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JSS2 FIRST TERM NOTES ON BASIC TECHNOLOGY

WEEK 1

Topic: Information and Communication Technology (1)

Content

- Analogue and Digital Communication system
- The merits and demerits of analogue and Digital Communication system

Information has been very important in business, politics, education and sports in particular and all walks of life in general. Several research works have been done on ways to improve communication of information from one location to another (point-to-point) and from location to many locations (point-to-multipoint). The technology for transferring information started with analog communication system and it has now been improved to digital communication system which offers efficiency, better performance and greater flexibility.

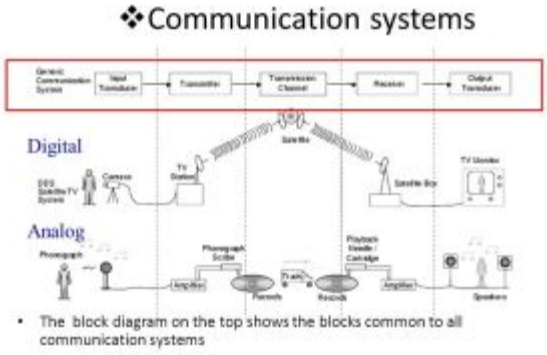
Analog and Digital Communication Systems

Analog communication systems can send along signals from one location to another or from one location to many locations. An analog signal is a continuously varying waveform that is similar to a voice or sound wave. One of the signals used in analog communication is Amplitude Modulation Radio Signal.

Digital communication systems can transmit real valued discrete time signals. A digital signal is a sequence of discrete pulses of 1's and O's. Global system for mobile communication (G.S.M) signal is an example of digital communication system.

Although, analog systems are less expensive in many cases than digital ones for the same application, digital systems offer greater efficiency, better performance and greater flexibility.

In addition to digital communication's ability to transmit a variety of signals than analog systems, point-to-point digital systems can be organized into global systems that provide efficient and flexible information transmission.



Digital. Analog. The block diagram on the top shows the blocks common to all communication systems.

The Merits and Demerits of Analog and Digital Communication System

Advantages of Digital Communication System

·Less expensive

·More reliable

·Easy to manipulate

·Flexible

·Compatibility with other digital systems

·Only digitized information can be transported through a noisy channel without degradation

·Integrated networks

Disadvantages of Digital Communication System

·Sampling Error

·Digital communications require greater bandwidth than analogue to transmit the same information.

·The detection of digital signals requires the communications system to be synchronized, whereas generally speaking this is not the case with analogue systems.

Advantages of Analogue Communication System

·Uses less bandwidth

·More accurate

Disadvantages of Analogue Communication System

- The effects of random noise can make signal loss and distortion impossible to recover.

ASSESSMENT

1. Differentiate between Analog and Digital communication system?
2. List FIVE merit of digital communication system?

WEEK 2

Topic: Information and Communication Technology (2)

Content:

- Meaning of ICT
- The nature of ICT

ICT is an acronym that stands for Information and Communication Technology. ICT covers a broad spectrum of activities involving production, processing and distribution of information and knowledge. The basic element of ICT and the determinants of level of access to it are explained below;

- Information "I" can be in the form of voice, text, images or data.
- Communication "C" is the transfer of information from either point-to-point or point-to-multipoint. The transfer is usually over some distance.
- Technology "T" with it, the transfer of information is affected. The technology is by electronic means. The transfer of information is often achieved via networks of sending and receiving equipment, wires and satellite links.

ICT can be categorized into three main interlocking sub-sectors:

- **Telecommunication:** It is the communication using fixed lines, mobile platforms, fixed wireless or optical fibre.
- **Computer Hardware**: It is used for sending and receiving information. Super computers, mainframe computers, minicomputers, microcomputers are examples of types of computers. Examples of computer hardware are keyboard, mouse, monitor and system unit.

- **Computer Software:** It is the program that instructs and directs the computer and other devices connected to it so that the computer will know what to do with the information or data to be sent or received. Operating system (OS) and application programs are examples of computer software.

ASSESSMENT

1. What is the meaning of ICT?
2. What are the three main sub-sectors of ICT?
3. What is computer software?

WEEK 2

Topic: Transmission System of GSM

Content:

- Schematic diagram of GSM Transmission process
- Meaning of internet and its process
- Internet equipment and transmission process
- Merits and demerits of internet

Schematic

GSM is an acronym that stands for *Global System for Mobile Communications.* The basic architect of the GSM network comprises *Base Transceiver Station (BTS), Base Station Controller (BSC)*, *Mobile Switching Centre (MSC)*, *Home Location Register (HLR), Visitor Location Register (VLR), Equipment-Identity Register (EIR), Network Management System (NMS)* and *Mobile Station (MS)* which is made up of the mobile equipment and the *Subscriber Identity Module (SIM)*.

GSM has defined several standard interfaces; the radio interface (Um), the interface between MSC and BSC (A interface) and the signaling interface, which allows roaming between networks. Roaming is a service unique to GSM which enables a subscriber to make and receive calls when outside the service area of his home network e.g. when traveling abroad.

The BTS and the BSC together form the base station subsystem (BSS) and carry out all the functions related to the radio channel management. This includes the management of the radio channel configurations, allocating radio channel for speech, data and signaling purposes, and controlling frequency hopping and power control. The BSS also includes, as does the MS, the speech encoding and decoding and channel coding and decoding. Often base transceiver stations are positioned at regular intervals close to main roads in order to give communication service coverage to motorists. Each BTS comprises the radio frequency component and the antenna for communicating with the mobile stations. Usually, several base transceiver stations are under the control of a BSC which in turn communicates directly by a land line or a microwave link with an MSC. Several base station controllers may report to one MSC.

MSC, VLR and HLR are concerned with mobility management functions. These include authentication and registration of mobile customer, location updating and call set up and release. The HLR is the master subscriber database and carries information about individual subscribers, numbers, subscription levels, call restriction, supplementary services and the current location (or more recent locations) of subscribers. The VLR acts as a temporary subscriber database for all subscribers between its coverage areas and contains similar information to that in the HLR. The provision of VLR means that the MSC does not need to access the HLR for every transaction.

The Authentication Centre (AUC) works closely with the HLR and provides information to authenticate all calls in order to guide against fraud. The EIR is used for equipment security and validation of different types of mobile equipment.

Network management is used to monitor and control the major elements of the GSM network. In particular, it monitors and reports faults and performance data. It is also used to reconfigure the network. The network behind the GSM seen by the customer is large and complicated in order to provide all of the services which are required. The network is divided into subsystems:

1. The *Base Station Subsystem* (the base station and their controllers).

2. *The network and switching Subsystem* (the part of the network most similar to a fixed network). This sometimes also called the core network.

3*. The General Packet Radio Service (GPRS) Core Network* (the optional part which allows packet based internet connections). All of the elements in the network combine to produce many GSM services such as voice calls and *short message service* (SMS).

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/* Style Definitions */
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mso-ascii-theme-font:minor-latin;
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mso-hansi-theme-font:minor-latin;
mso-bidi-font-family:”Times New Roman”;
mso-bidi-theme-font:minor-bidi;}
The image above is SIM (subscriber identity module) card; it is a detachable smart card containing the users subscription information and phonebook, it allows the user to retain his or her information after switching off his mobile phone commonly called handsets. In Nigeria, there are some major GSM operators namely; MTN, GLO Mobile, Airtel and Etisalat.

The images above are different GSM Handsets.

Meaning of Internet and its Process

Internet is a computer-based worldwide information network. The internet is composed of a large number of smaller interconnected networks called Internets.

These Internets may connect tens, hundreds or thousands of computers, enabling them to share information with each other, these computers can be located several thousands of miles from each other.

The internet is based on the concept of a client-server relationship between computers as described above. The arrangement is also called client/server architecture. In a client server architecture, some computers act like server or information providers, while other computers act as clients or information receivers. A single client computer may access many different servers and a single server may be accessed by a number of different client computers. To access information on the internet, a user must first log in from a computer. Such a computer is called the client computer. The computer may be a desktop or a notebook, which may be located at home, in an office, in a school or at a business centre referred to nowadays as cybercafé.

The client computer must be linked to an Internet Service Provider (ISP). An ISP or access provider is a company that sells computer access to the internet. A user pays a fee to an ISP, which gives the user an identifying username and a password. An example of a username is **oluwunmis@skannet.com.** This means that the username is Oluwunmis and is connected by an ISP called Skannet. The user specifies the password that he or she wishes to use. This is to prevent somebody else from using his account with the ISP. A password is therefore known to the user or to anybody authorized to use the account, the user must remember it always once it is typed into

the ISP's system, otherwise he or she will not be able to access the internet. The user will try as much as possible to guide and secure his password so that his account is not broken into by *hackers* for unauthorized access.

Internet Equipment and Transmission Process

With his or her computer and modem, the calls the telephone number of the ISP to log on to the service provider's computer. The user's computer then lets the service provider's computer take over. Once a connection has been established, the user may request information from a remote server located anywhere in the world.

Typically, the request may be transmitted through a telephone line (a process referred as dial-up) or through a radio link to the internet service provider's computer.

Merits of the Internet

1. It is used to send written messages between individuals or groups of individuals, often geographically separated by large distance.

2. It gives advertisers easy access to a large pool of consumers within a district, province, country, regional trading area and the whole world at a low cost.

3. It gives consumers access to worldwide information on the product they wish to buy and pay for it through the internet.

4. It makes distance learning education possible. Students can attend classes irrespective of their location by logging on to the internet.

5. It allows one to have access to libraries and database.

6. It allows one to get headlines and in-depth stories on everything going on in the world.

Demerits of the Internet

1. It is used in defrauding innocent people of their money by transacting illegal business with them, this is known as cybercrime.

2. Intellectual property is stolen on the internet.

3. It gives easy access to pornographic pictures and increases their level of sexual immoralities.

ASSESSMENT

1. What does GSM stand for?
2. List 3 merits of the internet
3. List 3 demerits of the internet
4. Define Internet
5. What does GPRS stand for?

WEEK 3

Topic: First Aid and Materials

Content:

- First aid box and materials
- Application of simple first aid

First Aid

First aid is the assistance given to any person suffering a sudden illness or injury, with care provided to preserve life, prevent the condition from worsening, and/or promote recovery. It includes initial intervention in a serious condition prior to professional medical help being available, such as performing CPR while awaiting an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut. It is the assistance given to any person suffering a sudden illness or injury,with care provided to preserve life, prevent the condition from worsening, and/or promote recovery.

It includes initial intervention in a serious condition prior to professional medical help being available, such as performing CPR whilst awaiting an ambulance, as well as the complete treatment of minor conditions, such as applying a plaster to a cut.

First aid is generally performed by the layperson, with many people trained in providing basic levels of first aid, and others willing to do so from acquired knowledge. Mental health first aid is an extension of the concept of first aid to cover mental health.

First Aid Box/Kit

It is a collection of supplies and equipment for use in giving first aid, and can be put together for the purpose by an individual or organization or purchased complete.

There is a wide variation in the contents of first aid kits based on the knowledge and experience of those putting it together, the differing first aid requirements of the area where it may be used and variations in legislation or regulation in a given area.

First aid kits are necessary for every household no matter the age of who lives in the home. Injuries can happen anytime and anywhere. When you have a first aid kit within easy access of wherever you are you will ensure the safety of everyone. First aid can reduce infections from open wounds and injuries. It can also reduce the severity of

an injury. You cannot always keep your family from getting hurt but you can protect them when they get injured with a first aid kit.

Materials Of First Aid Box

A basic first aid kit may contain:

- plasters in a variety of different sizes and shapes
- small, medium and large sterile gauze dressings
- at least two sterile eye dressings
- triangular bandages
- crêpe rolled bandages
- safety pins
- disposable sterile gloves
- tweezers
- scissors
- alcohol-free cleansing wipes
- sticky tape
- thermometer (preferably digital)
- skin rash cream, such as hydrocortisone or calendula
- cream or spray to relieve insect bites and stings
- antiseptic cream

- painkillers such as paracetamol (or infant paracetamol for children), aspirin (not to be given to children under 16), or ibuprofen
- cough medicine
- antihistamine tablets
- distilled water for cleaning wounds
- eye wash and eye bath

It may also be useful to keep a basic first aid manual or instruction booklet with your first aid kit.

Medicines should be checked regularly to make sure they are within their use-by dates.

Application of simple first aid

As individuals, these are the basic first aid knowledge we need to have about different injuries or emergency situations

First aid knowledge and skills promote safety awareness in home, at work, at play, on streets and highways. Through studying first aid, a person is prepared to assist others wisely. He is able to distinguish between what to do and what not to do. Below are some basic steps for treating bleeding and burns examples.

Bleeding

- Position the injured person properly and keep the injured limb elevated (except for fracture victims).
- Inspect the wound, flush with distilled water, exert direct pressure by hand over a dressing, and bandage the wound.
- Do not bandage the wound too tightly that obstruct normal blood circulation to the injured limb.
- Leave the impaled objects and protruding bones in place and protect the injured from further movement. Exert direct pressure on the edge of the wound to stop bleeding.
- Recheck blood circulation of the injured limb after bandaging.

Bleeding from The Nose

- Sit the injured down with his head leaning forward.

- Ask the injured to breathe with his mouth, forcefully pinch the soft part below his nasal bone and apply a cold dressing to the forehead.
- Ask the injured not to swallow the blood lodged in his throat.
- Loosen his tight clothing.
- If bleeding continues after pinching the nose for 10 minutes, continue to do so for another 10 minutes.
- If bleeding still continues, send the injured to the hospital at once.

General Treatment to different kinds of Burns

- Move the injured away from the heat source.
- Check the breathing and pulse of the injured.
- Check the extent and depth of his burns.
- Flush the burned area with water to alleviate pain.
- Cover the wound with a sterilised dressing.
- For facial burns, use sheet or triangular bandage to cover the burnt area. Provide openings on the sheet or triangular bandage for eyes, nose and mouth for the injured.

Heatstroke

To avoid heatstroke, you should halt strenuous activity in hot and humid weather. If you are still determined to go outdoors, you should:

- wear light loose-fitting clothing.
- rest in a cool place as often as possible.
- replenish your bodily fluids by regularly drinking electrolyte drinks or fruit juice.

You should also avoid alcoholic beverages under such circumstances.

Unconscious Person

If one of your companions falls unconscious or you come across someone else who is already unconscious, you should:

- stay calm and immediately call the emergency hotline at 999 for an ambulance.
- roll the person on his or her side to drain any saliva or vomit from the mouth.
- loosen any constricting clothing around the neck, chest and waist.
- keep the person warm and covered with a blanket or clothing.
- stay with the person until the ambulance personnel arrive.

You should not:

- place anything such as pillow under the person's head.
- sit him or her up.
- Feed him or her anything, no matter it is solid food or liquid.

ASSESSMENT

1. What is First Aid?
2. What is a First Aid box/kit?
3. List 8 materials that is contained in the First Aid box
4. What is the first aid treatment given to someone who suffered a burn?
5. What are the things you should not do for an unconscious person?

WEEK 4

Topic: Material and Their Common Uses

Contents

Uses of Wood

Wood is a porous and fibrous structural tissue found in the stems and roots of trees and other woody plants. It is an organic material, wood is sometimes defined more broadly to include the same type of tissue elsewhere such as in the roots of trees or shrubs.In a living tree it performs a support function, enabling woody plants to grow large or to stand up by themselves. It also conveys water and nutrients between the leaves, other growing tissues, and the roots.

Wood is used today in the following industries and processes.

Housing: The doors, windows and roofing of our houses.

Industrial Building: Many industries are constructed with wood, or they have wooden parts.

Joinery: The stair case in our homes.

Packaging: Crates, pallets, packing and cases, etc.

Furniture: Chairs, beds, wardrobes, tables, bookcases.

Transport: Railway wagons, coaches, lorry bodies.

Bridges and poles: Most farm bridges across the roads in villages are made of wood, Also, some electric poles and railway sleepers are made of wood.

Pulp and Paper: Exercise books, textbooks, newspapers, magazines, are made from pulp and paper derived from wood.

Medicine: When people have their arms or legs amputated (cut off), such are usually replaced by artificial limbs made from wood.

Clothing: Most heels and some soles of shoes are made from wood. The rayon stockings and shirts that we wear are made from wood.

Tool Making: Handles for hampers, pick axes, felling axes, screwdrivers, and many other tools are made from wood.

Some of the uses of 'Softwoods and hardwoods'

Softwoods

NAME AND ORIGIN	PROPERTIES	USES
Cedar (Asia and Africa)	Reddish-pink colour, Low density, Little grain pattern, Hardwearing under outdoor conditions	In the building industry for roofing and garages, doors and partitions
Pine (North America)	Yellow-brown colour, Clear growth rings, Durable and strong, with high resin content, Weather well	Railway sleepers, heavy gate posts. Decorative panels and stairways. Pattern making joinery.
Spruce (North America and Canada)	Very pale straw/yellow, Fairly durable	Aircraft industry, Ship masts, Interior joinery, Ladders, Packing cases.

Hardwoods

NAME AND ORIGIN	PROPERTIES	USES
Afromosia (Africa)	Dark brown colour, Similar appearance to teak, Durable, Easy to work	Ship building, Good quality furniture
Agba (Nigeria and Angola)	Yellow to reddish brown, Straight grinned, Resists decay	Joinery and Furniture, General construction
Balsa (America)	Creamy colour, One of the softest, and lightest of woods.	Model making, Life rafts, life belts, insulation (noise or heat)
Beech (Europe)	Pale pink colour, Hard and close-grained, Good bending qualities, Is attacked by fungus, Weathers well	Furniture mallets, Kitchen utensils, e.g. bread boards, rolling pins.

Ekki (Africa)	Red or dark brown colour, Tough and durable, Resists attack by insects.	Piers pile, dock gates, Bridge building.
Gaboon (Africa)	Pale mahogany colour, Fairly soft and easy to work,	
Iroko (Africa)	Yellowish brown colour, strong and durable, Hard and heavy.	Joinery
Mahogany (Africa, Spain, Honduras)	Lightish to deep red colour, Durable, very good working, qualities.	Cabinet making, Ship building, Panelling, Carving, Wood turnery, Veneers.
Oak (England and Northern Europe)	Golden brown colour, Strong and durable with pronounced grain. Distinctive figure pattern when quarter sawn.	Furniture making, Boat building, Veneers, plywood.
Obeche (West Africa)	Weathers well Creamy white to pale yellow Soft, fairly light Easy to work.	Interior joinery, Furniture, Model making.
Teak (INdis, Burma, Africa)	Darkish brown colour, Strong and durable, Feels greasy because of its oil content. Weather well, Resists attack by insects.	Ship building, Furniture, Laboratory benches, veneers.

Uses of Metals

Metals are some element that is typically hard, opaque, shiny, and has good electrical and thermal conductivity. Metals are generally malleable—that is, they can be hammered or pressed permanently out of shape without breaking or cracking—as well as fusible (able to be fused or melted) and ductile (able to be drawn out into a thin wire). Most metals are solid at room temperature, but this does not have to be the case.

Metals could be ferrous when it contains iron and non-ferrous when it does not contain iron.

Ferrous Metals

Name	**Melting Point ^{o}C**	**Composition**	**Properties**	**Uses**
Cast iron	1240	Mixture of carbon and iron, Carbon content 1.5-5%	Vary with carbon content. Brittle with a hard skin. Feel carbon content.	Very suitable for moving parts of machinery because use of the ability of one piece to slide on another due to another the carbon content.
Wrought iron	2000	99% iron with small amounts of impurities.	Malleable and ducile, Elastic, Not very hard, Can be shaped, easily when red hot (forged).	Engine blocks, Haulage gear, Vices, Crane hooks, and chains.
High carbon steel (Tool steel, cast steel)	Varies	99% iron with small amounts of impurities. Mixture of carbon and iron. Carbon	Malleable and ductile, Elastic, Not very hard, Can be shaped easily, when red hot (forged).	Haulage gear, Crane hooks and chains, Anchor chains, General constructional works Nuts,

		content 0.1-0.5%	Malleable and ductile. Very good working qualities: bends, files.	bolts, screws, Non-cutting tools steel sheets.
Low carbon steel (Mild steel)	Varies	Mixture of carbon and iron.	Forges and machines well, Harder than low, Carbon steel, Harder as carbon.	All kinds of cutting tools: Steel sheets.

Metals are very useful to people. They are used to make tools because they can be strong and easy to shape. Iron and steel (which are a variation of metal) have been used to make bridges, buildings, or ships. Some metals are used to make items like coins because they are hard and will not wear away quickly. For example copper (which is shiny and red in color), aluminium (which is shiny and white), gold (which is yellow and shiny), and silver and nickel (also white and shiny). Some metals, like steel, can be made sharp and stay sharp, so they can be used to make knives, axes or razors. Rare metals with high value, like gold, silver and platinum are often used to make jewellery. Metals are also used to make fasteners and screws. Pots used for cooking can be made from copper, aluminium, steel or iron. Lead is very heavy and dense and can be used as ballast in boats to stop them from turning over.

Many things that are made of metals may, in fact, be made of mixtures of at least one metal with either other metals, or with non-metals. These mixtures are called alloys. Some common alloys are:

- Steel (iron and carbon) (Carbon is a non-metal)
- Brass (copper and zinc)
- Bronze (copper and tin)

People first began making things from metal over 9000 years ago, when they discovered how to get copper from its ore. They then learned how to make a harder alloy, bronze, by adding tin to the copper. About 3000 years ago, they discovered iron. By adding small amounts of carbon to iron, they found that they could make a particularly useful alloy – steel.

Uses of Brass

Brass is a general term for a set of copper-zinc alloys that may include additional metals such as lead. Different types of brass have different properties, but all brass is strong, Machin able, tough, conductive, and corrosion resistant. This along with beauty and ease of production make brass one of the most widely used alloys.

Brass has, for centuries, been the metal of choice for many musical instruments. It's an ideal alloy for the transport of water through pipes and fittings. It's also appropriate for use in marine engines and pump parts. It should not be surprising that one of the first commercial uses of brass was on naval ships.

Another common usage of the metal comes from its non-magnetic nature. Clock and watch components, electrical terminals and munitions all require a metal that will not be affected by magnetism.

While compiling a complete list of all of brass's applications would be a colossal task, we can get an idea of the breadth of industries and the types of products in which brass is found by categorizing and summarizing some end-uses based on the grade of brass used.

Free Cutting Brass

Alloy C-360 brass, also called "free cutting brass," is alloyed with copper, zinc, and lead. Free cutting brass is very easy to machine, but also offers the same toughness and corrosion resistance as other forms of brass.

Some uses for free cutting brass include:

- Nuts, bolts, threaded parts
- Terminals
- Jets
- Taps
- Injectors
- Valve bodies
- Balance weights
- Pipe/water fittings

Gilding Metal (Red Brass)

Gilding metal is a form of brass that is made up of 95% copper and 5% zinc. A soft brass alloy, gilding metal can be hammered or easily formed into desired shapes.

Its unusual deep bronze color and ease of use make it ideal for craft-related projects. It's also commonly used for artillery shells. Some other uses include:

- Architectural fascias
- Grillwork
- Jewelry
- Ornamental trim
- Badges
- Door handles
- Marine hardware
- Primer caps
- Pen, pencil and lipstick tubes

Engraving Brass

Engraving Brass, also referred to as alloy C35600 or C37000, contains either 1% or 2% lead. Its name, not surprising, comes from its use in the creation of engraved nameplates and plaques. It may also be used for:

- Appliance trim
- Clock components
- Builders hardware
- Gear meters

Arsenical Brass

Arsenical brass (C26000, C26130 or 70/30 brass) contains about .03% arsenic to improve corrosion resistance in water. Like other forms of brass, arsenical brass is bright yellow, strong, and easy to machine. It's also an appropriate metal to use in plumbing. Other uses include:

- Heat exchangers
- Drawn and spun containers

- Radiator cores, tubes, and tanks
- Electrical terminals
- Plugs and lamp fittings
- Locks
- Cartridge casings

High Tensile Brass

High tensile brass is a particularly strong alloy which includes a small percentage of manganese. Because of its strength and non-corrosive qualities, it is often used for products that undergo a good deal of stress.

Some examples include:

- Marine engines
- Hydraulic equipment fittings
- Locomotive axle boxes
- Pump casting
- Heavy rolling mill housing nuts
- Heavy load wheels
- Valve guides
- Bushes bearings
- Swash plates
- Battery clamps

Uses of Bronze

bronze is typically used in outdoor sculpture. Its forms are almost limitless since it may be cast in any shape for which a mold can be devised. The most common types of forms include the human figure, landscapes, battle scenes, animals, weapons, decorative elements such as stars, rosettes, etc., and plaques.

Architectural bronze is typically used for:

Door and window frames

Door and window hardware

Mail boxes and chutes

Trim or rails

Furniture hardware

As a general rule, architectural applications seek to preserve the natural, highly polished “pinkish” finish of raw bronze, in contrast to the patination of outdoor sculpture/ornament. This is achieved by the frequent polishing and oiling of bronze/brass decorative and structural elements, or the application of clear lacquers which must be renewed on a periodic basis.

ASSESSMENT

1. Give two examples of softwood and their uses.
2. Give two examples of hardwood and their uses.
3. List 5 uses of bronze
4. List 4 types of brass
5. List 5 uses of brass
6. List 5 uses of wood
7. List 5 uses of metals

WEEK 5

Topic: Geometrical Construction

Content

1. Definition of lines
2. Types and uses of line
3. Construction of lines and angles
4. Bisections of lines
5. Division of limes

Lines

It is important to understand the following terms before proceeding to the construction of lines and angles.

A point is defined as something which has a position and an extremely small magnitude so that it is barely visible. A point can be made on paper by a well sharpened pencil or a needle. A point is used to indicate position only, and in technical drawing it is usually represented by a cross or a dot.

A line has position and length, but has virtually no thickness. A line may either be straight or curve. A straight is defined as the shortest distance between two points. Two lines are said to be parallel if they are always the same distance apart and cannot meet, however far they may be produced (extended) in either direction.

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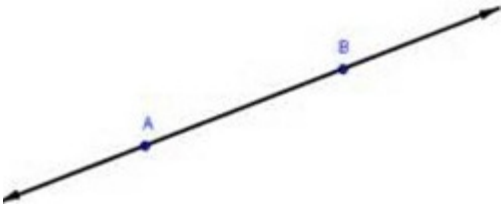


Types and Uses of Lines

Lines are represented in drawings in various ways;

Thick continuous lines are used for visible outlines and edges. The thickness of this kind of line is about 0.7mm. However, you do not have to measure the thickness of lines each time you draw. If you draw with a well-sharpened HB or 2Hpencil and apply a moderate pressure, you will produce a thick line.

Thin continuous lines are used as dimension lines, projection lines, construction lines, and outlines of adjacent parts and resolved sections. They are also used as hatching lines. Thin lines are usually drawn with well-sharpened 3H, 4H or harder pencils with moderate pressure and resolved sections. They are also used as hatching lines.

Thick long chain lines are used for cutting planes and viewing planes. They are also used ac centre lines, path lines and indicating movement, or extreme positions of movable parts, and for pitch circles. Like thick long-chain lines, thin long-chain lines, with thick ends may be used to indicate cutting planes.

Thick continuous wavy or irregular lines are used for short break lines and boundary lines.

Thin ruled lines with short zig-zags are used for long break lines.

Thin continuous wavy lines are used for limits or partial views or for sections when the line is not an axis.

Arrowheads are used at the ends of dimension lines. They are also used to indicate viewing planes and to indicate labeled parts. Arrowheads should be sharp, filled-in, and should be about 3mm long.

TYPES OF LINES	THEIR USES
Thin continuous lines	For dimension lines, projection lines and construction lines.
Thick continuous wavy line	For limits of partial waves.
Thin ruled line with short zig-zags	For long break lines.
Thick continuous line	For short break lines and boundary
Thin long chain line	For short break lines and boundary
Thick long chain line	For cutting and viewing planes as centre lines and path line for indicating movement.
..... Thin short	For hidden outlines and edges

Construction of Lines and Angles

Important guides to good construction;

i. In technical drawing, all horizontal lines are drawn with the T-square and all vertical lines are drawn with a triangle (or a set-square) placed on the T-square.

ii. When drawing a line with the triangle, ensure that its edge rests firmly on the edge of the T-square.

iii. Always ensure that the edge of the stock or head of the T-square slides firmly on the left hand side edge (the square of the drawing board. The T-square should never be used to draw a line in any other position.

iv. Use well pointed pencils and take utmost care to draw lines through the required points, otherwise the result will not be satisfactory.

v. In using dividers and compasses, avoid pressing the points deeply into the drawing paper, as this will cause in accuracy. Remember that a point has position only and should have no magnitude.

vi. In joining two points, adopt the following procedure: with the pencil point firmly placed on one point, slide the triangle up to meet it. Then swing the lower portion of the triangles until the lines up the other point on a straight-line with the first point. Check the second point for alignment by putting the pencil on point. Then draw the line joining the two points.

vii. There is no alternative to constant practice if you intend to draw accurately, neatly and fast.

Bisection of Lines

To bisect a given line;

i. Draw the given line AB

ii. With centre A and any radius greater than half AB, draw the arcs above and below the line.

iii. With centre B, draw arcs of the same radius to cut the previous ones.

iv. The line is drawn through the intersections of the arcs.

Division of Lines

(A) To divide a straight-line into a number of equal parts;

Suppose it is required to divide a straight-line 70mm long into 5 equal parts –

i. Draw AB 70mm long.

ii. Draw AC at any convenient acute angle and set off from A, five equal divisions on this line using either a pair of dividers or a scale and pencil.

iii. Join point 5 to B using at 60^{0} triangle. Through the other points draw lines parallel to 5B by sliding the triangle on any straight edge, such as a T-square. The line AB is divided into five equal parts by the line 1 – 1, 2 – 2, 3 – 3, and -4.

Division of Lines in a Given Line Proportion

Suppose it is required to divide a straight-line 9cm into four parts in the proportion of 2:3:7:4:

i. Draw AB9cm long

ii. Draw line AC at a convenient angle and set off on it from A 2 + 3 + 7 + 4 = 16.

iii. Join point 16 to B. Through the point 12 = 2 + 3 + 7, 5 = 2 + 3, and 2 = O + 2 draw lines parallel to 16B. The parallel lines divide AB in the required proportion.

ASSESSMENT

1. What is the definition of a point?
2. What are the steps in bisecting a line?
3. Mention 5 guides in making good construction.
4. List 5 types of lines.

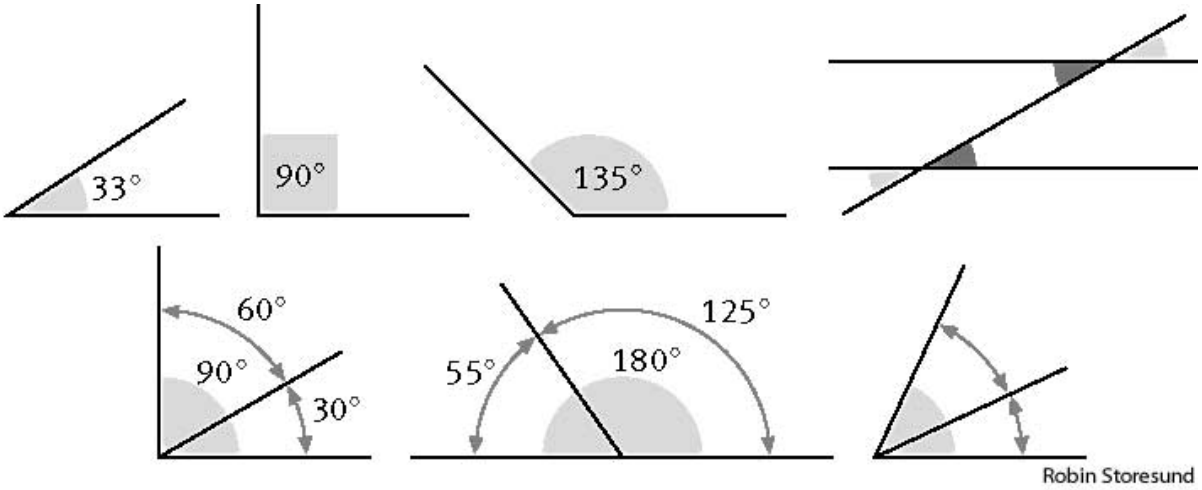
WEEK 6

Topic: Geometrical Construction (Angles)

Content

1. Definition of Angles
2. Types of Angles

An angle is formed when two straight lines meet at a set point. In other words, an angle is the inclination to each other of two straight lines, which meet at point as shown.



Types of Angles

The unit of measurement of angles is the degree, and the instrument used to measure the value or magnitude of an angle is called a *protactor.*

A **right angle** is an angle measuring 90°. Two lines or line segments that meet at a right angle are said to be perpendicular.

An **acute angle** is an angle measuring between 0 and 90°.

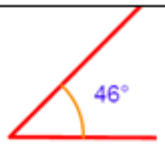
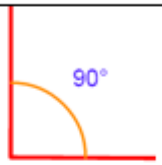
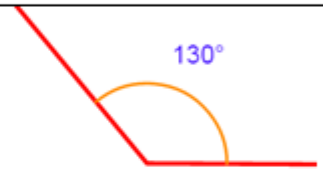
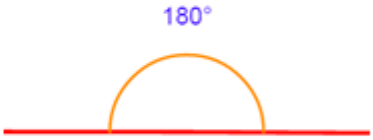
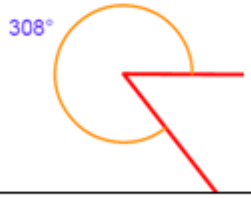
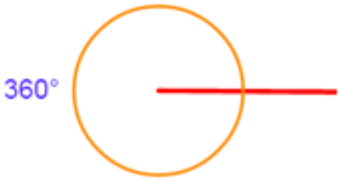
An **obtuse angle** is an angle measuring between 90° and 180°.

A **straight angle** is a straight line and it measures 180°.

A **reflex angle** is an angle measuring between 180° and 360°.

Complementary angles definition is either of two angles that added together produce an angle of 90°.

Supplementary angle is when the sum of two angles located side by side is equal to 180°.

Type of Angle	Description	Example
Acute Angle	An angle that is less than 90°	
Right Angle	An angle that is exactly 90°	
Obtuse Angle	An angle that is greater than 90° and less than 180°	
Straight Angle	An angle that is exactly 180°	
Reflex Angle	An angle that is greater than 180° and less than 360°	
Full Angle	An angle that is exactly 360°	

ASSESSMENT

1. What is an angle?
2. List 5 types of angles.
3. What is an angle measuring between 180° and 360°
4. What is the unit of measurement of an angle?
5. What is the instrument used for measuring angles?

WEEK 7

Topic: Geometric Construction (Circles)

Content

1. Definition of Circles
2. Types and Parts of a Circle
3. Bisection, construction of tangent and normal to given circle

Definition Of Circle

A **circle** is a simple closed shape in Euclidean geometry. It is the set of all points in a plane that are at a given distance from a given point, the centre; equivalently it is the curve traced out by a point that moves so that its distance from a given point is constant. The distance between any of the points and the centre is called the radius.

A circle is a simple closed curve which divides the plane into two regions: an interior and an exterior. In everyday use, the term “circle” may be used interchangeably to refer to either the boundary of the figure, or to the whole figure including its interior; in strict technical usage, the circle is only the boundary and the whole figure is called a disc.

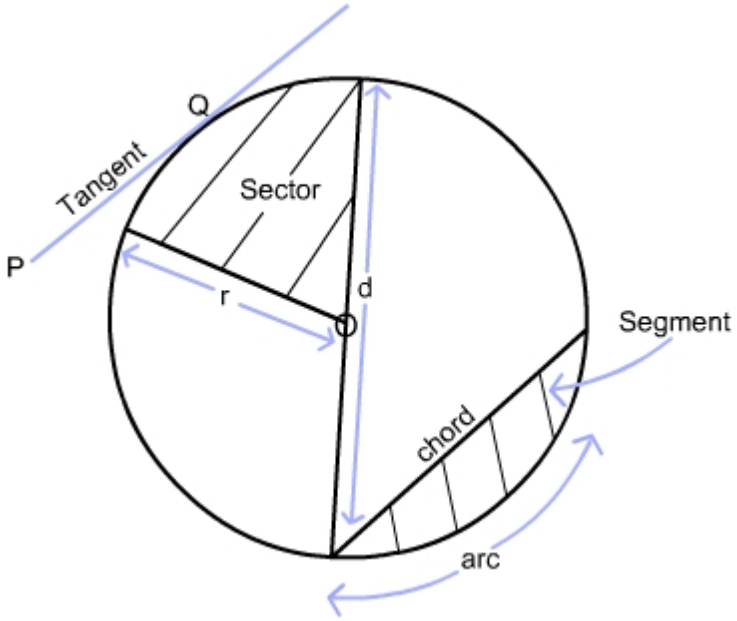
Simply put, a circle is a plane figure bounded by a curved line called circumference, which is always equidistant from the centre.

Types and Parts of a Circle

Below are the different parts of a circle

- **Circumference:** the distance around the edge of the circle.
- **Diameter:** the distance from one side of the circle to the other, passing through the centre.
- **Radius:** the distance from the centre of the circle to the edge.

Now we a going to look at a couple of new parts of a circle. Let’s start by checking out the picture below.

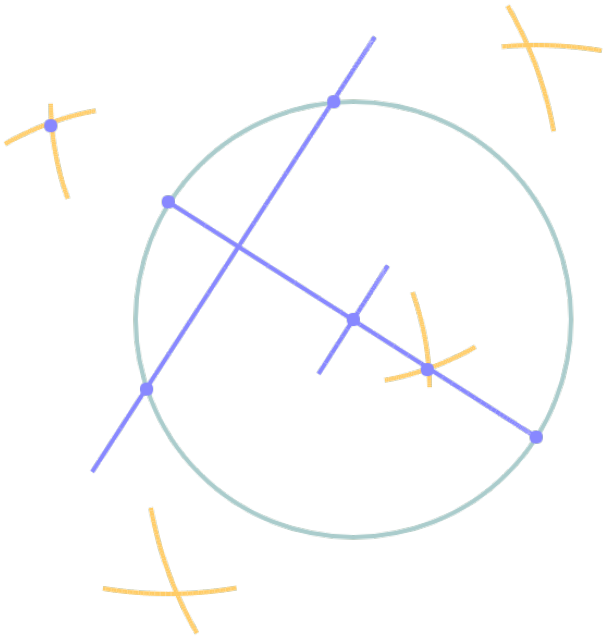


Now let's explain each of these features.

- Tangent: a line that intersects the circumference of a circle in exactly one point. A tangent is perpendicular to the radius from the point where the tangent touches the circle.
- **Arc:** part of the circumference of the circle.
- **Chord:** a line that goes from one point to another on the circle's circumference, without passing through the centre.
- **Sector:** a section of the circle defined by two lines from the centre to the circumference. It looks like a piece of pizza. However, there are different kinds of "slices." A minor sector has an angle at the centre of the circle of less than 180°. A major sector has an angle at the centre of the circle of more than 180°. There are are some special kinds of sectors:
    - **Semicircle:** a sector made from half the area of a circle.
    - **Quadrant:** a sector made from a quarter of the area of a circle.
- **Segment:** an area made from a chord and an arc of the circle. Each chord produces two segments: a major segment (the large shape) and the minor segment (the small shape, like the one shaded in the picture above).
- **Secant:** a line that touches and passes through two points on a circle's circumference.
- **Cyclic** quadrilateral: a four-sided shape whose four points touch the circumference of a circle.

Bisection, construction of tangent and normal to given circle

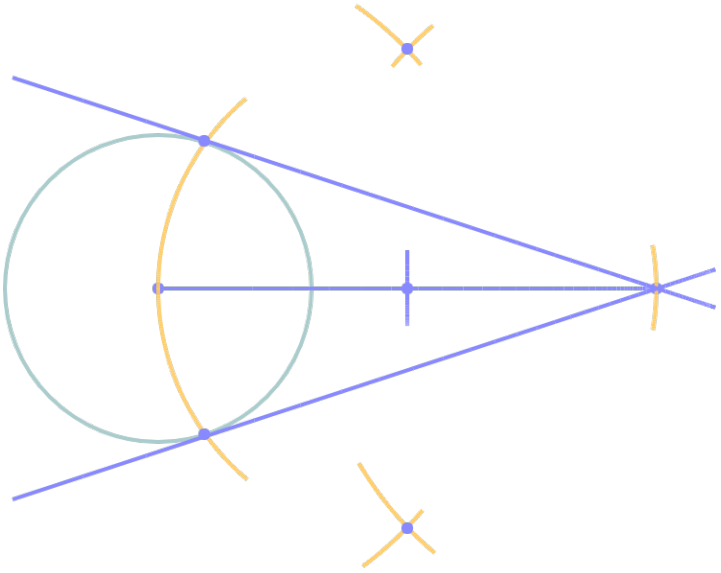
How to construct a Centre of Circle using just a compass and a straightedge?



Steps:

- Draw a line across the circle to make a “chord”
- Construct the perpendicular bisector of that chord to make a diameter of the circle
- Construct the perpendicular bisector of that diameter to get the centre of the circle
-

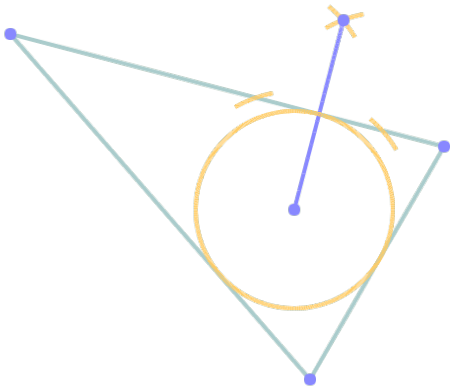
How to construct a Tangent from a Point to a Circle using just a compass and a straightedge?



Steps:

- Draw a line connecting the point to the centre of the circle
- **Construct the perpendicular bisector** of that line
- Place the compass on the midpoint, adjust its length to reach the end point, and draw an arc across the circle
- Where the arc crosses the circle will be the tangent points.

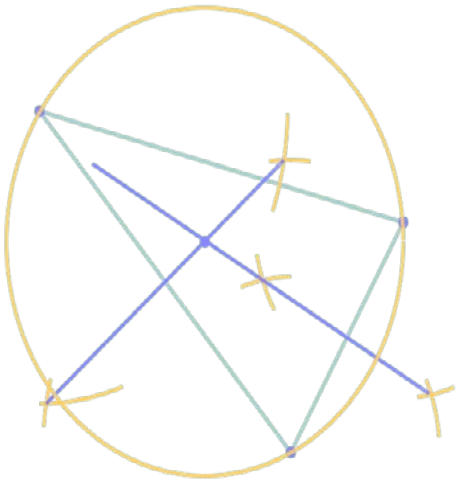
How to Inscribe a Circle in a Triangle using just a compass and a straightedge?



Steps:

- Bisect one of the angles
- Bisect another angle
- Where they cross is the centre of the inscribed circle
- Construct a perpendicular from the centre point to one side of the triangle
- Place compass on the centre point, adjust its length to where the perpendicular crosses the triangle, and draw your inscribed circle!

How to Circumscribe a Circle on a Triangle using just a compass and a straightedge?



- Construct the perpendicular bisector of one side of triangle
- Construct the perpendicular bisector of another side
- Where they cross is the centre of the Circumscribed circle
- Place compass on the centre point, adjust its length to reach any corner of the triangle, and draw your Circumscribed circle!

How to construct a Circle touching 3 Points using just a compass and a straightedge?

WEEK 8

Topic: Triangle

Content:

1. Definition and Types

INTRODUCTION

A triangle may be defined as a plane figure contained by three straight lines, known as the sides of the triangles. One of the sides, usually the one most nearly horizontal, is identified as the base.

A triangle, as its name implies, has three angles. The two angles at the ends of the base are called base angles. The third angle, which is opposite the base, is called the vertical angle is formed is termed the vertex of the triangle.

The sum of the three angles of any triangle is 1800.

You can check this statement by drawing a triangle in any manner you like. Measure the three angles formed using a protractor. Sum the angles and confirm that they add up to 1800.

The altitude or height of a triangle is the perpendicular distance from the vertex to the base.

Triangles are classified according to the magnitude of their angles or according to the length of their side.

i. Types of Triangles according to Angles

An **acute angle** triangle is one which has each of its three angles less than right angle.

A **right angled** triangle is one which has one of its as a right angle. The side of the triangle opposite the right angle is called the hypotenuse.

An **obtuse angled** triangle has one has one of its angles greater than a right angle.

ii. Types of Triangles according to sides

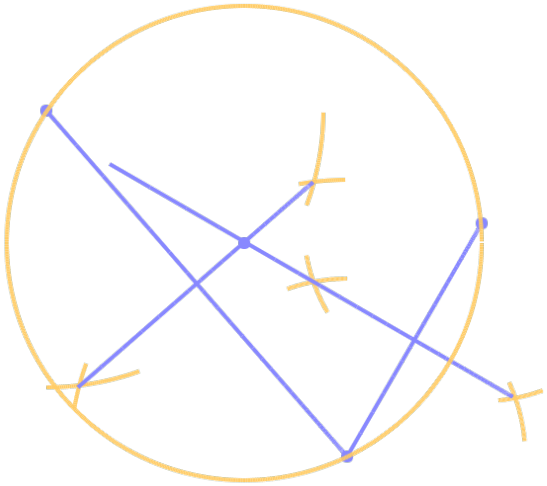
An **equilateral** triangle is one which has its sides equal.

(Note: The three angles are also equal, each being 600.)

The sides are also equal i.e., AB = BC =AC. An isosceles triangle has two of its sides equal.

(Note: The two angles of the feet of the equal sides are also equal.)

A **scalene** triangle is one in which no side is equal to another.



Steps:

- Join up the points to form two lines
- **Construct the perpendicular bisector** of one line
- Construct the perpendicular bisector of the other line
- Where they cross is the centre of the circle
- Place compass on the centre point, adjust its length to reach any point, and draw your circle!

ASSESSMENT

1. What is a circle?
2. What are the parts of a circle?
3. What are the steps taken to inscribe a circle in a triangle?
4. What is the difference between a circumference and a diameter?

WEEK 9

Topic: Material and Their Common Uses (cont'd)

Contents:

- Uses of Ceramics
- Uses of Rubbers

Ceramics

The basic material for the production of ceramics is clay, this is dug out of the ground. After water is added, the mixture is shaken and sieved so that unwanted material, such a stones, is removed. When the clay has settled and drained it is allowed to dry until it is suitable to be worked on.

Clay can however be bought already prepared. Red clay contains iron oxide. It has a fine texture and is fired (baked) in kilns at temperature between 900^{o}C and 1200^{o}C. It is used for making earthenware utensils.

Grey clay has a small amount of iron oxide. It is fired at about 1200^{o}C and is biscuit coloured. It is used to make stoneware utensils.

China clay is obtained from kaolin and is white in colour. It has very fine particles and is used for delicate utensils.

Articles made from clay usually need to be fired twice. The first time the temperature is about 500^{o}C, this drives off excess moisture. The second time, firing is at a higher temperature, and this hardens the utensils.

Uses of Ceramics

Ceramics can be used for many things. Due to the fact that ceramics can withstand very high temperature, they are used in making furnaces. A furnace is a structure or apparatus in which a lot of heat is generated. While the water in an electric kettle boils at about 100^{o}C, iron melts at about 1536^{o}C. Ceramics can withstand even higher temperatures.

Ceramics can carry heavy loads. As a result of this property, we use bricks and cement blocks to build houses. The walls of any building carry the roof of the building, the top floors, people and decorations.

Most electric poles are made from concrete which is a type of ceramic. The insulator between the lines is also ceramic. Other ceramics are the windscreens of vehicles, ordinary looking glass, television screens and ashtrays. A modern toilet is built entirely with ceramics. The walls are made from concrete blocks, which are ceramics, while the tiles, sinks, baths and toilet bowls are all made of ceramics.

Common types of clay mined include: common clay, kaolin (China clay), bentonite, ball clay, fuller's Earth, and fire clay, and each has a number of different uses:

- Common clay is mostly used for bricks, cement, and aggregate.
- Kaolin is widely used for making glossy paper.
- Bentonite has a variety of industrial uses, including drilling mud and foundary sand, and is also found in household products that absorb pet waste.
- Ball clay is a high quality clay prized for its use in ceramics, sanitaryware, and wall and floor tiles.
- Fuller's Earth is also used for pet-waste products.

Uses of Rubber

Think of rubber and you probably think of elastic bands, car tires, or pencil erasers. But this super-stretchy material actually finds its way into tens of thousands of different products—everything from rubber stamps and waterproof shoes to dishwasher hoses.

Rubber is a material which can stretch and shrink. It is a polymer and it can be produced from natural sources (eg. natural rubber) or can be synthesised on an industrial scale. Sometimes the word means only natural rubber (*latex rubber*). Natural rubber is made from the white sap of some trees while the other is called synthetic rubbers, made by chemical processes.

Rubber, in one form or another has been used since the times of old, evidence of its use going back 2,000,000 years or more. In those days the substance was derived naturally from the rubber tree. Individuals would then use it to make balls, and to waterproof handmade buckets, pails and more. As time went on more and more uses for rubber was discovered inspiring the invention of synthetic rubber because the natural alternative could not keep up with the growing demand. Every year an approximated 4 million tons of natural rubber and 7 million tons of synthetic rubber are produced to make more than 50,000 different products that we use on a daily basis worldwide.

Natural rubber production begins with the tapping of the matured rubber trees of South East Asia and Africa. Workers tap the trees by making an incision which cause the slow flow of the milky fluid called latex, after enough of the latex is collected in pails the water is then removed from it and the latex is then turned into raw rubber. There are approximately twenty different types of synthetic rubber used today including silicone rubber,acrylic rubber and butyl rubber. the production of this type of rubber consists of the adding of materials like petroleum, crude oil and different types of gases.

Today, rubber is as widely used as wood and this is largely due to its beneficial properties like strength, long lasting, water resistance and heat resistance all these benefits makes this material perfect for tire production, in fact a large percentage of rubber production goes into the automotive industry. Other benefits like being non slip, soft, durable, resilient makes this material the first choice for playground equipment, shoes, mats, flooring, healthcare supplies, household supplies, balls, toys and thousands of other rubber products. Rubber comes in a large variety of colors, styles and textures making it extremely diverse. Used rubber tires are often recycled to make other items like mulch, shoes, bags, jewelry and coats. It is safe and reliable and seen as a valuable material by many.

Uses of Plastics

Plastic when hot can be shaped by pressing or squeezing. There a few natural materials that are plastic but most are man-made. There are very many types of plastic with different purposes and these are gradually replacing wood and metals for many articles. Plastic are made from chemicals obtained from natural sources such as water, air, oil, gas and coal. Some of these chemicals have complicated formulae and long names which are so difficult to remember that the makers often call them by simple names, or trade names.

Thermoplastics

Thermoplastics are plastics which become soft when they are heated. They harden again as they cool, but may be reheated, when they will become soft again.

Properties of Plastics

There are some plastics which you can see through easily, and they are said to be transparent like a glass. Others allow strong light through but you cannot see through them. They are said to be translucent, like white plastic carrier bags. Some plastics do not let light through at all, these are said to be opaque. To check whether a plastic is

translucent, put it in front of a torch, switch on the torch and look to see whether any light is coming through.

Uses of Plastics

Plastic means something that can be shaped by pressing or squeezing. There are a few natural materials that are plastic but most are man-made. There are very many types of plastics with different properties for different purposes and these are gradually replacing wood and metal for many articles. Plastics are made from chemicals obtained from natural sources such as water, air, oil, gas and coal. Some of these chemicals have complicated.

ASSESSMENT

1. What is the most important material used for making ceramics?
2. What are some of the uses of ceramics?
3. What are the uses of rubber?
4. What are the uses of plastics?
5. What are the properties of plastics?

WEEK 10

Topic: Rescue Operation

Contents:

- Meaning of rescue operation
- Different aspects of rescue operation
- Steps involved in rescue operation

RESCUE OPERATION

This is the operations or organized procedures of a person or group of people to bring people or a person out of danger, attack, harm etc. Rescue comprises responsive operations that usually involve the saving of life, or prevention of injury during an incident or dangerous situation.

Tools used might include search and rescue dogs, mounted search and rescue horses, helicopters, the “jaws of life”, and other hydraulic cutting and spreading tools used to extricate individuals from wrecked vehicles. Rescue operations are sometimes supported by special vehicles such as fire department’s or EMS heavy rescue vehicle. Rescue operations are carried out mostly by trained firemen, police, military, first aid or ambulance attendants.

DIFFERENT ASPECTS OF RESCUE OPERATION

1. **Air-Sea Rescue (ASR)** is the coordinated search and rescue of emergency water landings as well as people who have survived shipwreck or boat mishap

Air-sea rescue

2. **Combat search and rescue (CSAR)** is the search and rescue operations that are carried out during war that are within or near combat zone.

3. **Mine rescue** is the specialized job of rescuing miners and others who are trapped or injured in underground mines after mine accidents.

cave rescue

4. **Cave rescue** is the operation involved in rescuing people trapped, lost or injured in wilderness or cave.

5. **Surface-water rescue** is the rescue of a person who is afloat on the surface of a body of water.

surface-water rescue

6. **Vehicle extrication** is the process of removing vehicle from around a person who has been involved in a motor accident.

7. **Confined space rescue** involves the rescue and recovery of victims trapped in a confined space like tanks, sewers and underground vaults.

8. **Urban search and rescue** involves the location extrication and initial medical stabilization of victims trapped in collapsed buildings or trenches.

STEPS INVOLVED IN RESCUE OPERATION

This acronym – REPORT – developed is useful when trying to plan for and execute technical rescue. The acronym assists in breaking down the differing phases of the technical rescue process to assist with resources, timelines and direction.
It stands for:
R– response
E– evaluation
P– pre-entry
O– operations
R– removal
T– termination

Every technical rescue operation goes through these six phases. Your department may utilize a different acronym, but essentially you will go through each to accomplish the completion of your specialized rescue event.

R — Response
The response phase of the call is broken down into two separate areas — the pre-dispatch and the responding phase. The pre-dispatch phase is that time when district familiarization, pre-planning and resource identification is paramount. You must know what hazards exist in your area, what options you will have to address those operational impacts and where you will get resources from to meet those impacts. The second phase, responding, is the time from when your crew is dispatched to a call to arrival. The company officer must be trained to know when to ask for additional resources and ask for it early. In addition, they should be aware of any special information that is known — such as ingress details, next-in unit instructions and staging areas — and communicate those details to incoming units.

E — Evaluation
Once on scene, your primary task will be to gather information. The first-in unit should conduct an initial approach assessment to determine hazards, type of emergency and additional resource requirements. After the approach assessment, the first arriving Company Officer should transmit a size-up report, implement the appropriate portions of the Incident Command System, establish staging locations, request appropriate resources, gather available information and conduct a risk/benefit analysis.

It is critical to know if the incident involves actually rescuing viable patients or if this is a body recovery. This knowledge determines the pace and urgency of the operation, and more importantly determines the acceptable level of risk in the risk/benefit analysis. Members should provide input into this ongoing analysis. Recovery operations undertaken by responders to recover the remains of victims or property should only be implemented when the risk to responders has been reduced to the lowest level possible.

P — Pre-entry
This step of the process of making the scene and surrounding area as safe as possible. The proper management of this phase of a technical consists of the following steps:
Isolate — Initial company operations should include taking steps to secure the scene from unauthorized access or actions, as well as attempting to identify and secure a witness or responsible party. With each incident, isolation zones will need to be established to appropriately secure the scene — hot, warm and cold.
Evacuate — Following the process of isolating the incident will often include evacuating people from the area of the rescue. These people will include Good Samaritan types, fellow workers, EMS, the press and onlookers.
Lock Out/Tag Out — Lock out/Tag out is a system used to secure and isolate equipment from its source of energy while personnel are working on or near that equipment. While the rescue/extrication is taking place, a firefighter should be posted as a guard with a radio at the energy source.

O — Operations
This phase consists of the actual application of personnel and equipment to perform a rescue or recovery based on the risk/benefit assessment performed in the evaluation phase. Personnel who are certified at the operations level for the specific rescue being performed — rope, confined space, etc. — generally carry out this operation. While it is not essential that all personnel in an operational area be certified as operational, they do need to be directly supervised by an individual who

is operations or technician certified. In addition, only those personnel who are integral in the operations and are actually working or delivering logistical needs should be inside the hot zone.

R — Removal
This phase of the technical rescue operation is the safe and effective removal of victims from the hot zone. This may require the collaboration of multiple disciplines to include rope rescue, EMS and extrication personnel. Remember also that specialized medical knowledge may be required to treat patients who may suffer from crush injuries and/or compartment syndrome secondary to structural or trench collapse.

T — Termination
The termination of a specialized rescue event is that time when rescue or recovery of a victim has occurred. The command team should take a short break to allow for members to rehab. It should also take this time to perform another risk/benefit analysis. Is the equipment in the hot zone worth the dangers required to remove them? This is especially critical when comparing the utilization of trench or structural collapse equipment. It may be better to detail the equipment left in the hot zone and bill the owners or contractor for their costs, rather than risk the loss of personnel. If the decision is made to remove equipment from a hot zone, remember to take your time! A large number of injuries and fatalities occur when in the termination phase of an event.

All of these directions will assist in remembering the steps necessary to complete a specialized rescue event. The REPORT acronym is nothing but a memory tool to assist with recalling the resources and requirements for managing a technical rescue call. The key is to practice utilizing this or other systems to ensure that should a specialized rescue event occur in your area, your members are practiced and capable in delivering those skills necessary in a safe effective fashion.

ASSESSMENT

1. Define the term ‘rescue’.

2. What are rescue operations?

3. What is the full meaning of CSAR?

4. Describe ASR.

5. When miners are trapped how are they rescued?

WEEK 11

Topic: Construction and Sketches

Outline:

- Construction of Triangles

Construction of Triangles

(A) To construct a triangle given the length of the three sides

i. Draw a horizontal line and mark off the base of the triangle AB.

ii. With center A and a radius equal to the length of the side of the triangle, strike an arc.

iii. With center B and a radius equal to the other side, strike another arc to cut the previous one at C.

iv. Join CA and CB to obtain the triangle ABC.

(B) To construct a triangle given two sides and the included angle

i. Draw a horizontal line and mark off one of the given sides AB.

ii. At A, construct the given included angle BAC with the aid of a protractor.

iii. With center A and a radius equal to the other given side of the triangle, cut AC at D.

iv. Join DB to complete the required triangle ABD.

(C) To construct an equilateral triangle using compasses

Note: An isosceles triangle may be similarly constructed once its base and sides are given. The equilateral triangle may also be drawn using the 600 set-square.

(D) To construct an equilateral triangle using 600 set-square

i. Draw a horizontal line and mark off base AB equal to the given side.

ii. Slide the T-square below AB. Place the hypotenuse side of the 600 set-square on the T-square.

iii. Through A, draw AC at 600.

Reverse the set square, and through D draw BD at 600. AC and BD intersect at E to give the equilateral triangle EAB.

ASSESSMENT

1. Construct an equilateral triangle using compasses.

Bisection of angle/Construction of angles

Content:

- Bisection of angles
- Construction of Angles

Bisection of Angles

To bisect a given angle

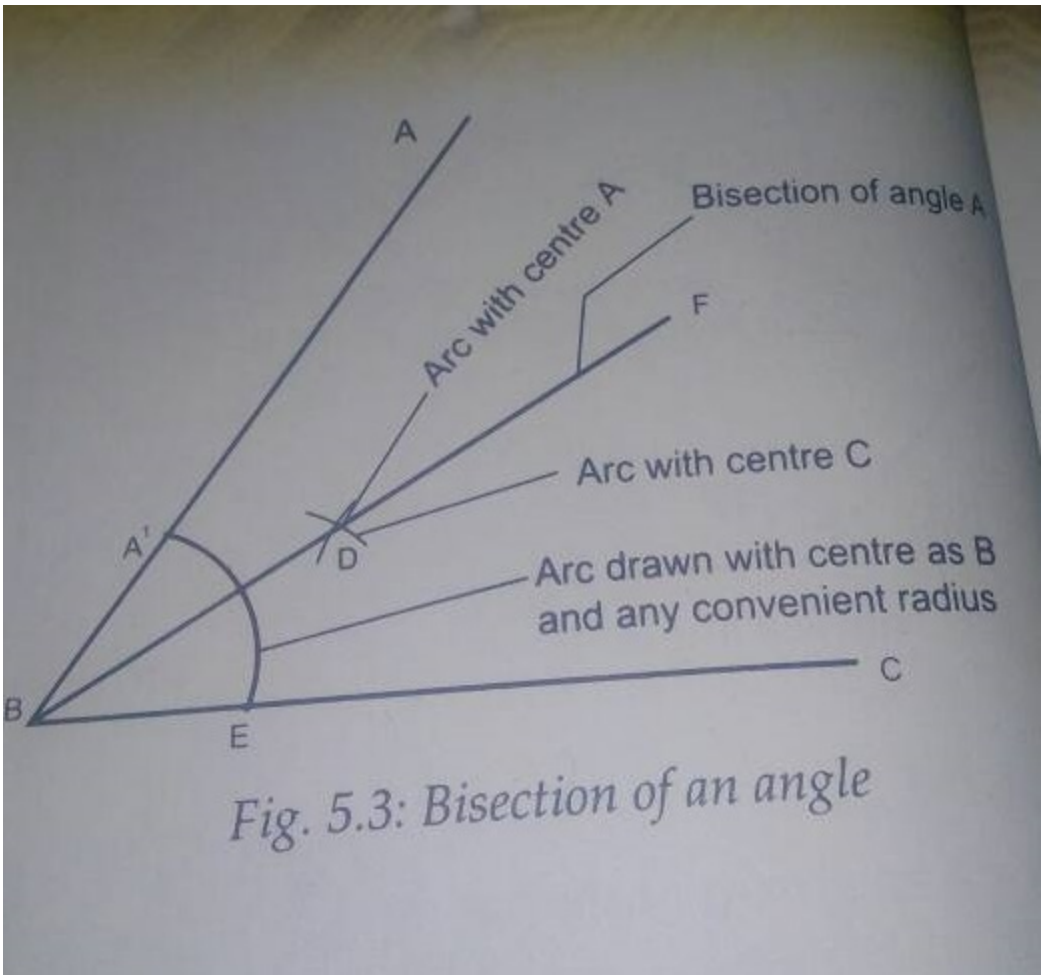


Fig. 5.3: Bisection of an angle

i. Draw a given angle ABC

ii. With centre B and any convenient radius draw ab arc to cut AB and D and BC at E.

iii. With centre A1 and any small radius draw an arc.

iv. With centre E and same radius draw an arc to intersect the previous one at F

v. Join BD, BD bisects angle ABC, i.e angle ABD = and DBC

vi. Use a protactor to check angles ABF and CBF.

SECOND TERM NOTES ON BASIC TECHNOLOGY

WEEK 1

TOPIC:Construction of Angles

Constructing a 90 Degree Angle

i. Draw a line with the measure is 5 cm 5 cm

ii. Draw point A at the line A

iii. Place the point of the compass at A and draw an arc that passes through the line at point P and Q P A Q

iv. Place the point of the compass at P and draw an arc that passes through Q P A Q

v. Place the point of the compass at Q and draw an arc that passes through P that cuts the arc drawn in Step 4at R. R P A Q

vi. By using ruler, joint A to R, so angle RAQ is 90-degree R 90-degree P A Q

Constructing a 60 Degree angle

i. Draw the arm PQ. P Q

ii. Place the point of the compass at P and draw an arc that passes through Q. P Q

iii. Place the point of the compass at Q and draw an arc that passes through P. Let this arc cut the arc drawn in Step 2 at R. R P Q

iv. Join P to R. The angle QPR is 60-degree R 60-degree P Q

Constructing a 30-degree Angle

i. Construct 60-degree angle R 60-degree P Q

ii. With the point of the compass at P, draw an arc intersecting arm PQ at M and intersecting arm PR at N. R N 60-degree P Q M

iii. At point M and N draw an arc with same radius then intersect at point T R T N 60-degree P Q M

iv. Join P to T. Then angle TPQ is 30-degree R T N 60 degree 30-degree P Q M

Constructing a 45 Degree angle

i. Construct 90 Degree angle R P Q

ii. Put your Compass at the point P, and draw an arc intersect PQ and PR at A and B. R B P A Q

Constructing a 45 Degree angle Step

iii. Put your Compass at the point A and B then draw an arc with the same radius so intersects each other at the point C C R B P A Q

Constructing a 45 Degree angle

iv. Joint P to C, so angle CPQ is 450 C R B 45 Degree P A Q

ASSESSMENT

1. Construct a 45 degree angle.
2. Construct a 60 degree angle
3. What are the steps taken to bisect an angle?

Week 2

Topic: QUADRILATERALS

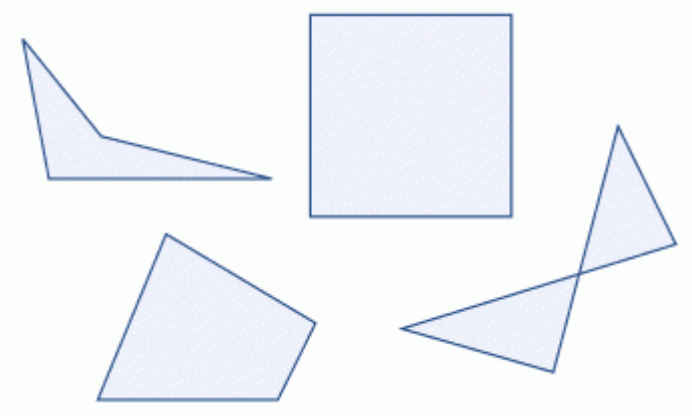
Definition

A quadrilateral is a closed figure with four straight sides. You can make a quadrilateral by taking (or imagining) anything straight and thin you might have handy: pens, toothpicks, chopsticks, etc. A square is one type of a special quadrilateral.

Quadrilateral just means "**four sides"**

(*quad* means four, *lateral* means side).

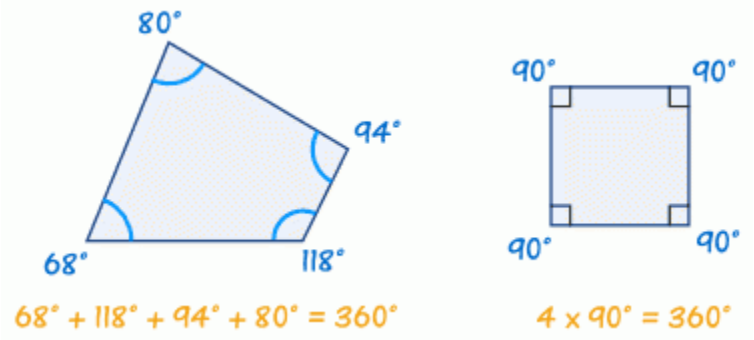
A Quadrilateral has four-sides, it is **2-dimensional** (a flat shape), **closed** (the lines join up), and has **straight** sides.



Properties

A quadrilateral has:

- four sides (edges)
- four vertices (corners)
- interior angles that add to **360 degrees**:



Exercise

Try drawing a quadrilateral, and measure the angles. They should add to **360°**

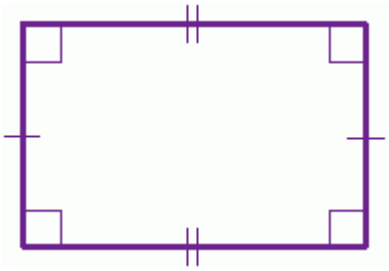
Types of Quadrilaterals

There are special types of quadrilateral:

Some types are also included in the definition of other types! For example, a **square**, **rhombus** and **rectangle** are also ***parallelograms***.

Let us look at each type in turn:

The Rectangle



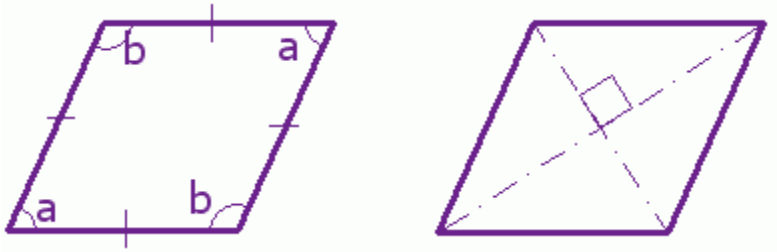
□ *means "right angle"*

| and || *show equal sides*

A rectangle is a four-sided shape where every angle is a right angle (90°).

Also **opposite sides** are parallel and of equal length.

The Rhombus



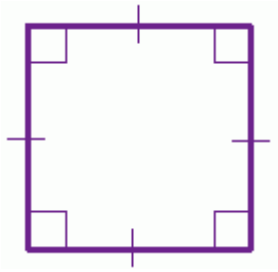
A rhombus is a four-sided shape where all sides have equal length.

Also opposite sides are parallel *and* opposite angles are equal.

Another interesting thing is that the diagonals (dashed lines in second figure) meet in the middle at a right angle. In other words they "bisect" (cut in half) each other at right angles.

A rhombus is sometimes called a **rhomb** or a **diamond**.

The Square



means "right angle"

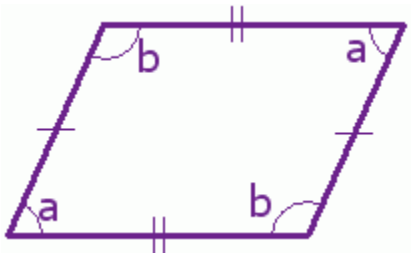
show equal sides

A square has equal sides and every angle is a right angle (90°)

Also opposite sides are parallel.

A square also fits the definition of a **rectangle** (all angles are 90°), and a **rhombus** (all sides are equal length).

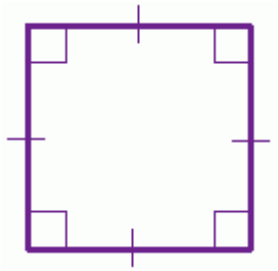
The Parallelogram



A parallelogram has opposite sides parallel and equal in length. Also opposite angles are equal (angles "a" are the same, and angles "b" are the same).

NOTE: Squares, Rectangles and Rhombuses are all Parallelograms!

Example:

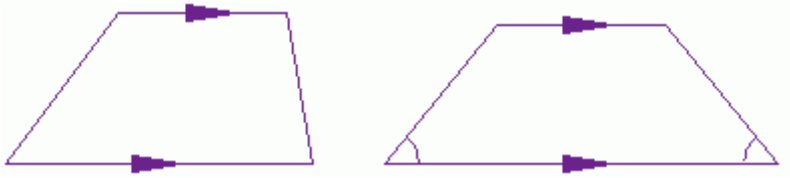


A **parallelogram** with:

- all sides equal and
- angles “a” and “b” as right angles

is a **square**!

The Trapezoid/Trapezium



Trapezoid **Isosceles Trapezoid**

A trapezoid *(called a trapezium in the UK)* has a pair of opposite sides parallel.

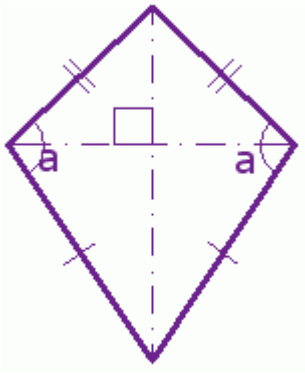
And a **trapezium** *(called a trapezoid in the UK)* is a quadrilateral with NO parallel sides:

	Trapezoid	**Trapezium**
In the US:	a pair of parallel sides	NO parallel sides
In the UK:	NO parallel sides	a pair of parallel sides

(the US and UK definitions are swapped over!)

An Isosceles trapezoid, as shown above, has left and right sides of equal length that join to the base at equal angles.

The Kite



Hey, it looks like a kite (usually).

It has **two pairs** of sides:

Each pair is made of two equal-length sides that join up.

Also:

- the angles where the two pairs meet are equal.
- the diagonals, shown as dashed lines above, meet at a right angle.
- one of the diagonals *bisects* (cuts equally in half) the other.

… and that's it for the special quadrilaterals.

Irregular Quadrilaterals

The only regular (all sides equal and all angles equal) quadrilateral is a square. So all other quadrilaterals are **irregular**.

The "Family Tree" Chart

Quadrilateral definitions are **inclusive**.

Example: a square is also a rectangle.

So we **include** a square in the definition of a rectangle.

*(We **don't** say "Having all 90° angles makes it a rectangle except when all sides are equal then it is a square.")*

This may seem odd, as in daily life we think of a square as **not** being a rectangle … but in mathematics it **is**.

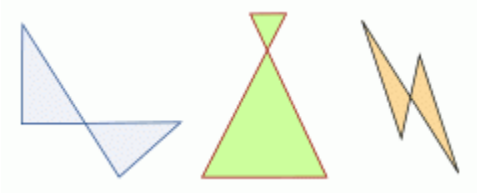
Using the chart below we can answer such questions as:

- Is a Square a type of Rectangle? (Yes)

- Is a Rectangle a type of Kite? (No)

Complex Quadrilaterals

Oh Yes! when two sides cross over, we call it a “Complex” or “Self-Intersecting” quadrilateral, like these:



They still have 4 sides, but two sides cross over.

Polygon

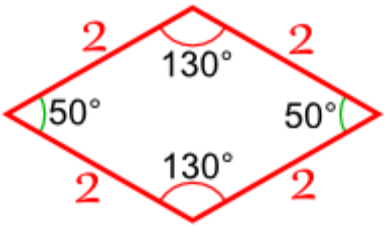
A quadrilateral is a polygon. In fact it is a 4-sided polygon, just like a triangle is a 3-sided polygon, a pentagon is a 5-sided polygon, and so on.

Other Names

A quadrilateral can sometimes be called:

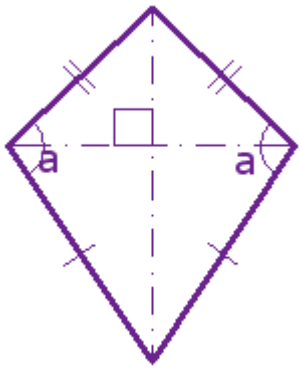
- a **Quadrangle** (“*four angles*“), so it sounds like “triangle”
- a **Tetragon** (“*four* and *polygon*“), so it sounds like “pentagon”, “hexagon”, etc.

ASSESSMENT



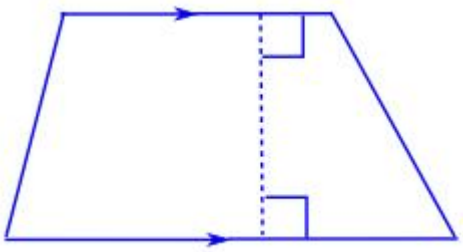
1. What is the name of this quadrilateral?
   (a) kite
   (b) square
   (c) rhombus
   (d) trapezium

2. What is the name of this quadrilateral?



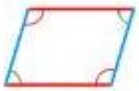
(a) trapezoid or trapezium
(b) kite
(c) parallelogram
(d) rhombus

3. What is the name of this quadrilateral?



(a) kite
(b) parallelogram
(c) rhombus
(d) trapezoid or trapezium

4. What is the name of this quadrilateral?



(a) parallelogram
(b) rectangle
(c) trapezoid or trapezium
(d) kite

5. One of these statements is **not true** of kites
(a) it has two pairs of sides
(b) it has three pairs of sides
(c) the angles where the two pairs meet are equal
(d) one of the diagonals *bisects* (cuts equally in half) the other

ANSWERS

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

Week 3&4

PLANE FIGURE

Content:

- POLYGON: Definition
- Types/Sketches
- Construction

Definition of a Polygon

Polygons are everywhere! A polygon is any 2-dimensional shape formed with straight lines. Triangles, quadrilaterals, pentagons, and hexagons are all examples of polygons. The name tells you how many sides the shape has. For example, a triangle has three sides, and a quadrilateral has four sides. So, any shape that can be drawn by connecting three straight lines is called a triangle, and any shape that can be drawn by connecting four straight lines is called a quadrilateral.

A polygon is a plane figure formed by joining three or more straight sides. A polygon is said to be regular if all its sides are equal and its angles are equal.

Types of Polygon

A **pentagon** is a polygon with five sides.

A **hexagon** is a polygon with six sides.

A **heptagon** has seven sides.

An **octagon** has eight sides.

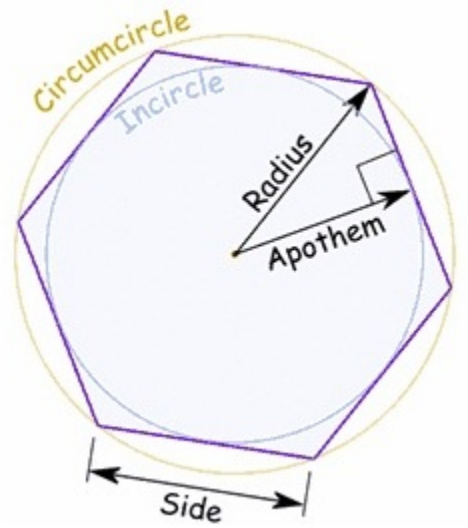
A **decagon** has ten sides.

Construction of a Polygon

(A) To construct a regular a Regular Hexagon given its side

(I) Using 60^0 set square

i. Draw a horizontal line and mark off AB equal to the side of the hexagon.



ii. Through A, draw a line at 60^{o} and mark off AC equal to AB.

iii. Through B, draw a line at 60^{o} parallel to BD and mark off BD equal to AB.

iv. Through C, draw a line of 60^{o} parallel to BD and mark off CE equal to AB.

v. Through D, draw a line of 60^{o} parallel to AC and mark off DF equal to AB.

vi. Join EF to complete the hexagon

(II) Using a pair of Compass

This method is best remembered as the constant Radius Rule.

i. Draw a circle whose radius is equal to the side of the hexagon. Draw the horizontal diameter AB.

ii. With centre A and the same radius, cut the circle above AB at E and below AB at F.

iii. With centre B and the same radius, cut the circle above AB at E and below AB at F.

iv. Join AD, DF, FB, BE, EC, and CA to obtain a hexagon.

Note: This procedure is required to draw a regular hexagon given the distance across corners. The diameter of the circle is equal to the distance across corners.

(B) To construct a regular hexagon given the distance across flats

i. Draw a circle whose diameter is equal to the distance across flats. Draw the vertical diameter AB.

ii. Draw diameter CD and EF at 30^{o}.

iii. Through A and B, draw horizontal tangents.

iv. Through C, D, E, F, in turn, draw tangents at 60^{o}. The figure that is formed by the intersection of the tangents is the required hexagon.

Hexagon

Note: This is the procedure when it is required to describe a regular hexagon about a given circle.

(C) To construct a regular octagon given its side

i. Through C and D, draw vertical lines and mark off CE and DF equal to AB.

ii. Through E and F, draw lines at 45^{o} and mark off EG and FH equal to AB.

iii. Join GH to complete the octagon.

iv. Through C and D, draw vertical lines and mark off CE and DF equal to AB.

v. Through E and F, draw lines at 45^{o} and mark off EG and FH equal to AB.

vi. Join GH to complete the octagon.

(D) To construct a regular octagon given the distance across flats

i. Draw a circle whose diameter is equal to the distance across flats. Draw horizontal diameter AB and vertical diameter CD.

ii. Draw diameters EF and GH at 45^{o}.

iii. Draw vertical tangents through A and B and horizontal tangents through C and D.

iv. Through E, F, G H in turn draw tangents at 45^{o}. The figure formed by the intersection of the tangents is the required octagon.

Note: This is the procedure when it is required to describe a regular about a given circle.

(E) General methods for constructing a regular polygon on a given base

(a) The 'External – 360^{o}/N Rule'

i. Obtain the external angle of the required polygon by dividing 360^{o} by the number of sides (N) of the polygon i.e. external angle = 360^{o}/N.

ii. Draw a horizontal line and mark off AB equal to the given base.

iii. Through A, draw a line at $360^{o}/N$ and mark off a length equal to AB. Also N at B, draw a line at $360^{o}/N$ and mark off a length to AB.

iv. Continue the process until you have obtained the polygon N side where N = 5, 6, 7, 8, 9, 10, ...

Suppose that N = 5, then external angle = $360^{o}/N = 72^{o}$. The pentagon will be obtained by drawing at 72^{o}(b).

(b) The 'Two-Triangle Rule'

i. Draw a horizontal line and mark off AB equal to the given base.

ii. Bisect AB and produce its bisector as long as it is convenient.

iii. On AB as base, draw an isosceles triangle with base angle 45^{o} and an equilateral triangle so that the apexes of the two triangles lie on the bisector of AB. Denote the apex of the isosceles triangle as d, and that of the equilateral triangle as f.

iv. Bisect fd to obtain point e.

v. Along the bisector of AB, from the point f, step off length de (or ef) to obtain points g, h, I, j, etc. The points d, e, f, g, I, j are the centres of the circumscribing circles for a square, regular pentagon, hexagon, heptagon, octagon, nonagon and decagon respectively.

vi. suppose you want to draw a polygon of 9 sides (nonagon). With centre I and radius I A (or iB) draw a circle. Take length AB and step it off on the circle to obtain the points, C, D, E, F, G, H, I.

Join the points to obtain the required regular nonagon.

(Observed that d = 4; e = 5; f= 6; g = 7; h = 8; i = 9; j = 10.)

(F) The General Method for Describing a Regular about a given Circle

The method is best remembered as the 'Centre – $360^{o}/N$ Rule'.

i. Obtain the angle included by any two normals at the centre of the given circle by dividing $360^{o}/N$ by the number of sides N of the required described polygon, i.e. angle at centre = $360^{o}/N$.

ii. Draw the given circle with centre O and draw a vertical radius OA.

iii. Use a protractor to set out angles of $360^{o}/N$ and draw radii of OB, OC, OD etc., until you have got N radii.

iv. Through the points A, B, C, D, etc., draw tangents to obtain the required polygon. Suppose it is required to draw an octagon.

$360^{o}/N = 360^{o}/8 = 45^{o}$.

ASSESSMENT

1. Define Polygon?
2. List FIVE types of Polygon?

Week 5

Topic: AREA OF PLANE FIGURES

INTRODUCTION

The idea of area may be explained as the amount of space enclosed within the boundary of a figure. For instance, the area of the floor of a classroom is the amount of space enclosed within the four corners of the room. Also, the area of the top of the teacher's table is the amount of space enclosed within the edges of the table.

To measure this amount of space, we determine the number of square units. As an example, let us find the area of the rectangular floor of length 10cm and width 6cm. To do this, one method may be to take a square cardboard of one centimeter side and starting from one corner of the floor, mark the outline of the cardboard, edge to edge, until the whole space of the floor is covered. Then the number of the one-square centimeter marking is counted and that gives the area of the floor in square centimeters.

(A) To construct a triangle equal area to give a given triangle

(a) When the triangles are on equal bases

i. Draw the given triangle ABC and produce the base AB to D, making DE = AB.

ii. Through C, draw CF parallel to AD.

iii. With centre E and radius equal to a side of the required triangle, cut CF at G.

(B) To construct a triangle given its base and its area

Suppose that the given base and area are 5cm and 9sq. cm respectively:

i. Divide the given area by the given base, i.e. 9/5 =1.8cm.

ii. Draw a rectangle ABCD whose length is 5cm and width is 1.8cm.

iii. Produce the width of the rectangle to twice it magnitude, i.e. mark off CE = BC = 1.8cm.

iv. Join E. Triangle ABE is the required triangle.

(C) To construct a triangle equal in area to any to any given parallelogram

i. Draw the given parallelogram ABCD and draw diagonal BD.

ii. Through C, draw a line parallel to DB to intersect AB produced at E.

iii. Join DE. Triangle AED is the required triangle.

(D) To construct a rectangle equal in area to a given rectangle of different length

i. Draw the given rectangle ABCD.

ii. On AB (produced), mark off AE equal to the different length of the required rectangle.

iii. Join DE.

iv. Through B, draw a line parallel to ED to intersect AD (produced)at F. AF is the width of the required rectangle AEGF.

(E) To construct a square in area to a given rectangle

i. Draw the given rectangle ABCD.

With centre B and radius BC, swing arc CE to intersect AB produced at E.

iii. Bisect AE in F and draw a semi-circle on AE diameter.

iv. Produce BC to meet the semi-circle at G. BG is the side of the required square.

v. Complete square BGHI.

(F) To construct a square equal in area to the sum of the area of two given squares

i. Draw a line and mark off AB equal to the side of one of the given squares.

ii. At A, erect a perpendicular and mark off AC equal to the side of the other given square.

iii. Join CB. CB is the side of the required square.

iv. Complete the required square CBDE.

Note: This is based on Pythagoras' theorem. This theorem states that the square on the hypothenuse of a right-angled triangle is equal to the sum of the squares on the other two sides.

Enlargement and Reduction of Regular Plane Figures

(A) To construct a figure similar to a given figure ABCDEF with its sides in the ratio of 6.4 to those of the given figure.

i. Draw the given figure ABCDE.

ii. Divide the figures into triangle by drawing lines AC, AD and AE.

iii. Draw line AG at a convenient angle and set off on it from A, 6 equal parts.

iv. Join point 4 to B and draw GB1 parallel to GB to cut AB produced at B1.

V. Draw B1, C1, D1, and D1 E1 parallel to BC, CD, and DE respectively to complete the required figure.

(B) To construct a figure similar to a given figure ABCDEF with its sides in the ratio of 4:6 to those of the given figure

i. Draw the given figure ABCDEF.

ii. Divide the figures into triangles by drawing lines AC, AD and AE.

iii. Divide AB into six equal parts.

iv. Draw B1, C1, C1, D1 and D1 E1 parallel to BD, CD and DE respectively to complete the required figure.

(C) To construct the size of a given rectangle by a given proportion

Let the proportion be 6:4.

1. Draw the given rectangle ABCD.

ii. Choose point P at any convenient distance from the rectangle, and from radiate lines to corner A, B, C and D.

iii. Divide PA into 6 equal parts.

iv. Draw A1, D1, D1, C1 and B1 A1 respectively to complete the required rectangle.

ASSESSMENT

1. Define Area?

Week 6

Topic: WOOD WORK MACHINES

INTRODUCTION

Woodwork machines refer to the common equipment used in the workshop. Most of these machines are heavy and cannot be handled ordinarily. Some of them are fixed on the ground and are used with electric power. A few of these machines will be discussed.

Two sections exist here in this topic:

1. Portable power tools

2. Machines

Portable Power Tools

These are tools that are held in the hand and operated with electric current. The examples to be discussed here are:

1. Sanders

2. Hand drills

3. Fret-saw

Sanders

Sanding means smoothing of work with coated abrasives. The abrasives may be made of glass, garnet (a type of precious stone), silicon carbide, aluminium oxide (a brown African abrasive), etc.

Available portable sanders for wood-work smoothing including belt sanders and drum sanders.

Disc sander

Orbiter sander

Belt Sander

Drum sander

Hand Drills

Holes in materials can be made by many methods, e.g. punching, flame cutting, boring and drilling. This section is concerned only with making cylindrical holes with the aid of drills. Drills and drilling machines are the commonest tools used for making holes. The operation is called drilling and the tool used is called a drill.

There are different types of drills used in a metal workshop:

a. Twist drill;

b. Flat drill;

c. Straight-fluted drill;

d. Counter-sink drill.

Sensitive Drilling Machine (Bench)

This type of drilling machine is also designed for light jobs. It is possible to drill holes from 1mm diameter to about 18mm.

The main difference between this machine and the electrical hand-drilling machine is that the bench type is to the work bench.

Fret-Saw

This saw is used for complex shapes and curves in plywood and veneers. The blade of this saw is finer than the coping saw blade. It has a high frame which allows it to be used over a wide area. Its blade is about 125mm long.

Fret Saw

Machines

The other types of the equipment's used in woodworks are those equipment which are not portable as the discussed earlier. These machines are heavy. They are fixed on a spot most of the times. Examples are circular saw, band saw, wood lathe, surface planner, thicknesser, sanders, drills, etc.

Safety Hints in Using the Woodwork Machines

1. Remove loose fitting clothings, rolling sleeves aprons and eye shield.

2. Remove scraps from saws, tables and floor.

3. Regular oiling and greasing of bearing must be encouraged.

4. Use the correct saw for each job.

5. Saws should be properly set and should be sharp.

6. Before switching one, make sure the blade runs free.

7. Stand to one side when switching on.

8. Switching on to make adjustments on machine or checking measurements or changing belt speed.

9. Do not overload the machine or force it to work beyond its capacity.

10. Make sure you know how to use the machine that you want to use.

ASSESSMENT

Week 7

Topic: METAL WORK MACHINES

Introduction

A machine tool is a machine that cuts metals and performs some other operations by manipulation of its parts. This chapter introduces you to the five basic machines normally regarded as machine tools.

Content:

- Types of metal work
- The centre lathe and its operation

Types of Metal work

Machines and their Functions

i. Lathe

ii. Shaper and planer

iii. Milling machine

iv. Drill press

Modern machinery production technology has made it possible to manufacture other production machine tools for special purposes by utilizing the technology of these basic ones. In this chapter, we shall briefly present the functions and uses of these machine tools.

Lathes

There are two types of metal lathes – the plain lathe and the screw cutting lathe. The purpose of a lathe is to remove metal by use of a rigidly controlled hard steel-cutting tool. The revolving is the held firmly in a chuck or between centres while the tool cuts. Lathes are equipped with various devices as presented below:

a. Setting the tail stock

b. Checking for correctness

c. Turning between centers

Taper Turning

Taper turning is the production of a piece of round work in which one end is bigger than the other. It is always a conical shape. There are few methods by which the shape could be produced on the lathe. Tapering with a form tool is the simplest. It involves the use of shaped tool or cutter fed into the work piece to produce the taper required. Such tapers are termed short tapers and can be used for either internal or external turning.

Surfacing

Surfacing is achieved when the cutting tool moves perpendicular to the axis of rotation of the job being machined and therefore produces a flat surface. A good face is got when a suitable surfacing tool is used. While surfacing to the center point of a work, it is important to set the tool tip to the exact centre height. On the other hand, if the tool moves parallel to the axis of rotation of the workpiece, a cylindrical surface is produced. This is called a plane face.

Turning of a series of plain diameters on a work piece can simply be carried out on the centre lathe. This is better achieved with the use of carriage movement, because the straightness of the bed ways ensures the parallelism of the work piece, and can be power-operated and produced at one setting. The further maintains concentricity between the different diameters. If the workpiece is removed for any reason while still turning, accuracy is lost, and this should be avoided. This process is ideal in producing what is termed stepping turning.

Sawing

The power sawing machine is used to cut the soft material with coarse tooth back-saw blades. The coarse tooth ensures that the metal chips do not clog the teeth. There are many brands of the hack sawing machine but a good one is the type incorporated with relief of pressure on return stroke by oil pump or by adjustable oil dash pot in conjunction with the angular setting of the slide. The work piece should be gripped rigidly, and the frame lowered carefully to start the cut.

Abrasives

In metal working, two types of abrasive are used. These are aluminium oxide and silicon carbide. Silicon carbide is suitable for the grinding of materials of low tensile strength such as iron, brass, bronze, copper, aluminium and cemented carbide.

Its abrasive forms are obtainable in powder form, grinding paste, lapping compound wheels and variously shaped stones and on cloth or paper in grades O, FF, 1, 1½, 2, 2 2/2 – 3 to 4 which is the coarsest.

Drill Press

Small diameter holes can be drilled with the use offhand drills, as the holes to be drilled becomes larger, the handle of the drill can be replaced with breast plates at right angles.

(Most work is gripped in a vice, fastened to work table with boils. The bottom of the vice must be parallel, and square to the jaws.

It is dangerous to drill a piece of work on the drill press without holding the job firmly and securely. In order to avoid accidents, it is necessary to clamp down the work to the body of the drill, thus becoming breast drill as much pressure is needed, say about 25mm or over, hand powered drilling machine can be used, or a drilling pillar and a ratchet brace. For thicker metal boring, the use of power-driven sensitive drilling machine can be used. The work table is a special vice or jig as the case may be. Work held by hand on a drill press often results in injuries, and should be avoided. These are twist drill, combination drill, reamer (sunblind drill), countersink, counter bore cutter, spot face cutter, trepanning tool, tap, etc.

Cutting Fluids

These are sometimes called coolants or cutting lubricants. They are important on machine tools. They are used to:

a. cool works and tools, and to lessen distortion.

b. lubricate, thereby reducing power consumption.

c. preventing welding of chips to tool.

d. wash away tools chips and swarf.

e. improve surface finish

f. protect tools against corrosion.

Coolant may be divided into three main classes:

a. Soluble oils

b. Straights oils

c. Water-based fluids

Soluble oils: These are mineral oils treated to form an emulsion when added to water. They can be used neat, or diluted with water to increase their cooling powder.

They usually leave on the machine a protective cooling or film that is rust resistant.

Straight oils: These are mainly mineral and extreme pressure (EP) cutting oils. They are used undiluted for slow heavy-cutting operations, as they process good lubricating properties.

Water-base fluids: These are solutions of salts and other minerals in water. They have good cooling properties. They are best applied by using a point, an oil tray and reservoir to give a slow continuous stream over the cutting action. An oil pipe can be used where pumping devices are not possible.

ASSESSMENT

1. A machine tool is___
2. List THREE types of metal work?

Week 8

Topic: METAL WORK MACHINES (continued)

INTRODUCTION

Metalwork tools are split in two major categories. The first category includes the industrial metalwork tools. They are very advanced and can easily do various jobs with minor help from an engineer. Industrial metalwork tools can easily be referred to as machines. Their prices reach astronomical numbers. If you own such tools, then you probably need a professional to take care of them. They require particular maintenance operations that cannot be done by a regular owner. However, this is a valid statement only if you own a large scale company or you are... An eccentric person.

A regular person interested in metalworking opts for a different category of tools. Most garage owners don't usually use them to host their car inside. Almost every garage has a small area in a corner full of tools. It is a common hobby for men to do various crafting operations. Sometimes they are needed in the house, sometimes they are just fun times. However, such metalwork tools are easier to maintain than industrial machines. Let's see how.

Among the most common tools, hammers and screwdrivers are the easiest to take care of. They must be kept out of moisture and if somehow they end up wet, they need to be taken through scrapping operations. However, such unpleasant situations appear over long periods of time, like for instance constant leaks through your garage roof in your tools set. On the other hand, clippers may require more operations. Every once in a while, oil their mechanisms in order to keep them working smoothly. Also, avoid using them for anything else they are not designed for. Especially if you own pneumatic or blading clippers. Blades need to be used for very clear and soft surfaces. Any small particle of dirt may ruin them.

If your passion goes beyond the Sunday fun metal crafting, then you probably need more than just the basic tools. If you are practicing to become a professional or just having a little business going in your garage, you may opt for mechanical or electric tools. They are more expensive, but they can make a better job. They also need particular maintenance operations for a good functionality.

For a proper care of more advanced metal crafting tools, make sure you read their manuals first. It is imperative to avoid going beyond the limits if you care for your tools. Since most of them come with warranty periods, you are basically obliged to resume to exactly what you should do. If somehow you think you are smarter than the

manufacturers and start doing your own things, you will lose the warranty. This only means two things – you have a wrecked tool and you need to pay money to fix it, congratulations!

Among the basic maintenance operations for mechanical or electrical tools, you might have to clean them with wet and clean sponges, or use oil for their joints. Make sure you keep them at the temperatures indicated in their manuals and avoid direct sunlight or moisture. Dusty places are also a bad idea for depositing your tools.

Assessment

1. List the two metal works categories.
2. How do you care for metals?

Week 9

Topic: FRICTION

Definition of Friction

Friction is the resistance to motion of one object moving relative to another. It is not a fundamental force, like gravity or electromagnetism. Instead, scientists believe it is the result of the electromagnetic attraction between charged particles in two touching surfaces.

In liquids, friction is the resistance between moving layers of a fluid, which is also known as viscosity. In general, more viscous fluids are thicker, so honey has more fluid friction than water.

The atoms inside a solid material can experience friction as well. For instance, if a solid block of metal gets compressed, all the atoms inside the material move, creating internal friction.

In nature, there are no completely frictionless environments: even in deep space, tiny particles of matter may interact, causing friction.

Causes of Friction

Friction is a force that resists the relative motion between two objects or materials. The causes of this resistive force are molecular adhesion, surface roughness, and deformations.

Adhesion is the molecular force resulting when two materials are brought into close contact with each other. Trying to slide objects against each other requires breaking these adhesive bonds. For years, scientists thought that friction was caused only by surface roughness, but recent studies have shown that it is actually a result of adhesive forces between the materials.

But surface roughness is a factor when the materials are rough enough to cause serious abrasion. This is called the sandpaper effect.

When one or both of the materials is relatively soft, much of the resistance to movement is caused by deformations of the objects or by a plowing effect.

Molecular adhesion

When two objects are brought into contact, many atoms or molecules from one object are in such close proximity to those in the other object that molecular or

electromagnetic forces attract the molecules of the two materials together. This force is called adhesion. Trying to slide one object across the other requires breaking these adhesive bonds. Adhesion is the essence of friction.

You've seen a water drop adhere to a window pane. The force of friction prevents this liquid from sliding down the solid material. But most cases of friction you see concern a solid object sliding or moving against another solid.

Sliding objects against each other requires breaking these millions of contact points where the adhesion force takes effect, only to result in millions of new contact points of adhesion.

Sticky materials

Some solid materials may have a composition that greatly increases their adhesion and makes them even "sticky" to the touch. This stickiness greatly increases the fiction. Rubber and adhesive tape are examples of sticky materials that have this type of friction.

Fluids

Fluids often exhibit molecular adhesion, increasing the friction. This adhesion force is often seen in the capillary effect. This is where water will be pulled up a glass tube by the forces of molecular adhesion. That same force can slow down fluid motion.

One example is how a coin will easily slide down a ramp. But if you wet the coin, it will stay in place. That is because of the molecular friction of the fluid on the hard surfaces.

The motion of two fluids or two sections of a fluid against each other is also slowed down by the molecular attraction factor. This type of fluid friction is usually not considered as friction and is studied under the complex field of fluid dynamics.

Surface roughness

All solid materials have some degree of surface roughness. If you looked at what seems to be a smooth surface under a high-powered microscope, you would see bumps, hills and valleys that could interfere with sliding motion.

Close-up view of surface roughness

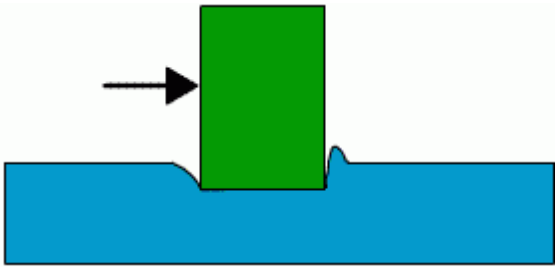
At one time it was thought that the surface roughness of materials was the cause for friction. In reality, it only has a small effect on friction for most materials.

If the surfaces of two hard solids are extremely rough, the high points or asperities can interfere with sliding and cause friction because of the abrasion or wear that can take place when you slide one object against the other. This is the “sandpaper effect” where particles of the materials are dislodged from their surfaces. In such a case, the friction is caused by surface roughness, although the adhesion effect still plays a part in the abrasion.

Deformations

Soft materials will deform when under pressure. This also increased the resistance to motion. For example, when you stand on a rug, you sink in slightly, which causes resistance when you try to drag your feet along the rug’s surface. Another example is how rubber tires flatten out at the area on contact with the road.

When materials deform, you must “plow” through to move, thus creating a resistive force.



Pushing object on soft surface

When the deformation becomes large, such that one object sinks into the other, streamlining can affect the friction, similar to what happens in fluid friction.

ADVANTAGES OF FRICTION

Friction plays a vital role in our daily life. Without friction we are handicap.

1. It is becomes difficult to walk on a slippery road due to low friction. When we move on ice, it becomes difficult to walk due to low friction of ice.

2. We can not fix nail in the wood or wall if there is no friction. It is friction which holds the nail.

3. A horse can not pull a cart unless friction furnishes him a secure Foothold.

DISADVANTAGES OF FRICTION

Despite the fact that the friction is very important in our daily life, it also has some disadvantages like:

1. The main disadvantage of friction is that it produces heat in various parts of machines. In this way some useful energy is wasted as heat energy.

2. Due to friction we have to exert more power in machines.

3. It opposes the motion.

4. Due to friction, noise is also produced in machines.

5. Due to friction, engines of automobiles consume more fuel which is a money loss.

METHODS OF REDUCING FRICTION

There are a number of methods to reduce friction in which some are discussed here.

USE OF LUBRICANTS: The parts of machines which are moving over one another must be properly lubricated by using oils and lubricants of suitable viscosity.

USE OF GREASE: Proper greasing between the sliding parts of machine reduces the friction.

USE OF BALL BEARING: In machines where possible, sliding friction can be replaced by rolling friction by using ball bearings.

DESIGN MODIFICATION: Friction can be reduced by changing the design of fast moving objects. The front of vehicles and airplanes made oblong to minimize friction.

ASSESSMENT

1. What is friction?

2. What are the causes of friction?

3. Mention 3 advantages of friction.

4. identify 4 disadvantages of friction.

Week 10

Topic: FRICTION (Continued)

Reduction of friction

It is beneficial to reduce the friction between surfaces to make movement easier or reduce the wear and tear on a surface. There are a number of ways to reduce friction:

1. **Make the surfaces smoother:** Rough surfaces produce more friction and smooth surfaces reduce friction. Some swimmers wear suits to reduce underwater resistance. These suits mimic the smooth skin of sharks.

2. Lubrication is another way to make a surface smoother. A lubricant is a slippery substance designed to reduce the friction between surfaces. You might use oil to stop a door from squeaking – the oil reduces the friction in the hinge. Water can be used as a lubricant – think of how a floor becomes slippery after it has been mopped.

3. **Make the object more streamlined:** A streamline shape is one that allows air or water to flow around it easily, offering the least resistance. Compare a boxy old car with a new car that has a rounded shape, allowing it to move with less effort.

4. **Reduce the forces acting on the surfaces:** The stronger the forces acting on the surfaces, the higher the friction, so reducing the forces would reduce the friction. If you apply the handbrake when you try to drive a car, the car will have a lot of difficulty moving because of the force immobilizing (stopping the movement of) the wheels. If you release the handbrake, the wheels will move more freely because there is no extra force acting on them.

5. **Reduce the contact between the surfaces:** Have you ever tried to roll a cube? Spheres are the best shape for reducing friction because very little of a spherical object is in contact with the other surface. Several types of wheels, such as skateboard wheels, contain small spheres called ball bearings to reduce the friction between the moving parts. You can witness the effect of ball bearings by comparing the friction between sliding a book on a table and then doing the same, but using marbles between the book and the surface of the table. Notice how the marbles act as ball bearings, reducing the friction.

LUBRICATION

Lubrication is simply the use of a material to improve the smoothness if movement of one surface over another; the material which is used in this way is called a lubricant. Lubricants are usually liquids or semi-liquids, but may be solids or gases or any combination of solids, liquids, and gases.

The smoothness of movement is improved by reducing friction. This is not, however, always the case, and there may be situations in which it is more important to maintain steady friction than to obtain the lowest possible friction.

In addition to reducing or controlling friction, lubricants are usually expected to reduce wear and often to prevent overheating and corrosion.

TYPES OF LUBRICANTS

Lubricants are usually divided into four basic classes.

(a) **Oils**: A general term used to cover all liquid lubricants, whether they are mineral oils, natural oils, synthetics, emulsions, or even process fluids.

(b) **Greases**: Technically these are oils, which contain a thickening agent to make them semi-solid. It is convenient, however, to include the anti-seize pastes and the semi-fluid greases under the same heading.

(c) **Dry lubricants**: These include any lubricants, which are used in solid form, and may be bulky solids, paint-like coatings, or loose powders.

(d) **Gases**: The gas usually used in gas bearings is air, but any gas can be used which will not attack the bearings, or itself decompose.

The advantages and disadvantages of oils stem from their ability to flow easily. Thus, on the credit side, it is very easy to pour them from a container, to feed them into a bearing by dripping, splashing or pumping, and to drain them out of a machine when no longer fir for use. Other advantages are the cooling of a bearing by carrying away heat, and cleaning it by removing debris.

The behavior of greases is very similar to that of oils, but the former are used where the advantages of easy flow are outweighed by the disadvantages. Thus grease do not easily leak out of a machine, or container, do not migrate away, and will form an effective seal against contaminants.

The advantages and disadvantages of solid lubricants are rather like the extremes for greases, where the lubricant will not flow at all. Similarly, the advantages and disadvantages of gas lubricants are like the extremes of oils, where the flow properties are almost too good.

ASSESSMENT

1. Which of the following actions will reduce friction?
   (a) Make the surfaces rougher
   (b) Make the surfaces smoother
   (c) Increasing the contact between the surfaces
   (d) Exerting more force on the surfaces

2. Lubrication is a way to make a surface
   (a) clean
   (b) smooth
   (c) rough
   (d) dirty

3. The stronger the forces acting on the surfaces...
   (a) the higher the friction
   (b) the lower the friction
   (c) the higher the smoothness
   (d) the lower the smoothness

4. One of these is not a class of lubricants
   (a) solid
   (b) liquid
   (c) gaseous
   (d) flat

5. Greases contain a thickening agent that makes them
   (a) solid
   (b) semi-solid
   (c) liquid
   (d) gas

ANSWERS

1. b
2. b
3. d
4. d
5. b

THIRD TERM NOTES ON BASIC TECHNOLOGY

WEEK 1

Topic: ENERGY BASED TECHNOLOGICAL APPLIANCES

CONTENT:

- Electrical energy to heat energy
- Chemical energy to heat energy
- Electrical energy to mechanical
- Mechanical energy to Electrical energy

Introduction

We shall discuss the following:

1. Operation of a pressing iron, Operation of an electric kettle, operation of cookers, water heaters, gas lamp, gas cooker, kerosene cooker and charcoal pressing iron

2. Principles of evaporation leading to cooling by refrigeration

3. Operation of a compressor as responsible for the circulation of refrigerants

4. Principle of operation of electric fan and grinder

5. Working principle of generator bicycle-dynamo

1 (a). Operation of Pressing Iron (Electrical)

The basic principle of the appliance is that a heating element is built into it. The heating element is made of a material with high resistance and high melting point.

As current flows through the circuit, the immense electrical energy used to overcome the resistance is turned into heat energy and the heat thus produced is used in ironing. The high melting property of the element enables it to withstand the great heat. The electric iron is made up of the following parts.

(a) A nichrome element wound on mica former

(b) Two heavy stainless steel plates in between which the element is fixed. The weight of the steel plates applying pressure which, coupled with the heat from the element, smoothens the clothes being ironed.

(c) An asbestos pad, a poor conductor of heat, which is fitted to the upper steel plate to minimize the upward flow of heat from the element.

(d) Mica plates which insulate the steel plates from electricity but conducts the heat from the elements to the steel plate for ironing.

(e) A bimetallic thermostat which controls the extent to which the plates are heated.

The temperature produced by such irons varies between 1210C and 2040C. The lower temperature range is used for ironing synthetic materials like nylon, terrylene and so on, while the higher range of temperature is used for pressing cotton materials.

(b) Operation of an electric Kettle

This is made up of the following:

(a) A chrome-plated aluminium or copper body.

(b) A nichrome element encased in a metal tube and insulated with a refractory material such as magnesia. The tube must be watertight to avoid water leaking into the element. When the element is heated, the magnesia insulation conducts the heat to the metal tube which is in contact with the water to be heated.

(c) Operation of an electric cooker

A modern electric cooker has several cooking points so that several items can be cooked at the same time. Each cooking point consists of a steel plate in which two nichrome elements spiral shape are fixed. The spiral shape of the elements makes it possible for a greater length of the element to be contained in a small space. We should remember that the longer the elements, the greater its resistance and also the greater the heat produced.

The elements are encased in magnesia to insulate them from the steel plate. When the electric circuit is switched on, the element heats the metal disc to cooking temperature.

(d) Water heater (Free outlet)

There are various types of electric water heater such as (1) Free outlet (Pressure type and (3) Cistern types. They operate on the basic principle of electric energy converted into heat and by conduction, cold water is heated. The main differences are (a) The free outlet type supplies limited hot water by the inrush of cold water to

displace the heated quantity at turning the only tap. Use in the bathrooms with single tub.

The pressure type has an advantage of its ability to supply many hot water outlet points since many taps can be fitted on its outlet pipe but will always depend on the supply mains pressure. If a free outlet water is filled with a cistern, smaller quantity of hot water can be ready for use always as in the cistern type water heater. An example of this is the cylindrical tank found in bathrooms. Like the electric kettle, the ceramic or metal tank contains nichrome elements insulated with magnesia and enclosed with a metal tube. Water heater by the immersion of the element, rises up in the tank thereby forcing the topmost hot water to flow freely outward.

Conversion of Chemical Energy to Heat Energy

The commonest method of obtaining heat for cooking and other purposes in our homes is by burning fuel such as firewood, charcoal, kerosene and gas. Burning is a combustion process in which chemical energy is converted to heat energy. During the combustion process, heat is released. Solid fuel such as wood and charcoal are complex compound of carbon, nitrogen, metal and sulphur, while gaseous fuel of various types are compounds of hydrogen and carbon.

Gaseous fuel is usually referred to as hydrocarbon. Examples of hydrocarbon are butane (cooking gas) and kerosene. In the process of burning, oxygen from the air combines with hydrocarbons to form carbon(iv)oxide and water in form of steam, and heat is released. Many appliances have been designed to convert chemical energy to heat energy for domestic and industrial uses. Some of them are described below:

(e) Gas Lamp

A gas lamp consists of a gas cylinder, a pipe and cylindrical or spherical glass. The natural gas (butane) is compressed into the cylinder. A metal pipe is fixed at the top of the cylinder. At the upper end of the metal pipe, the mantle is fixed. A regulator is fixed on the pipe to control the amount of gas that comes out fir burning. To use the gas lamp, the regulator is opened and the gas that appears at the top of the pipe is

ignited. The gas burns at a very high temperature and the flame that results from the burning heat mantle.

(f) Gas Cooker

The principle of operating a gas cooker is similar to those of the gas lamp except that the cooking unit is not fixed on top of the cylinder; rather it is connected to the cylinder by a rubber tube. Also, the metal pipe through which the gas flows to the burning points are built into the cooker. A metal disc is placed at the burning point to guide abs spread the flame. The very hot flame resulting from the burning of the gas flows out and provides the heat used in the cooking.

(g) Kerosene

Kerosene is a liquefied gas. Its chemical action during burning is similar to that of cooking gas. The kerosene cooker consists of the stand, a gas container, perforated cylinders are usually three in number and the assembled concentrically. The innermost and the middle ones are perforated to allow in air during burning while the outermost one is not. To cook with the cooker, the metal pipe is opened, kerosene flows from the container through the wick, which provides easy passage for the kerosene to travel to the top of the wick and evaporate. When ignited, the vaporized kerosene burns and provides the heat required for cooking.

(h) Charcoal Pressing Iron

Charcoal is an incompletely burnt wood, which is very high in carbon content. The pressing iron is a heavy steel container whose bottom plate is in the form of an isosceles triangle. The cover plate, which has the same shape as the bottom plate, is hinged to the main container at the base of the sides to let in air.

When the container is loaded which charcoal and ignited, it burns to release heat energy. The heat energy heats up the steel container, which is then used for pressing clothes.

WEEK 2

Topic: PRINCIPLES OF OPERATION OF AC MOTOR MACHINES

CONTENT:

- **Electric fan, Shaver, Washing machine, loud speaker, Blender, etc**

(a) The Electric Fan

The electric fan is basically an induction motor of the squirrel – cage rotor type in most cases. The shaft of the motor at the fan blade end is provided with a flat side onto which the fan blade is tightly fitted to and secured with a screw or a left hand thread cap to prevent the fan blade form becoming loose and sliding off during motion.

Ceiling fan

Mini table fan

(b) The Grinder

Any machine which employs electric motor as its 'prime movers' turning force in order to produce granulated, paste or powdered form from solid substances e.g. maize, sorghum, soybeans, groundnuts, dried beans, etc. Grinder in many case perform the function of blending e.g. liquidizing of soft fruits and plants products e.g. fruits, tomatoes, soft pepper, onions, etc. Grinding stones are usually limited to benches and hand tools for metal surface. Below is the construction and operation of a regular grinder for foodstuffs only.

Grinding Machine

Grinding Shaft

The figure shows the complete assembly of grinder with is prime mover i.e. the electric motor coupled with a set of pulley and belt.

The grinding shaft image above shows the actual grinder, which is a small cross sectional rod, welded to a larger shaft carefully chosen to turn in the grinder with no space for wastage of items being grinded.

WEEK 3

Topic: PRINCIPLES OF OPERATION OF BICYCLES, GENERATORS, DYNAMOS

INTRODUCTION

The bicycle electrical power supply is in a few different methods but this section will treat the method where a dynamo is used. A dynamo is a generator but supplies direct current (D.C.) only. The other generator is referred to as “alternator” because its output is collected via slip rings instead of split rings or commutators.

Operation: The dynamo is hinged for huge movement but with a firm bracket. When in use, it is pushed against the cycle tyre on its nulled rubber cap which is free to rotate at the pedaling speed of the rider.

The armature and the commutator rotate between the carbon brushes are in a fixed position so that the conductors situated at a right angle to the magnetic field always release its current to the same brush therefore maintaining same polarity of the generated output e.m.f. i.e. polarized + and – (D.C.) similar to a battery.

WEEK 4

Topic: TRANSMISSION OF ELECTRICITY

INTRODUCTION

Electrical power is said to be transmitted when it is conveyed from it source of generation to distances far way or near the sending end.

The positions or destinations at which the power is received is referred to as “The receiving end”. The equipment, required for the transmission is referred to as transmission equipment such as generator (alternators), synchronizing/control panel, circuit breakers, substations, transformers, insulators, power lines, uprisers, etc.

Electricity can be generated at low frequencies by using hydropower as in Kainji Dam, burning gas as in Afam Power station and Egbin Power station, and burning charcoal as in Oji River power station. In each of these big power stations, electricity is generated for the use of people located at, and away from the source of generation. For example, the electric power generated at the Kainji is used by people in Kainji as well as people in Lagos, a distance of 560km from Kainji. This is one of the major advantages of electricity. It can be generated at a point and can be made available in place far from the point of generation. This is made possible by providing transmission lines to transmit electricity to sub stations, from where it can be distributed to different consumers.

Here in, the student is introduced to the basic principles of transmission of electricity from the source of generation, and its eventual distribution to the consumer.

Basic Principles of Transmission of Electricity at Low Frequencies

Electricity is transmitted by underground cables or overhead lines on poles or towers over considerable distances. The lines which are usually steel, cored aluminium or hard drawn copper, are called the transmission lines. The transmission of electric power is usually at very high voltage and at low frequency in the range of 50 cycles per second (referred to as 50 Hertz or 50 Hz) in most part of the world and up to 60 Hz in some countries. The reason for generating and transmitting at higher voltages than required in premises and appliances will be **discussed later.**

Basic Principles of Transmission at High Frequencies

The transmission of electricity at high frequency takes place at low voltage. Instead of using high tension transmission power, it uses low tension transmission power. The frequency cuts across a broad band so that many networks can operate at the same time.

Appliances like radio, television and telecommunication gadgets operate on these

frequencies. The frequencies or bands include AM, MW, SW and FM bands (this is for the radio frequencies). For the television band, we have the UHF, VHF and SHF channels.
The basic principle in the transmission of electricity at high frequency lies in the principle of the tank circuit. It is the conversion of audio or visual signals into electromagnetic waves, which is radiated from a sending aerial into space, where the receiving aerial cuts across it, to be transmitted to the final consumers.

Differences between Low and High Frequency Transmission
Low Frequency can travel around the world
High Frequency are mostly straight line of sight

Low Frequency has low energy power
High Frequency have a lot of energy power

Low Frequency (AM) can have interference by a lot of things
High Frequency (FM) have clearer reception over a wide range

WEEK 5

Topic: TRANSMISSION OF ELECTRICITY

INTRODUCTION

When electricity is supplied to various consumers, e.g. domestic and industrial premises, it is said to be distributed. All distribution in Nigeria are carried out with Alternating Current (AC) system. The following (AC) supply systems are available by the Power Holding Corporation of Nigeria.

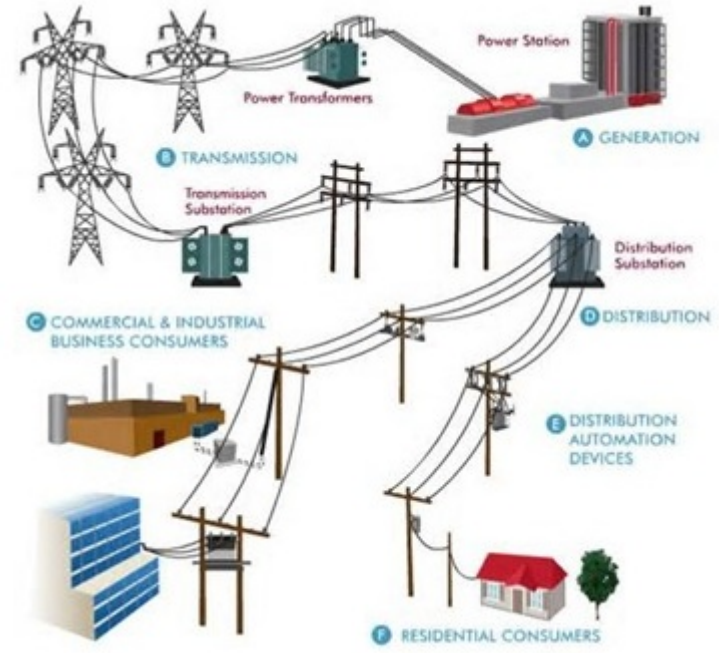
(i) Single phase 2-wire

(ii) Single phase 3-wire

(iii) Three phase 3-wire

(iv) Three phase 4-wire

The three phase 4-wire is the most widely used for the basic reason that the other systems can be easily obtained from it.



Utilization of Electricity

We have discussed how electricity is from the generating station to sub stations, and distributed from there to homes, factories, etc. In order to enjoy the many advantages of electricity in premises, certain precaution, accessories and methods of wiring need to be adopted to avoid hazards or danger associated with the use of electricity.

Utilization in the Home and Industries and Types of Consumers

There are two main classes of electrical consumers, namely:

(i) Domestic consumers

(ii) Industrial consumers

The domestic consumers, e.g. private houses, like bungalows and multistory buildings, which are not for commercial purposes, utilize less electric power than commercial, industrial and institutional premises where the demand for electricity is much higher due to more electricity-consuming activities.

The total electric power in kilowatts (1000 watts) of appliances such as cookers, fans, refrigerators, grinders, blenders, water heaters, and lighting fittings, for both incandescent and discharge lamps in private homes, when added up, is quite small compared with the power consumed by industrial machines. These electricity-consuming appliances are generally referred to as electrical load. An electrical circuit is said to be loaded when one or more appliances are connected to the circuit to form a complete current flow path. A circuit is referred to an unloaded circuit when it is “offloaded”, i.e. when the load is removed by switching off.

WEEK 6

Topic: BUILDING SITE PREPARATION

Hand tools

Among typical hand tools used in the site preparation operations are:

I. Spade

This is used for digging usually relatively loose or soft earth.

ii. Shovel

This is used for digging usually relatively loose or soft earth.

iii. Chain Saw

This is a portable diesel or petrol-operated motorized chain saw used in felling trees and for cutting the tree trunk into smaller lengths.

iv. **Matchet**

This tool is used for cutting grasses, tree branches and shrubs.

v. **Hoe**

This is used for digging usually about the surface of the ground.

vi. **Axe**

The axe is used for cutting bigger branches.

Mechanical Tools/Plants

Mechanical tools, which are also very valuable in speedy operation of site clearing, tackle the bulk of the heavy jobs on the site. Among these are the following:

i. **Bulldozer**

This is a very powerful machine which can push down almost any obstacle on its way, scu as walls, buildings and trees and clear them from site.

ii. **Tractor Shovel (Pay Loader)**

This machine has a tipping shovel bucket at the front. It is used for lifting large quantities of loose materials at a time and loading them into trucks or tippers.

iii. **Grader**

The grader is used mainly for grading, that is, for leveling of excavated areas. It is also used for trimming of banks or edges of roads and for cutting ditches.

Removal of Vegetable Soil, Small Trees and Shrubs

The bulldozer is moved in to push down unwanted structures like old buildings, and to uproot trees and shrubs. This debris is moved away to the outskirts of the site where parts of the trees are later salvaged for firewood. The bulldozer then scrapes or excavates the topsoil to a depth to strip or remove the vegetable soil into grasses growing on the site so as to live the site with a reasonably hard and firm surface. To prevent weed growth, herbicide is applied/ herbicides are chemicals that are capable of preventing the growth of weeds when applied on a building site. There are many types of herbicides. 'Round Up' is a general-purpose herbicide and a national chemical product. 'Grammazon' is another trade name for a type of herbicide which can be used on the building site.

Techniques for Grubbing our Roots and Stumps

For small trees and shrubs, when bulldozer pushes them down, some of the roots are either pulled out or snapped and left in the ground. However, those left in the ground are easily moved during subsequent excavation and clearing operations by the bulldozer. But there are very big trees, like mature Iroko tree, it may not be easy for bulldozer to pull or push down the tree. If it does, it is likely that some of the roots will be exposed thus making it easier for the entire roots to be pulled out when the tree is being pulled away.

However, it is better to first fell the tree, cut the trunk and transport to the sawmill for conversion into timber. The stump left is then tackled. Some digging is done around the tree stump to expose the roots, which are then cut either with an axe of the chain saw and the stump finally pulled out by the bulldozer.

In the absence of this mechanical equipment for grubbing out the tree roots, labourers dig around the tree stump to locate the rot which are chases and uprooted.

The taproot is located and exposed after further digging, cut, and the tree stump finally pulled away.

Leveling the Site

When all the tree stumps and roots have been grubbed out, and the top vegetable soil excavated to a depth of between 150mm and 300mm, a grader is moved in, to level the site. Here, earth is cut from the higher ground and moved down to fill valleys holes and gullies. On sloping grounds, it may not be necessary to attempt to achieve one level surface, instead, terraces are provided thus allowing for buildings to be erected at different ground levels. Wall may be constructed to retain the different ground positions.

Examination of Termites and their Nests

When termites' nests and anthills are found on the construction site, they should be destroyed. The anthill is knocked down and some poisonous chemicals like Gamaline or antitermite chemicals are mixed and poured in to the nest to kill the termites.

WEEK 7

Topic: SETTING OUT

Setting Out

For us to understand and appreciate what setting out operation is all about, let us first discuss the preliminary roles of some professionals in the job.

(A) Preliminary Site Operations

Anybody wishing to construct a building usually first consults an architect to discuss the need for a building and the type of building wanted. The architect will find out from his client, the land area available for the project and nature of the ground, his preference for single-storey buildings to two-or three-storey buildings, and perhaps how much he intends to spend on the building. After obtaining all the necessary information and data, the architects plan and design a building that satisfies the wishes and need of the client.

This architectural damage is then sent to a structural engineer. The structural engineer works within the civil engineering field as a specialist. He determines and specifies the strength and types of building materials to be used in different parts of the building structure. The structural engineer studies the building design sent to him and recommends the sizes of steel bar and positions and methods of placement in the different parts of the building to reinforce the concrete. He also specifies the ratio of mix of the concrete required for the building for maximum strength.

The building design is returned to the architect who now prepares the building plan in greater details, as he adds all the information specifications and advice from the structural engineer.

He finally prepares the contract documents for the building project. The quantity surveyor may be consulted to study the working drawings of the proposed structure to determine the cost of materials, labour and workmanship that can be charged to the proposed building structure.

Finally, a construction company or a contractor wins the contract for the construction of the building and having finished the preliminary operations of site preparation, is now ready to set out the building.

(B) Setting Out – The Need for Accuracy

Setting out is, therefore, a process of driven pegs into the ground here and there, in a manner that agrees with the dimensions of the buildings specified on the architect's drawings.

Setting out a building is a simple job. Although a simple job, it is very important that it be skillfully executed to have the building true to shape or square and level.

Indeed, the satisfaction and the success of the whole project depends upon the setting out. It is certainly impossible to make any amendments if the rooms of a building are found to be out of shape, and that building shall forever remain a good and living advertisement for an unskilled and inexperienced builder at least as far as setting out is concerned.

Setting out is the process of transferring, with a high degree of skill and accuracy, the details of the foundation plan from the drawing sheet on to the ground, with pegs, line and tape. In setting out, the exact positions of the foundation trenches which will carry the entire walls of the building are properly located on the ground, true to the dimension and squareness as specified in the building plan sheet.

Simple Drawing Practice

An architect plans and designs building structure and prepares all the drawings and specifications required to successfully carry out the building project. The working drawings usually contain the various drawings discussed below:

i. *The floor plan* showing the layout of the building, the dimension and location of the walls, rooms doors and windows. The floor plan may or may not show the foundation trenches. When it does, the foundation trenches are shown in dotted lines.

ii. *The elevation* showing the building as viewed from the East, West, North and South.

iii. *The sections* showing the building as it would look when cut through from the roof to the foundation.

iv. *The detailed drawings* showing extra details to aid the builder in carrying out the building operation to be required specification, e.g. the fixing of the flashing of or method of placing and spacing the reinforcement bars.

v. *The schedules* showing the different types of doors and windows, their sizes and their locations in the building plan. The schedules will also show the types and locations of the kitchen cabinets, or any other room divider, such as a shelf.

vi. *The electrical plan* giving a layout of the electrical installations and wiring of the building.

1. *The plumbing plan* showing the plumbing network of the building including the drainage and sewage system. it will also show the water supply system and distribution in the building including the size and location of the septic tank and soak-away.

Builder's Square

This is a wooden version of the steel square. The square template is made out of 150mm x 38mm timbre, framed and braced, and the arms should be about 2 metres or longer. It is used in the same way as the steel square, and has the advantage that it is bigger and can give an easier and more accurate setting out.

Tape and Pegs

Tape and pegs can be used in setting out the square end of a building, based on the Pythagoras' theorem which proves that any triangle whose sides in the ration of 3:4:5 is a right angled triangle.

When the building line is established, and a distance of 3m is measured along the building line, a peg is driven into the ground at this point. A nail is driven into the centre of the top of each peg.

WEEK 8

Topic: MAINTENANCE OF DOMESTIC APPLIANCES

Simple Maintenance Methods

The major concern of this unit is to discuss the maintenance of common domestic appliances. The methods used include cleaning, dusting, washing, oiling and replacement of damaged parts. The electronic appliances used are to be handled with care because they are fragile and costly. Users should be familiar with the contents of the manufacturer's manual concerning the handling and maintenance of such appliances. Examples are radio, television, refrigerator, fan, etc.

Kitchen utensils also need to be maintained. They should be cleaned constantly and kept dry. Furniture items should be dusted while machines should be oiled regularly.

Maintenance of Furniture

A. Tables

A table is a piece of furniture with a flat top, which can be oval, rectangular, round or may take any other shape. The commonest shape is the rectangular shape. A table top can be made of plastic laminates, metal, formica, finished wood or may even be padded.

A table has one or more legs, but tables with four legs are more common. It is usual to see tables with iron legs and sheet metal tops or made of plastic. The tables made completely of wood are very common. If a table is made of wood, it is important to emphasize that the wood must be well seasoned; that is, the excess moisture in the wood must have been dried out. If the wood is not properly seasoned, the table can easily become warp and the drawers become shabby. Since most of our homes have tables made of seasoned wood and finished tops, attention will be given more to tables made of wood I this discussion.

i. Uses

Tables are used for various purposes. In our homes, they are used for writing, for dining, for keeping various articles and ornaments. They are also used in schools,

hospitals shops and so on, for doing different kinds of work. Tables are also used for decorating homes to provide comfort, e.g. sitting rooms and dining areas.

ii. Care

The care of a table depends upon the material used in making the table. If the table is made of plastic, dusting and cleaning with damp cloth and drying properly is enough. If made of metal, dusting properly everyday is sufficient. But tables made of finished wood, that is, varnished, painted or polished, need a little more attention.

Varnished table top

I. Varnished Table

a. Dust carefully

b. Wash, using warm water and a soft cloth. Add one table spoonful of paraffin per litre of water

c. Wash in such a way as to avoid water marks

d. Dry thoroughly and polish with a clean soft duster.

II. Painted Wood Table

a. Dust thoroughly

b. Wash carefully with warm, slightly soapy water

c. Remove dirty marks with fine whiting

d. Rinse and dry well e. Rub up with a clean soft duster.

III. Polished Wood Table

This wood is noted for its texture and fine grains, (e.g. Mahogany). Tables made of cheaper wood are given a thin covering of thin line wood (known as veneer)

i. Care of Polished Wood

a. Avoid heat, which softens and removes the polish and causes white heat marks.

b. Avoid the use of abrasives or harsh cleaners, as they will scratch the polished surface.

c. Avoid spilling water, perfumes or medicine on polished wood as they remove the polish.

ii. Cleaning of Polished Wood

a. Dust well and rub with a soft clean duster.

b. Wash only if the table is very dirty but with great care.

c. Cleaning with a soft cloth dipped in warm water with a table spoonful of vinegar in 4 litres of water.

d. Wipe well over the surface. This removes greasy finger marks and so on.

e. Dry very well and polish with a soft cloth duster.

f. You may apply very little furniture cream with a cloth and rob it thoroughly into the wood.

g. Polish with two soft dusters, first rubbing with circular motions with and duster and finally along the grain with the other clean duster.

IV. Formica-Topped Table

This type of table is very common in homes nowadays because of the ease in cleaning and care.

To care for formica-topped tables, always clean properly with a damp cloth and dry with a clean top. If oily, use a cloth from soapy water and clean properly, then dry very well. Do not scrape off any particle that sticks fast on the table rather soak with water and rub off. Do not put very hot items on the table. Put hot foot on the table mat.

B. Chairs (Different Kinds of Chairs)

The simplest definition of a chair is a seat for one person. A chair is a seat with one or more legs, a back, and sometimes, arms. The chair has a very long history. This found in the furniture of furniture development. In the fifteenth century, chairs were a symbol of authority used by kings and nobles, and ministers in the church.

In courts, only kings sat on chairs, nobles sat on stools. A chair is usually made of seasoned wood, iron, cane or of recent, plastics.

Chairs are made from different designs. Some hairs are carved from wood (e.g. awka craved chairs). Some chairs have a central rod upon which their seats revolve. Most barbers' chairs and some executive chairs in offices are like that.

Chairs

C. Beds

A bed is a framework made of wood or iron, of late, a combination or iron and wood. It is complemented with a mattress to provide comfort. When a bed is made of wood, it is usually a well seasoned hard wood, e.g. Iroko. If made of iron or brass other metals are used to coat it in order to provide a shiny exterior.

Bed

To provide comfort, spring and foam mattresses are recommended. Such bed should have a felt or hessian underlay between the metal spring and the mattress to prevent rust marks. The pillow should be moderately full enough, if too full, it will be hard and if not full enough, it will be flat and uncomfortable. A bed should have a sheet and a blanket. The sheet could be linen and cotton. A mixture of nylon and cotton is very common nowadays. The blanket should be light, not heavy; could be all wool, or a mixture of wool and other fibres. Beds come in different sizes.

The common sizes seen in the markets are:

Cot Size	60 x 120cm
Bunk or divan bed	75 x 190cm
Single bed	90 x 190cm
Three-quarter bed	100 or 120 x 190cm
Double bed	140 x 190cm

A. Pots

The most common household pots are aluminium pots of various shapes and sizes.

Most cooking utensils are made of aluminium. In most homes, large aluminium pots are used for storing water. Enamel pots are used in some homes. Other types are cast-ironpots, tin pots and earthen pots.

Kitchenware/Utensils

i. Uses of Pots

Pots are used mostly for cooking. Large ones are also used for storing water. Cas iron pots are used for frying garri and plantains in commercial quantities.

ii. Care of Aluminium Pots

Care should be taken to avoid scratching the surface. This can be cause by metal scourers or putting aluminium away without drying. New utensils should be boiled out for ten minutes adding a teaspoonful of boraz to half a litre of water. This prevents the formation of discoloration due to minerals in the water. After use, aluminium pot should be cleaned with a nylon scourer with fine abrasive powder or paste or pad of fine steel wool softened with soap. Rinse with clean water and dry thoroughly. Always avoid the use of soda.

iii. Enamel

Enamel utensils should be washed after use. If necessary, use an abrasive paste or fine powder. Rinse and dry thoroughly before putting away.

iv. Tin Utensils

Fill with water, add a little soda and allow to boil on a hot plate for a few minutes. Pour a way, wash and dry thoroughly. In case of cake tins, wipe with a damp cloth. After use, dry well before putting away in a dry storage place.

B. Cutlery

The cutlery on our table usually consists of spoons, knives, fork and so on. They come in various sizes. For example, spoons comprise tablespoon, dessertspoon, teaspoon; knives comprise table knife; and fork consists of table fork, desert fork. Different metals are used to make cutlery. They vary from the very cheap ones made of aluminium to the expensive ones which are usually electroplated with material such a s nickel, chromium and gold to prevent corrosion and provide a shiny exterior used for storing water. Cast iron pots are used for frying garri and plantains in commercial quantities. Earthen pots are used for storing water and for fermenting cassava.

Care of Cutlery

Cutlery should be stored in such a way that it is easy to reach. It should be stored each in its own pile, for tidiness, easy selection and to avoid scratching. The drawer should be lined with hardwearing fabric e.g. green baize, and covered properly. Solid silver needs constant polishing because it tarnishes easily and should be cleaned with wood-ash and lime, lemon or silver dip.

It should be rinsed in warm soapy water, dried properly and polished with dry starch in order to retain the shiny appearance. Stainless steel cutlery is cleaned with common abrasive powder and dried with clean cloth.

C. Crockery

Crockery is the term given to plates, cups and dishes in the house made of baked clay, usually referred to as ‘chinaware’. The first white porcelain was made in China, hence the name ‘chinaware’. The name ‘china’ is loosely used to cover not only porcelain which is made from fine white clay (china clay or kaolin), but also earthenware made form coarse clays. Porcelain is more expensive than earthenware. It is stronger. It is translucent and takes a fine glaze.

Crockery

Earthenware:

Impurities in clay give rise to different texture and colours. Special treatment in the process of manufacture produces earthenware which is good for the oven.

Care of Crockery

Scrape and rinse after use. If necessary soak, then wash in hot salty water. Rinse in hot. Dry with lintless cloth, if necessary. Special stains in the tea or coffee cups may be removed by rubbing with a little salt or baking soda.

Caution: Avoid alkalis and coarse abrasives. Use mild detergent only. Handle chainware very gently. Do not drop or knock against hard objects. Generally wash in plastic bowl with foam plastic mat, drain on folded cloth or plastic.

D. Enamel Pots and Dishes

For those who cannot afford chainware, enamel plates and dishes are equally good for serving food. They are cheaper and more durable. We should avoid washing them with coarse abrasives or metal scourer, High heat should be avoided, which may raze or crack the enamel. Handle gently to avoid chipping.

WEEK 9

Topic: MAINTENANCE OF DOMESTIC APPLIANCES

A. Radio

A radio is an instrument used to receive messages without wire connections but through electromagnetic waves. The various types of radio sets in our homes are made to serve the same purpose, namely to receive information such as music for our entertainment news, both local and foreign; religious, political and social discussions.

Care of the Radio

a. Dust everyday with soft cloth.

b. Clean delicate parts gently.

c. If the radio is battery-operated, remove the battery cells whenever they become dead. Do not allow dead batteries to become rotten inside the radio.

d. Do not tamper with components or electrical parts. If there is any fault, take it to an experienced radio technician.

B. CD/DVD Music Player

A CD/DVD player is an instrument designed to play CDs, DVDs and supply music for entertainment or for enjoyment.

Most CD and DVD players are made to use only electricity. This type is used in places where there is electricity supply. Some players use only flashlight batteries and can be used in rural villages without electricity supply, as well as for outings such as picnics. The most recent record players use both electricity and flashlight batteries. Others have radio attachments built into them, e.g. loudspeakers and cassette recorders.

i. Maintenance of the Music Player

Read through the instruction manual thoroughly. The directions in the instruction manual should be followed strictly.

Most record players have double speed, e.g. 33rpm and 45rpm. Always select the correct speed for any particular record. Clean record pins should always be used, and should be changed as soon as they go bad.

ii. Care of the Music Player

A record player has many delicate parts and should be used with great care. The tone-arm should be handled with care. Check the power source, the correct speed of the record before playing. If batteries are used, remove them as soon as they are dead. Always check record pins for dust, which must be removed carefully using a special soft brush.

Dust the record player from time to time with a soft brush. In case of fault, take to the maker or an experienced radio technician.

C. The Refrigerator

A refrigerator is a device for keeping food item cool. It is used to preserve food items such as meat, fruit, fish and vegetables for a short period of time. It also has a section called a 'freezer' which is used for freezing food. Frozen foods can be preserved for a much longer period of time e.g. weeks, months and even up to a year.

The design of the refrigerator is such that it has many shelves and fittings for proper storage of food items.

Most refrigerators use electricity as their source of power. Others use gas or paraffin. They come in various sizes, from the giant commercial types of medium household sizes, down to the dormitory sizes.

Care of Refrigerators

The instruction manual which comes with the refrigerator gives the detailed instructions on how to use and care for the refrigerator. It should be followed strictly.

a. Arrange food items in the refrigerator properly so that air can circulate all around and keep them cool enough avoid their getting bad easily.

b. Always cover milk and butter very well because they can easily absorb odour from other strong scented foods.

c. Check the refrigerator regularly for any spoilt food which must be removed immediately.

d. Wipe the inside with damp cloth, using bicarbonate of soda as detergent. Do not use soap or other detergents as they may leave undesirable odour inside.

e. Wash occasionally; both inside and outside of the refrigerator.

f. Thick frost reduces the cooling effect of the refrigerator. So defrost the refrigerator once a week or as soon as the frost has become about 13mm thick in the freezer. When the ice has melted, clean the refrigerator and dry properly.

A refrigerator usually becomes faulty due to the exhaustion of the refrigerant. The refrigerant is the fluid which flows in the coil to keep the inside of the refrigerator cool. Hence, such faulty refrigerator does not keep food cool. If this happens, there must have been a leakage, in such a case, call an expert who will locate and eliminate leakage and then recharge the refrigerator with the appropriate refrigerant.

D. Pressing Iron

Pressing iron is used to keep the surface of the clothes we wear smooth and straight; that is, to remove the rumples from washing or rough handling. Different types of iron are in use in Nigeria. In villages, where there is no electricity supply, they use (a) Flat iron (b) Box iron or coal and (c) Tilley iron. In places where electricity is available, people use electric iron or steam iron for pressing their clothes.

i. Types of Iron

a. Flat iron: Flat irons are heated with charcoal fire or wood fire. It is advisable to use them in pairs, while one is in use, the other is being heated. This makes it possible to have a continuous pressing exercise. The handle of a flat iron is made up of iron and wood. The body of the iron is heated along with the handle. It is important that we have a well stuffed small pad to hold the hot handle always.

When a flat iron is heated, the whole body becomes hot and smoky. The smoky body should be cleaned properly with a clean cloth.

The bottom surface should be rubbed on sand or powdered bath brick to keep it clean. Finally, it should be thoroughly cleaned with a clean cloth. A flat iron should stand on a metal strong enough to prevent scorching the sheet and large enough to keep the iron from slipping off.

b. Box iron or coal iron: The box iron or coal iron is generally made of cast iron. To use the box iron, it has to be stuffed with charcoal fire and allowed to heat up

properly. The box iron has a lock, which must be locked very well before use, otherwise the lid may suddenly open while using the iron, and charcoal fire pours out on clothes and sheets and burns them.

Before starting to iron clothes, the bottom surface of the box iron should be cleaned with a clean cloth, Ash should be blown out from time to time from the box iron and the body rubbed over with waste material. Like the flat iron, it should be kept on a strong metal to avoid scorching the sheets and large enough to keep the iron from slipping off.

c. Tilley iron: This uses paraffin or kerosene to get its heat through a tank and a pump attached to it. When kerosene is poured into the tank and pumped properly, heat flows from the iron sufficiently to make pressing possible. It has nothing to regulate the heat. Always stand the iron on an end when not in use.

Gas iron: Recently, the gas iron has appeared in the market. It has an adaptor that hangs from the iron and connected to the gas tank. When the gas tank is opened, gas flows into the iron through the adaptor. When the burner is lit, it supplies sufficient heat to press clothes. One disadvantage is that it has nothing to control the heat, as in the case of the electric iron.

e. Electric iron: In towns and villages where there is electricity, people prefer to use electric pressing irons than any of the types already mentioned. This is because the electric iron is very simple to use. To use, fit in the plug into the outlet socket and switch on, then select the appropriate heat for the type of material being pressed.
f. Steam iron: This uses electricity as its main power source and can be used dry. 'Dry' here means, using the pressing iron as an ordinary electric iron, without putting any water. 'Steam pressing' is achieved by pouring water into the iron. The water is heated and the steam produced is forced through the vents.

E. Air-Conditioner

Air-Conditioners are appliances installed in homes, offices, cars, surgery rooms in hospitals and other places for cooling, while also protecting the space from dust.

Air-Conditioning appliances are always equipped with connections for air intake and exhaust. For this reason, they have to be installed through walls or windows. The best location for then is where they will receive no direct sunshine. Air-conditioners come

in different sizes. People should always get the correct size for the rooms they are to be installed into.

Types of Air-Conditions

Air-conditioners have powerful fans, which draw in air from outside by suction through filter, which purifies the air. It is then cooled by the heat exchanger and the cooled fresh air circulates to every corner of the room. Most air-conditioners have a thermostat, which keeps the temperature constant at required level. Others have temperature control switches, which enable the individual to select the room temperature he or she wants. It is equally possible to make the air-conditioner fan the room without actually cooling it.

All the doors and windows must be closed when the air-conditioner is one.

Care of Air-Conditioners

a. Always operate an air-conditioner according to the maker's directive.

b. After a period of use, the air-conditioner collects a lot of dust. Switch off at the outlet socket and use soft cloth to dust it all over.

c. In case of a mechanical fault, refer to the maker or an experienced air-conditioner repairer.

F. Fan

A fan is a device or an instrument which rotates when switched on giving a current of air for ventilation. Three types of domestic fan, are available; the table fan, the standing fan and the ceiling fan. A table fan is normally put on the table, where it can easily rotate when it is switched on and supply current of air to the room. A standing fan is usually kept standing in a convenient corner of the room. A ceiling fan is installed hanging down from the ceiling. The switch box for operating the ceiling fan is usually installed on a wall. Each of these fans mentioned above has blades, a a control box to switch off and on and to control speed.

The table fan and the standing fan have a guard to cover and protect the blades.

Care of Fans

a. Use fans according to maker's instructions.

b. Whenever the fan is not needed, it should be switched off.

c. To clean the fan, open the guard and dust the blades and every other part. First dust, then clean with a damp cloth and dry very well.

d. Whenever the fan has any mechanical fault, an experienced technician should be invited to do the necessary repairs.

Electric Kettle

An electric kettle uses electricity as its main source of power to boil water. Most electric kettles are made of aluminium, and have well-insulated handles, knobs and bases. The lid is very well secured so that it cannot easily drop or fall out. The kettle is also well vented for the escape of steam. A safety cut out or a warning device is fitted to indicate that boiling is complete.

i. Care of Electric Kettle

New kettles, if made of aluminium, should be boiled out for 10 minutes, adding one teaspoonful of borax to each litre of water.

This prevents the formation of discoloration due to water which should not be allowed to standing an electric kettle for a long time. In hard water areas, kettle 'fur' should be periodically removed by a removing agent. After use, an electric aluminium little should be cleaned with a nylon scourer used with fine abrasive powder or paste or fine steel wool softened with soap.

ii. Uses of Other Aluminium Kettles

The use and care of other aluminium kettles which can be for boiling water on gas cookers or paraffin or kerosene stoves are just the same as in electric kettle.

The only difference is that paraffin or kerosene cookers very often produce smoke which stains the kettle. So, a little more pressure or force is required to wash the kettles clean with the same kitchen abrasives.

Radio Maintenance (General Maintenance)

a. Switch off the mains, and clean the framework with a dry soft cloth, brush or duster. Avoid cleaning plastics with petrol.

b. If battery-operated, remove the cells, and the clean the contact with an emery cloth, dry-clean the battery compartment, and replace the cells correctly, ensuring good contact.

c. Turn the radio upside down with the cover removed, or blow compressed dry air to remove insects and unwanted particles.

Faults and Remedies

a. Volume not being high: Clean the volume control switch with a liquid cleaner, or replace the volume control switch.

b. Cracking noise: This may be corrected the same way.

Intermittent Failure:

Partial contact of the mains connection may be the cause. Check the plug or switch contact and ascertain good contact.

Maintenance of Cassette Tape Recorder:

a. Clean with a dry clean duster or brush when in ‘off’ position.

b. Clean the battery compartment, cells and contact terminals as in the case of the radio.

c. Clean the recording and play head with clean soaked in methylated spirit or pure alcohol.

d. Clean capstan rollers with the same clean cotton, and dry off quickly by blowing excess spirit off.

e. Remove insects and unwanted particles, as in the case of the radio.

Faults and Remedies

Sluggish motion: The fault could be due to a faulty motor, poor belt tension due to expansion, rubber belt, or worn out capstan.

Change the motor if cleaning/oiling of shaft fails to correct the speed. Clean the belt with spirit and apply chalk dust to increase the friction or change and replace the capstan rollers.

Maintenance of Television Set

General Maintenance

a. Switch off, and remove connections to the mains by removing the plug (isolate).

b. Clean as in the case of the radio.

c. The induced voltage developed at the rear side of the television from its output transformer is more than 10KV. This is many times the supplied voltage, it is advisable for students to carry out repairs under the supervision of their technical teacher in order to avoid severe electric shock, which is even possible when the T.V. is off.

Faults and Remedies

a. Total failure: Check the fuse in the plug if electricity supply is still on in the room.

b. Picture continuing to roll up or down: Adjust the vertical hold knob at the back or side of set marked 'V. Hold'.

c. Appearance of dark broad lines on screen: Adjust the horizontal hold knob marked 'H. Hold', or switch off for a few seconds and or again.

d. Appearance of 'ghost pictures' or double image: Adjust the aerial until the picture becomes a unit.

e. Absence of pictures, presence of rasters on screen: Relocate the position of the aerial; other components in the television may cause this fault.

Maintenance of the Pressing Iron

The general maintenance operations for the different types of pressing iron (electric, coal-pot, gas, tilley, steam, etc.) have been covered previously. You are advised to make a quick reference to the materials presented in that unit. Here, we shall detect the method of fault detection when an electric iron fails to heat up. If there is a total failure and the fuse in the 13A plug is intact, check with an insulation and continuity tester, e.g. a 'megga tester' for continuity between the life (L) and neutral (N) terminals in the iron. An open circuit (i.e no current flow) indicates a broken element or permanently open thermostat contacts.

Fault and Remedies

Failure to heat up: Open up the iron and test separately (a) the thermostat (b) the element. If the element is open circuited, change it.

Maintenance of Rotating Appliances

Rotating appliances which are powered by electric motors for their operation include table fans, ceiling fans, extractor fans, grinders, liquidizers, food mixers, hair dryers etc. The basic principles of operation of these appliances have been covered earlier.

Faults of Fans

Possible faults are as follows:

a. lack of electricity supply at motor terminals

b. Humming of fan motor, i.e. inability to rotate or tendency to rotate very slowly.

c. Noisy rotation (if table type) of fan walking i.e fan altering position.

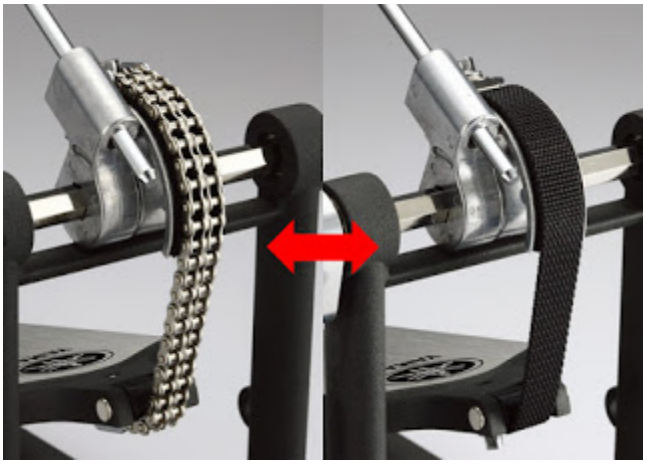
d. Overheating

WEEK 10

Topic: BELT AND CHAIN DRIVES

BELT AND CHAIN DRIVES

Belts are made of rubber and materials whose length and nature change with temperature. Examples of belts are motor fan belts, grinding machine belts, sewing machines. etc.



Chain and Belt drives

Chains are made of metals. Common examples are bicycle and motorcycle chains.

Friction is greatly needed in belt and chain drives. Belts and chains cannot work when friction is absent. Belts and chains are used in pulley mechanisms.

Belt and chain drives are used to:

1. Transmit energy from one shaft to another when both shafts are separated by a distance greater than that require for gears.

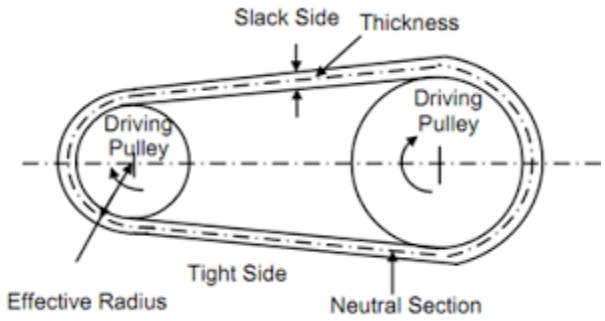
2. Change the speed of a pulley.

3. Change the running direction of a pulley.

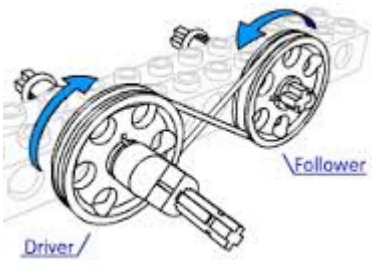
4. Carry materials as conveyors from one point to another.

TYPES OF BELT AND PULLEYS

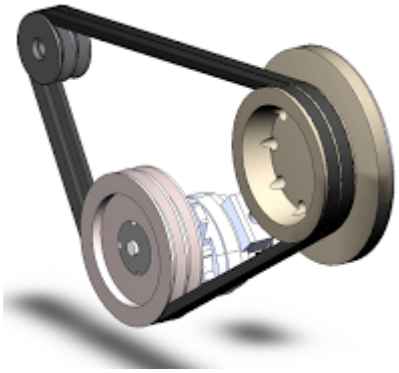
1. Open belt



2. Crossed belt



3. V-belt



4. Chain belt.

ASSESSMENT

1. What is the main difference between belts and chains?

2. What are four uses of belt and chain drives?

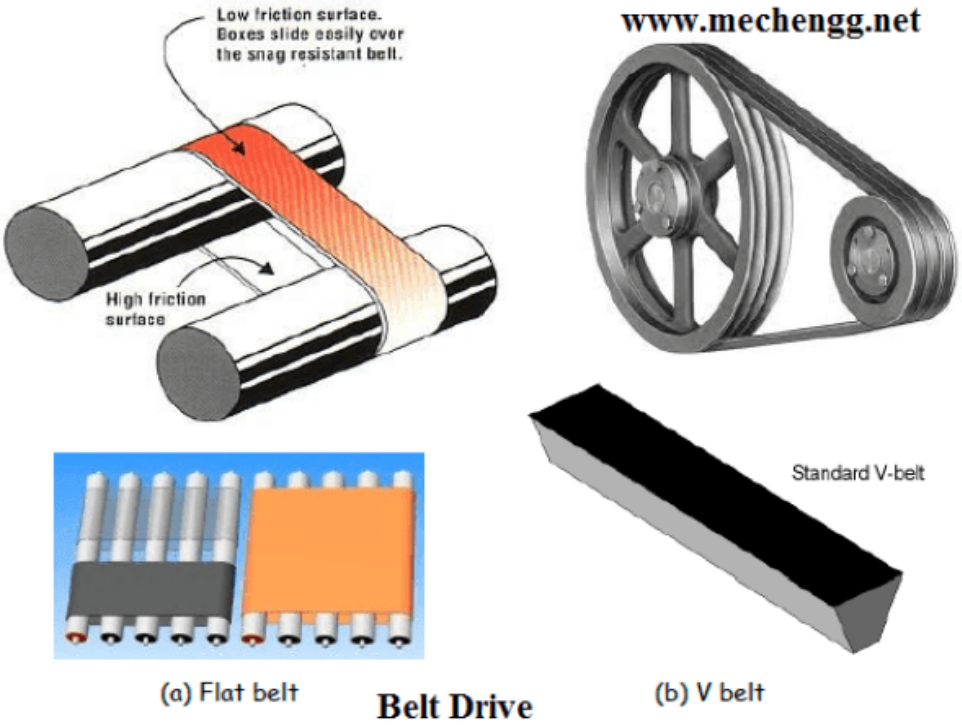
3. What are the names of four types of belt and pulleys?

WEEK 11

Topic: ADVANTAGES AND DISADVANTAGES OF BELT AND CHAIN DRIVES

BELT DRIVE

To transmit power from one shaft to another, pulleys are mounted on the two shafts. The pulleys are then connected by an endless belt passing over the pulleys. The connecting belt is kept in tension so that motion of one pulley is transferred to the other without slip. The speed of the driven shaft can be varied by varying the diameter of the two pulleys.



(a) Flat belt **Belt Drive** (b) V belt

ADVANTAGES BELT DRIVES

1. Made from flexible material, it can be used for the shafts whose axes are note parallel.

2.Lubricant is not required.

3. Noise is relatively less.

4. It is flexible member, it slips or break during overload and safeguards the machine.

5. Initial cost is low.

DISADVANTAGES OF BELT DRIVES

1. Drive is not positive as the belt slip over the pulleys.

2. Occupies relatively more space.

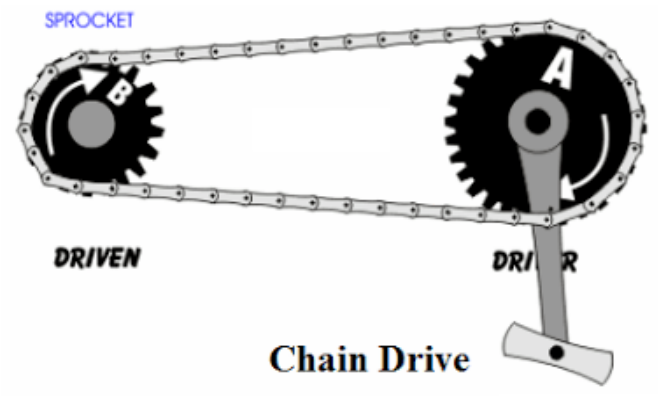
3. Speed ration can not be maintained because of slipping of belt.

4. Adjust the tension in the belt is require time to time.

5. Life is relatively low.

CHAIN DRIVES

The chain drive consist of three elements – driving sprocket, driven sprocket and endless chain wrapped around the sprocket as shown in fig. Pin joint contains, pin, bush and roller to minimize the friction and such chains are known as roller bush chain. The chain drive is positive drive where there is no slip & constant velocity ratio can be maintained. Chain drive used in bicycle, motorbike, printing machine, textile machine etc.



ADVANTAGES CHAIN DRIVES

1. 1. Positive drive as there is no slip, hence constant velocity ratio.
2. Occupies less space compared to belt drive.
3. Life is more compared to belt drive.
4. Used for large center distance.
5. Transmission efficiency is larger than belt drive.

DISADVANTAGES OF CHAIN DRIVES

1. Noisy compared to belt drive.
2. Initial cost is higher compared to belt drive
3. Adjustment in the center distance is necessary.
4. Maintenance cost is higher & complex compared to belt drive.

ASSESSMENT

1. State 5 differences between chain and belt drives
2. List 3 advantages and disadvantages each of belt drives
3. List 3 advantages and disadvantages each of chain drives

WEEK 12

Topic: GEARS

GEARS: DEFINITION

Gears are Power transmission elements. It is the Gears that decides the torque, speed and direction of rotation of all the driven machine elements. Broadly speaking, Gear types may be grouped into five major categories. They are Spur, Helical, Bevel, Hypoid, and Worm. A lot of intricacies are there in the different types of gears. Actually The choice of gear type is not a very easy process. It is dependent on a number of considerations. Factors that go into it are physical space and shaft arrangement, gear ratio, load, accuracy and quality level.

A number of gears are manufactured using different materials and with different performance specifications depending on the industrial application. These gears are available in a range of capacities, sizes and speed ratios, but the main function is to convert the input of a prime mover into an output with high torque and low RPM. These range of gears find use in almost every industry right from agriculture to aerospace, from mining to paper and pulp industry. Some of the popular types of gears in use are:

Spur Gears

Spur Gear

Spur gears are straight-toothed gears having radial teeth used to transmit power and motion between parallel axes. These gears are widely used for speed increase or reduction, high torque, resolution for positioning systems.These gears can either be mounted on a hub or a shaft. The gears are available in different size, design, shape and also offer a variety of features and functions to cater to different industrial requirements.

Materials Used
Spur gears are fabricated from superior quality materials, like:

- Metal- steel, cast iron, brass, bronze and stainless steel.
- Plastic- acetal, nylon and polycarbonate.

Materials used to manufacture these gears are used keeping in mind certain factors including design life, power transmission requirements, noise generation.

Important Specifications to be Considered

- Gear center
- Bore diameter
- Shaft diameter

Use of Spur Gears
These gears find wide application in a number of fields including :

- Automobiles
- Textiles
- Industrial engineering

Bevel Gears

Bevel Gears

Bevel gears are mechanical devices used for transmitting mechanical power and motion. These gears are widely used for transmitting power and motion between nonparallel axes and are designed to transmit motion between intersecting axes, generally at right angles. The teeth on bevel gear can be straight, spiral or hypoid. The gears are suitable when the direction of a shaft's rotation needs to be changed.**Materials used**
Materials used to manufacture these gears are used keeping in mind certain factors including design life, power transmission requirements, noise generation. Some of the important materials used are :

- Metal – Steel, cast iron and stainless steel.
- Plastic – Acetal and polycarbonate.

Important specifications to be considered

- Gear center
- Bore diameter
- Shaft diameter

Use of Bevel Gear
These gears find wide application in a number of fields including :

- Automotive industry
- Textile industry
- Industrial engineering products

Helical Gears

Helical Gear

Helical gear is a popular type of gear having its teeth cut at an angle, thus allowing for more gradual and smoother meshing between gear wheels. The helical gears are a refinement over spur gears.The teeth on helical gears are specially cut at an angle, so as to face the gear. As two teeth on the gear system engage, it starts a contact on one end of the tooth which gradually spreads with the gear rotation, until the time when both the tooth are fully engaged.

The gears are available in different sizes, shapes and designs to meet the customer specifications.

Materials Used
These gears can be manufactured from superior quality materials including stainless steel, steel, cast iron, brass etc. depending on the application.**Use of Helical Gears**
These gears are used in areas requiring high speeds, large power transmission, or where noise prevention is important.

- Automobiles
- Textile
- Aerospace

- Conveyors

Worm Gears

Worm Gear

A worm gear is a type of gear, engaging with a worm to significantly reduce rotational speed, or allowing higher torque to be transmitted. The gear can achieve a higher gear ratio than spur gears of the same size.**Materials Used**
Worm gears can be constructed from a number of materials depending on the end application. Some of the popularly use materials are :

- Brass
- Stainless steel
- Cast iron
- Aluminum
- Hardened steel

The gears can operate under difficult conditions and have the ability to achieve large speed reductions. The gears also transmit high loads at high speed ratios.

Types of Worm Gears

- Non-throated
- Single-throated
- Double-throated

Use of Worm Gears
These gears find application in :

- Electric motors
- Automotive components

Ground Gears

Ground Gears

As generally seen grinding is most of the time conceived in context of quantity fabrication of superior quality gears as a form of secondary refining procedure. We incline to forget that grinding is essentially a basic process in the step towards production of case hardened gears. Moreover, the teeth of precision-engineered fine-pitch gears completely ground from the blank itself.The advent of trawling also led to the development and manufacturing of Ground Gears. Ever since then ground gears have made substantial improvement in the terms of designing and component accuracy. These gears assure high transmission accuracy and deliver superior efficiency, greater load capacity, and correction of profile and durability.

Ground gears can be made using different materials, such as cast iron, carbon steel, alloy steel, hardened steel, bronze, and more.

Advantages of Ground Gears
Ground Gears offer various advantages to its users, some of which are:

- **High Precision:** Achieving high precision is not a difficult task for ground gears since in the grinding process, there is little removal of material in the final pass.
- **Superior Surface Finish:** Grinding makes the surface of ground gears more shiny than that obtained from any other machining technique.
- **Improved Flexibility**: Hardened steel alloys can be used to developed into ground gears that gives its added flexibility.
- **Minimal Surface Stress:** There is minimum residual surface stress in ground gears.
- **Load Carrying Capacity:** Ground Gears exhibit a higher load carrying capacity.
- **Minimal Wear and Tear:** Ground gears have minimal wear and tear that results in prolonged life.

Limitations of Ground Gears
Though ground gears offer multiple benefits and advantages, they too have some limitations:

- There is a limit to grinding procedures and that is to ferrous material.
- Hard metals can be grind in an efficient and better way than the soft ones.
- In case of worm or helical gears, grinding may not be the ideal solution. This is due to the reason that it often involves deviations in terms of removal and profile.
- Gear grinding machines are not as popular as hobbing machinery.
- Grinding demands higher costs, as it is a secondary operation.

Applications
These gears find wide application in a number of fields including :

- **High Speed Rotation**: Ground gears are ideal for uses in applications that need noise and vibration resistance in the case of high-speed gear drives. An example can be that of ground spur gears.
- **Positioning:** CP Racks and Pinions are recommended for perfect positioning applications. In these cases, ground gears are used in calculating for reducing pitch errors.

Precision Gears

Precision Gear

Precision gears are custom-made actuators that can be designed for varying uses and applications. These gears are generally used in applications under conditions of light loading. Precision gears are generally preferred for their precise, smooth, compact, noiseless and reliable performance.Precision gears can be manufactured as per the customer's drawings or based on a functional description depending on the type of application. The different types of precision gear products include, – spur gears, helical gears, worm gears, anti-backlash gears, cluster gears, clutch gears, face gears, planetary gears, gear assemblies, gear boxes, bevel gears, miter gears, metric gears, internal gears, idler gears, gear rack & pinion, worms, worm shafts, splines, spline shafts, se shafts, and more. These gears can be manufactured as per the exact customer specifications or according to application need.

The quality and performance of a precision gear depends on the quality of blank in which it is cut. Thus it is essential to hold tight tolerances without grinding.

Precision gears are known for their trouble free superior performance, long service life, and excellent surface finish and customization capability. These gears are used in a variety of industrial applications, such as heavy machinery Industry, metal casting, metal processing, construction, and more.

Rack Gears

Rack and Pinion Gears

A rack is generally used for converting rotational motion into linear motion. It is a flat bar onto which the teeth of a pinion gear are engaged. It is a kind of gear whose axis is at infinity. These gears are designed to accommodate a wide variety of applications.**Materials Used**
A variety of materials are used keeping in mind the application. Some popularly used materials are :

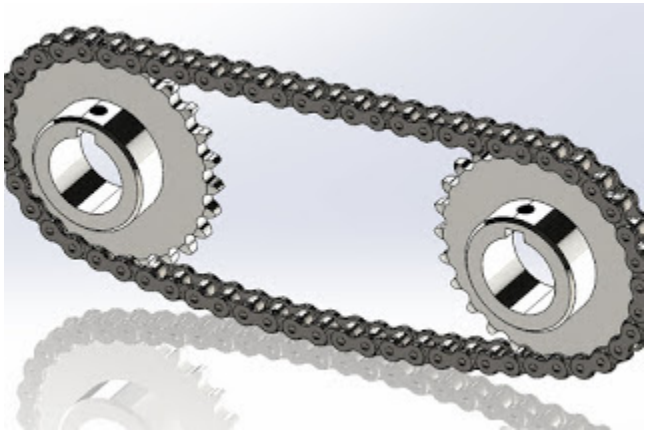
- Plastic
- Brass
- Steel
- Cast Iron

These gears ensure quieter and smoother operation. The mechanism provides less backlash and greater steering feel.

Use of Rack Gear
The gear is commonly used in steering mechanism of cars. Other important applications of rack gears include :

- Construction equipment
- Machine tools
- Conveyors
- Material handling
- Roller feeds

Sprockets



Sprocket wheel

A sprocket is a gear having metal teeth that meshes with a chain. Also known as a cog wheel, it is a small toothed ring that can fit onto the rear wheel. It is a thin wheel having teeth that engage with a chain.**Materials Used**
A variety of materials can be used to manufacture superior quality sprockets used in different industries. Some of the materials used are :

- Stainless steel
- Hardened steel
- Cast iron
- Brass

Use of Sprockets
This simple gear finds application in diverse areas including :

- Food industry
- Bicycles
- Motorcycles
- Cars
- Tanks
- Industrial machines
- Movie projectors and cameras

Segment Gears

Segment Gears

The segment gear, as the name suggests, is basically a gear wheel. These gear wheels are composed of a large number of pieces that are small parts of a circle. A segment gear is connected to the arms or trappings of the water wheel.The segment gear comes with a part for receiving or communicating the reciprocating motion from or to a cogwheel. These gears also comprise of a sector of a circular ring or gear. There are also cogs on the periphery.

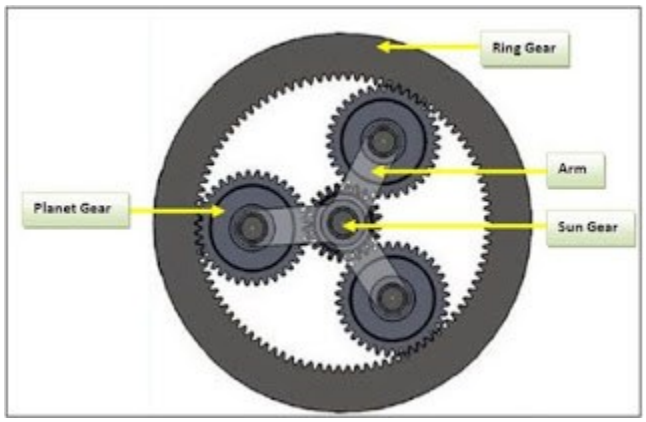
Segment Gears are available in various finishes, such as untreated or heat-treated and can be designed as a single component or as an entire system.

Applications

Segment gears, which are basically gear wheels, are used in variety of industrial uses and applications. These gears offer various advantages such as improved flexibility, superior surface finish, high precision and minimum wear and tear. Some of the uses of segment gears include:

- Defense
- Rubber
- Railways

Planetary Gear



Planetary Gears

Planetary gear is an outer gear that revolves around a central sun gear. Planetary gears can produce different gear ratios depending on which gear is used as the input, which one is used as the output.**Materials Used**
The gears can be constructed from a variety of materials including :

- Stainless steel
- Hardened steel
- Cast iron
- Aluminum

The gears are suitable for reduction of high RPM electric motors for use in high-torque low RPM applications. These gears are used in precision instruments because of their reliability and accuracy.

Use of Planetary Gears
These gears are the most widely used gears having diverse applications including :

- Sugar industry
- Power industry
- Wind turbines
- Marine industry
- Agriculture industry

Internal Gear

Internal Gear

An internal gear is a hollow gear with teeth cut on its internal surface. The teeth in such a gear project inwards instead of outwards from the rim.

Materials Used

There is a variety of materials being used to manufacture internal gears depending on the end application. Some of the popularly used materials are :

- Plastic
- Aluminum alloys
- Cast iron
- Stainless steel

The teeth in such gears can either be spur or helical. The internal teeth have a concave shape with a base thicker than that of an external gear. The convex shape and a strong base help in making the teeth stronger and also creating less noise.

Advantages of Internal Gear

- The gears are specially designed to accommodate a wide range of equipment.
- The gears are cost-effective and ideal for a broad range of light-duty applications.
- The non-binding tooth design ensures smooth and quiet operation.

Use of Internal Gears

- Light duty applications
- Rollers
- Indexing

External Gear

External Gears

One of the simplest and most used gear units, external gears are extensively used in gear pumps and other industrial products for smooth functioning. These gears have straight teeth parallel to the axis. The teeth transmit rotary motion between parallel shafts.

Materials Used

The gears can be constructed from a variety of materials including :

- Stainless steel
- Hardened steel
- Cast iron
- Aluminum

The kind of material used in manufacturing these gears depends on the end use they are being put to.

Use of External Gears

These gears are used in diverse fields including :

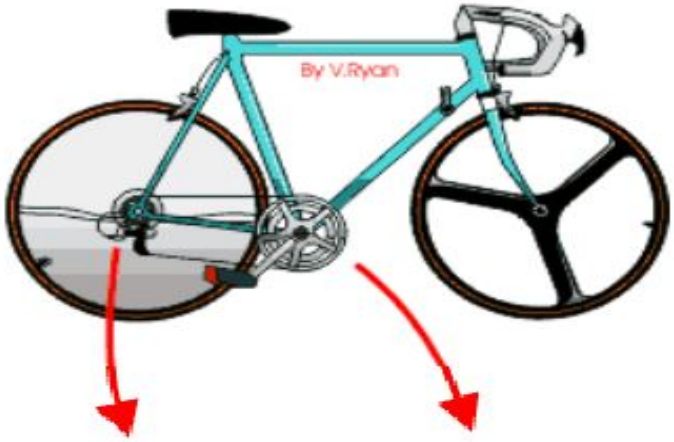
- Coal industry
- Mining
- Steel plants
- Paper and pulp industry

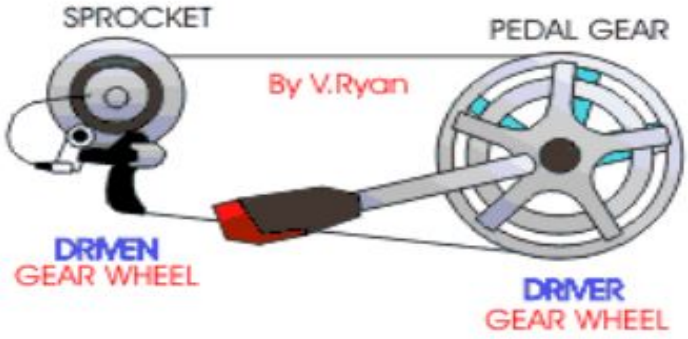
WEEK 13

Topic: GEARS (COntinued)

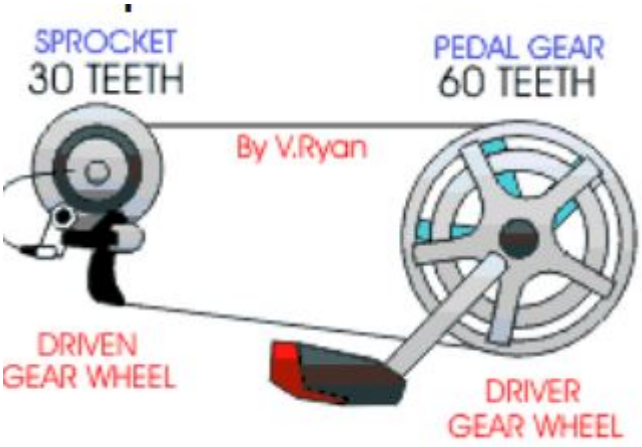
GEARS RATION (Velocity Ratio)

Many machines use gears. A very good example is a bicycle which has gears that make it easier to cycle, especially up hills. Bicycles normally have a large gear wheel which has a pedal attached and a selection of gear wheels of different sizes, on the back wheel. When the pedal is revolved the chain pulls round the gear wheels at the back.





The reason bicycles are easier to cycle up a hill when the gears are changed is due to what is called Gear Ratio (velocity ratio). Gear ratio can be worked out in the form of numbers and examples are shown. Basically, the ratio is determined by the number of teeth on each gear wheel, the chain is ignored and does not enter the equation.



$$\frac{Driven}{Driving} = \frac{30}{60} = \frac{1}{2} \rightarrow 1:2$$

But WHAT does this mean? It means that the DRIVEN gear makes TWO rotations for every ONE rotation of the Driving Gear.

How Does Gear Ratio Affect Speed?

The gear ratio tells us how fast one gear is rotating when compared to another.

If our input gear (10 teeth) is rotating at 5 rpms , and it is connected to our output gear (50 teeth), our output gear will rotate at 1 rpms.

Why?
Our gear ratio is 50:10... or 5:1

If our small gear rotates 1x, our large gear only rotates 1/5. It takes 5 rotations of our small gear to = 1 rotation of our large gear. Thus our large gear is rotating at 1/5 the speed = 1rmp.

What if our gear ratio where 1:3 ?
In this case our input gear is 3x larger as large as our output gear.

If our input gear were rotating at 20rmps.... each rotation, would result in 3 rotations of our output gear. Our output would be 60rpm

WEEK 14

Topic: PRINCIPLES OF EVAPORATION LEADING TO COOLING BY REFRIGERANTS

INTRODUCTION

Compressor: The refrigerant is a low pressure gas at the evaporator section while it is expected to be a high pressure gas at the condenser side. Therefore, in order to circulate the refrigerant throughout the system, we must provide the means to raise the pressure of the refrigerant from low evaporator pressure to high condenser pressure. This can be achieved by simply using a device called a compressor. The compressor takes the gas at the suction pressure (evaporator pressure) and increases it to the discharge pressure (condenser pressure). In addition to increasing the pressure of the refrigerant gas, the compressor circulates the refrigerant through the system.

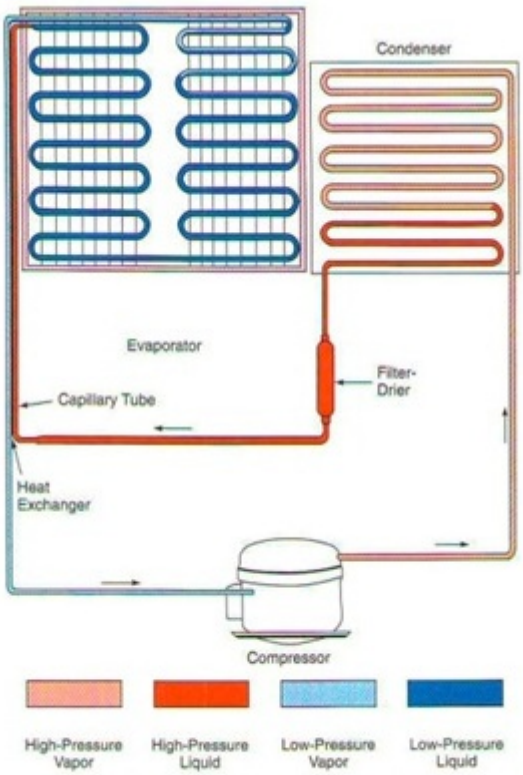


Figure 5-48. *A capillary tube refrigerant control. Note heat exchanger, which cools capillary tube by transferring heat from capillary tube to suction line. (Frigidaire Company)*

Controls: The foundation of the control is to maintain a proper rate of cooling and the temperature of cooled space. There are different methods of achieving control. The capillary tube is one of the most popular. The capillary tube is a tube with small internal diameter and a specific length, which throttles the high-pressure liquid/gas going into the evaporator. This type of control is called the capillary tube refrigerant control. This system is commonly used in household refrigerators, freezer and air conditioners.

Basic Features of a Domestic Refrigerator

A modern domestic refrigerator and a freezer consists primarily of three parts:

(i) The cabinet

(ii) The refrigeration system (condenser, evaporator and compressor);

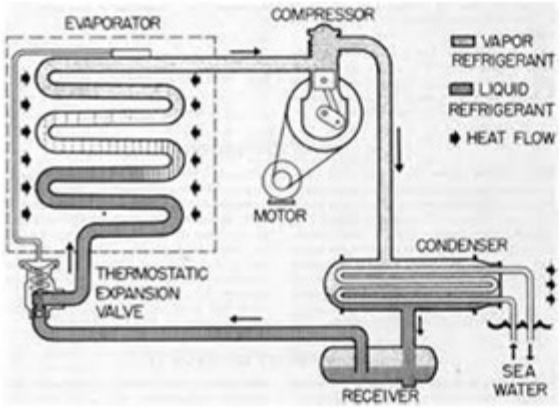
(iii) The electric circuits.

A typical refrigerator is shown below. While the other figure shows the refrigeration cycle diagram locating the different components whose main functions have already been discussed.

You should endeavour to locate these components in your refrigerator at home, or more easily in scrapped refrigerator. The condenser is a wire type condenser, which uses small metal wires welded to the condenser tubing to achieve rapid cooling. The compressor is what is called a hermetic type. This means that it is completely sealed.

Fig. Household refrigerator

Fig. Household refrigerator



Refrigeration cycle