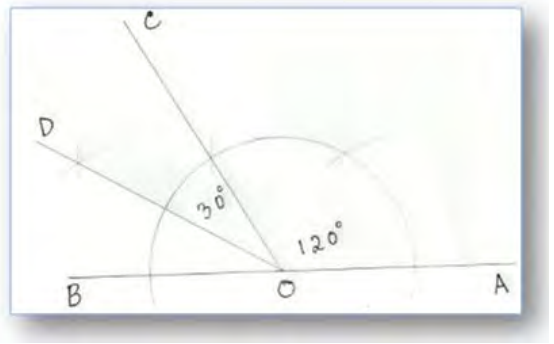
(i) Construct ∠AOC = 120°

(ii) Produce ∠AO to B.

(iii) Draw OD to bisect ∠COB.

Now ∠COD = 30°

Therefore, ∠AOD = 120° + 30° = 150°



Then, ∠AOD = 150°.

11.3 Construction of Triangles by Given Side

When the lengths of all three sides are known, a triangle is created using SSS procedure. The following essential property of a triangle must be met by the lengths of all three sides before we can begin building it. The third side of a triangle is never greater than the total of any two of its sides.

We won't be able to create a triangle with the given three sides if they don't satisfy the triangle's aforementioned property. The following mathematical tools are required in order to form a triangle when the lengths of all three sides are known.

Ruler

Compass

Let's see how we can construct a triangle using SSS Property with an example.

Using a ruler and compass, construct a triangle ABC with AB = 3 cm, BC = 4 cm and AC = 5 cm.

Step 1: Draw an AB line 3 cm in length.

Step 2: Using B as the centre, draw an arc with a radius of 4 cm.

Step 3: To cut the arc drawn in Step 2 at C, draw an arc with a radius of 5 cm using A as its centre.

Step 4: Connect the points A and B with C, the intersection of the two arcs.

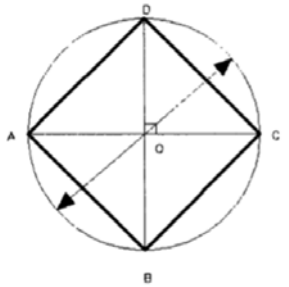
Step 5: Remove the arcs to create the triangle ABC that is needed.

11.4 Construction of Rectangle, Square, Pentagon Hexagon, Heptagon etc.

To inscribe a square in a given circle.

Steps

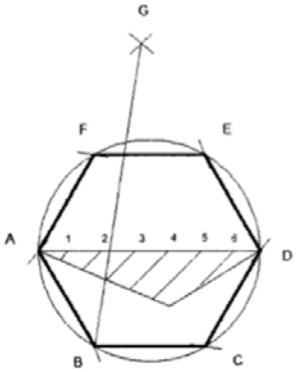
1. With Centre 0, draw a circle of diameter D.
2. Through the Centre 0, drawn two diameters, say AC and BD at right angle to each other.
3. Join A-B, B-C, and C- D, and D-A. ABCD is the required square.
4. To inscribe a regular polygon of any number of sides in a given circle



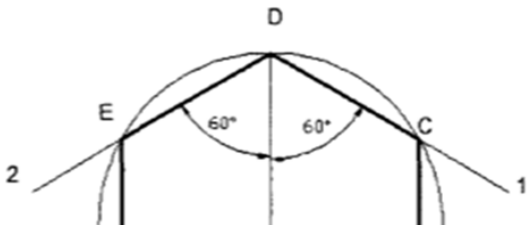
Steps:

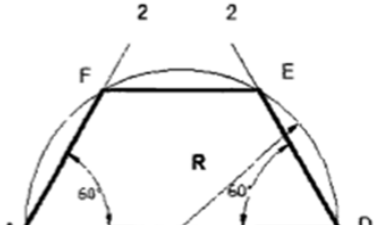
1. Draw the given circle with AD as diameter.
2. Divide the diameter AD into N equal parts say 6.
3. With AD as radius and A and D as centers, draw arcs intersecting each other at G
4. Join G-2 and extend to intersect the circle at B.
5. Join A-B which is the length of the side of the required polygon.
6. Set the compass to the length AB and starting from B mark off on the circumference of the circles, obtaining the points C, D, etc.

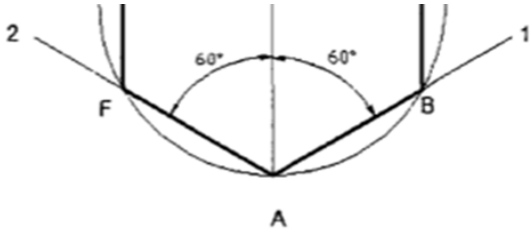
   The figure obtained by joining the points A, B, C etc., is the required polygon

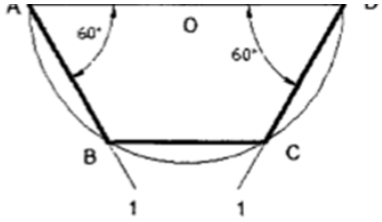


To inscribe a hexagon in a given circle.







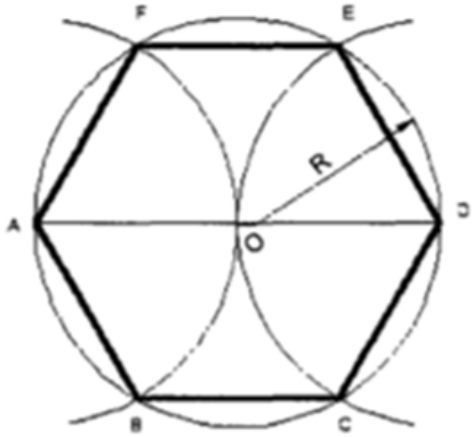


(a) Construction by using a set-square or mini-drafter

1. With Centre 0 and radius R draw the given circle.
2. Draw any diameter AD to the circle.
3. Using 30° - 60° set-square and through the point A draw lines AI, A2 at an angle 60° with AD, intersecting the circle at B and F respectively. 4. Using 30° - 60° and through the point D draw lines Dl, D2 at an angle 60° with DA, intersecting the circle at C and E respectively.

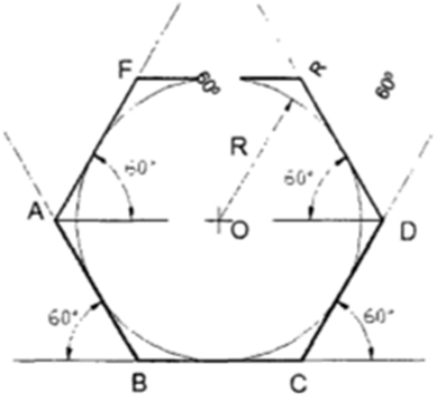
   By joining A, B, C, D, E, F, and A the required hexagon is obtained.

(b) Construction by using compass



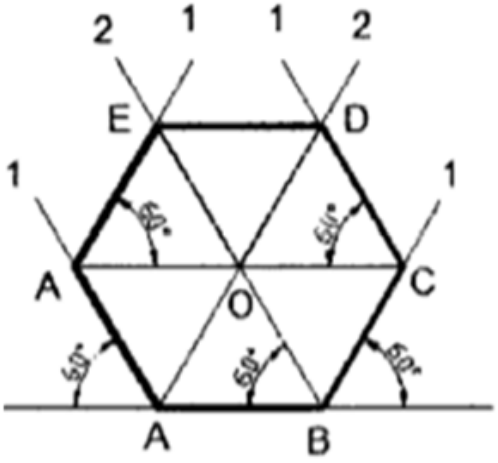
1. With Centre 0 and radius R draw the given circle.
2. Draw any diameter AD to the circle.
3. With centers A and D and radius equal to the radius of the circle draw arcs intersecting the circles at B, F, C and E respectively.
4. ABC D E F is the required hexagon.

11.5. To Circumscribe a Hexagon on a Given Circle of Radius R



Steps

1. With Centre 0 and radius R draw the given circle.
2. Using 60° position of the mini drafter or 300-600set square, circumscribe the hexagon as shown.
3. To construct a hexagon, given the length of the side. (a) Construction Using set square



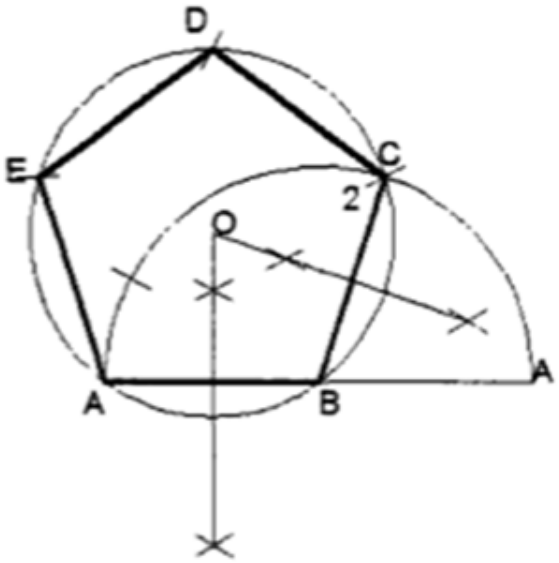
Draw a line AB equal to the side of the hexagon.

2. Using 30° - 60° set-square draw lines AI, A2, and BI, B2.
3. Through 0, the point of intersection between the lines A2 at D and B2 at E.
4. Join D, E
5. ABC D E F is the required hexagon.

(b) By using compass

1. Draw a line AB equal to the side of the hexagon.
2. With centers A and B and radius AB, draw arcs intersecting at 0, the Centre of the hexagon.
3. With centers 0 and B and radius OB (=AB) draw arcs intersecting at C.
4. Obtain points D, E and F in a similar manner.

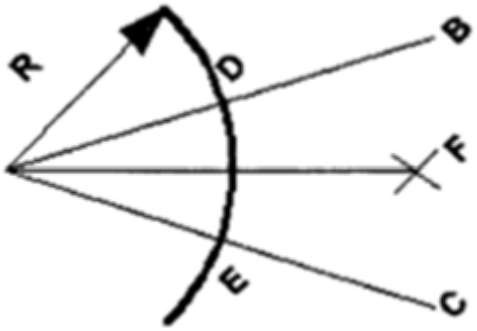
To construct a regular polygon (say a hexagon) given the side AB – alternate method.



Steps:

1. Steps 1 to 3 are same as above
2. Join B- 3, B-4, B-5 and produce them.
3. With 2 as Centre and radius AB intersect the line B, 3 produced at D. Similarly get the point E and F.
4. Join 2- D, D-E, E-F and F-A to get the required hexagon.

11.5 Bisection and Trisection of Line and Angle



To bisect a given angle

Steps:

1. Draw a line AB and AC making the given angle.
2. With center A and any convenient radius R draw an arc intersecting the sides at D and E.
3. With centers D and E and radius larger than half the chord length DE, draw arcs intersecting at F 4. Join AF, <BAF = <PAC.

1. To inscribe a Square in a Given Circle

Steps

1. With Centre 0, draw a circle of diameter D.
2. Through the Centre 0, drawn two diameters, say AC and BD at right angle to each other.
3. Join A-B, B-C, and C- D, and D-A. ABCD is the required square.
4. To inscribe a regular polygon of any number of sides in a given circle.

Steps

1. Draw the given circle with AD as diameter.
2. Divide the diameter AD into N equal parts say 6.
3. With AD as radius and A and D as centers, draw arcs intersecting each other at G
4. Join G-2 and extend to intersect the circle at B.
5. Join A-B which is the length of the side of the required polygon.
6. Set the compass to the length AB and starting from B mark off on the circumference of the circles, obtaining the points C, D, etc.

The figure obtained by joining the points A, B, C etc., is the required polygon

To inscribe a square in a triangle.

Steps

1. Draw the given triangle ABC.
2. From C drop a perpendicular to cut the base AB at D.
3. From C draw CE parallel to AB and equal in length to CD.
4. Draw AE and where it cuts the line CB mark F.
5. From F draw FG parallel to AB.
6. From F draw F J parallel to CD.
7. From G draw GH parallel to CD.
8. Join H to 1. Then HJFG is the required square.

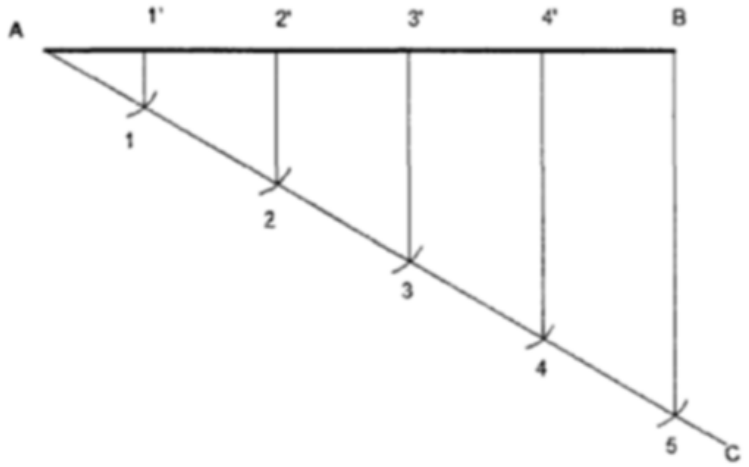
11.6 Line Dividing in any Number of Equal Parts

Problem

1. To divide a straight line into a given number of equal parts say 5.

Steps

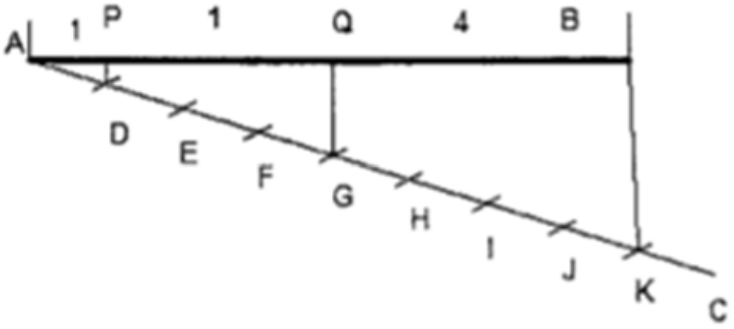
1. Draw AC at any angle e to AB.
2. Construct the required number of equal parts of convenient length on AC like 1, 2, and 3.
3. Join the last point 5 to B
4. Through 4, 3, 2, 1 draw lines parallel to 5B to intersect AB at 4', 3', 2' and 1'.



2. To divide a line in the ratio 1:3: 4.

Steps:

As the line is to be divided in the ratio 1:3:4 it has to be divided into 8 equal divisions. By following the previous example divide AC into 8 equal parts and obtain P and Q to divide the line AB in the ratio 1:3:4.



11.7 Circle- Dividing Five, Six, Seven and Eight Equal Parts

Tangent

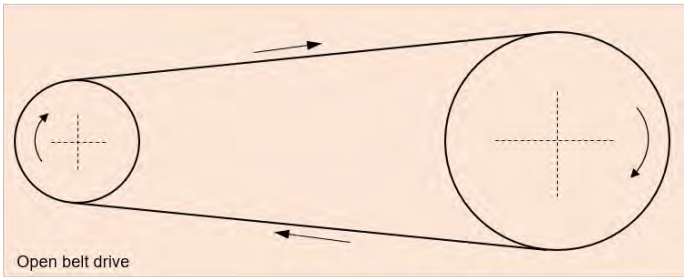
11.8 Line Tangent to a Circle from any Point

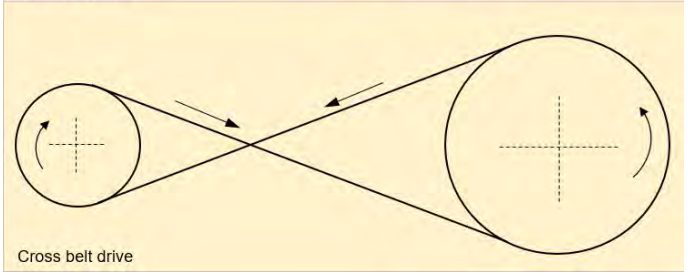
a) At any point P on the circle

1. With 0 as Centre, draw the given circle. P is any point on the circle at which tangent to be drawn.
2. Join 0 with P and produce it to p' so that OP = pp'
3. With 0 and p' as centers and a length greater than OP as radius, draw arcs intersecting each other at Q.
4. Draw a line through P and Q. This line is the required tangent that will be perpendicular to OP at P.

(b) From any Point Outside the Circle

1. With 0 as Centre, draw the given circle. P is the point outside the circle from which tangent is to be drawn to the circle.
2. Join 0 with P. With OP as diameter, draw a semi-circle intersecting the given circle at M. Then, the line drawn through P and M is the required tangent.
3. If the semi-circle is drawn on the other side, it will cut the given circle at MI. Then the line through P and MI will also be a tangent to the circle from P.

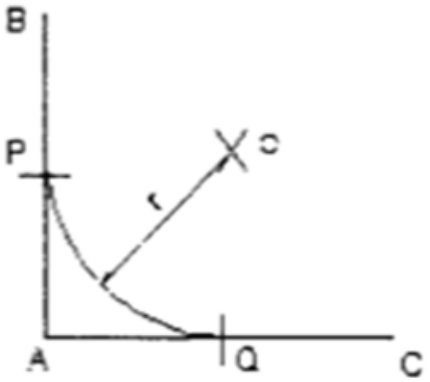




11.9 Uncrossed (open belt) and Crossed (crossed belt) Line Tangent

11.10 Arc Tangent (Internal, external and combined)

To draw an arc of given radius touching two straight lines at right 8rngles to each other. Construction (Fig 4.17) Let r be the given radius and AB and AC the given straight lines. With A as Centre and radius equal to r draw arcs cutting AB at P and Q. With P and Q as centers draw arcs to meet at O. With 0 as Centre and radius equal to r draw the required arc.



To draw an arc of a given radius, touching two given straight lines making an angle between them. Construction (Fig 4.18) Let AB and CD are the two straight lines and r, the radius. Draw a line PQ parallel to AB at a distance r from AB. Similarly, draw a line RS parallel to CD. Extend them to meet at O. With 0 as Centre and radius equal to r draw the arc to the two given line

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following is not a line segment?

   a. Bamboo b. Ruler

   c. Laser beam d. Pencil

2. The angle bisector bisects the angle exactly _____

   a. Perpendicular b. 60 degree

   c. Half d. Any ratio

3. What must you be given to construct an equilateral triangle by compass?

   a. One side b. One angle

   c. Two side d. One angle and one side

4. Which of the property given below is false regarding a square?

   a. A square is a particular case of a rectangle and a rhombus simultaneously

   b. A square is a parallelogram with right angles and equal sides

   c. The diagonals of a square cut at 90 degree

   d. A square is a particular case of a rectangle only

5. If you are given only a compass and a ruler which angle is not possible to construct?

   a. 37.5 b. 33.75 c. 40 d. 120

6. N number of circles are formed with a common centre, what is that geometry called?

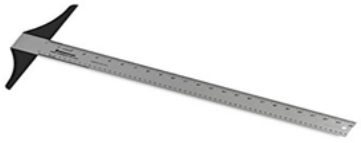
   a. Inscribed circle b. Sphere

   c. Circumscribed circle d. Concentric circle

7. What is the value of each angle of a regular hexagon?

   a. 120 b. 135 c. 720 d. 108

8. What is the below instrument called?

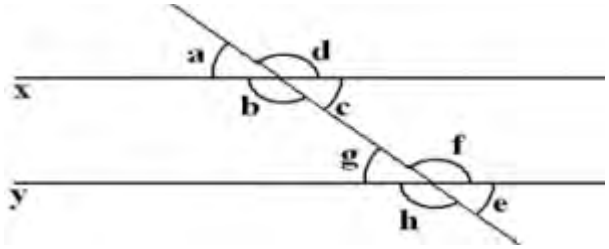


   a. Set square b. Straightedge c. T-square d. Opisometer

9. If X is a point on AB and A – X – B (X is between A and B), then AB =?

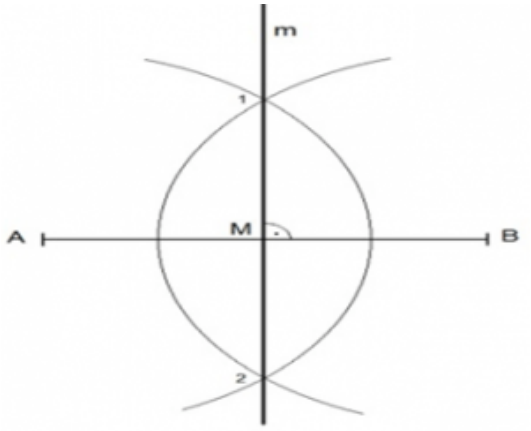
a. AX + XB
b. AB – XB
c. AB – XA
d. AX – XB

10. Which geometric principle is used to justify the construction below?



a. A line perpendicular to one of two parallel lines is perpendicular to the other
b. Two lines are perpendicular if they intersect to form congruent adjacent angles
c. When two lines are intersected by a transversal and alternate interior angles are congruent, the lines are parallel
d. When two lines are intersected by a transversal and the corresponding angles are congruent, the lines are parallel

11. The diagram below shows the construction of the perpendicular bisector of AB.



Which statement is not true?

a. AM=MB
b. MB=1/2AB
c. AM=2AB
d. AM+MB=AB

Write short answer to the following questions.

1. Define and explain the use of construction joints?
2. How can we make butt joint?
3. Define mortise and Tenon joints.
4. Define Cross half lap joints .Write about Dado joint.
5. Define Biscuit joint.
6. Explain briefly in points four kinds of joints.
7. What do you understand by a perpendicular bisector?
8. How the drafter is being used for drawing perpendicular lines and parallel lines?
9. How can you divide a line into given equal number of parts?
10. Distinguish between exterior and interior tangents used to connect two circles?

Write long answer to the following questions.

1. Explain possible ways by which an arc can connect two circles
2. Explain the method of inscribing hexagon in the given circle.
2. Distinguish between inscribed figures and circumscribed figures

Project Work

1. Demonstration of different types of lettering technique and explanation in classroom in group of 4-5 students.

Unit 12 : Curves

12.1 Introduction of Curve and Its Types

Curve is the part of circle as an arc which is in both way of circular path. The profile of number of object various types curves. These chapter details with various types of curves which are commonly used in engineering practice are as follow:

A) Conic section

B) Involutes

C) Cycloids

D) Helices

A) Conic Section

Conic section formed when right angle triangle with an apex, an angle is rotated at the altitude on the axis. The length or the height of the cone is equal to the base of triangle. The apex angle of the cone is q and when the cone is cut by a plane the cut formed along the section is known as conic section.

Types of Conic Section

1. Circular conic section
2. Elliptical conic section
3. Parabolic conic section
4. Hyperbolic conic section

1. Circular Conic Section

When a conic is cut by a plane at the section making angle of 90 degree with the axis the section obtained is known as circular conic section.

2. Elliptical Conic Section

When the cone is cut by a plane and a section A-A making angle more than half of apex angle. The obtained section is elliptical conic section.

3. Parabolic conic section:

When a section is parallel to the slant of cone than the section obtained is

parabolic conic section.

4. Hyperbolic Conic Section

If the section plane is not passing through the apex, the apex line of the cone is known as the hyperbolic conic section.

12.2 Line and Circular Involutes

Involutes

An involutes is a curve traced by a coin in a perfectly flexible string while onwinding from a round circle or polygon, the string being kept tight.it is also a curve traced by a point on a straight line, while a line is rolling around a circle or polygon without sleeping. In the differential geometry of curves, an involute is a curve obtained from another given curve by attaching an imaginary taut string to the given curve and tracing its free end as it is wound onto that given curve; or in reverse, unwound. It is the rolling curve is a straight line containing the generating point. For example, an involute approximates the path followed by at ether ball as the connecting tether is wound around the center pole. If the center pole has a circular cross-section, then the curve is an involute of a circle. Alternatively, another way to construct the involute of a curve is to replace the taut string by a line segment that is tangent to the curve on one end, while the other end traces out the involute. The length of the line segment is changed by an amount equal to the arc length traversed by the tangent point as it moves along the curve. The involute of an involute is the original curve, less portions of zero or undefined curvature the involute is defined as the path of a point on a straight line which rolls without slip along the circumference of a cylinder. The involute curve is required for the construction of gear teeth. The construction method is:

1. As above, draw the given base circle, divide into, say, 12 equal divisions, and draw the tangents from points 1 to 6. -
2. From point 1 and with radius equal to the chord length from point 1 to point A, draw an arc terminating at the tangent from point 1 at point B.
3. Repeat the above procedure from point 2 with radius 2B terminating at point C.
4. Repeat the above instructions to obtain points D, E, F and G, and join points A to G to give the required involute.

Involutes

An involute is a curve traced by a point on a perfectly flexible string, while unwinding from around a circle or polygon the string being kept taut (tight). It is also a curve traced by a point on a straight line while the line is rolling around a circle or polygon without slipping. To draw an involute of a given square.

1. Draw the given square ABCD of side a.
2. Taking A as the starting point, with center B and radius BA=a, draw an arc to intersect the line CB produced at Pl.
3. With Centre C and radius CP 1= 2 a, draw on arc to intersect the line DC produced at P 2. 4. Similarly, locate the points P3 and P4•

   The curve through A, PI' P2, P3and P4 is the required involute.

   A P 4 is equal to the perimeter of the square.

Note: To draw a normal and tangent to the curve at any point, say M on it, as M lies on the arc P l4 with its center at A, the line AMN is the normal and the line TT drawn through M and perpendicular to MA is the tangent to the curve.

Involutes of a triangle, Pentagon and Hexagon.

To draw an involute of a given circle of radius R.

Problem : Draw involute of a square of 25 mm sides.

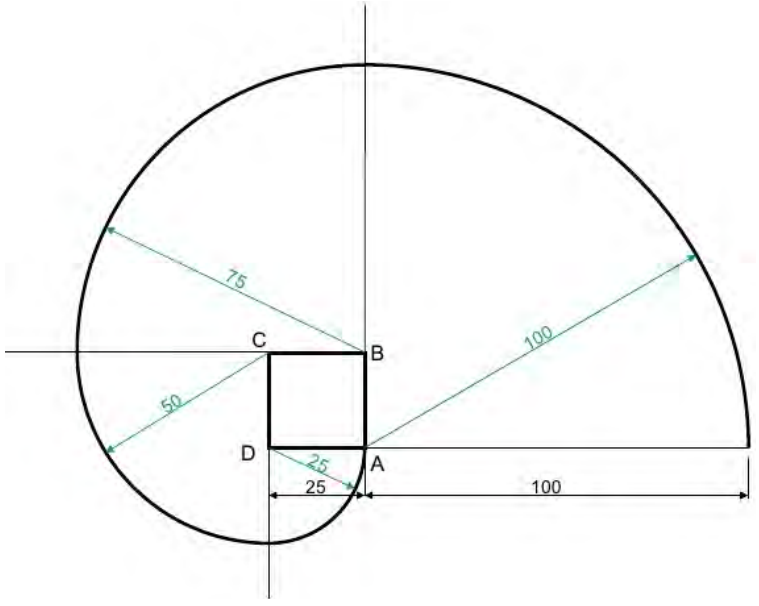


Fig. Involutes

Steps:

1. With 0 as center and radius R, draw the given circle.
2. Taking P as the starting point, draw the tangent PA equal in length to the circumference of the circle.
3. Divide the line PA and the circle into the same number of equal parts and number the points.
4. Draw tangents to the circle at the points 1, 2, 3 etc., and locate the points PI' P2, P 3 etc., such that PI = PI 1, 2P2 = P21 etc.

12.3 Cycloids

Cycloids curve is generated by a fixed point in the circumference of a circle when it is rolling without sleeping along a fixed straight line or circular path.

A cycloid generated by a rolling circle. A cycloid is the curve traced by a point on the rim of a circular wheel as the wheel rolls along a straight line without slippage. A curve generated by a curve rolling on another curve. The cycloid, with the cusps pointing upward, is the curve of fastest descent under constant gravity, and is also the form of a curve for which the period of an object in descent on the curve does not depend on the object's starting position. The cycloid is defined as the locus of a point on the circumference of a cylinder which rolls without slip along a flat surface. The method of construction is:

1. Draw the given circle, and divide into a convenient number of parts; eight divisions are shown in Figure.
2. Divide line AA1 into eight equal lengths. Line AA1 is equal to the length of the circumference.
3. Draw vertical lines from points 2 to 8 to intersect with the horizontal line from center O at points 02, 03, etc.
4. With radius OA and center 02, describe an arc to intersect with the horizontal line projected from B.
5. Repeat with radius OA from center 03 to intersect with the horizontal line projected from point C. Repeat this procedure.
6. Commencing at point A, join the above intersections to form the required cycloid.

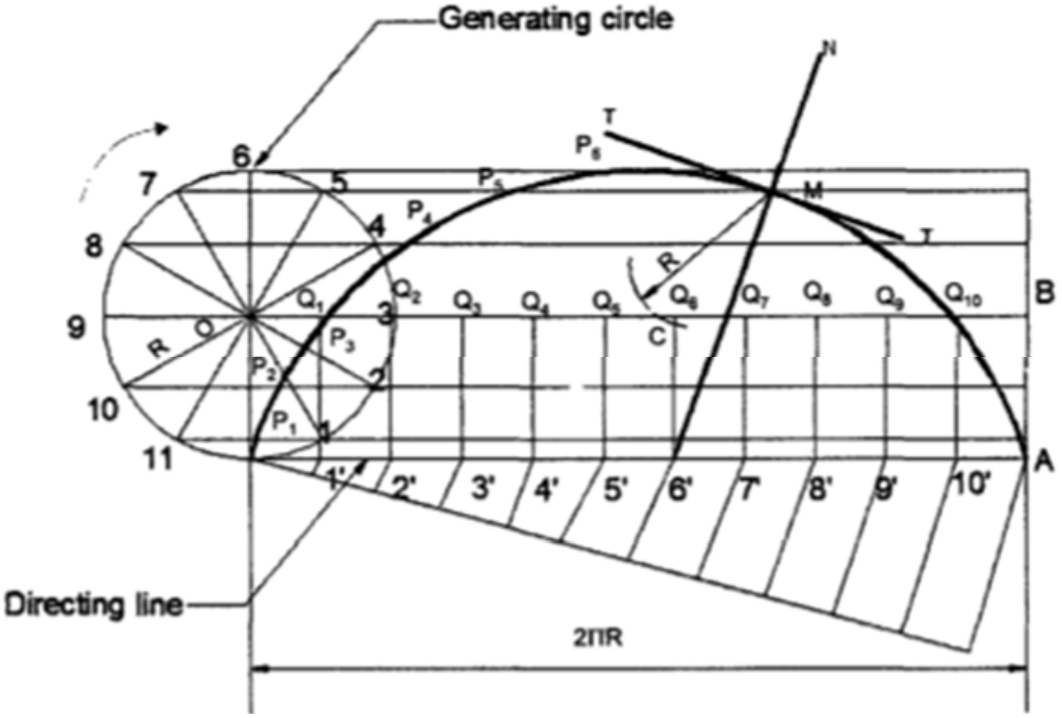
Cycloid Curves

Cycloid curves are generated by a fixed point in the circumference of a circle whenit rolls without slipping along a fixed straight line or circular path. The rolling circleis called the generating circle, the fixed straight line, the directing line and the fixed circle, the directing circle.

Cycloid

A cycloid is a curve generated by a fixed point on the circumference of a circle, when it rolls without slipping along a straight line.

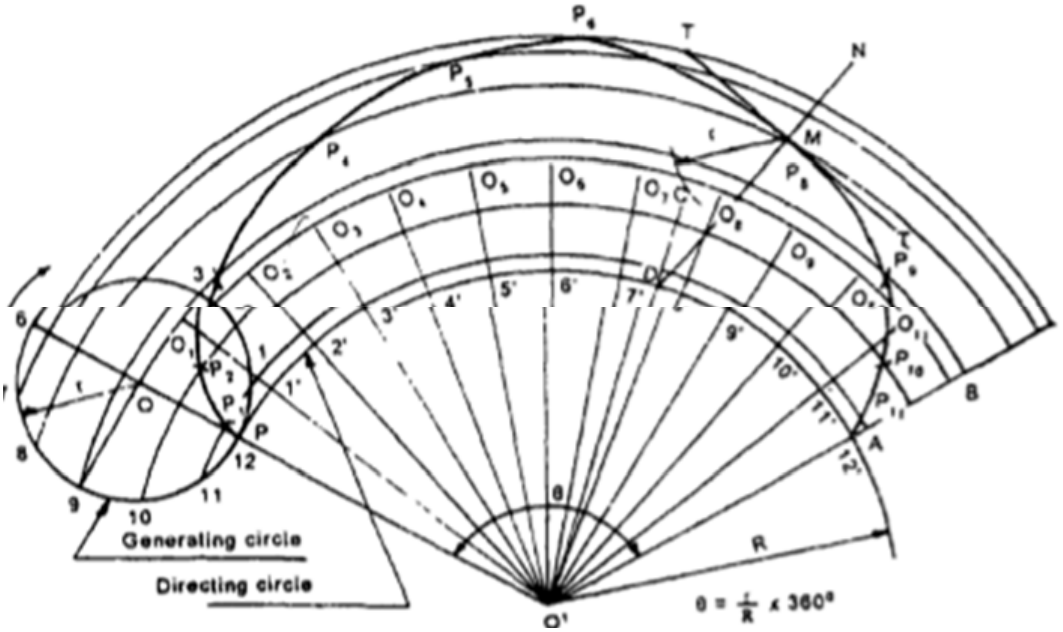
To draw a cycloid, given the radius R of the generating circle.



Construction of a Cycloid

1. Take diameter of rolling circle= 50mm.
2. Divide circle in equal parts.
3. Divide the circle in 12 equal parts.
4. Marks 1 to 12
5. Draw a tangent @point 12 having length 2 □R
6. Divide this line in 12 equal parts.
7. Produce 93 and tangent on 6 parallel to the line 93 and complete rectangle.

8. Again produce 7-5,8-4,10-2 and 11-1.
9. Draw perpendicular from 1 to the center line and mark c1.
10. Similarly draw 2c2, 3c3, 4c4, 5c5, 6c6, 7c7, 8c8, 9c9, 10c10, 11c11 and 12c12.
11. Take radius equal to that of rolling circle and take arc on locus 1 with c center to get point p1.



12. Similarly take c2 center and get p2 on locus of 2, c3 as center get p3 on locus of 3. Draw all arc intersecting point p4, p5…p12 draw from c4, c5, c12 as center.
13. Join the point p1, p2, p3, p4, .p12 to get a cycloid.

An epi-cycloid is a curve traced by a point on the circumference of a generating circle, when it rolls without slipping on another circle (directing circle) outside it.If the generating circle rolls inside the directing circle, the curve traced by the point in called hypo-cycloid

To draw an epicycloid, given the radius 'r' of the generating circle and the radius 'R' of the directing circle.

1. With center 0' and radius R, draw a part of the directing circle.
2. Draw the generating circle, by locating the center 0 of it, on any radial line 0 1 P extended such that OP = r.
3. Assuming P to be the generating point, locate the point, A on the directing circle

such that the arc length PA is equal to the circumference of the generating circle. The angle subtended by the arc PA at 0' is given by e = <P

0' A = 3600 x rlR.

4. With center 0' and radius 0' 0, draw an arc intersecting the line 0' A produced at B. The arc OB is the locus of the center of the generating circle.
5. Divide the arc PA and the generating circle into the same number of equal parts and number the points.
6. Join 0'-1', 0'-2', etc., and extend to meet the arc OB at 01'02 etc.
7. Through the points 1, 2, 3 etc., draw circular arcs with 0' as center.
8. With center 0 1 and radius r, draw an arc intersecting the arc through 1 at PI.
9. Similarly, locate the points P2, P3 etc.
10. A smooth curve through the points P1, P 2'P 3 etc., is the required epi-cycloid.

Note: The above procedure is to be followed to construct a hypo-cycloid with the generating· circle rolling inside the directing circle.

The Epicycloids

A hypocycloid is defined as the locus of a point on the circumference of a circle which rolls without slip around the inside of another circle.

Archimedean Spiral

The Archimedean spiral is the locus of a point which moves around a center at uniform angular velocity and at the same time moves away from the center at uniform linear velocity. The construction is shown in figure.

1. Given the diameter, divide the circle into an even number of divisions and number them.
2. Divide the radius into the same number of equal parts.
3. Draw radii as shown to intersect radial lines with corresponding numbers, and connect points of intersection to give the required spiral.

12.4 Helices (cylindrical and conical helix)

The helices are a curve generated on the surface of the cylinder by a point which revolve uniformly around the cylinder and at the same time either up or down on its surface.

Concentric Circle Method

Construct two concentric circles equal in diameter to the major and minor axes of the required ellipse. Let these diameters be AB and CD. Divide the circles into any number of parts; the parts do not necessarily have to be equal. The radial lines now cross the inner and outer circles. Where the radial lines cross the outer circle, draw short lines parallel to the minor axis CD. Where the radial lines cross the inner circle, draw lines parallel to AB to intersect with those drawn from the outer circle. The points of intersection lie on the ellipse. Draw a smooth connecting curve.

Right-hand Cylindrical Helix

The helix is a curve generated on the surface of the cylinder by a point which revolves uniformly around the cylinder and at the same time either up or down its surface. The method of construction is shown in figure.

1. Draw the front elevation and plan views of the cylinder, and divide the plan view into a convenient number of parts (say 12) and number them as shown.
2. Project the points from the circumference of the base up to the front elevation.
3. Divide the lead into the same number of parts as the base, and number them as shown.
4. Draw lines of intersection from the lead to correspond with the projected lines from the base.
5. Join the points of intersection, to give the required cylindrical helix.
6. If a development of the cylinder is drawn, the helix will be projected as a straight line.
7. The angle between the helix and a line drawn parallel with the base is known as the helix angle.

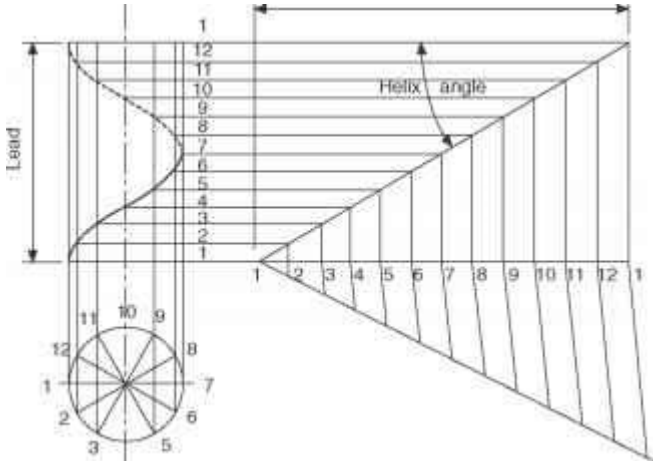
Note. If the numbering in the plan view is taken in the clockwise direction from point 1, then the projection in the front elevation will give a left-hand helix. The construction for a helix is shown applied to a right-hand helical spring. The spring is of square cross-section, and the four helices are drawn from the two outside corners and the two comers at the inside diameter. The pitch of the spring is divided into 12 equal parts, to correspond with the 12 equal divisions of the circle in the end elevation, although only half of the circle need be drawn. Points are plotted as previously shown. A single-start square thread is illustrated in Figure. The construction is similar to the previous problem, except that the center is solid metal. Four helices are plotted,

spaced as shown, since the thread width is half the pitch.

Construct a Helix (Cylindrical)

Given: Diameter of a circle

1. Construct a circle with given diameter.
2. Divide the circle in twelve equal parts. Numerate 1 to 12 as in sketch
3. Produce PQ and RS having length 2 πr as in sketch extended by tangent @ 9 and 3 in the circle.
4. Divide the lines in 12 equal parts.
5. Draw parallel lines of PQ extended through 8-10, 7-11, 6-12, 5-1, and 4-2.
6. Join the points as is done in the sketch to get a cylindrical helix.



Right-hand Conical Helix

The conical helix is a curve generated on the surface of the cone by a point which revolves uniformly around the cone and at the same time either up or down its surface. The method of construction is shown in figure.

1. Draw the front elevation and plan of the cone, and divide the plan view into a convenient number of parts (say 12) and number them as shown.
2. Project the points on the circumference of the base up to the front elevation, and continue the projected lines to the apex of the cone.
3. The lead must now be divided into the same number of parts as the base, and numbered.
4. Draw lines of intersection from the lead to correspond with the projected lines

from the base.

5. Join the points of intersection, to give the required conical helix.
6. Draw the front elevation and plan of the cone, and divide the plan view into a convenient number of parts (say 12) and number them as shown.
7. Project the points on the circumference of the base up to the front elevation, and continue the projected lines to the apex of the cone.
8. The lead must now be divided into the same number of parts as the base, and numbered. Draw lines of intersection from the lead to correspond with the projected lines from the base.
9. Join the points of intersection, to give the required conical helix

Exercises

Choose the correct answer from the given alternatives.

1. For eccentricity in ellipse (e) which relation is correct?

   a. $e < 1$ b. $e = 1$ c. $e > 1$ d. $e = \infty$

2. A curve defined by an equation x2/a2 + y2/b2 = 1 is known as _____

   a. Ellipse b. Directrix c. Parabola d. Hyperbola

3. The curve generated by a point on the circumference of a circle, rolling along another circle inside it, is called a _____

   a. Epicycloid b. Epitrochoid c. Hypocycloid d. Trochoid

4. Which of the following is not true regarding concentric and eccentric circles?

   a. Concentric circles have a common centre point

   b. Eccentric circles have no common centre point

   c. Concentric circles have no common centre point

   d. Two or more circles with a common centre point are called concentric

5. Which of the following is not present in a circle?

   a. Angle b. Centre c. Sector d. Eccentricity

Write short answer to the following questions.

1. Differentiate between epicycloid and hypocycloid.
2. Define a cycloid? How a tangent is drawn at a point on a cycloid?
3. What is an epicycloid? Give its practical applications.
4. What is a hypocycloid? Give its practical applications.
5. Define an involute of a polygon.

Write long answer to the following questions.

1. Construct a Helix (Cylindrical) Given: Diameter of a circle
2. Construction of a Cycloid
3. Take diameter of rolling circle= 50mm.

Project Work

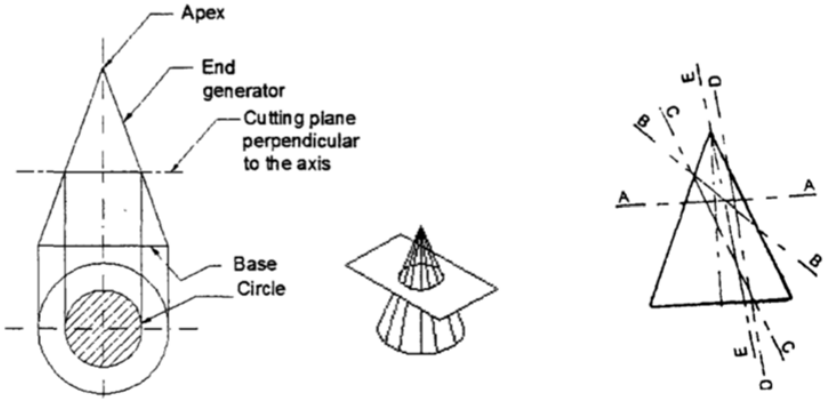
1. Demonstration of different types curves and their construction method in classroom in group of 4-5 students.

Unit 13 : Draw Parabola and Ellipse

13.1 Introduction of Cone and Its Terminology and Various Shapes

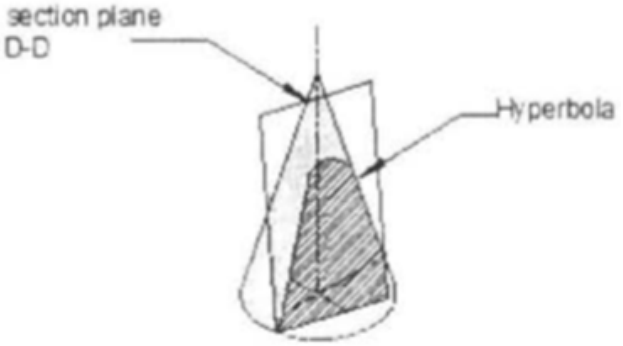
A) Conic Section

Conic section formed when right angle triangle with an apex, an angle is rotated at the altitude on the axis. The length or the height of the cone is equal to the base of triangle. The apex angle of the cone is q and when the cone is cut by a plane the cut formed along the section is known as conic section. Cone is formed when a right angled triangle with an apex and angle e is rotated about its altitude as the axis. The length or height of the cone is equal to the altitude of the triangle and the radius of the base of the cone is equal to the base of the triangle. The apex angle of the cone is 2.

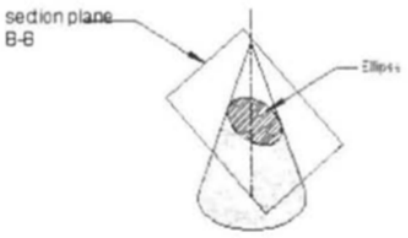


Fig; Conic Section

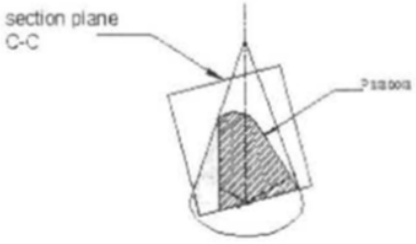
When a cone is cut by a plane, the curve formed along the section is known as a Conic. For this purpose, the cone may be cut by different section planes and the conic sections obtained



e- Hyperbola



c- Ellipse



d- Parabola

Types of conic section

1) Circular conic section
2) Elliptical conic section
3) Parabolic conic section
4) Hyperbolic conic section

1) Circular conic section

When a conic is cut by a plane at the section making angle of 90 degree with the axis the section obtained is known as circular conic section.

2) Elliptical conic section:

When the cone is cut by a plane and a section A-A making angle more than half of apex angle. The obtained section is elliptical conic section.

3) Parabolic conic section:

When a section is parallel to the slant of cone than the section obtained is parabolic conic section.

4) Hyperbolic conic section:

If the section plane is not passing through the apex, the apex line of the cone is known as the hyperbolic conic section.

13.2 Ellipse (concentric circle, oblong, and foci method)

When a cone is cut by a section plane B-B at an angle, a more than half of the apex angle i.e., e and less than 90°, the curve of the section is an ellipse. Its size depends on the angle and the distance of the section plane from the apex of the cone. An ellipse has two unequal diameters or axes, which are at right angles to each other. The longer one is called the transverse diameter, and the shorter one the conjugate diameter. The transverse diameter is also called the major axis and the conjugate diameter the minor axis, as CD.

Finding the Foci Points of an Ellipse

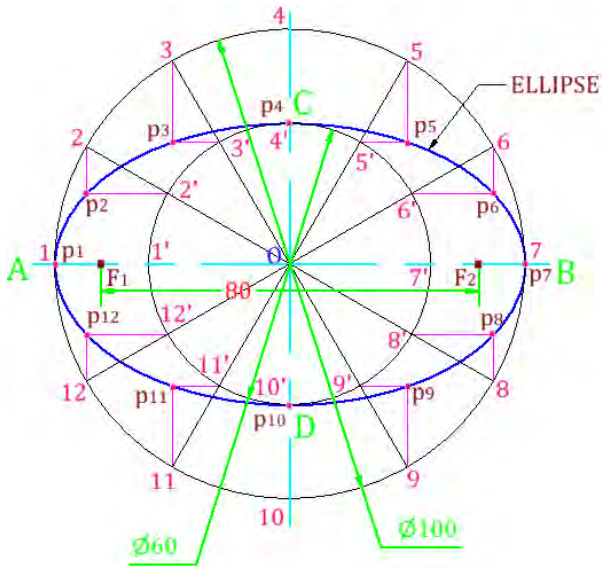
The foci points are found by striking arcs with radius equal to half the major axis & with center at the end of the minor axis (point C or D)

Concentric Circle Method

Construct two concentric circles equal in diameter to the major and minor axes of the required ellipse. Let these diameters be AB and CD. Divide the circles into any number of parts; the parts do not necessarily have to be equal. The radial lines now cross the inner and outer circles. Where the radial lines cross the outer circle, draw short lines parallel to the minor axis CD. Where the radial lines cross the inner circle, draw lines parallel to AB to intersect with those drawn from the outer circle. The points of intersection lie on the ellipse. Draw a smooth connecting curve.

Concentric Circle Method

To draw a parabola with the distance of the focus from the directrix at 50mm (Eccentricity method).



1. Draw the line AB and Draw perpendicular to CD to AB
2. Take AF= 50mm, F being focus.
3. Make V so that AV=VF or AV=25.
4. Mark E in Perpendicular VE. Extend AE.
5. Mark 1, 2,3,4,5 at equal distance.
6. Extend 1,2,3,4,5, up and down to meet up to extended line of AE @1',2',3',4',5'.
7. Take radius 11' and bisect at p1 taking F as center
8. Similarly take radius 22', 33', 44', 55' and bisect @ p2, p3, p4, p5 taking F as center.
9. Similarly bisect @p1', p2', p3', p4', p5'.
10. Join p1p2, p3, p4, p5 and also p1', p2', p3', p4', and p5'.
11. Get parabola.

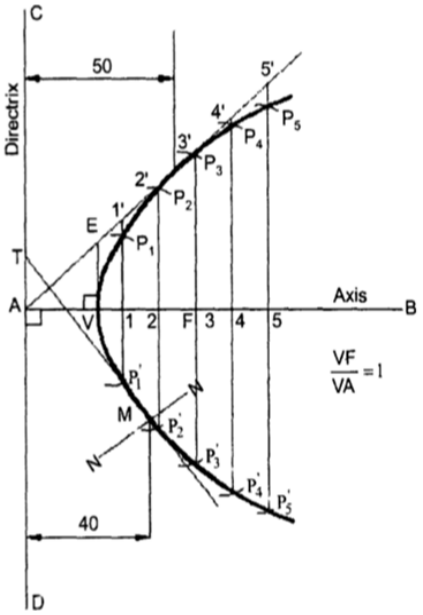
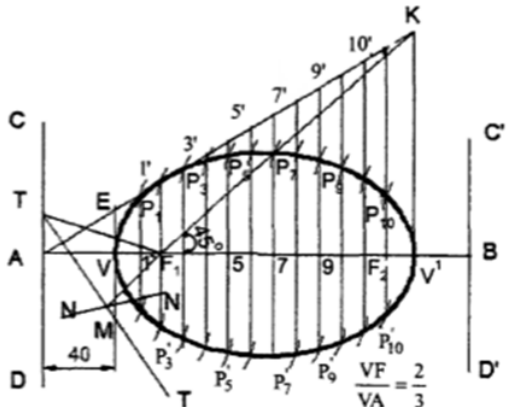


Fig. Construction of a Parabola -Eccentricity Method

To draw a normal and tangent through a point 40mm from the directrix.

To draw a tangent and normal to the parabola. Locate the point M which is at 40mm from the direct Qx. Then join M to F and draw a line through F, perpendicular to MF to meet the directrix at T. The line joining T and M and extended is the tangent and a line NN, through M and perpendicular to TM is the normal to the curve.

To draw an Ellipse with eccentricity equal to 2/3 for the above problem



Construction is similar to the one in fig. to draw an ellipse including the tangent and normal. Only the eccentricity is taken as 2/3 instead of one.

Problem: Draw an ellipse with major axis 120 mm and minor axis 80 mm.

Determine the eccentricity and the distance between the directories.

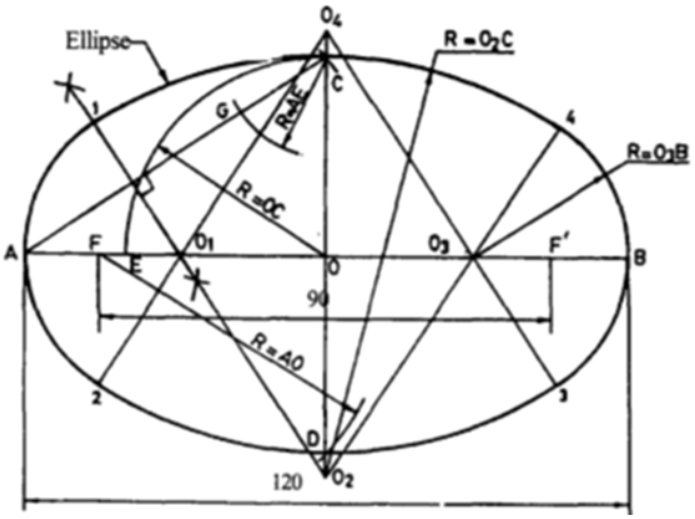
Steps:

Eccentricity e = VI FI / VI A = VI F2 / VIB therefore VI F2-VIFI / VIB-VIA = FI F2/ V1V2 From the triangle FI CO OC = 40 mm (half of minor axis) File = 60 mm (half of major axis) Thus FO = 602 -402 = 44.7mm Hence Fl2 = 2FIO = 89.4 mm

On substitution e = 89.4 = 0.745Also, eccentricity e = VI V JAB, Hence, the distance between 120 - the directories AB = VIV /e = 161mm

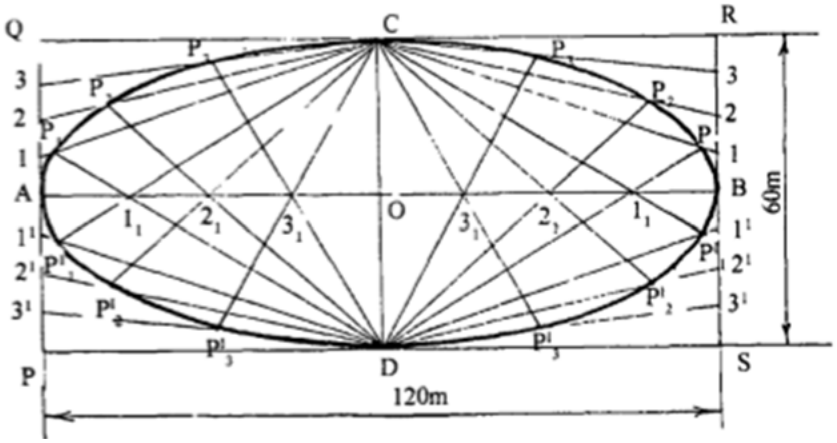
Problem: The foci of an ellipse are 90 mm apart and the major axis is 120 mm long. Draw the ellipse by using four center methods.

1. Draw the major axis AB = 120 mm. Draw a perpendicular bisector COD. Mark the foci F and P such that FO = PO = 45 mm.
2. With center F and radius = AO = 60 mm draw arcs to cut the line COD at C and D as shown in Fig. 4.51. Now, CD is the minor axis.
3. Join AC .With ° as center and radius = OC draw an arc to intersect the line AB at E.
4. With C as center and AE as radius draw an arc to intersect the line AC at G
5. Draw perpendicular bisectors of the line AG to intersect the axis AB at °1 and the axis CD (extended) at 02' now °1 and 02 are the centers of the two arcs. The other two centers 03 and 04 can be located by taking 003 = 0°1 and 004 = 002' Also locate the points 1, 2, 3 and 4 as shown.
6. With center 03 and radius = 03B draw an arc 4B3 and with center 02 and radius = 02C draw an arc 1 C4. 7. Similarly draw arcs for the remaining portion and complete the ellipse.



Problem: A ground is in the shape of a rectangle 120 m X 60 mm. Inscribe an elliptical lawn in it to a suitable scale.

1. Draw the line AB and CD with length 120mm and 60mm resp. and bisect at O.
2. Divided the OA and OB in 4 equal parts
3. Prolong rays from C through the intersection points.
4. Prolong rays from D through the intersection points.
5. Draw lines parallel to AB both sides through C and D
6. Draw lines PQ and RS parallel to CD through A and B
7. Divide AP, AQ, BR, and BS to equal 4 parts.
8. Prolong rays from C and D both sides to the division
9. Join the point as in drawing and prepare ellipse.

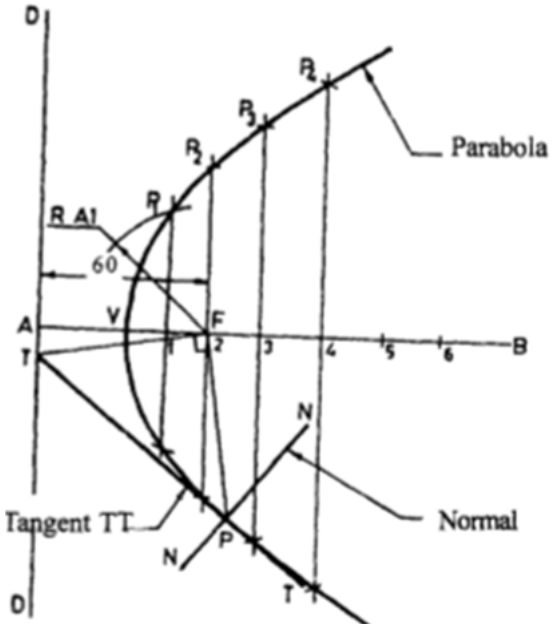


13.3 Parabola (rectangle, tangent method)

Parabolic Curve

The parabolic curve feds its application for reflecting surfaces of light, Arch forms, cable forms in suspension bridges, wall of uniform strength, etc.

The parabolic reflector may be used as a solar heater. When it is properly adjusted, the sun rays emanating from infinite distance concentrate at the focus and thus produce more heat. The wall bracket of parabolic shape exhibits equal bending strength at all sections.



Construction of a Parabola

Construct the rectangle PQRS such that PS is the double ordinate and PQ = RS = VO (abscissa).

1. Divide PQ and RS into any number of (say 8) equal parts as 1, 2, ... 8 and 11 21 .... 81 respectively, starting from P on PQ and S on SR. Join 1,2, ... 8 and 11,21 .... 81 with V.
2. Divide PO and OS into 8 equal parts as 1121 ..... 81 and 1'12..... 8'1 respectively, starting from P on PO and from S on SO.
3. From 11 erect vertical to meet the line VI at PI'

4. Similarly from 21, 81 erect verticals to meet the lines V2,.... V8 at P2.... Pg respectively.
5. Also erect verticals from III 2and to meet the lines VI'.... V21..... V81 at PII ....P 2 1 '" ...P81 respectively.
6. Join P, PI' P2, ••••••• PI7.VI .....Pll and S to represent the path of the ball which is a parabola.

Problem: Draw a parabolic arc with a span of 1000 nun and a rise of 800 mm. U.se rectangular method. Draw a tangent and normal at any point P on the curve.

Solution: (Fig.4.58)

1. Draw an enclosing rectangle ABCD with base AB = 1000 mm and height BC = 800 mm using a suitable scale.
2. Mark the axis VH of the parabola, where V is the vertex and mid-point of line CD. Divide DV and AD into the same number of equal parts (say 4). 3. Draw a vertical line through the point II lying on the line DV. Join V with 1 on the line

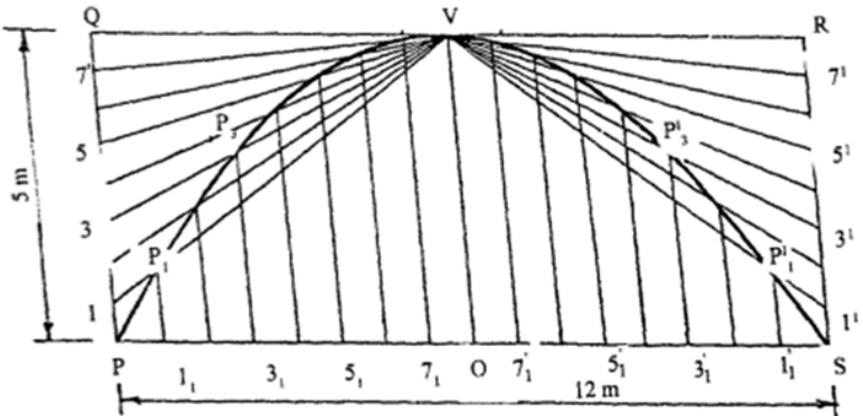


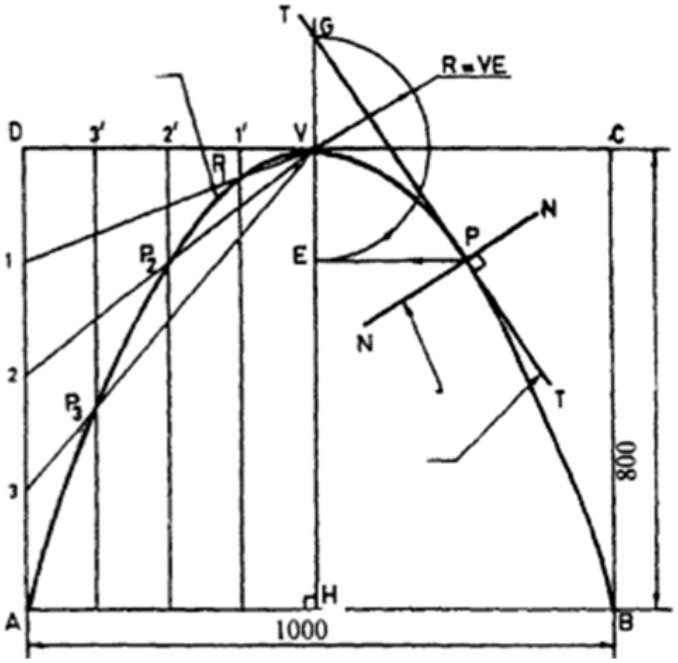
Fig. Rectangle Method

These two lines intersect at point PI as shown in Fig. Similarly obtain other points

P 2'P 3' etc. 5. Draw a smooth curve passing through these points to obtain the required parabola.

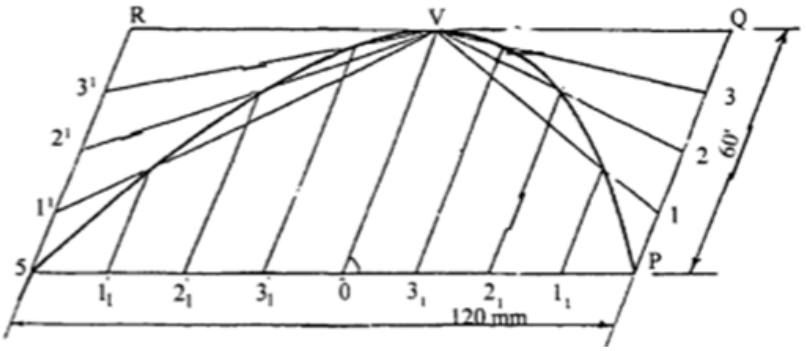
Problem: Construct a parabola within a parallelogram of sides 120mm X 60 mm.

One of the included angles between the sides is 75°.



1. Construct the parallelogram PQRS (PS = 120 mm PQ = 60 mm and angle QPS = 75°). Bisect PS at 0 and draw VO parallel to PQ.
2. Divide PO and SR into any number of (4) equal parts as 1, 2, 3 and 11,21 , 31 respectively starting from P on PQ and from S on SR. Join VI, V2 & V3. Also join VI1, V21, and V31
3. Divide PO and OS into 4 equal parts as 11,21,31 and 1 \ ,2\ ,311 respectively starting from P on PO and from So on SO.
4. From 1I draw a line parallel to PQ to meet the line VI at PI' similarly obtain the points P: and P.
5. Also from 1\ ,21 1,3\ draw lines parallel to RS to meet the lines VII, V21, and V31 at P/, P2I, and P31 respectively and draw a smooth parabola

Problem: A fountain jet discharges water from ground level at an inclination of 55°to the ground. The jet travels a horizontal distance of 10m from the point of discharge and falls on the ground. Trace the path of the jet.



1. Taking the scale as 1: 100 draw PQ = 10 cm. Jet discharges water at 55° to the ground. So, at P and Q draw 55° lines to intersect at R. PQR is an isosceles triangle.
2. Bisect PQ at O. At 0, erect vertical to pass through R. Bisect OR at V, the vertex.
3. Divide PR into any number of (say 8) equal parts as 1, 2, ... 7 starting from P on PR. Divide RQ into same number of (8) equal parts as 11 , 21 .... 71 starting from R on RQ.
4. Join 1, 11 and also 7, 71. Both will meet the vertical OR at a point. Join 2, 21, and also 6, 61,. Both will meet the vertical OR at another point. Join 3, 31 and also 5,51. Both will meet the vertical OR at a third point. Join 4, 41 and it will meet the vertical OR at V.
5. Draw a smooth parabola through P, V, Q such that the curve is tangential to the lines 1 II, 221,771 .

Exercises

Choose the correct answer from the given alternatives.

1. Which of the following is incorrect about Ellipse?
   a. Eccentricity is less than 1
   b. Mathematical equation is $X^2/a^2 + Y^2/b^2 = 1$
   c. If a plane is parallel to axis of cone cuts the cone then the section gives ellipse
   d. The sum of the distances from two focuses and any point on the ellipse is constant

2. Which of the following constructions doesn't use elliptical curves?
   a. Cooling towers b. Dams
   c. Bridges d. Man-holes

3. The line which passes through the focus and perpendicular to the major axis is _____
   a. Minor axis b. Latus rectum c. Directrix d. Tangent

4. Which of the following is the eccentricity for an ellipse?
   a. 1 b. 3/2 c. 2/3 d. 5/2

5. Axes are called conjugate axes when they are parallel to the tangents drawn at their extremes.
   a. True b. False

6. Steps are given to draw an ellipse by loop of the thread method. Arrange the steps.
   i. Check whether the length of the thread is enough to touch the end of minor axis.
   ii. Draw two axes AB and CD intersecting at O. Locate the foci F1 and F2.
   iii. Move the pencil around the foci, maintaining an even tension in the thread throughout and obtain the ellipse.
   iv. Insert a pin at each focus-point and tie a piece of thread in the form of a loop around the pins.
      a. i, ii, iii, iv
      b. ii, iv, i, iii
      c. iii, iv, i, ii
      d. iv, i, ii, iii

7. Steps are given to draw an ellipse by trammel method. Arrange the steps.

   i. Place the trammel so that R is on the minor axis CD and Q on the major axis AB. Then P will be on the ellipse.

   ii. Draw two axes AB and CD intersecting each other at O.

   iii. By moving the trammel to new positions, always keeping R on CD and Q on AB, obtain other points and join those to get an ellipse.

   iv. Along the edge of a strip of paper which may be used as a trammel, mark PQ equal to half the minor axis and PR equal to half of major axis.

   a. i, ii, iii, iv

   b. ii, iv, i, iii

   c. iii, iv, i, ii

   d. iv, i, ii, iii

8. Steps are given to draw a normal and a tangent to the ellipse at a point Q on it. Arrange the steps.

   i. Drawa line ST through Q and perpendicular to NM.

   ii. ST is the required tangent.

   iii. Join Q with the foci F1 and F2.

   iv. Draw a line NM bisecting the angle between the lines drawn before which is normal.

   a. i, ii, iii, iv

   b. ii, iv, i, iii

   c. iii, iv, i, ii

   d. iv, i, ii, iii

Write short answer to the following questions.

1. Write differences between Construction of parabola by rectangle method and tangent method.

2. Draw a parabola with the distance of the focus from the directrix at 50mm (Eccentricity method).

Write long answer to the following questions.

1. Problem: A ground is in the shape of a rectangle 120 m X 60 mm. Inscribe an elliptical

lawn in it to a suitable scale.

2. Write down the steps of Construction of ellipse by foci and concentric circle method

Project Work

1. Demonstration of different types of ellipse and parabola and their construction method in classroom in group of 4-5 students.

Unit 14 : Orthographic Projection

14.1 Theory of Projection

Theory of projection

Projection is defined as an image or drawing of an object made on a plane. All drawings used in the field of engineering are based on the principles of projection. That is why engineering drawings are capable to precisely convey the external as well as internal features of objects in terms of their shape and size. Projections can be classified on the basis of line of sight and the position of plane on which the drawing is made. Projection lines are parallel, (while in case of perspective they come from a fixed point) visible rays perpendicular to the plane of the projection. Object may be behind or in front of the plane of the projection, while the viewer will be at infinity. Three principle planes of projections are Horizontal plane, Vertical plane and Profile plane (a plane perpendicular to both horizontal and vertical plane where side view lies).

Basic Principle of Projection

To better understand the theory of projection, one must become familiar with the elements that are common to the principles of projection. First of all, the POINTOF SIGHT (aka STATION POINT) is the position of the observer in relation to the object and the plane of projection. It is from this point that the view of the object is taken. Secondly, the observer views the features of the object through an imaginary plane.

14.2 Introduction Principal Plane

PLANE OF PROJECTION (or IMAGE PLANE). Imagine yourself standing in front of a glass window, IMAGE PLANE, looking outward; the image of a house at a distance is sketched on to the glass and is a 2D view of a 3D house. As per the optical physics, an object is seen when the light rays called visual rays coming from the object strike the observer's eye. The size of the image formed in the retina depends on the distance of the observer from the object. If an imaginary transparent plane is introduced such that the object is in between the observer and the plane, the image obtained on the screen is as shown in Figure. This is called perspective view of the object. Here, straight lines (rays) are drawn from various points on the contour of the object to meet the transparent plane, thus the object is said to be projected on that plane. The figure or view formed by joining, in correct sequence, the points at which these lines meet the plane is called the projection of the object. The lines

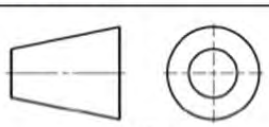
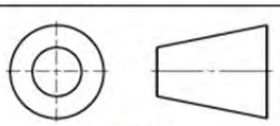
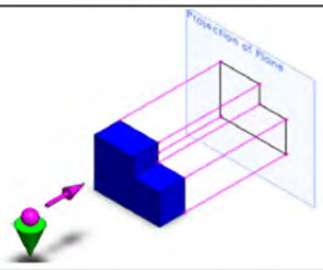
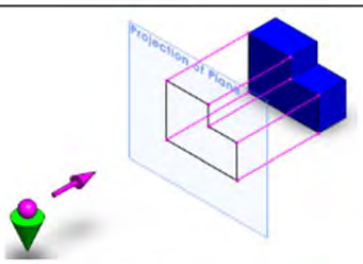
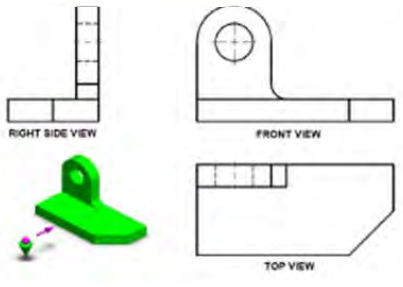
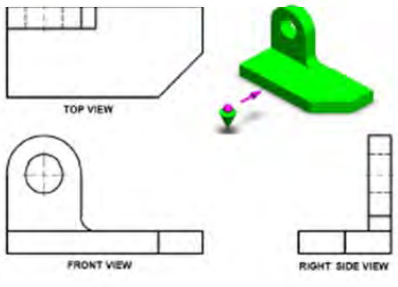
or rays drawn from the object to the plane are called projectors. The transparent plane on which the projections are drawn is known as plane of projection

14.3 Introduction of First and Third Angle Projection

Introduction of first angle and third angle projection

In third-angle projection, the view of a component is drawn next to where the view was taken. In first-angle projection, the view is drawn on the other end of the component, at the opposite end from where the view was taken

14.4 Difference Between First and Third Angle Projection.

First Angle Projection	Third Angle Projection
The object is imagined to be in first quadrant.	The object is imagined to be in third quadrant.
The object is lies between the observer and plane of projection.	The plane of projection lies between the observer and object.
The plane of projection is assumed to be non transparent.	The plane of projection is assumed to be transparent.
When view are drawn in their relative position Top view comes below Front view, Right side view drawn to the left side of elevation.	When view are drawn in their relative position Top view comes above Front view, Right side view drawn to the right side of elevation.
 SYMBOL	 SYMBOL
	
 RIGHT SIDE VIEW FRONT VIEW TOP VIEW	 TOP VIEW FRONT VIEW RIGHT SIDE VIEW

14.5 Projection of Point(s) and line(s) in First Angle

Projection

Projection of Points and Lines in First Angle Projection

Method of Obtaining Front View

Imagine an observer looking at the object from an infinite distance. The rays are parallel to each other and perpendicular to both the front surface of the object and the plane. When the observer is at a finite distance from the object, the rays converge to the eye as in the case of perspective projection. When the observer looks from the front surface F or the block, its true shape and size is seen. When the rays or projectors are extended further they meet the vertical plane (V.P) located behind the object. By joining the projectors meeting the plane in correct sequence the Front view is obtained. Front view shows only two dimensions of the object, via. Length "L" and height". It does not show the breadth "B". Thus one view or projection is insufficient for the complete description of the object. As Front view alone is insufficient for the complete description of the object, another plane called Horizontal plane (H.P) is assumed such that it is hinged and perpendicular to V.P and the object is in front of the V.P and above the H.P

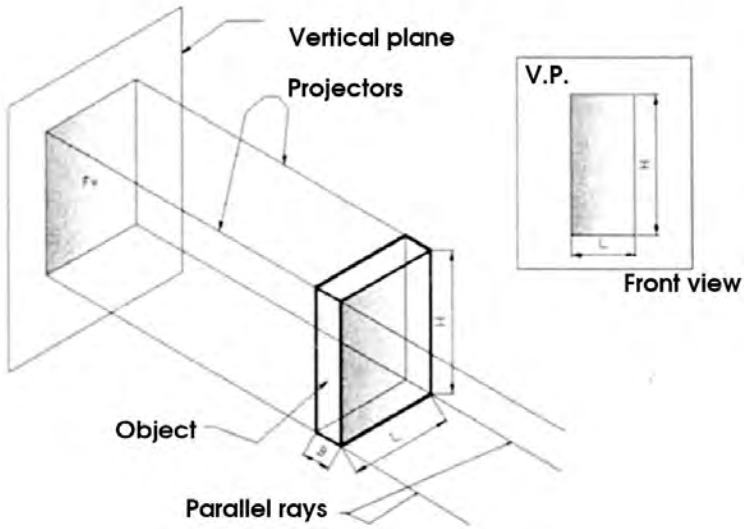
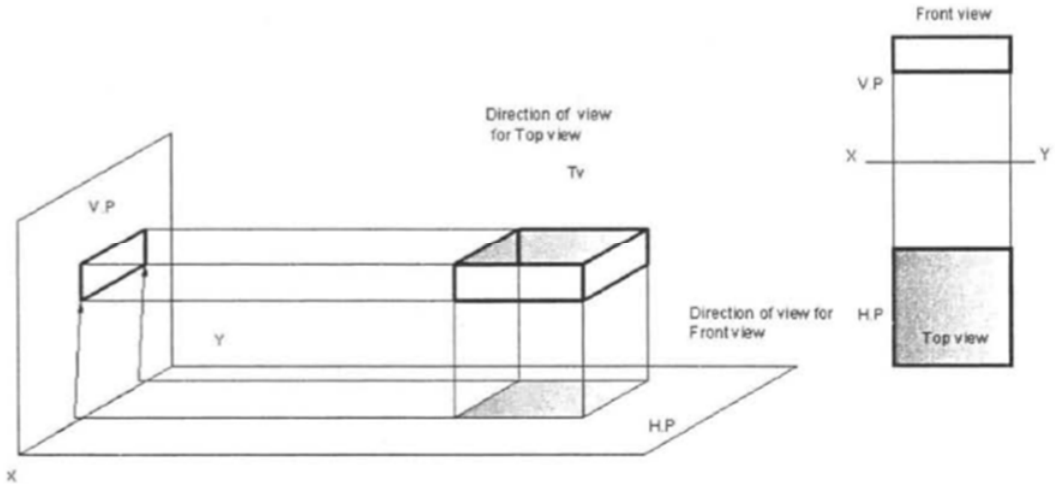


Fig:-Method of Obtaining Orthographic Top View.

Method of Obtaining Top View

Looking from the top, the projection of the top surface is the Top view (TP). Both top surface and Top view are of exactly the same shape and size. Thus, Top view gives the True length L and breadth B of the block but not the height H.



Note:

(1) Each projection shows that surface of the object which is nearer to the observer. And far away from the plane.

(2) Orthographic projection is the standard drawing form of the industrial world Y Line: The line of intersection of VP and H.P is called the reference line and is denoted as xy.

Obtaining the Projecting on the Drawing Sheet

It is convention to rotate the H.P through 900 in the clockwise direction about xy line so that it lies in the extension of VP as shown in Fig. The two projections Front view and Top view may be drawn on the two dimensional drawing sheet as shown in Figure.

Thus, all details regarding the shape and size, Viz. Length (L), Height (H) and Breadth (B) of any object may be represented by means of orthographic projections i.e., Front view and Top view.

Obtaining the Projecting on the Drawing Sheet

It is convention to rotate the H.P through 900 in the clockwise direction about xyline so that it lies in the extension of VP as shown in Fig. The two projections Frontview and Top view may be drawn on the two dimensional drawing sheet as shown in Figure. Thus, all details regarding the shape and size, Viz. Length (L), Height (H) and Breadth (B) of any object may be represented by means of orthographic projections i.e., Front view and Top view.

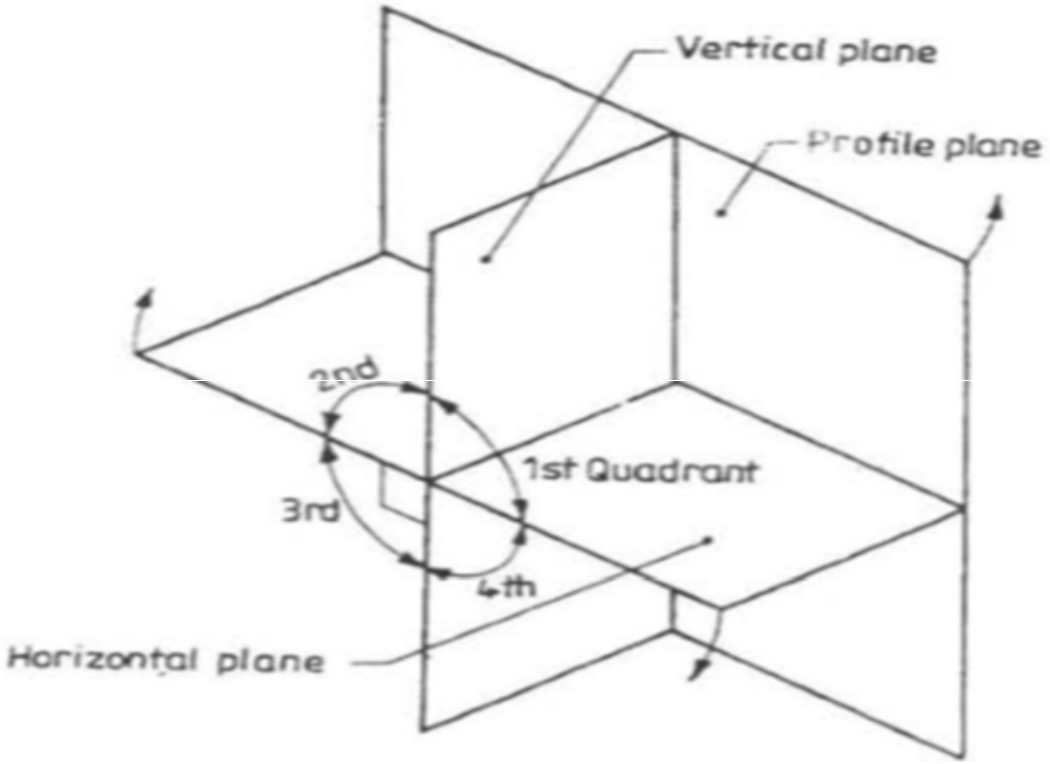
Terms Used

V.P and H.P are called as Principal planes of projection or reference planes. They are always

transparent and at right angles to each other. The projection on VP is designated as Front view and the projection on H.P as Top view.

Four Quadrants

When the planes of projections are extended beyond their line of intersection, they form Four Quadrants. These quadrants are numbered as I, II, ill and IV in clockwise direction when rotated about reference line xy as shown in Figure



In the Figure the object is in the first quadrant and the projections obtained are "First angle projections" i.e., the object lies in between the observer and the planes of projection. Front view shows the length (L) and height (H) of the object, and Top view shows the length (L) and the breadth (B) of it.

Orthographic Projections

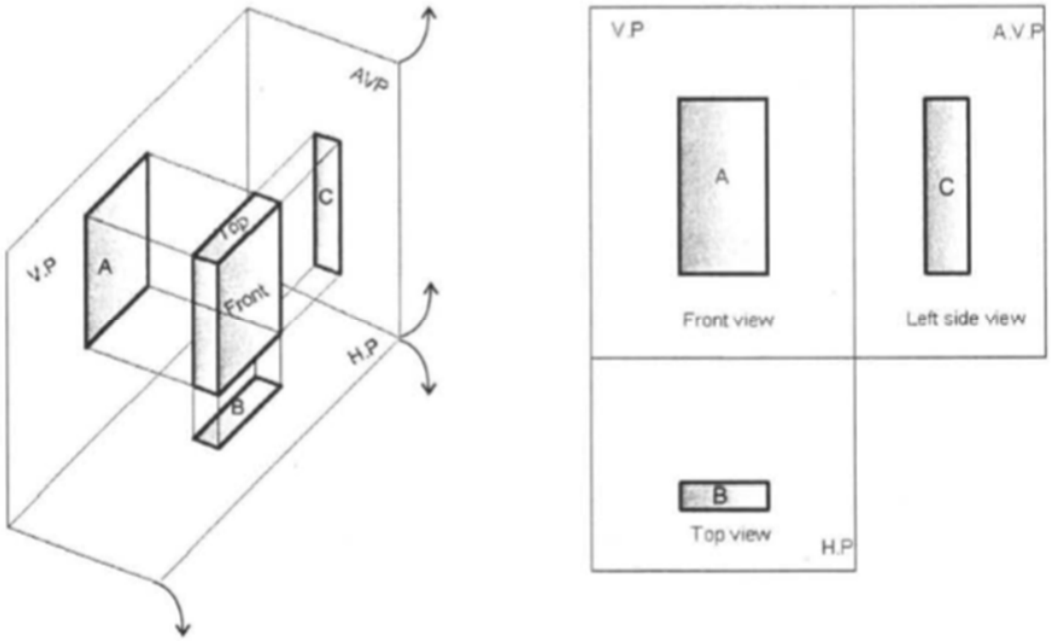


Fig. Orthographic Projection of Front, Top and Side views

The object may be situated in anyone of four quadrants, its position relative to the planes being described as in front of Y.P and above H.P in the first quadrant and so on. Figure shows the two principle planes H.P and V.P and another Auxiliary vertical plane (AVP). AVP is perpendicular to both VP and H.P.

Front view is drawn by projecting the object on the V.P. Top view is drawn by projecting the object on the H.P. The projection on the VP as seen from the left of the object and drawn on the right of the front view is called left side view.

14.6 Projection of Line: Parallel to HP, Parallel to VP and Perpendicular to HP and VP. Inclined to HP and VP

Parallel to HP

A line **parallel** to the horizontal plane is called **horizontal** (level) **line** and all its points have the same distance to the horizontal plane, i.e. have the same zcoordinate. Therefore, the vertical projection of that line is parallel to the groundline x. A horizontal line does not have a horizontal trace.

Parallel to VP

If a line is parallel to the vertical plane all its points have the same distance to the vertical

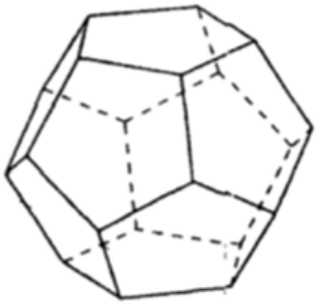
plane, i.e. have the same **y**-coordinate. Such line is called **vertical** (frontal) **line.** Hence, the **horizontal projection** of the line is **parallel** to the **x-axis**. A vertical line does not have a vertical traces.

14.7 Orthographic Projection of Prism, Cylinder, Pyramid and Cone

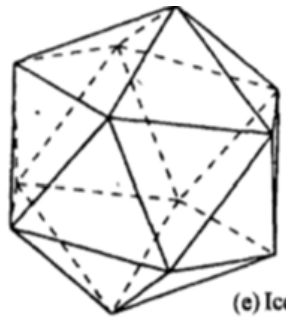
Introduction

A solid has three dimensions, the length, breadth and thickness or height. A solidmay be represented by orthographic views, the number of which depends on thetype of solid and its orientation with respect to the planes of projection. Solids areclassified into two major groups.

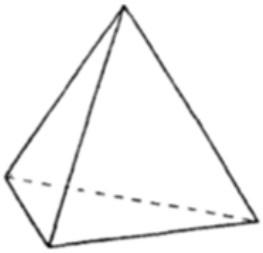
(i) Polyhedral, and (ii) Solids of revolutionPolyhedralA polyhedral is defined as a solid bounded by plane surfaces called faces. They are:i. Regular polyhedronii. Prisms andiii. Pyramids.Regular Polyhedron A polyhedron is said to be regular if its surfaces are regular polygons. Thefollowing are some of the regular polyhedron



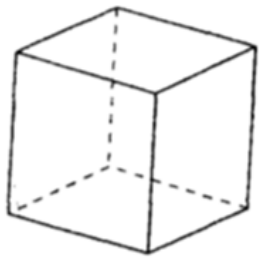
(d) Dodecahedron



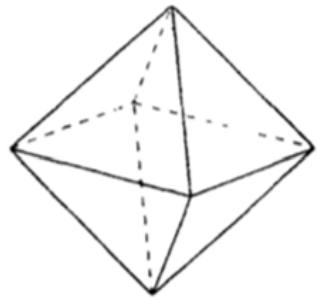
(e) Icosahedron



(a) Tetrahedron



(b) Hexahedron(cube)



(c) Octahedron

(a) Tetrahedron: It consists of four equal faces, each one being a equilateral triangle.

(b) Hexahedron (cube): It consists of six equal faces, each a square.

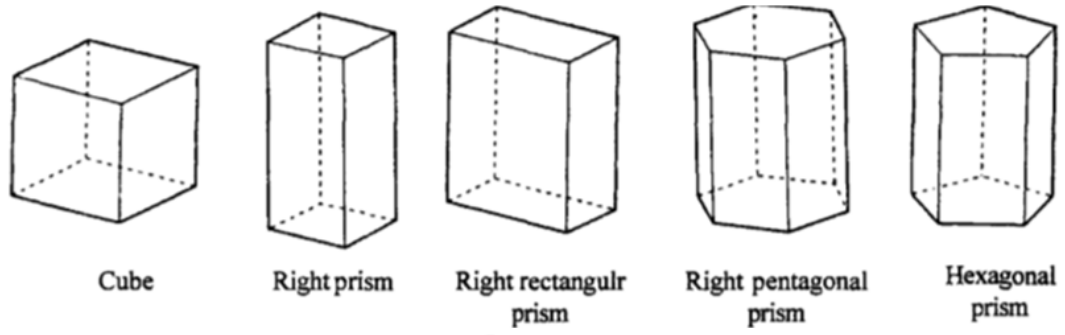
(c) Octahedron: It has eight equal faces, each an equilateral triangle.

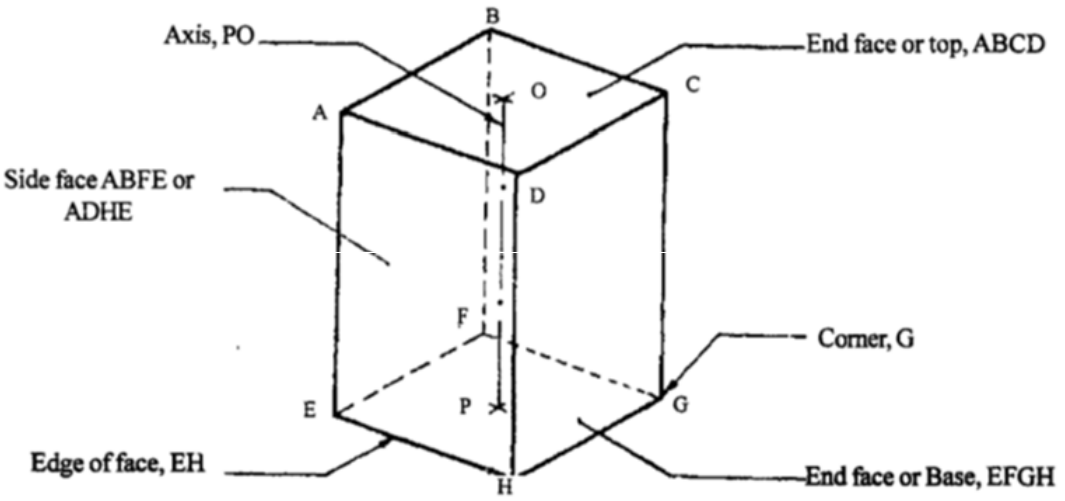
(d) Dodecahedron: It has twelve regular and equal pentagonal faces.

(e) Icosahedrons: It has twenty equal, equilateral triangular faces.

Prisms

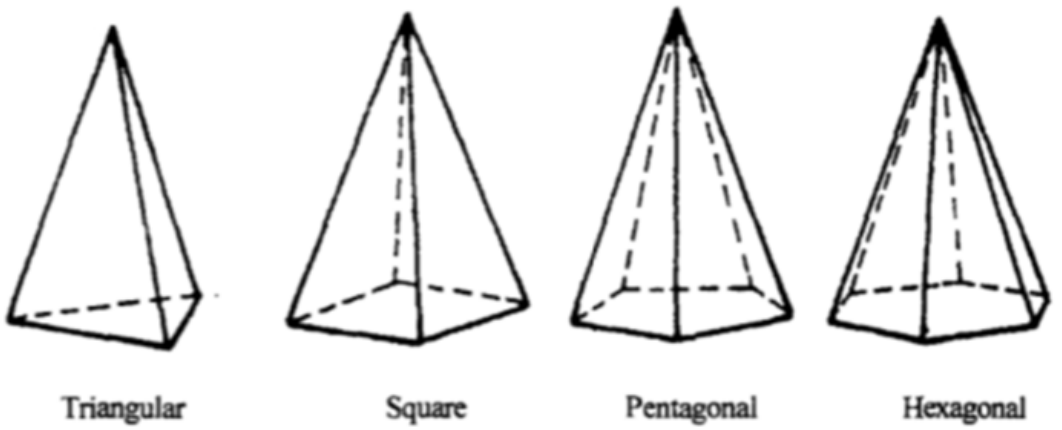
A prism is a polyhedron having two equal ends called the bases parallel I to each other. The two bases are joined by faces, which are rectangular in shape. The imaginary line passing through the centers of the bases is called the axis of the prism. A prism is named after the shape of its base. For example, a prism with square base is called a square prism, the one with a pentagonal base is called pentagonal prism, and so on the nomenclature of the prism is given in Fig.

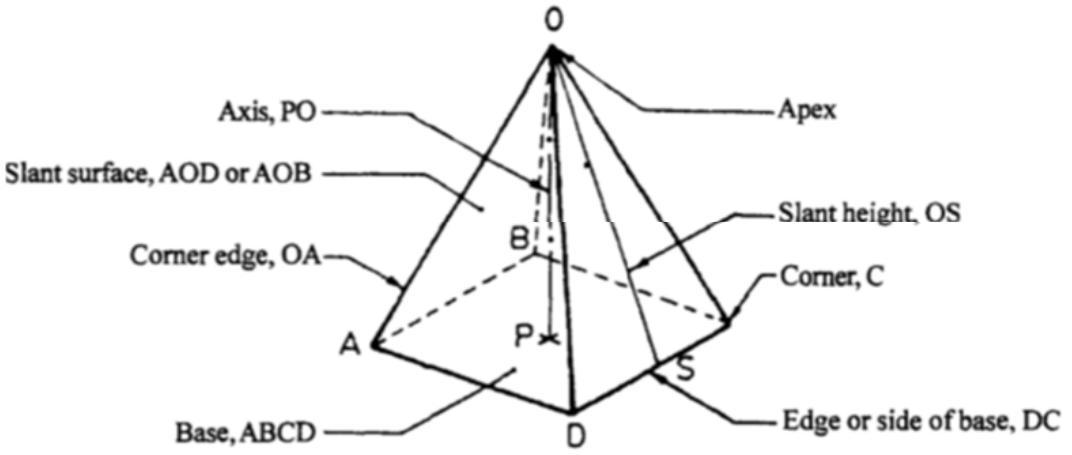




Pyramids

A pyramid is a polyhedron having one base, with a number of isosceles triangular faces, meeting at a point called the apex. The imaginary line passing through the center of the base and the apex is called the axis of the pyramid. The pyramid is named after the shape of the base. Thus, a square pyramid has square base and pentagonal pyramid has pentagonal base and so on (Fig.6.4 (a)).The nomenclature of a pyramid is shown in Fig.6.4 (b).





14.8 Orthographic Projection of Different Models with Flat, Inclined and Circular Surface

Solids of Revolution

If a plane surface is revolved about one of its edges, the solid generated is called a solid of revolution. The examples are:-

(i) Cylinder

(ii) Cone

(iii) Sphere

Frustums and Truncated Solids

If a cone or pyramid is cut by a section plane parallel to its base and the portion containing the apex or vertex IS removed, the remaining portion is called frustum of a cone or pyramid.

Prisms (problem) Position of a Solid with Respect to the Reference Planes

The position of solid in space may be specified by the location of the axis, base, edge, diagonal or face with the principal planes of projection. The following are the positions of a solid considered.

1. Axis perpendicular to one of the principal planes.
2. Axis parallel to both the principal planes.
3. Axis inclined to one of the principal planes and parallel to the other.
4. Axis inclined to both the principal planes.

The position of solid with reference to the principal planes may also be grouped as follows:

1. Solid resting on its base.
2. Solid resting on anyone of its faces, edges of faces, edges of base, generators, slant edges, etc.
3. Solid suspended freely from one of its comers, etc.

Theory

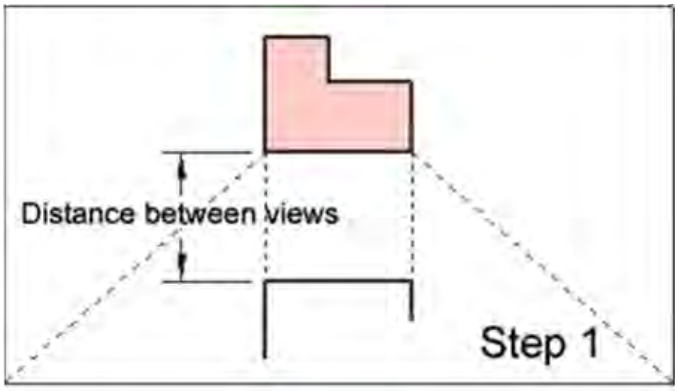
'ORTHO' means right angle and orthographic means right angled drawing. When the projectors are perpendicular to the plane on which the projection is obtained, it is known as orthographic projection.

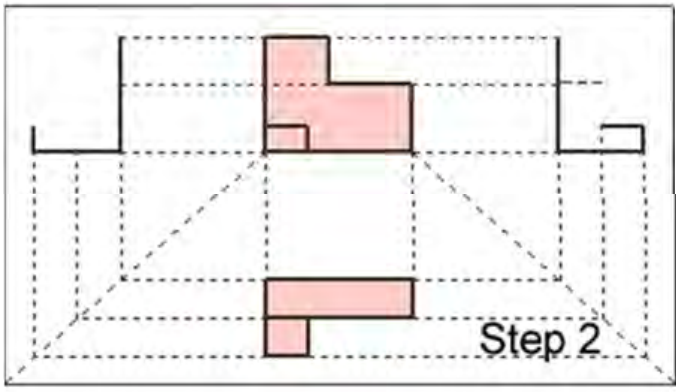
Procedure

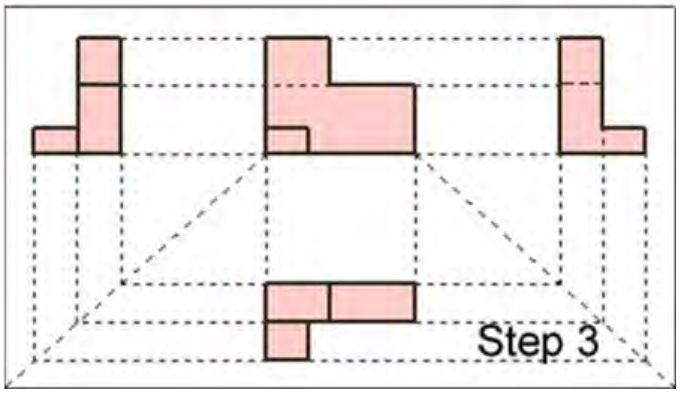
1. Place the paper in landscape mode, long dimension left and right.
2. Choose the front view, see the instructions for front view choice in the rules for making an orthographic projection.
3. Draw the FRONT VIEW IN THE LOWER LEFT AREA OF THE PAPER. The Front View is our base view, with all other views aligned with the Front. Draw the Front View to scale using construction lines, object lines and making sure all lines are straight and neat.
4. Draw the TOP VIEW above the Front View. Extend the construction lines for the front view up to the area of the Top View. The left side of the top view should exactly line up with the left side of the front view. This also applies to the right side. Finish the Top View.

5. Draw the SIDE VIEW to the right of the Front View. Extend the construction lines of the top and bottom of the Front View to the right to the location of the Side View. Finish the Side View. We have chosen the Right View perspective to always be used for this class.

6. If needed, we could arrange the drawing to show other views such as the bottom, left side and possibly a section view. This is beyond the scope of the class.







7. If time allows, the student may elect to create an ISOMENTRIC VIEW. This is typically placed in the upper right corner. Reduced scale is acceptable if needed.
8. After the required views are complete, the student will then add extension lines and dimension lines. A dimension line has arrowheads at the end that touch the extension lines or the object line. Dimension lines show the actual size of the object. The inch symbol " is usually omitted for this type of drawing. If needed, leader lines would be added to include additional information such as diameters of holes, radius of a curve or other important notes for the fabricator.
9. The student will then proceed to add a border to the drawing using a thick solid line approx. 3/8 inches from the edge of the paper.
10. The student will add a title block to their drawing. This is typically in the lower right corner of the paper, touching the border line in this area. The Title Block would show the name of the Organization/Company, the name of the drawing, the person's name who prepared the drawing and possibly the date and revision.
11. To complete the drawing, any extraneous marks such as unused construction lines would be erased.

Exercise

Choose the correct answer from the given alternatives.

1. The straight lines which are drawn from various points on the contour of an object to meet a plane are called as _____

   a. Connecting lines
   b. Projectors
   c. Perpendicular lines
   d. Hidden lines.

2. When the projectors are parallel to each other and also perpendicular to the plane, the projection is called _____

   a. Perspective projection
   b. Oblique projection
   c. Isometric projection
   d. Orthographic projection

3. In the Oblique projection an object is represented by how many views?

   a. One view
   b. Two views
   c. Three views
   d. Four views

4. The object we see in our surrounding usually without drawing came under which projection?

   a. Perspective projection
   b. Oblique projection
   c. Isometric projection
   d. Orthographic projection

5. In orthographic projection, each projection view represents how many dimensions of an object?

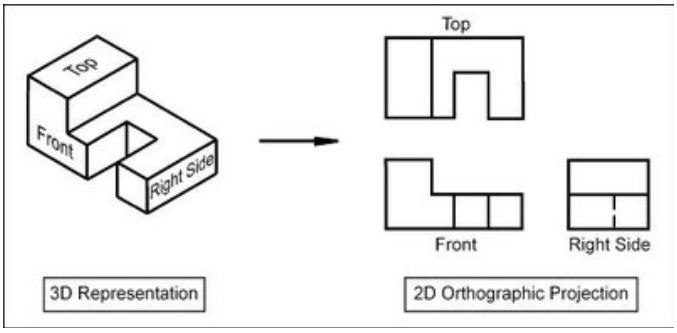
   a. 1 b. 2 c. 3 d. 0

6. In orthographic projection an object is represented by two or three views on different planes which _____

   a. Gives views from different angles from different directions
   b. Are mutually perpendicular projection planes
   c. Are parallel along one direction but at different cross-section
   d. Are obtained by taking prints from 2 or 3 sides of object

Write short answer to the following questions.

1. Draw the orthographic projection on the following object:



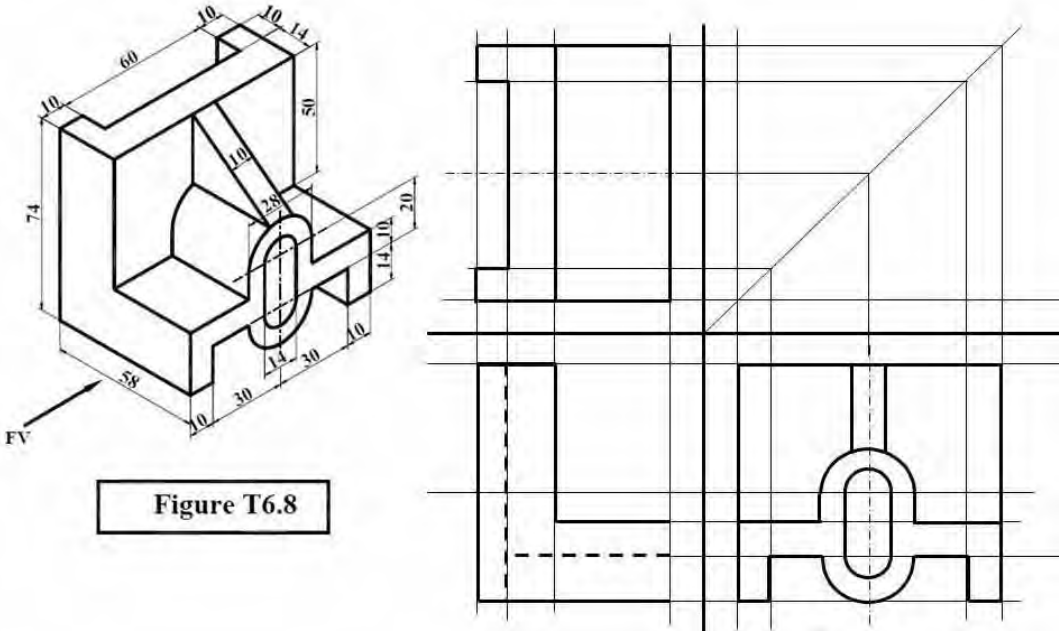
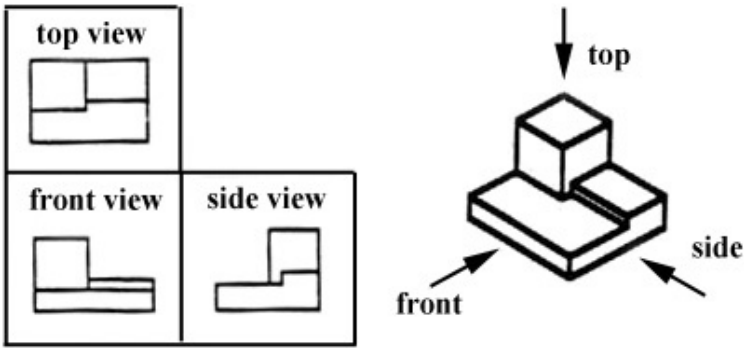
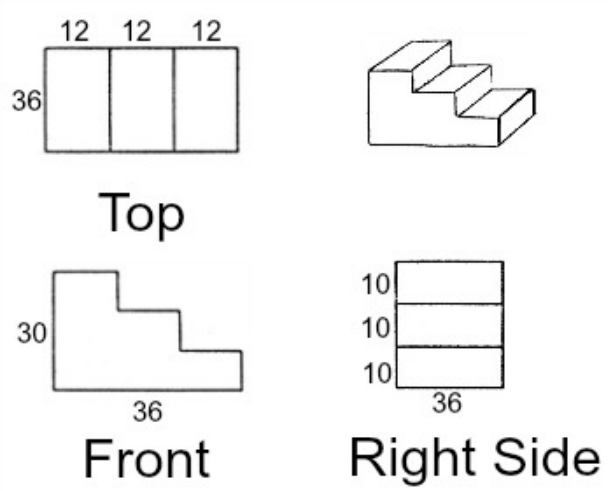


Figure T6.8

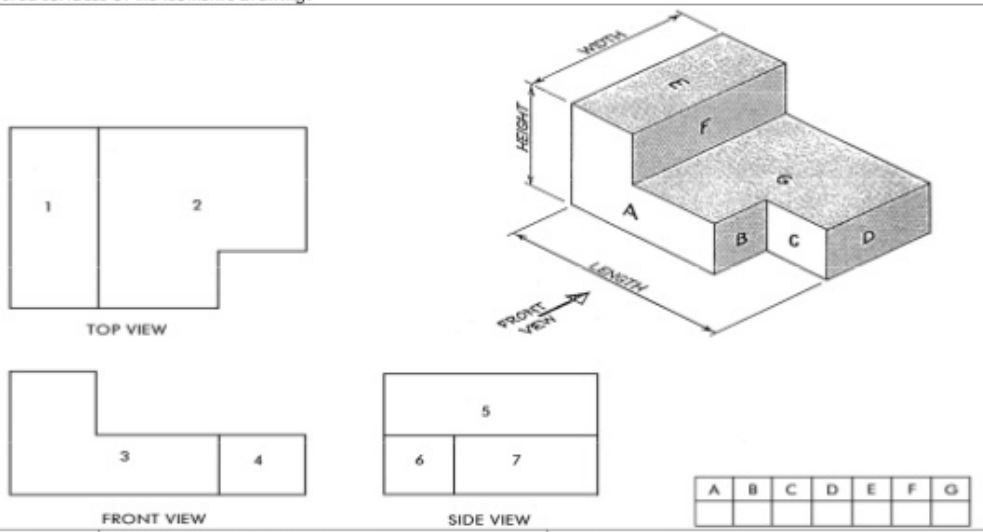
Write long answer to the following questions.

1. Draw the orthographic projection on the following object:

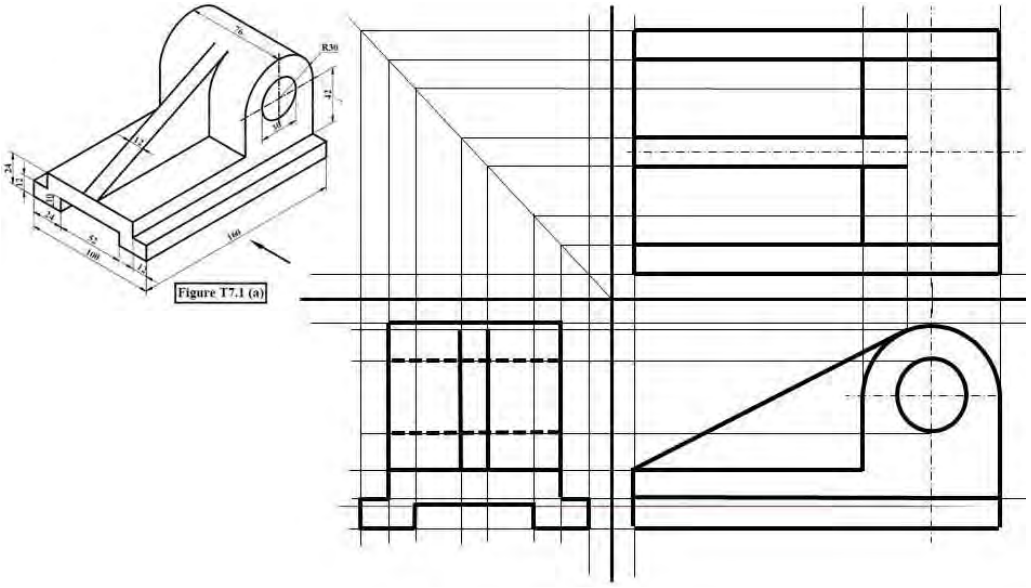




EXERCISES. Study the two drawings and complete the table by matching the numbered surfaces of the orthogonal drawing with the lettered surfaces of the isometric drawing.



DRG.	ORTHOGRAPHIC PROJECTION	EXERCISE 2



Project Work

1. Demonstration of different orthographic projection technique and explanation in classroom in group of 4-5 students.

Unit 15 : Draw Isometric Views

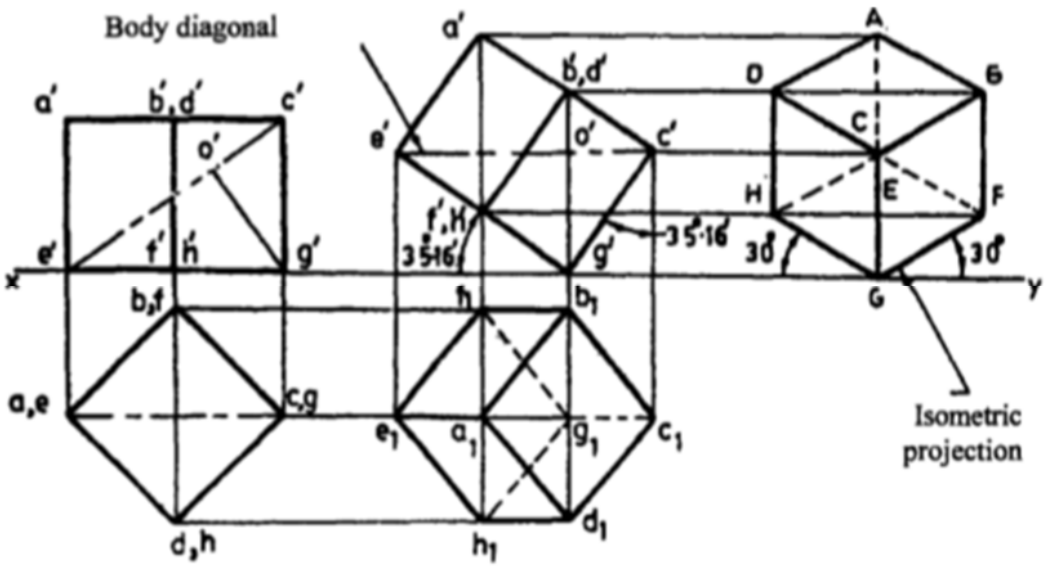
15.1 Define Isometric Projection

Introduction

Pictorial projections are used for presenting ideas which may be easily understood by persons even without technical training and knowledge of multi-view drawing. The Pictorial drawing shows several faces of an object in one view, approximately as it appears to the eye.

Principle of Isometric Projections

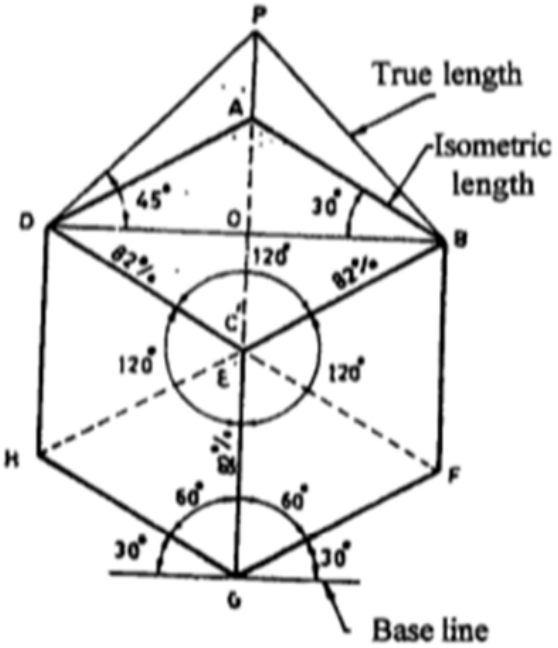
It is a pictorial orthographic projection of an object in which a transparent cube containing the object is tilted until one of the solid diagonals of the cube becomes perpendicular to the vertical plane and the three axes are equally inclined to this vertical plane. Isometric projection of a cube in steps is shown in Fig. Here ABCDEFGH is the isometric projection of the cube.



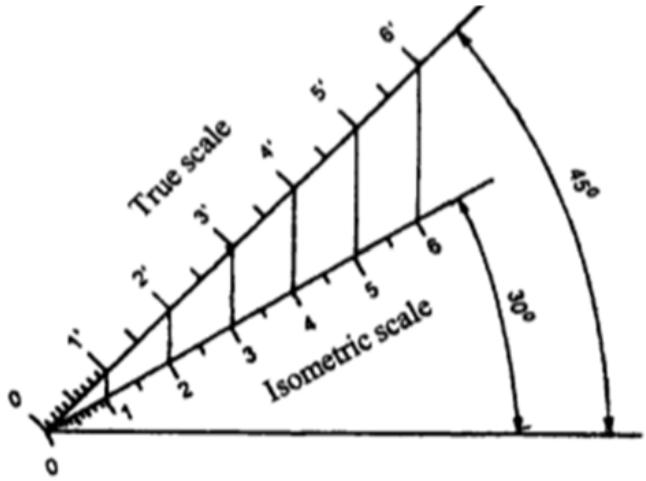
The front view of the cube, resting on one of its corners (G) is the isometric projection of the cube. The isometric projection of the cube is reproduced in Fig.

15.2 Describe Isometric Scale

In the isometric projection of a cube shown in Fig, the top face ABED is sloping away from the observer and hence the edges of the top face will appear foreshortened. The true shape of the triangle DAB is represented by the triangle DPB.The extent of reduction of an isometric line can be easily found by construction of diagram called isometric scale. For this, reproduce the triangle DPA as shown in Fig. Mark the divisions of true length on DP. Through these divisions draw vertical lines to get the corresponding points on DA. The divisions of the line DA give dimensions to isometric scale.



The extent of reduction of an isometric line can be easily found by construction of a diagram called isometric scale. For this, reproduce the triangle DPA as shown in Fig. Mark the divisions of true length on DP. Through these divisions draw vertical lines to get the corresponding points on DA. The divisions of the line DA give dimensions to isometric scale.



From the triangle ADO and PDO in Fig, the ratio of the isometric length to the true ength, i.e., DAIDP = cos 45°/cos300 = 0.816

The isometric axes are reduced in the ratio 1:0.816 i.e. 82% approximately.

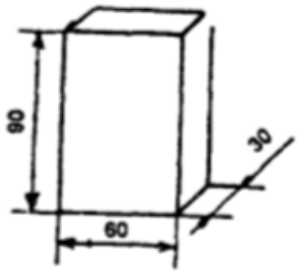
Lines in Isometric Projection

The following are the relations between the lines in isometric projection which are evident from Fig.

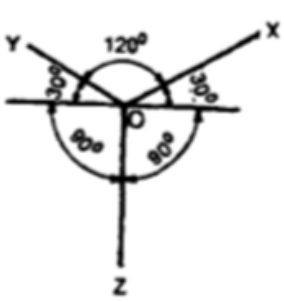
1. The lines that are parallel on the object are parallel in the isometric projection.
2. Vertical lines on the object appear vertical in the isometric projection.
3. Horizontal lines on the object are drawn at an angle of 3 0° with the horizontal in the isometric projection.
4. A line parallel to an isometric axis is called an isometric line and it is fore shortened to 82%.
5. A line which is not parallel to any isometric axis is called non-isometric line and the extent of fore-shortening of non-isometric lines are different if their inclinations with the vertical planes are different.

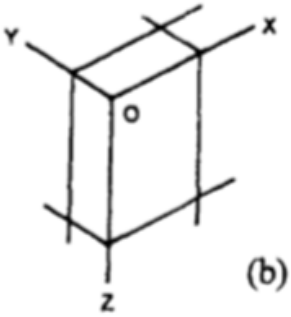
Isometric Projection

Figure shows a rectangular block in pictorial form and Fig, the steps for drawing an isometric projection using the isometric scale.



(a)





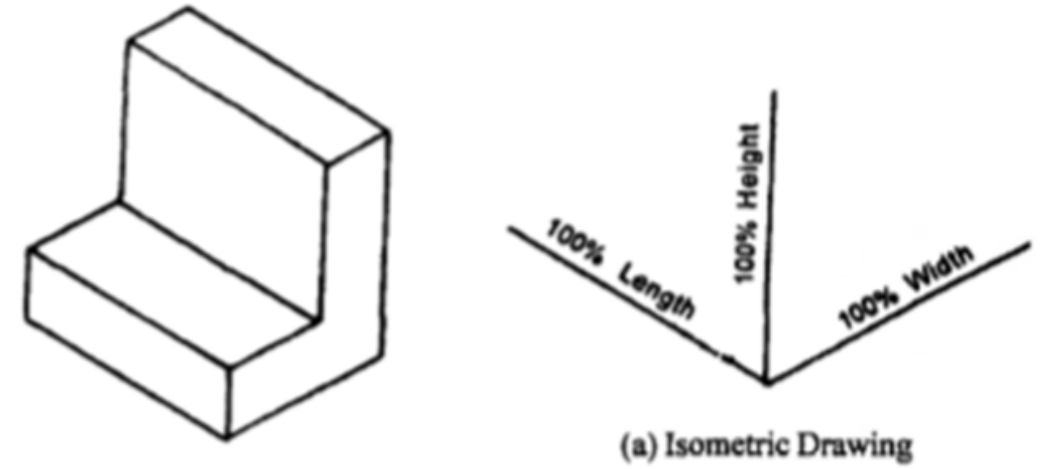
(b)

15.3 Practice Process of Preparation of Isometric Drawing

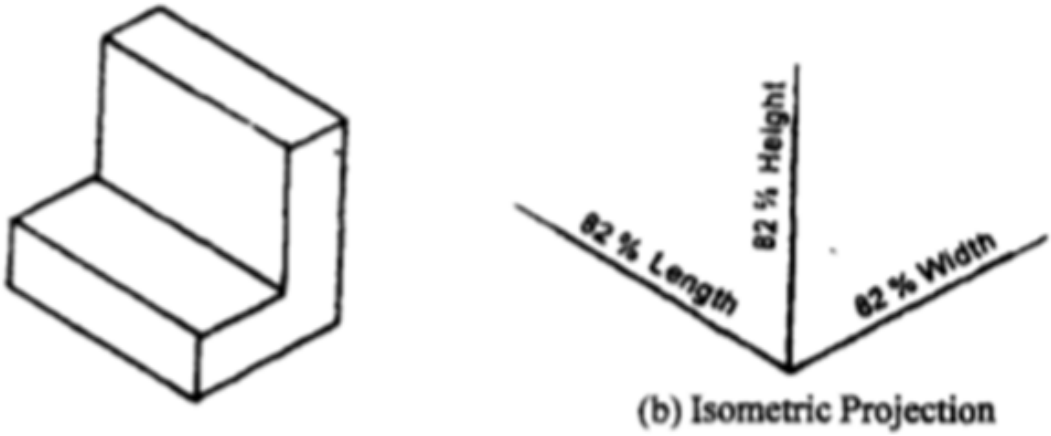
Isometric Drawing

Drawing of objects is seldom drawn in true isometric projections, as the use of a shortening of lengths is ignored and actual or true lengths are used to obtain the projections, called isometric drawing or isometric view is normally used. This is advantageous because the measurement may be made directly from a drawing.

The isometric drawing of figure is slightly larger (approximately 22%) than the isometric projection. As the proportions are the same, the increased size does not affect the pictorial value of the representation and at the same time, it may be done quickly. Figure shows the difference between the isometric drawing and isometric projection.



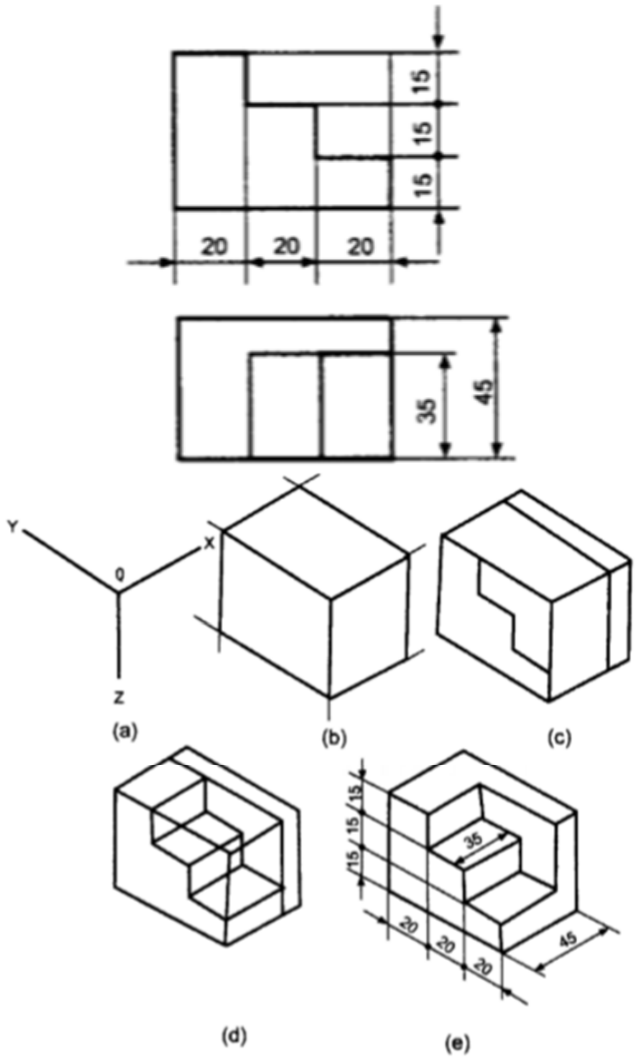
(a) Isometric Drawing



(b) Isometric Projection

Steps to be followed to make isometric drawing from orthographic views are given below Fig.

1. Study the given views and note the principal dimensions and other features of the object.
2. Draw the isometric axes (a).
3. Mark the principal dimensions to-their true values along the isometric axes (b).
4. Complete the housing block by drawing lines parallel to the isometric axes and passing through the above markings (e).
5. Locate the principal corners of all the features of the object on the three faces of the housing block (d). 6. Draw lines parallel to the axes and passing through the above points and obtain the isometric drawing of the object by darkening the visible edges (e).



15.4 Practice Free Hand Sketch of Isometric View

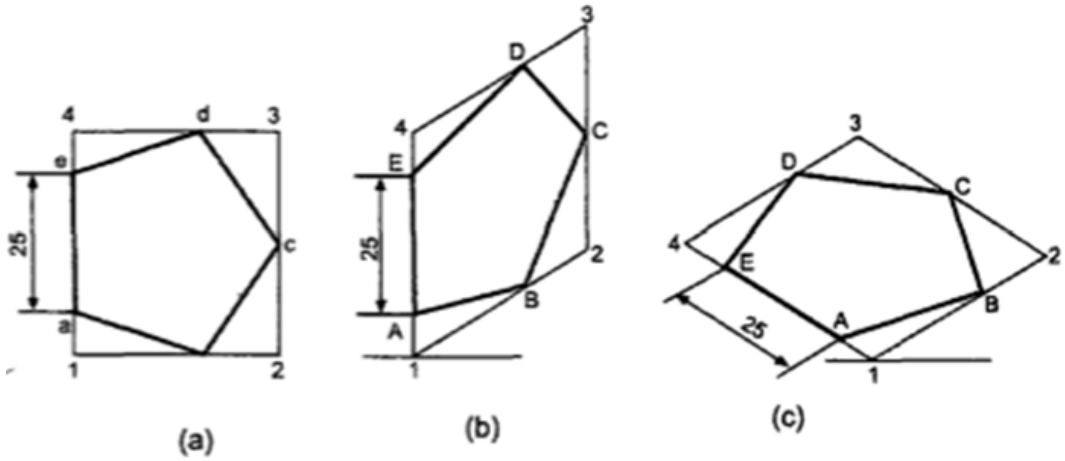
Problem

Figure shows the projection of a pentagonal plane. Draw the isometric drawing of the plane (i) when the surface is parallel to v.p and (ii) parallel to H.P.

Construction

1. Enclose the given pentagon in a rectangle 1234.
2. Make the isometric drawing of the rectangle 1234 by using true lengths.
3. Locate the points A and B such that Ia = lA and 1b = IB.

4. Similarly locate point C, D and E such that 2c = 2C, 3d = 3D and e4 = E4. 5. ABCDE is the isometric drawing of the pentagon. 6. Following the above principle of construction can be



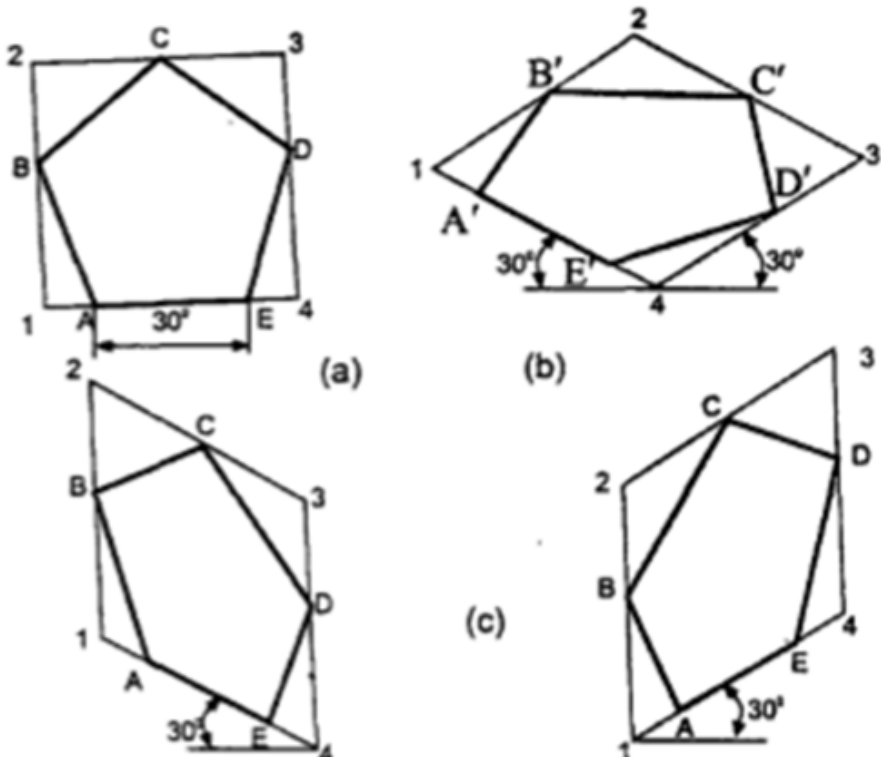
Problem

Draw the isometric view of a pentagonal plane of 30mm side when one of its side is parallel to H.P, (a) When it is horizontal and (b) vertical.

Steps

1. Draw the pentagon ABCDE and enclose it in a rectangle 1-2-3-4 as shown in figure.
   (a) When it is horizontal the isometric view of the pentagon can be represented by ABCDE as shown in Figure.
   (b) When the plane is vertical it can be represented by ABCDE as shown in Figure.

Note: It may be noted that the point A on the isometric view can be marked after drawing the isometric view of the rectangle 1-2-3-4 for this, mark 1AI = IA and so on.

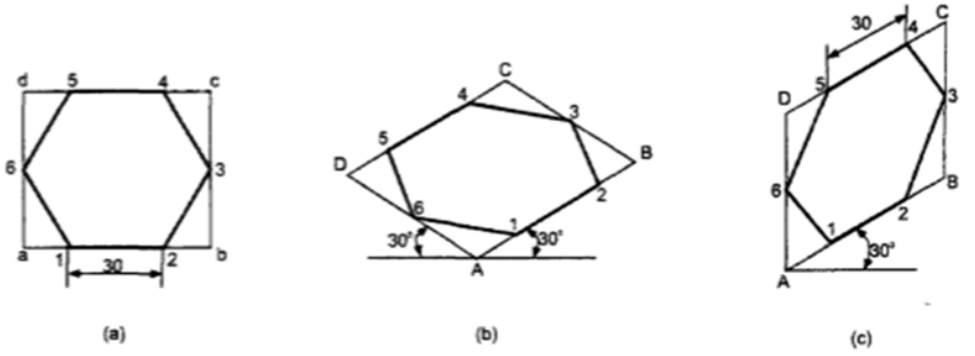


Problem

Figure shows the orthographic view of a hexagonal plane of side 30mm. Draw the isometric drawing (view) of the plane keeping it (a) horizontal and (b) vertical.

Steps:

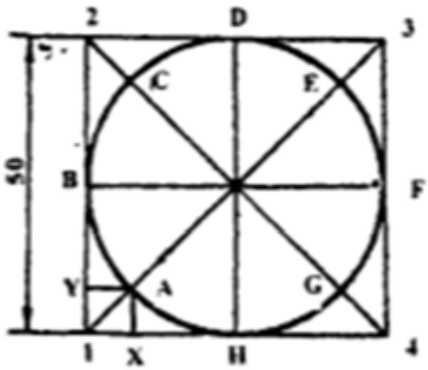
Following the principle of construction of figure a obtain the figure b and cnmrespectively for horizontal and vertical position of the plane.



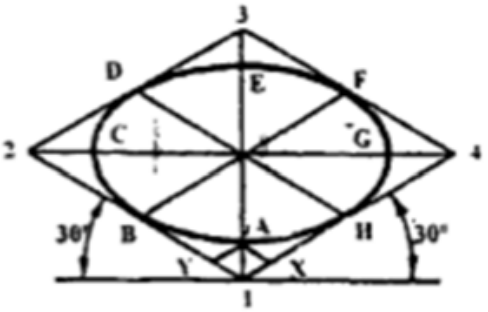
Problem

Draw the isometric view of a circular plane of diameter 60mm whose surface is (a) Horizontal, (b) Vertical.

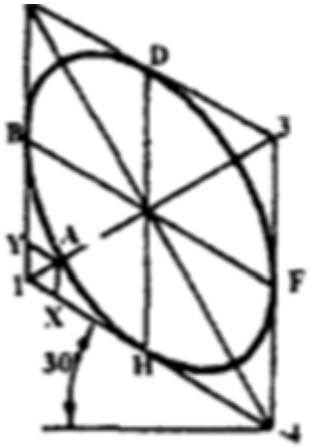
Construction using the method of points



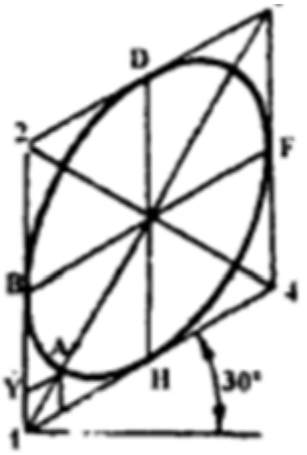
(a)



(b)



(c)



(d)

3. Locate the points X and Y on lines 1-4 and 1-2 respectively.
4. Through the point X, draw A X parallel to line 1-2 to get point A on the diagonal 1-3. The point A can be obtained also by drawing Y A through the point Y and parallel to the line 1-4. S. Similarly obtain other points C, E and G
6. Draw a smooth curve passing through all the points to obtain the required isometric view of the horizontal circular plane.
7. Similarly obtain isometric view of the vertical circular plane as shown in Fig.c

and d.

8. Enclose the circle in a square 1-2-3-4 and draw diagonals, as shown in Fig. a. Also draw lines YA horizontally and XA vertically.

   To draw the isometric view of the square 1-2-3-4 as shown in Fig.b.

9. Mark the mid points of the sides of the square as B 0 F and H.

Exercises

Choose the correct answer from the given alternatives.

1. If isometric projection of an object is drawn with true lengths the shape would be same and size is how much larger than actual isometric projection?

   a. 25% b. 29.5% c. 22.5% d. 33.3%

2. If an isometric projection is drawn with true measurements but not with isometric scale then the drawings are called _____

   a. Isometric projection b. Isometric view

   c. Isometric perception d. Orthographic view

3. If an isometric drawing is made use of isometric scale then the drawings are called _____

   a. Isometric projection b. Isometric view

   c. Isometric perception d. Orthographic view

Write short answer to the following questions.

1. Draw the isometric projection of cone,pyramid etc.

Write long answer to the following questions.

1. Draw the isometric projection of cone,pyramid with steps and explanation.

2. Draw an isometric projection of hemisphere resting centrally on its curved surface, on the top horizontal rectangular face of an equilateral triangular prism, keeping two triangular faces parallel to the VP. Side of equilateral triangle = 50mm, length of the prism = 70 mm and diameter of the hemisphere = 60 mm.

3. Draw the isometric projection of an equilateral triangular prism of 50 mm base side and 75 mm axis resting on its base in HP with one of its base edge parallel to VP in front.

4. Draw an Isometric Projection of 32 mm cube resting centrally on the top face of an equilateral triangular prism having 50 mm base side and height = 30 mm. One rectangular face of the prism is away from the observer and kept parallel to the V.P.

5. Draw the isometric projection of an inverted hexagonal pyramid of base edge 30 mm

and height of 60 mm keeping two of its base side parallel to the VP.

6. Draw an Isometric Projection of a vertical regular pentagonal pyramid resting centrally, having one base edge away from the observer parallel to V.P., on top of a vertical cylinder. Side of the pentagon = 32 mm, height of pyramid = 50 mm, diameter of cylinder = 76 mm and height of cylinder = 40 mm.

7. Draw the isometric projection of cone of diameter 40 mm and axis of 60 mm resting on its base perpendicular to H.P.

8. Draw an Isometric Projection of a sphere resting centrally on a rectangular face of a horizontal hexagonal prism having its hexagonal ends perpendicular to V.P. Side of hexagon = 30 mm, length of the prism = 80 mm and diameter of sphere = 60 mm.

9. A Pentagonal prism of base side of 25 mm and axis length of 55 mm is resting on its face with its axis parallel to both H.P and V.P. Draw its isometric projection.

Project Work

1. Draw different isometric projections with discussion about the isometric views.

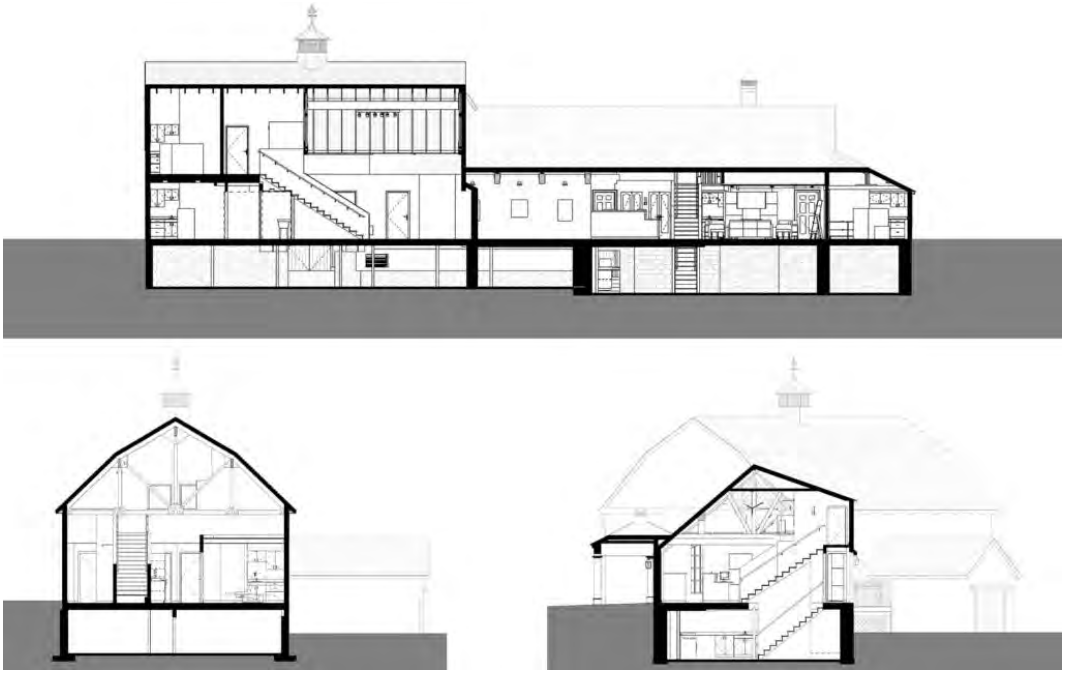
Unit 16 : Section

16.1 Explain need and Importance of Section Sectioning

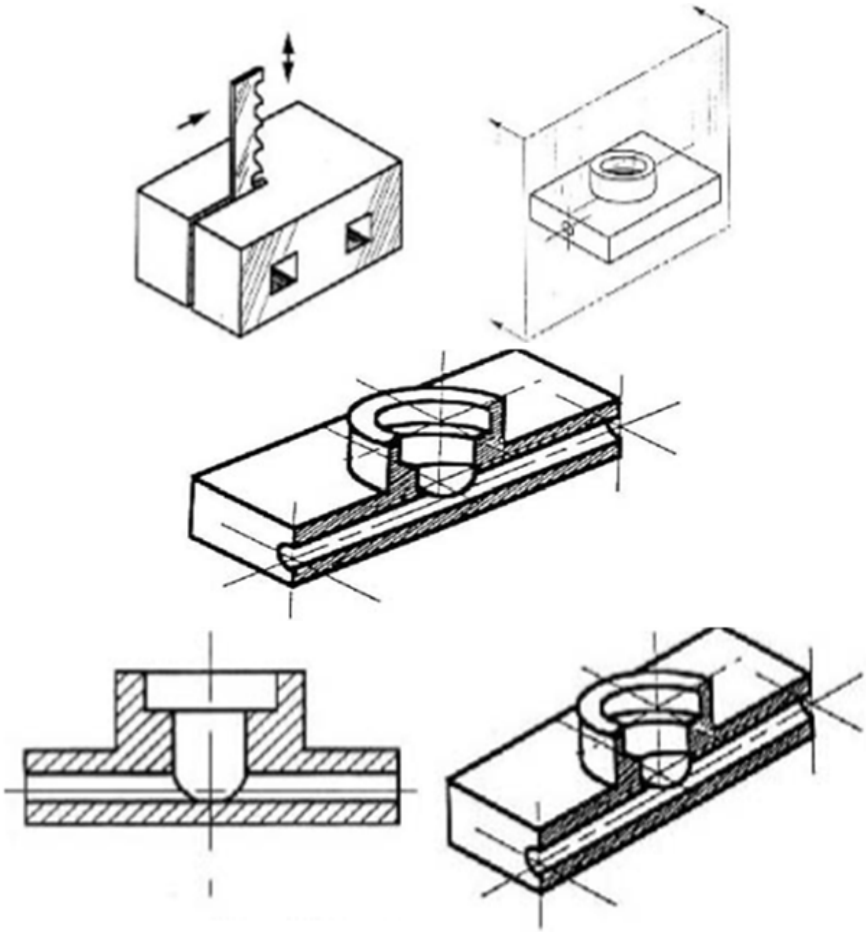
It is defined as an imaginary cut made through an object to expose the interior or to reveal the shape of a portion.

Sectional view

It is a view in which all or a substantial portion of the view is sectioned. There are many times when the interior details of an object cannot be seen from the outside



We can get around this by pretending to cut the object on a plane and showing the "sectional view". The sectional view is applicable to objects like engine blocks, where the interior details are intricate and would be very difficult to understand through the use of "hidden" lines (hidden lines are, by convention, dotted) on an orthographic or isometric drawing. Imagine slicing the object in the middle.



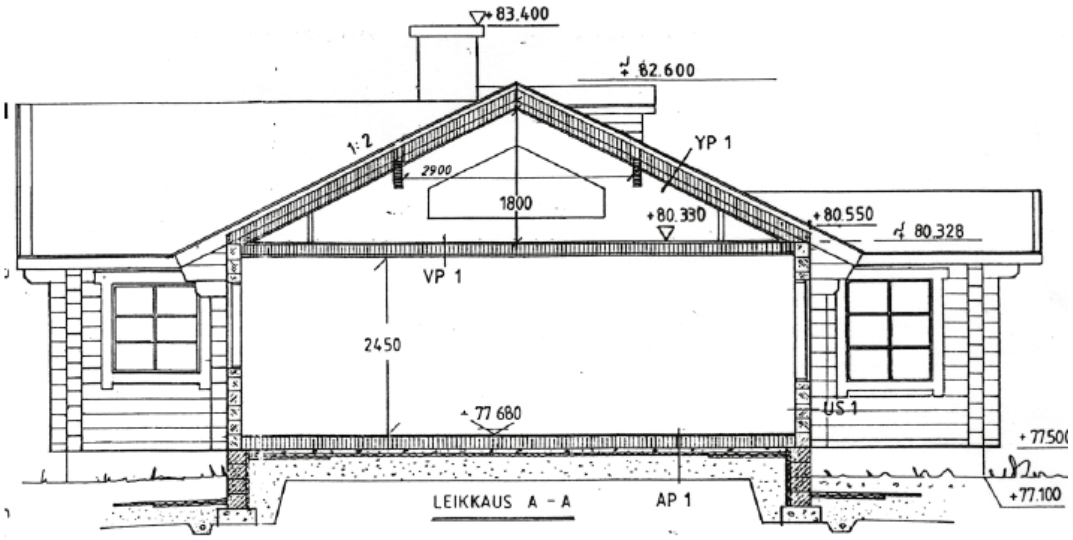
The cross section look like this when it is viewed from straight ahead. In short, when the interior of the object is complicated or when the component parts of a machine are drawn assembled, an attempt to show hidden portions by the customary dashed lines in regular or graphic views often results in a confusing networks, which is difficult to draw and almost impossible to read clearly. In case of this kind, to aid in describing the object, one or more views are drawn to show the object as if a portion has been cut away to show the interior.

For some simple objects where the orthographic un sectioned views can be easily read, sectional views are often preferable because they show clearly and emphasis the solid portions, the voids, and the shape.

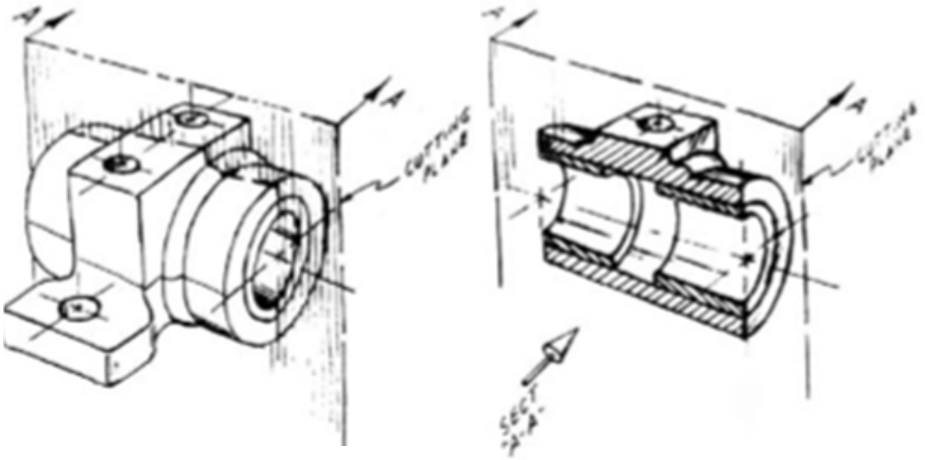
Cross-Sectional Views

A cross-sectional view portrays a cut-away portion of the object and is another way

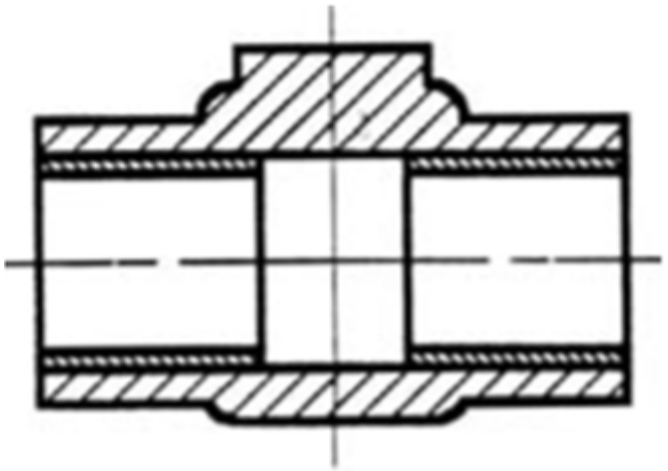
to show hidden components in a device.



Imagine a plane that cuts vertically through the center of the pillow block as shown in figure.



Then imagine removing the material from the front of this plane, as shown in figure. This is how the remaining rear section would look. Diagonal lines (cross-hatches) show regions where materials have been cut by the cutting plane.



Section
"A-A"

16.2 Compare Different Type of Sectional Plane

HOW SECTIONS ARE SHOWN

To clearly draw the sectional views, we have to understand the following terminologies.

A. Cutting Plane Lines

The cutting plane line indicates the path that an imaginary cutting plane follows to slice through an object. Think of the cutting plane line as a saw blade that is used to cut through the object. The cutting-plane line is represented by a thick black dashed line.

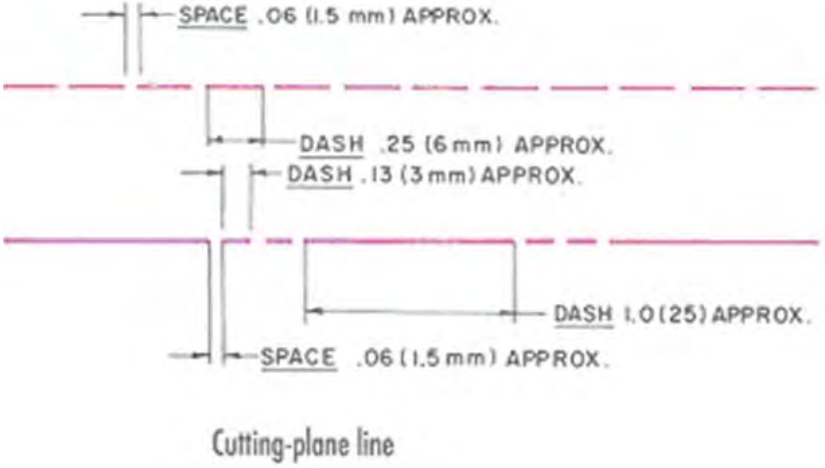
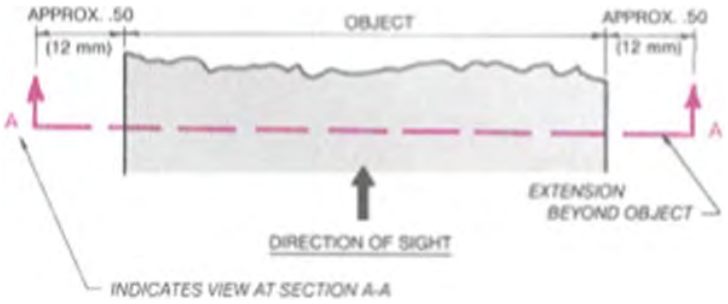


Fig: Cutting plane lines

B. Direction of Sight

The drafter must indicate the direction in which the object is to be viewed after it is sliced or cut through. This is accomplished by adding a short leader and arrowhead to the ends of the cutting-plane. And these arrows indicate the direction of sight.



C. Section Lining

Section lining shows where the object is sliced or cut by the cutting plane line. Section lining is represented by thin, black lines drawn at 45° to the horizontal. Section lining is spaced by eye from 1.5mm to 6mm apart, depending up on the overall size of the object. The average spacing used for most drawings is 3mm. vbSection lines must be of uniform thickness (thin black) and evenly spaced by eye.If the cutting plane passes through more than two parts, section lining of each individual part must be drawn at different angles. Where an angle other than 45° is used, the angle should be 30° or 60°. Section lining should not be parallel with the sides of the object to be section lined.

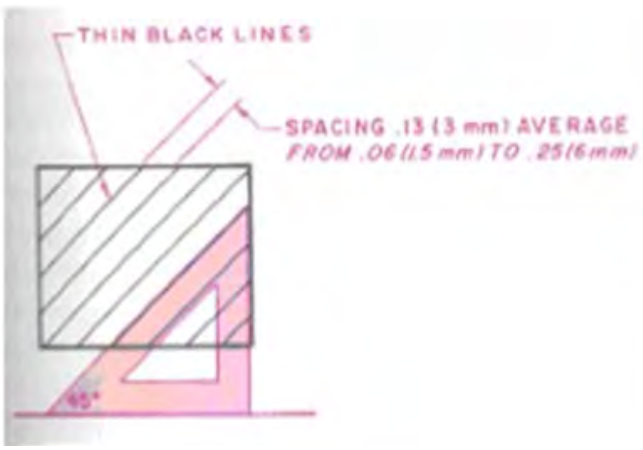


Fig: section lining

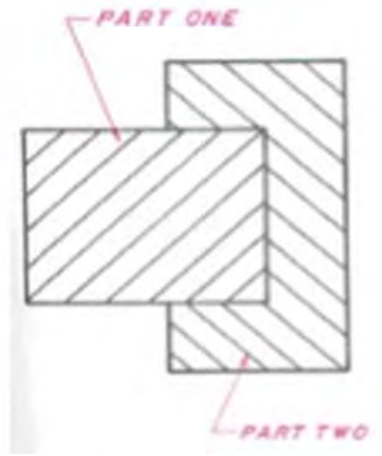


Fig: two pairs with section lining

16.3 Practice Types of Section (Longitudinal and crossed section, as well as full and half section)

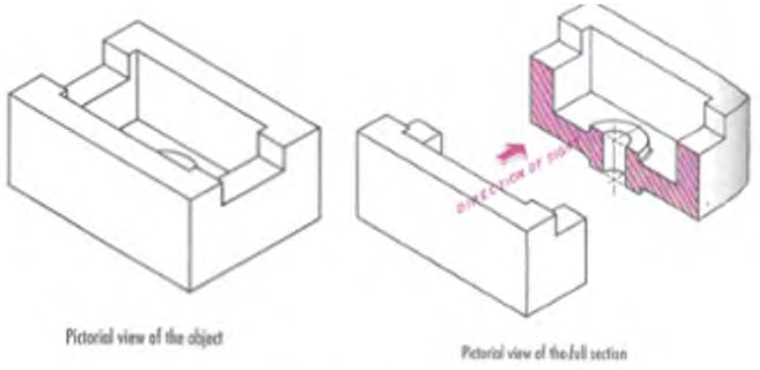
MULTSECTION VIEWS

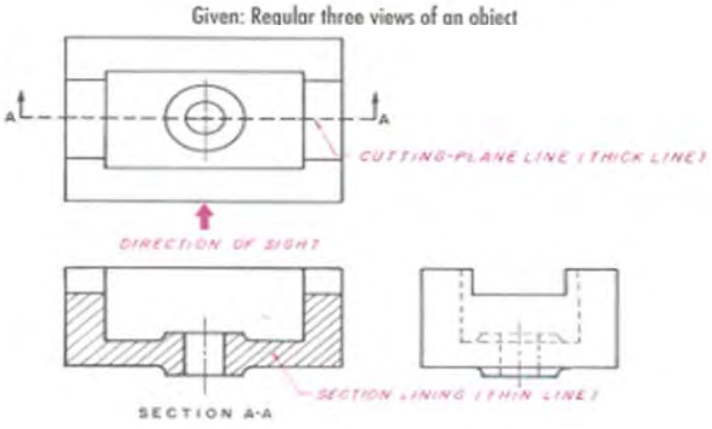
The different kinds of sections used today are:

1. Full section
2. Offset section
3. Half section
4. Broken-out section
5. Revolved section
6. Auxiliary section etc.

In this part, we only consider the most commonly used types of sections.

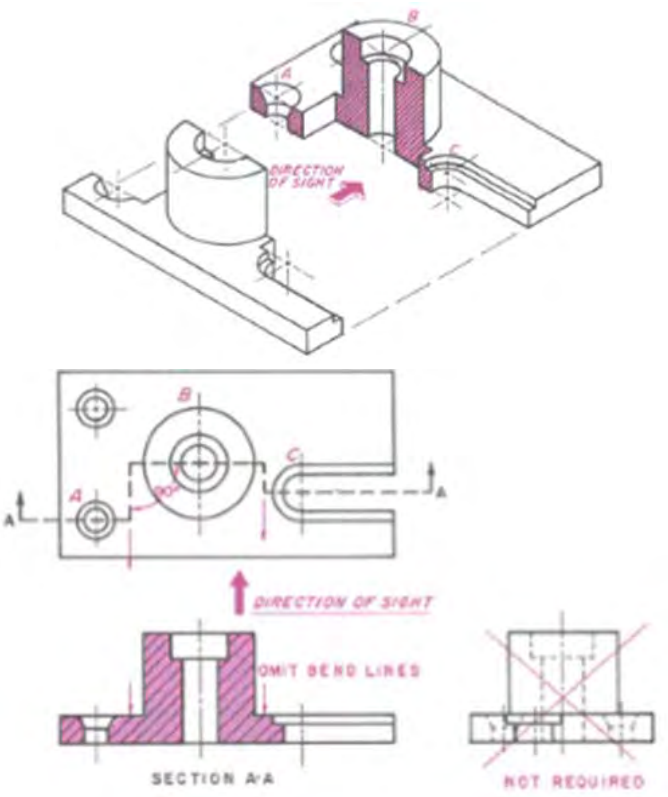
Full Section: It is simply a section of one of the regular multi-views that sliced or cut completely in two.





Offset Section

Many times, important features do not fall in a straight line as they do in a full section. These important features can be illustrated in an offset section by bending or offsetting the cutting-plane line. An offset section is very similar to a full section, except that the cutting plane line is not straight.



Half-Sections

A half-section is a view of an object showing one-half of the view in section, as in Figure

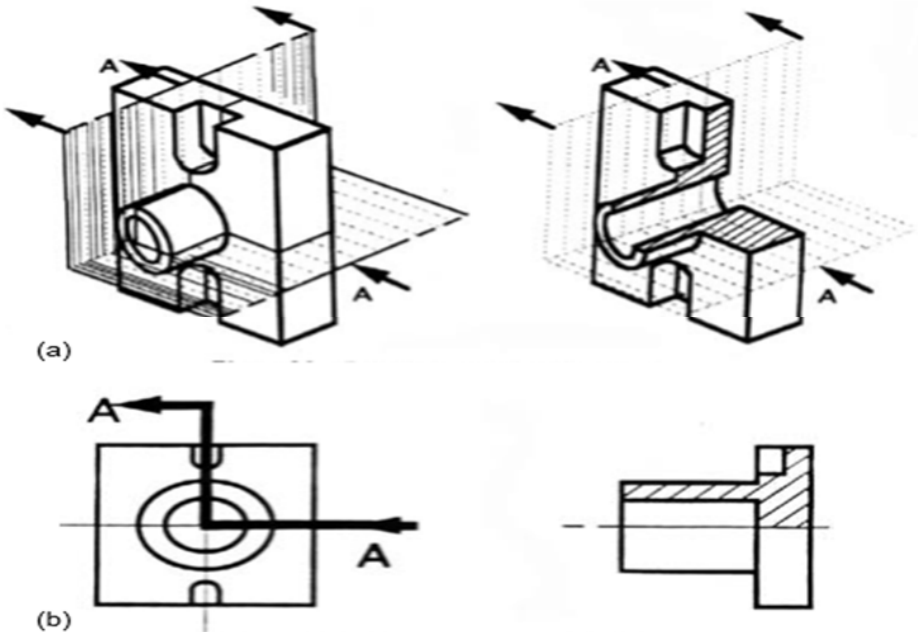
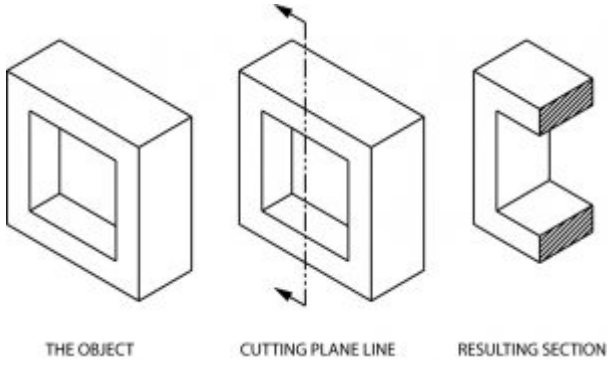


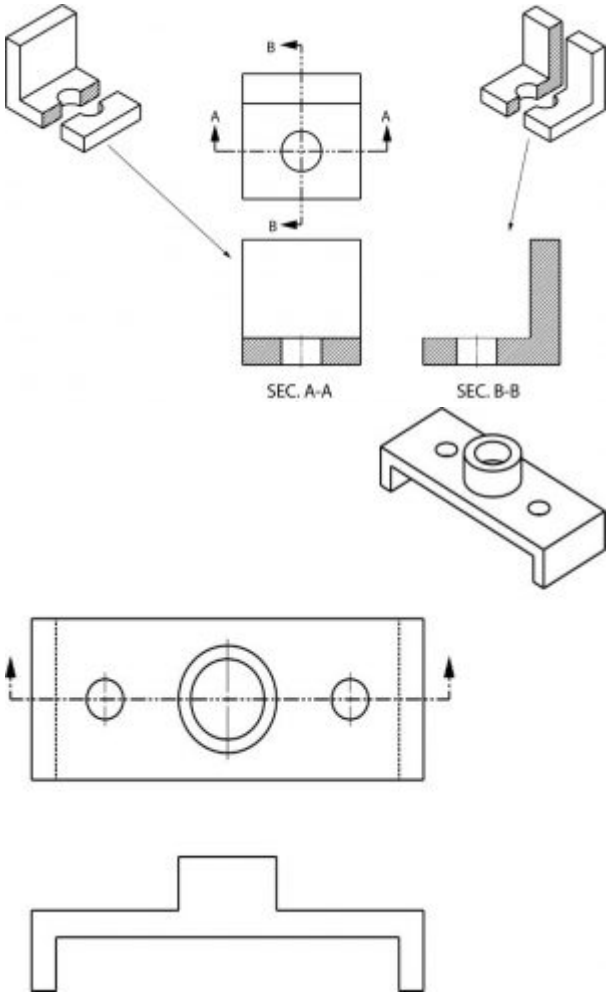
Figure (a) Full and sectioned isometric views

(b) Front View and Half Section

The diagonal lines on the section drawing are used to indicate the area that has been theoretically cut. These lines are called section lining or cross-hatching. The lines are thin and are usually drawn at a 45-degree angle to the major outline of the object. The spacing between lines should be uniform.

16.4 Practice Sectional View of Simple Object




B
A
A
B
SEC. A-A
SEC. B-B

Exercises

Choose the correct answer from the given alternatives.

1. When the interior of an object is complicated, which of the following view is used?

   a. Front view b. Side view c. Top view d. Sectional view

2. What is the type of sections from given option?

   a. Full section b. Side section

   c. Top section d. Front section

3. When the cutting plane cuts the entire object the section is known as _____

   a. Full section b. Half section

   c. Revolved section d. Removed section

4. Straight cutting plane in one line can be used if _____

   a. All the hidden objects are not in one line

   b. All the hidden objects are in one line

   c. The single line nor offset sectioning is useful and shape of the object is inclined

   d. Sit is used for combined objects

5. Inclined and offset cutting planes can be used if _____

   a. All the hidden objects are not in one line

   b. All the hidden objects are in one line

   c. The single line nor offset sectioning is useful and shape of the object is inclined

   d. It is used for combined objects

6. For the object which is symmetrical about the central axis; from which method of section it can be drawn _____

   a. Full section b. Half section

   c. Revolved section d. Removed section

7. When the section is to be drawn for a small area of the object, a _____section is used.

   a. Full section b. Half section c. Revolved section d. Removed section

9. The section in which the sectional views are not drawn there itself, but at a place adjacent to it is known as _____

a. Removed section
b. Broken out section
c. Auxiliary section
d. Assembly section

10. The cutting plane cut the small portion after before the is cut by the full or half section, the section is known as _____

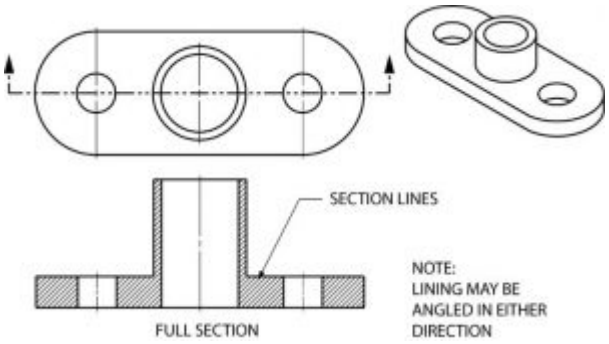
a. Removed section
b. Broken out section
c. Auxiliary section
d. Assembly section

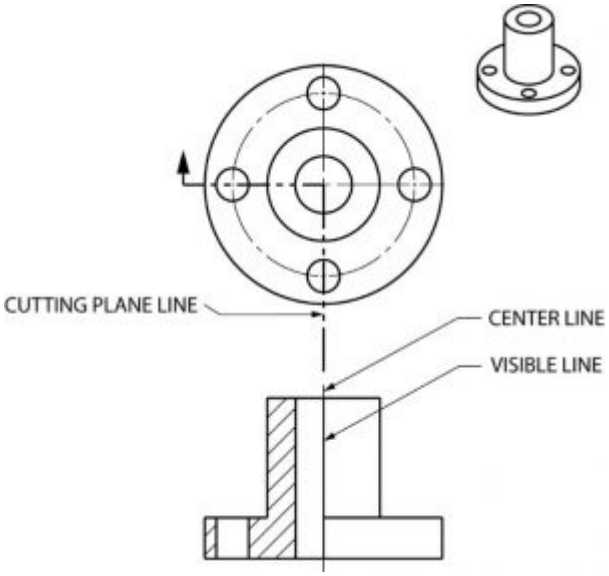
Write short answer to the following questions.

1. Describe the purpose of sectioning in technical drawings
2. What is "direction of sight" in sectioning?
3. Mention the difference between offset section and full section.
6. How would you locate the section plane which cuts a cone to get an isoscelestriangle as true shape of section?
7. How would you locate the section plane which cuts a square pyramid to get atrapezium as true shape of section?
8. How would you locate the section plane which cuts a cube to get an equilateraltriangle of largest possible side as true shape of section?

Write long answer to the following questions.

1. Draw the section of following plane figures:





2. Explain in detail about sectioning and their uses with figures and elaboration.

Project Work

1. Demonstration of different types of sections of objects and their construction method in classroom in group of 4-5 students.

Unit 17 : Surface Development

17.1 Introduce Surface Development

Introduction

Surface development is done to provide actual shape of an object when it is made flat for purpose of easiness of cutting plane sheets. It as a layout of the complete surface of a three dimensional object on a plane is called the development of the surface or flat pattern of the object. The development of surfaces is very important in the fabrication of articles made of sheet metal. The objects such as containers, boxes, boilers, hoppers, vessels, funnels, trays etc.are made of sheet metal by using the principle of development of surfaces.

In making the development of a surface, an opening of the surface should be determined first. Every line used in making the development must represent the true length of the line (edge) on the object.

The steps to be followed for making objects, using sheet metal are given below:

1. Draw the orthographic views of the object to full size.
2. Draw the development on a sheet of paper.
3. Transfer the development to the sheet metal.
4. Cut the development from the sheet.
5. Form the shape of the object by bending.
6. Join the closing edges.

Note: In actual practice, allowances have to be given for extra material required for joints and bends. These allowances are not considered in the topics presented in this chapter.

Methods of Development

The method to be followed for making the development of a solid depends upon the

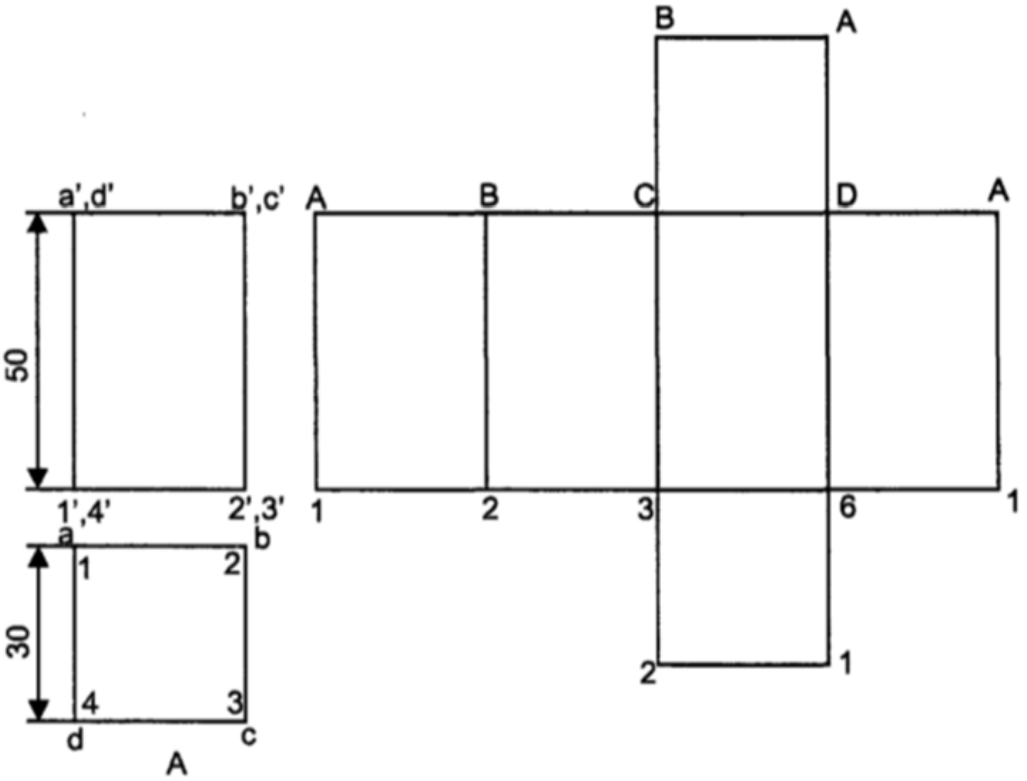
nature of its lateral surfaces. Based on the classification of solids, the following are the methods of development.

Parallel-line Development

It is used for developing prisms and single curved surfaces like cylinders in which all the edges / generators of lateral surfaces are parallel to each other.

Radial-line Development

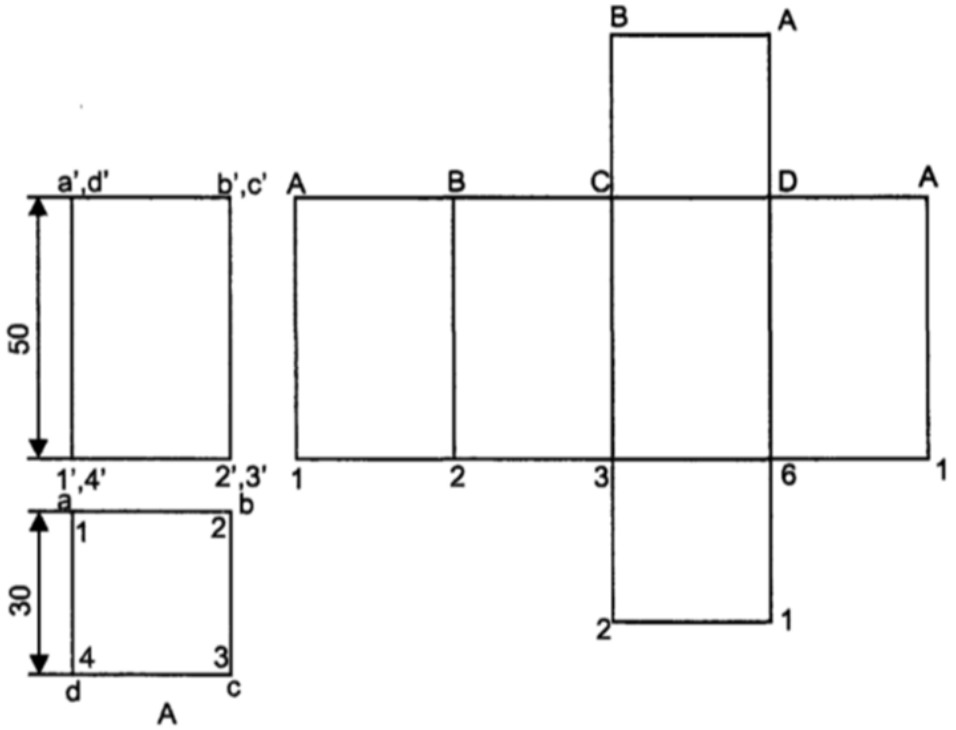
It is employed for pyramids and single curved surfaces like cones in which the apex is taken as center and the slant edge or generator (which are the true lengths) as radius for its development.



17.2 Practice Method of Surface Development (parallel and radial line method).

Problem

To draw the development of a square prism of side of base 30mm and height 5Omm.



1. Draw plan of the prism and sides view having length L and l respectively.
2. Draw AB line as long as the perimeter of the section.
3. Divide it in 4 equal parts by points 1, 2,3.
4. Join points 1-1', 2-2', 3-3', parallel to AD on the line DC where DC=AB.
5. The required surface to be developed for a prism is ABCD.

Surface Development for a Truncated Prism

Given

1. Length and breadth of a prism.
2.. The angle at which the prism is to be truncated.

Steps:

1. Draw side view and prolong it and draw plan.
2. Draw line BC equal to perimeter of section; name B, 1, 2, 3, c dividing BC in 4 equal

parts.

3. Draw AD parallel to BC and line BA equal to length of the prism. Join DC. Also join 1-1, 2-2, 3-3.'
4. Draw line PQ for forming truncated prism in given angle.
5. Join the points AED to get the required surface AEDCB, as in the sketch.

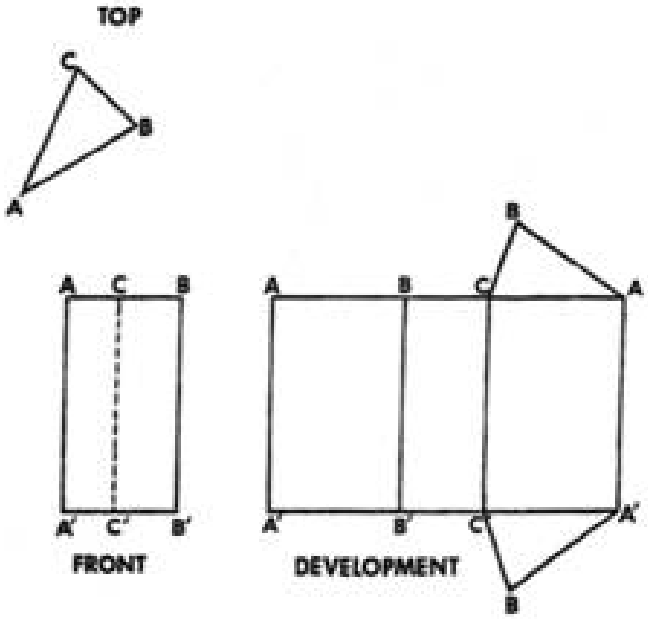


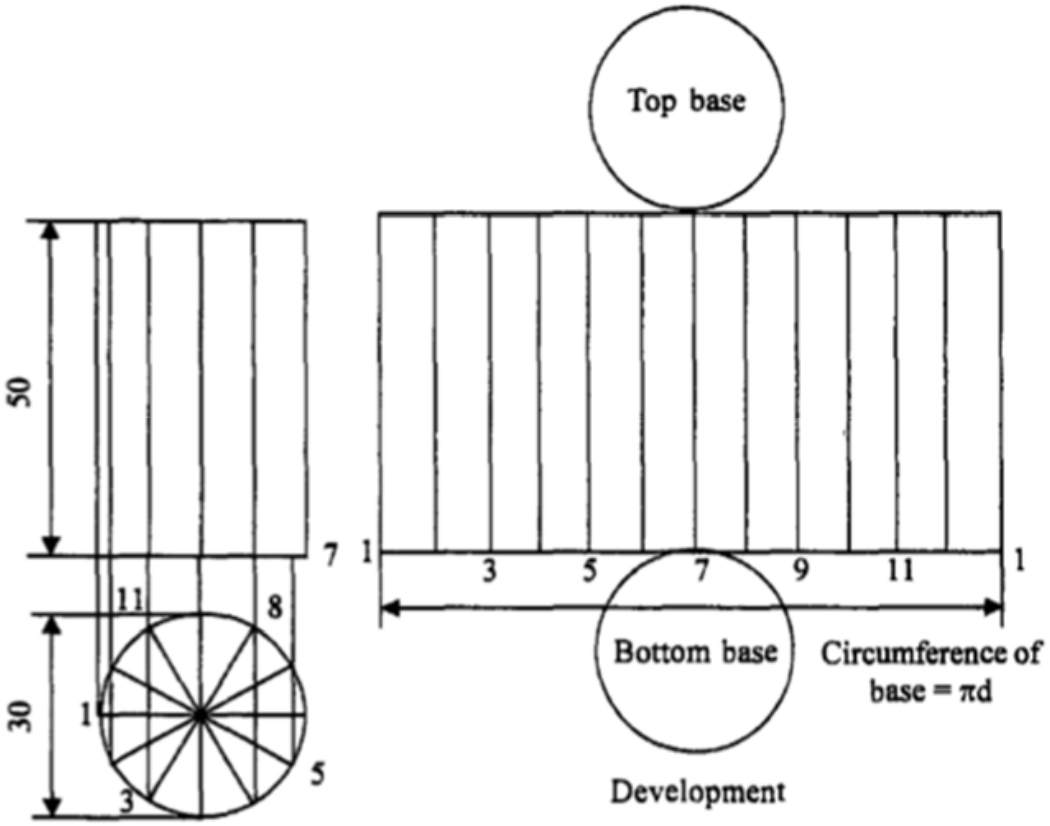
Fig: Surface Development for a Truncated Prism

Surface Development of a Cylinder

Given: Radius of base of Cylinder.

Steps:

1. Draw the circle with given radius and divide it to 12 parts.
2. Draw front view of the cylinder construction with length circumference 2*2.77*r and divide to into 12 equal parts as: line A-12.
3. Draw AC and 12-12' and join c-12'.
4. Join 1-1', 2-2', ….12-12'. Which gives developed surface for a cylinder of given diameter.

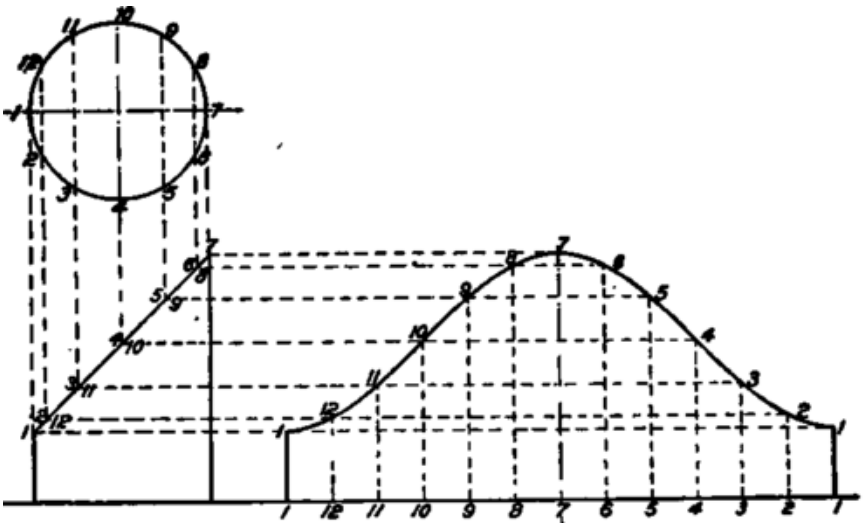


Surface Development of Truncated Cylinder

Given: Radius of base of truncated cylinder

Steps

1. Draw a circle i.e. base of cylinder with given radius.
2. Divide it in 12 equal parts as in sketch.
3. Draw front view of cylinder projection from base circle.
4. Cut the cylinder as required truncating.
5. Extend lines from the circle as 1', 2-12', 3-11', 4-10', 5-9', 6-8',7' as above. Name points of intersection as 1'.2'.3'.4'.5'.6'.and 7', truncated line.
6. Marks P1, P2&P12, P3&P11, P4&P10, P5&P9, P6&P8 and p7 lying in the respective lines and lastly draw the line joining these points.
7. Required shape of sheet required for truncated cylinder is obtained.

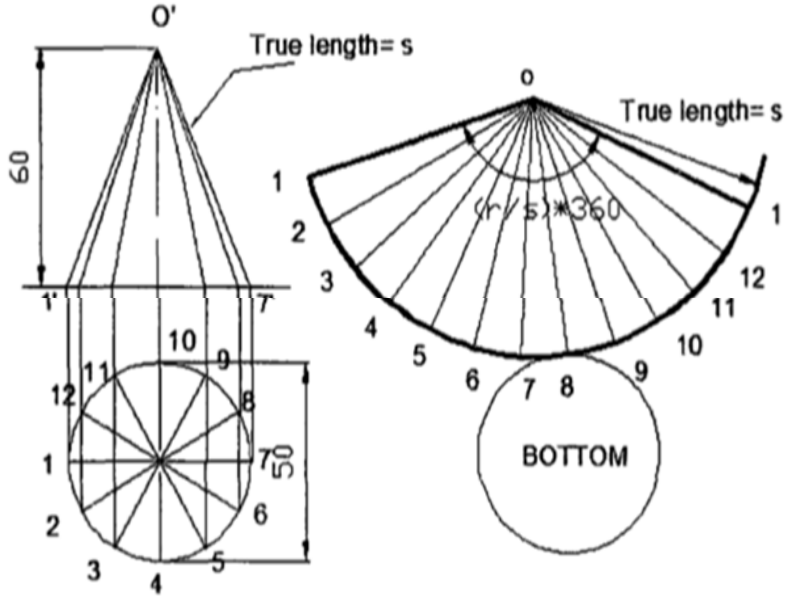


Surface Development of Cone

Given: Diameter of the base of the cone and height of the cone.

Steps:

1. Draw the base circle of the cone and divide it in 12 equal parts.
2. Draw front view of the cone as in sketch having given base and height. Name it as OPQ
3. From O as center draw a curve having length equal to 2*2.77*r.
4. Join 01, 02, 03,……012 and get required surface for cone as 0Q12.

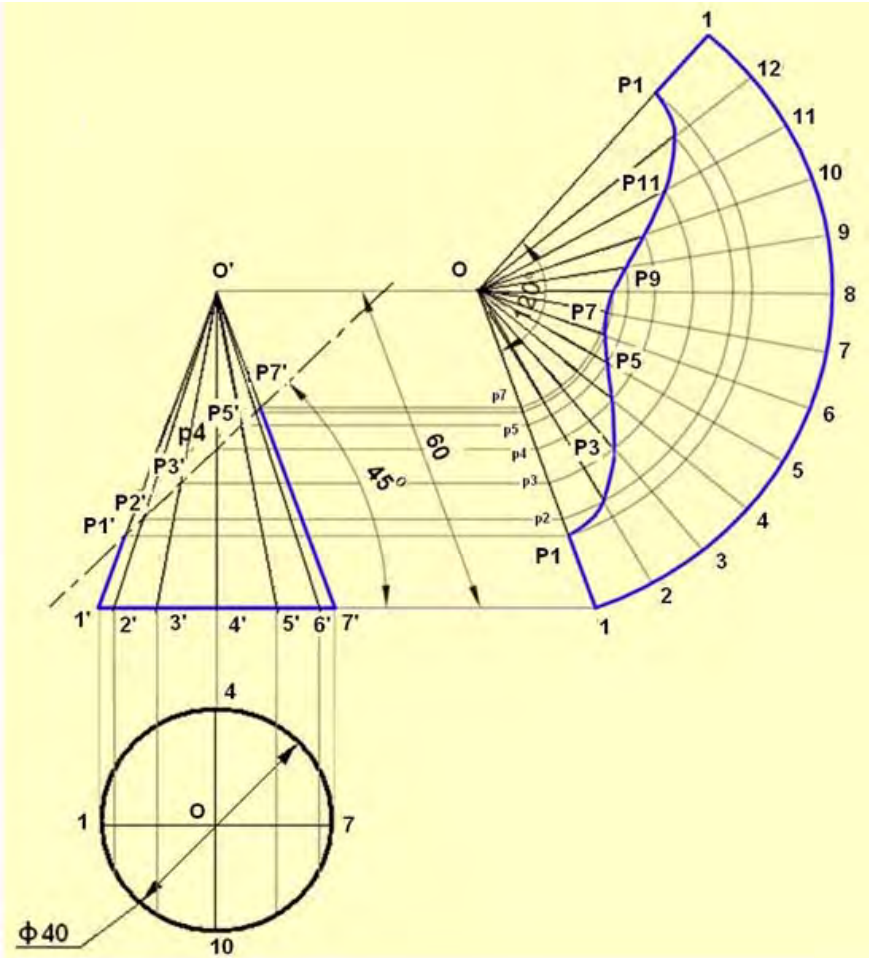


Surface Development of Truncated Cone

Given: Diameter of the base of the cone and height of the cone and angle at which to be truncated

Steps

1. Draw the base circle of the cone and divide it in 12 equal parts
2. Draw front view of the cone as in sketch having given base and height
3. Draw line to make it truncated with given angle
4. Draw a curve with O' as center and radius equal to 01' having length equal to 2*2.77*r.
5. Divide the curve in 12 equal parts
6. Extend the point on base circle to the base of the elevation as 1 to 1', 2 & 12 to 2', 3&11 to 3', 4&10 to 4', 5&9 to 5', 6&8 to 6', and 7 to 7'.



7. Take 0 as center and radius equal to the line from o' to the point cut by the truncated line on 0'-1'. Similarly take other radii 0'-2'', 0'-3'', 0-4'', 0'-5'', 0'-6'' and 0'-7'' and cut at the lines 0'-2", 0'-3",…., 0'-12, 0'-1 according and join the dots to get required surface

Surface Development of Pyramid

Given: length of the base of the pyramid height of the pyramid.

Steps

1. Draw front view of pyramid with base l and height h.
2. Take OA radius and draw an arc equal to perimeter of the base of pyramid.
3. Divide it in 4 equal parts as 1, 2, 3, 4,
4. Join A-1, 1-2, 2-3, and 3-4 to get required surface for a pyramid.

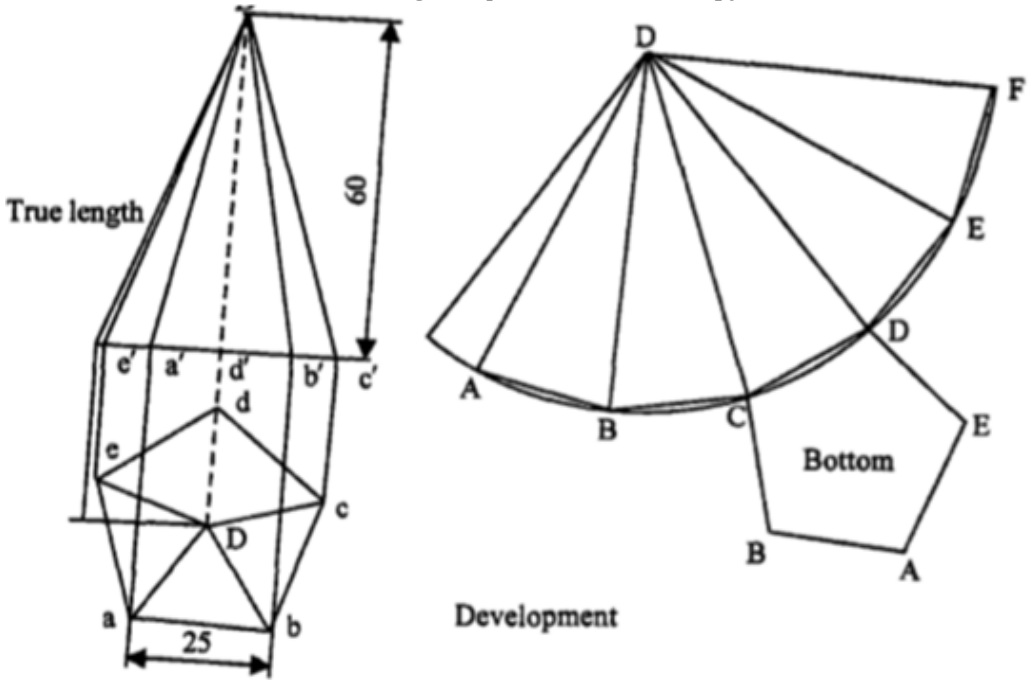


Fig: Surface Development of pyramid.

Exercise

Choose the correct answer from the given alternatives.

1. What are the methods of development
   a. Parallel line
   b. Radial line
   c. Both a and b
   d. None
2. The development of a cylinder is .....
   a. Circle
   b. Trangle
   c. Rectangle
   d. Parabola
3. The development of a cone is .....
   a. Sector of a Circle
   b. Trangle
   c. Rectangle
   d. Parabola

Write short answer to the following questions.

1. Draw the surface development of regular cylinder, cone, and pyramid.
2. Differentiate between singly curved surface and doubly curved surface
3. Name the method used for obtaining the developments of prisms and cylinders.
4. Name the method used for obtaining the developments of pyramids and cones
5. Name two common methods of getting the development of spheres.

Write long answer to the following questions.

1. Explain in detail about Construction of surface development of regular cylinder, cone ,pyramid.
2. What precaution should be taken while obtaining the development of pyramids?
3. What are the dimensions of the cone whose development is a semicircle of 120 mm diameter?
4. State a few practical applications of development of surfaces.

Project Work

1. Demonstration of different types of surface development and their construction method in classroom in group of 4-5 students.

Unit 18 : Land measurement/Symbol

18.1 Practice Land Measurement by Triangulation Method

In the engineering the main parts is the surveying of the land. Before any project start the surveying must be conducted. The land measurement also the part of the surveying and it will calculate the area of the land where building can be constructed or other any project.

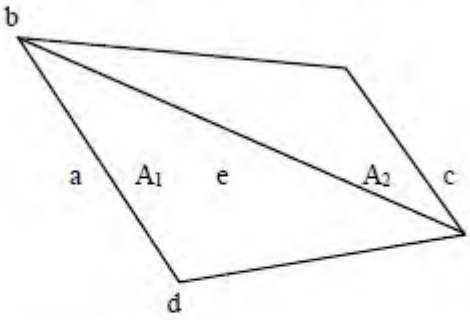
There are many methods to calculate the area of the land. Among them triangulation is the easy and most common method for the engineers.

Triangulation method for land measurement

Let area is a quadrilateral with four side a, b, c, d.

Then,

Divide quadrilateral into 2 triangles by drawing diagonal let diagonal be length e.



Now, $A_1 = \sqrt{s(s-a)(s-b)(s-e)}$

Where, $S = \frac{a+b+e}{2}$

And

$A_2 = \sqrt{s(s-d)(s-c)(s-e)}$

Where, $S = \frac{c+d+e}{2}$

Now by adding the A1 and A2, we get the area of land.

Some unit's conversion on land measurement

18.2 Practice Unit of Length/Unit of Land

Roppani/Bigha/Hectare.

1 Bigha = 20 kattha

1 Bigha = 6772.63 m2

1 Bigha = 72900 sq ft.

1 ropani = 16 anna

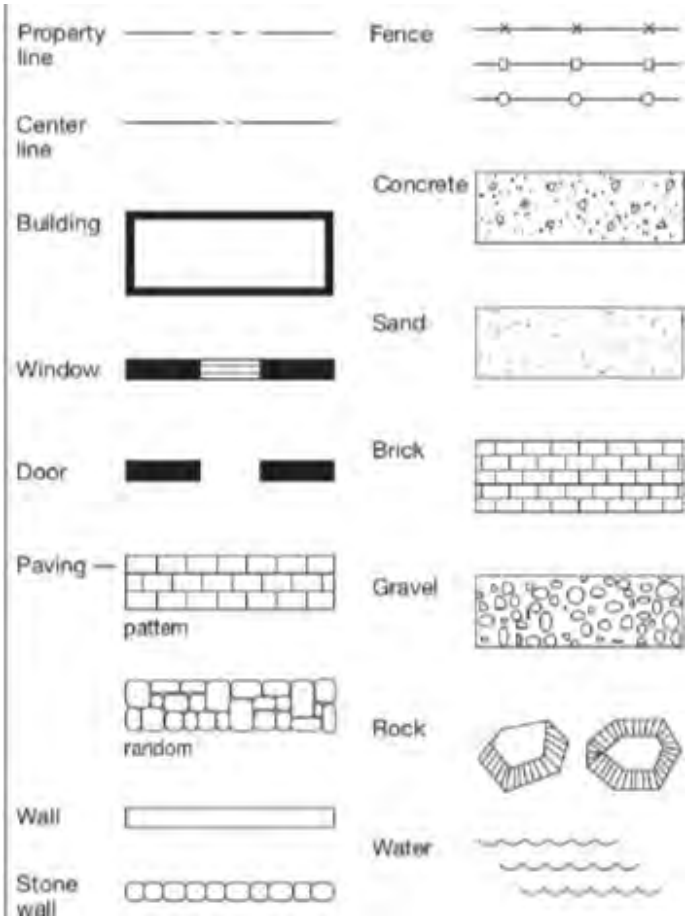
1 Ropani = 64 paisa

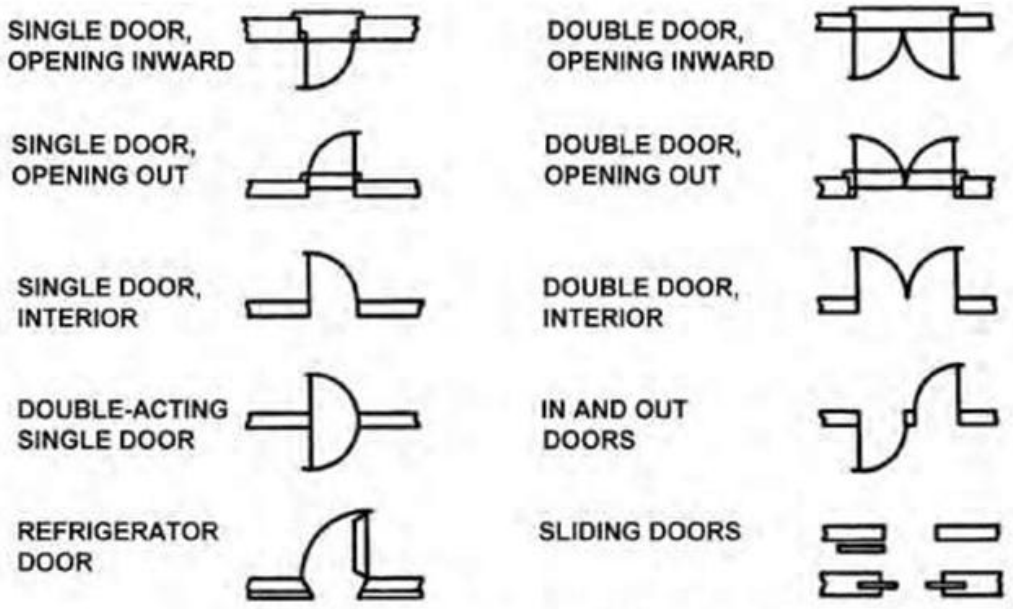
1 Ropani = 256 Daam

1 Ropani = 5476 sq. ft.

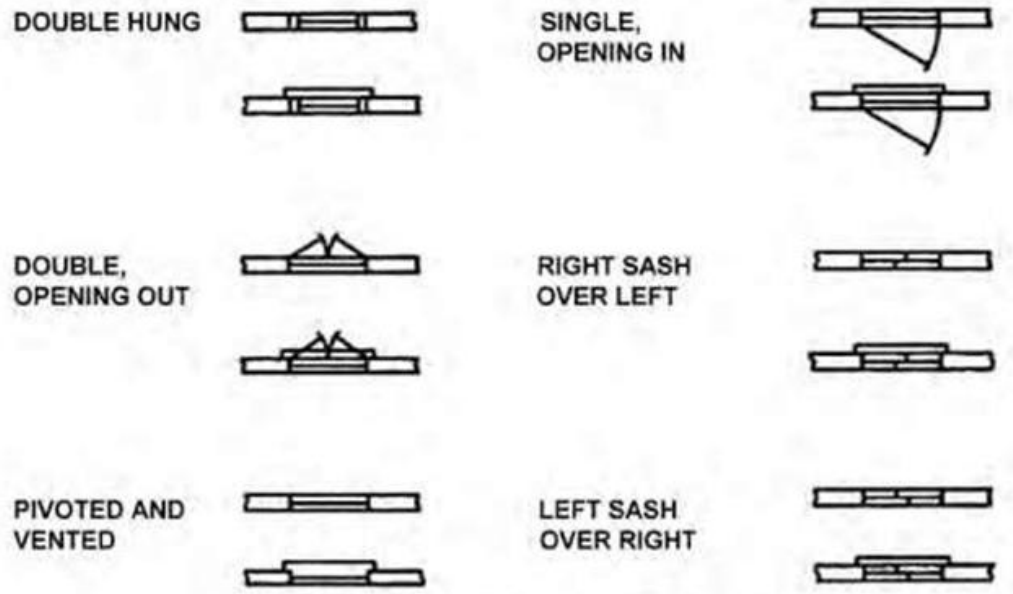
1 anna = 342.25 Sq.Ft.

18.3 Practice General Symbol of Civil, Domestic Electrical (fixtures) Works and Plumbing Works.

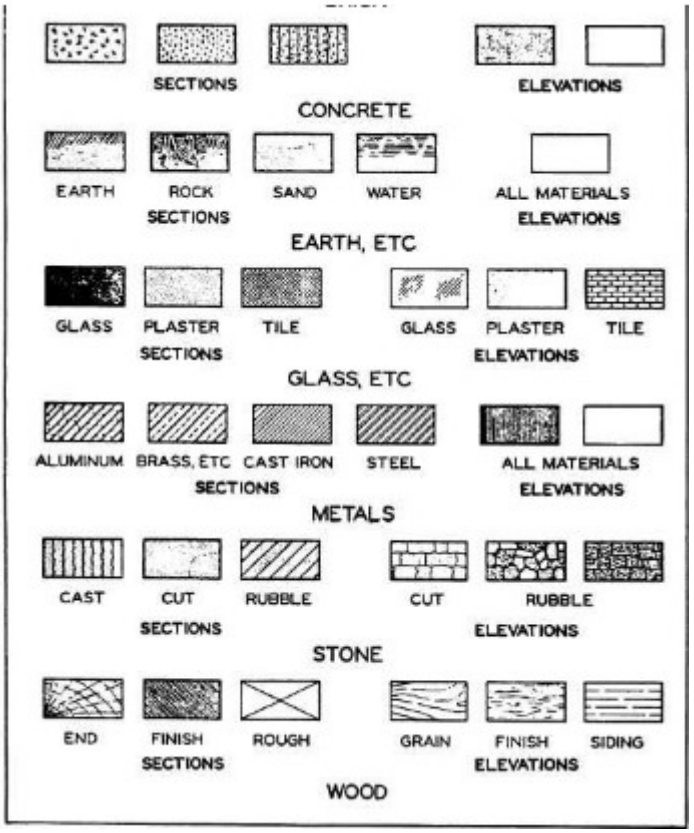


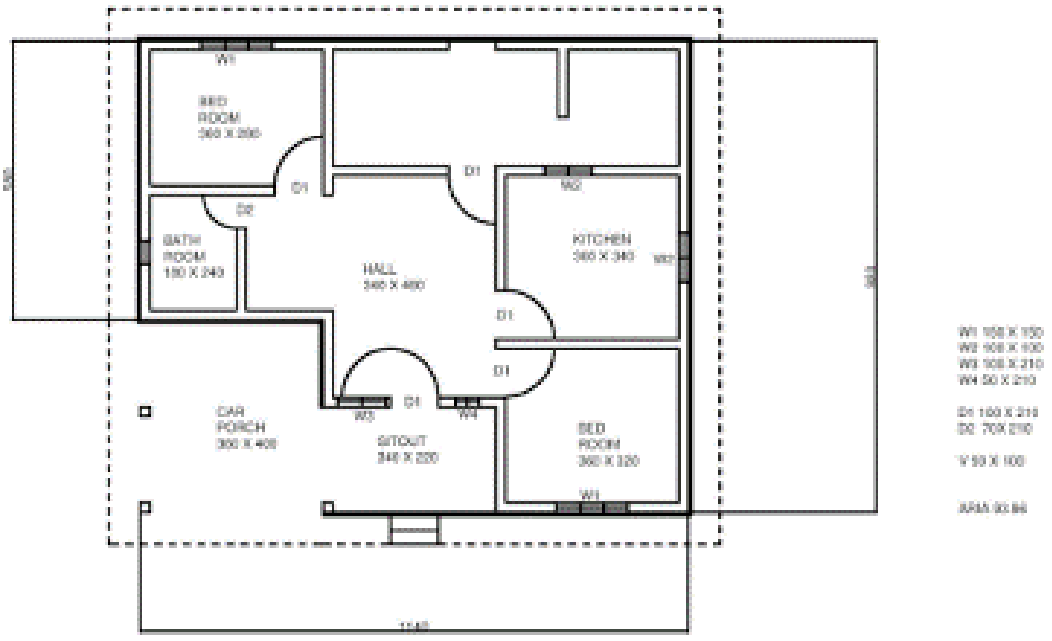


TYPICAL DOOR TYPES



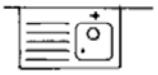
TYPICAL WINDOW TYPES


SECTIONS
ELEVATIONS
CONCRETE
EARTH
ROCK
SAND
WATER
ALL MATERIALS
SECTIONS
ELEVATIONS
EARTH, ETC
GLASS
PLASTER
TILE
GLASS
PLASTER
TILE
SECTIONS
ELEVATIONS
GLASS, ETC
ALUMINUM
BRASS, ETC
CAST IRON
STEEL
ALL MATERIALS
SECTIONS
ELEVATIONS
METALS
CAST
CUT
RUBBLE
CUT
RUBBLE
SECTIONS
ELEVATIONS
STONE
END
FINISH
ROUGH
GRAIN
FINISH
SIDING
SECTIONS
ELEVATIONS
WOOD


W1
BED ROOM 360 X 300
D1
D2
BATH ROOM 180 X 240
HALL 340 X 480
D1
W2
KITCHEN 360 X 340
W3
D1
D1
CAR PORCH 300 X 400
W3
D1
W4
SITOUT 340 X 220
BED ROOM 360 X 320
W1
1540
W1 100 X 150
W2 100 X 100
W3 100 X 210
W4 50 X 210
D1 100 X 210
D2 700 210
V 50 X 100
AREA 90.86

SYMBOLS FOR WATER INSTALLATION

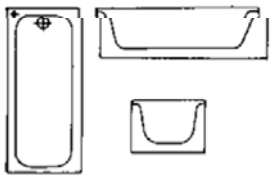
Wash hand basin



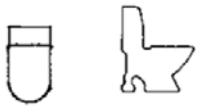
Sink and drier

Shower

Shower tray



Bath tub



Water closet

Tap hole

Waste hole

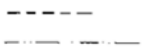
Valve

Stop valve

Hydrant point for fire protection

Pump

Pressure tank



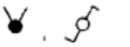
Cold water pipe

Hot water pipe

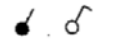
SYMBOLS FOR ELECTRICAL INSTALLATION

Ceiling switch

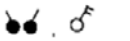
Cord operated ceiling switch



Two way switch



One way switch



One way two gang switch

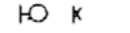
Push switch

Electric bell

Ceiling lighting point (bulb)

Ceiling lighting point with drop cord

Ceiling lighting point (bulb) in section

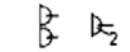


Wall lighting point (bulb)

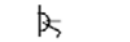
Fluorescent light one tube

Two tube fluorescent light

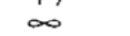
Socket outlet



Two gang socket outlet



Switched socket outlet



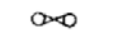
Fan

Intake and main control

Clock point

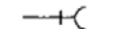
Outdoor lighting point

Emergency light fitting

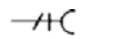


Fuse

Earthing



One phase power outlet with earthing



Three phase power outlet socket with earthing

Electric motor

Electric cooker

Gas cooker

SYMBOLS FOR SANITATION

Manhole

Gulley trap

Floor drain

Soil vent pipe

Drain pipe

Exercises

Choose the correct answer from the given alternatives.

1. bigha = ... kattha

   a. 20 b. 25 c. 40 d. 30

2. bigha= ..... sq ft.

   a. 1662.63 b. 1552.53 c. 1662.93 d. 1442.43

3. Ropani = 256 Daam

   a. 256 b. 285 c. 245 d. 265

4. anna = ... Sq.Ft.

   a. 342.25 b. 324.45 c. 365.45 d.395.55

Write short answer to the following questions.

1. Define and explain the method used for land measurement.

2. Mention the land unit conversion system prevailing in Nepal.

Write long answer to the following questions.

1. Draw the symbols of civil ,sanitary, electrical and plumbing neat ketches and label them.

Project Work

1. Demonstration of different land measurement techniques and their application in field in group of 4-5 students.

References

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