JSS 3

BASIC TECNOLOGY

FIRST TERM

TABLE OF CONTENT

Basic Technology, JSS 3 First Term,

Week: 1

Topic: Career Prospects and Opportunities in Technology

Introduction

Technology is a family of professions. It involves artisans, craftsmen, technicians, engineers and scientists, all these professions are involved in the developments and production of the different products of technology that we are enjoying today.

Technology professionals work kin every sector of our economy. When you fly in a plane, drive a car, walk or drive across a bridge, make telephone call, watch on television football matches being played several thousand kilometers away, go under an x-ray machine to reveal broken bones, you are experiencing some of the products of technology.

Technology professionals work daily not only to operate and maintain these products but also to develop new products and processes. Thus, technology professionals are always thinking of new ways of doing things. This is what is called innovation.

In developing new products, the professionals work together. Take for example, the construction of a new building; the architect produces the conceptual model of the building which is translated by a draughtsman into a set of architectural drawings. The civil engineers carry out the structural design to make sure that the building is safe for the planned usage. The design is also translated by a draughtsman into a set of structural drawings specifying the various materials, in quality and quantity, to be used for construction. The mechanical engineer handles the design of the water supply system and air conditioning. The electrical engineer is responsible for the design of the electric power supply and distribution network to the different power consuming units in the building. The electrical and mechanical drawings are also produces by the draughtsman. At the building sites the technicians (civil, mechanical and electrical interpret the various drawings and supervise the various craftsmen/artisan (electricians, plumbers, masons, welders, painters, carpenters, etc.) during the construction of the building. The architect, the engineers, the technicians, the craftsmen and the artisans, all work as a team to execute the project.

In this topic we shall focus our attention on engineers to illustrate the unlimited career opportunities generally available in technology. We are interested in what it takes to be an engineer, the different careers in engineering, what engineers do and how you can become an engineer.

Who are Engineers?

Engineers are problems solver. They put their knowledge of science and mathematics to solve practical problems in a creative manner. Basically, they are involved with the design, the construction and operations of everything from bicycles to aeroplanes to electric generators to bridges. In fact, without engineers we will only be a little better than a cave man! So, engineers are thinkers and doers. Engineers usually meet to discuss problems of applying science, technology and engineering to solving our developmental problems.

Are you interested in a career in Engineering?

To determine whether you have the potential, faithfully answer these questions:

1. Are you good at mathematics and science subjects? Do you enjoy these classes in school?
2. Are you creative and imaginative? Do you like to build new things, or improve the way things work?

iii. Have you found Basic Technology taught in both JSS1 and JSS2 interesting?

1. Are you curious about things you do not readily understand?
2. Do you like working in teams? Are you a member of a school club, the boys scout or a sports team?
3. If you answer yes to some of these questions, you might have what it takes to be an engineer!

Major Areas of Specialization in Engineering

Engineering has lots of options to choose from, depending on your interest. There are nearly twenty areas of specialization, or disciplines. Each area of specialization also offers a wide range of career options. For example, a civil engineer can choose to specialize in any of these areas: design of structures, hydrology, highway design, sewage treatment, etc. As mentioned above, engineers do not work alone.

An engineer has the opportunity of working with engineers from many other specializations and even other professionals, you can understand why engineers need to be team players, when you think about many specialties of engineering join together to design and execute a major project. So, regardless of your area of your specific interest, you will probably be involved in several kinds of engineering.

Aerospace Engineering (AeroE)

Overall Focus: Flight vehicles and systems, covering both space flight (spacecraft, rockets, satellites, etc.) and sub-space flight (airplanes, helicopters, missiles, etc). Many Aerospace Engineers also work on land-based vehicles as well (race cars, regular cars, etc), typically focusing on aerodynamics (designing external surfaces) Related Fields: Astronautical Engineering (focusing just on space flight) and Aeronautical Engineering (focusing just on sub-space flight). Most offered academic programs are in Aerospace Engineering.

Primary Areas of Specialization:

1. Aerodynamics (design of external surfaces)
2. Structural Design & Materials Selection
3. Propulsion Systems
4. Guidance & Control Systems

Agricultural Engineering (Age)

Alternative Names: Biological Engineering; Biological Systems Engineering; Biosystems Engineering.

Overall Focus: Production and processing of agricultural products (“agriculture” = crops, livestock and poultry).

Primary Areas of Specialization:

1. Agricultural Equipment & Technology (tractors, harvesters, animal feeding systems, crop irrigation systems, etc.)
2. Agricultural Product Handling/Processing Equipment (to clean, sort, dry, package, etc.)
3. Biotechnology(as specifically applied to agriculture)
4. Land and Water Management (irrigation systems, erosion control, pesticide/fertilizer use/management)
5. Storage Structures (housing of farm animals and farm products)

Architectural Engineering (Arche)

Overall Focus: "Engineered systems" (that is, structural, mechanical, and electrical systems) for commercial, industrial, and institutional buildings/facilities. Overall, Architectural Engineers seek to "bridge the gap" between Architects (who focus on "form and function") and Engineers (who focus on "buildability") in designing/building buildings and facilities.

Core Curriculum Areas:

1. Structural Systems
2. Mechanical and Electrical Systems (including power systems, communications and control systems; lighting systems; and heating, ventilation, and air conditioning (HVAC) systems)
3. Construction/Construction Management

Biomedical Engineering (Biomede)

Alternative Name: Bioengineering

Overall Focus: Engineering applications within the broad fields of medicine and the life sciences.

Primary Areas of Specialization:

1. Biomaterials (both living tissue and artificial materials used in implantation applications)
2. Biomechanics (applying classic engineering mechanics principles to medical problems and/or to gain a better understanding of living things.)
3. Biotechnology (focusing on the development and production of pharmaceutical products – drugs, etc.)

4. Clinical Engineering (overall use of technology for health care in hospitals)
5. Medical Devices/Equipment (including diagnostic units (x-ray, CAT scan, MRI, etc.), treatment devices (for surgery, etc.), and prosthetics)

Chemical Engineering (Cheme)

Overall Focus: Chemical based manufacturing – applying chemistry for commercial quanlity production of a wide variety of products, including:

Fuels (gasoline, natural gas), Petro-Chemicals (chemicals obtained from petroleum or natural gas)

Agricultural Chemicals (fertilizers, pesticides), Industrial Chemicals (acids, alkalis, organics, salts), Plastics, Polymers and Fibers, Paper and Paper Products, Pharmaceuticals and Drugs, Consumer Products (paints, soaps, household cleaners, etc.), Food Additives/Product, Advanced Materials (ceramics, electronic materials, composites, etc.)

Civil Engineering (Ce)

Overall Focus: "Public works"/infrastructure and buildings/structures.

Note: Given the number of potential applications, Civil Engineering is a very broad discipline.

Primary Areas of Specialization:

Construction Management (combining engineering and management skills to complete construction projects designed by other engineers and architects).

Environmental Engineering (see separate entry)

1. Geotechnical Engineering (analysis of soils and rock in support of engineering projects/applications -building foundations, earthen structures, underground facilities, dams, tunnels, roads, etc)
2. Structural Engineering (design of all types of stationary structures – buildings, bridges, dams, etc.)
3. Surveying (measure/map the earth' surface in support of engineering design and construction projects and for legal purposes – locating property lines, etc.)
4. Transportation Engineering (design of all types of transportation facilities/systems – streets/highway, airports, railroads, other mass transit, harbors/ports, etc.).

5. Water Resources Engineering (control and use of water, focusing on flood control, irrigation, raw water supply, and hydroelectric power applications)

Computer Engineering (Compe)

Overall Focus: Utilize knowledge in both Computer Science and Electrical Engineering to design integrated computer systems (that is, integrating hardware and software components).

Primary Areas of Specialization:

1. Artificial Intelligence (developing computers that simulate human learning and reasoning abilities)
2. Computer Architecture (designing new computer instruction sets, and combining electronic or optical components to yield powerful computing systems)
3. Computer Design and Engineering (designing new computer circuits, microchips, and other electronic computer components)
4. Computer Theory (investigating the fundamental theories of how computers solve problems, and applying the results to other areas of computer engineering)
5. Information Technology (developing and managing information systems that support a business or other organization)
6. Operating Systems and Networks (developing the basic software computers use to supervise themselves or to communicate with other computers)
7. Robotics (designing computer-controlled robots for performing repetitive industrial tasks)
8. Software Applications (applying computing software to solve problems outside the computer field – in education or medicine, for example)
9. Software Engineering (generating computer programs)

Electrical Engineering (Ee)

Overall Focus: All things electrical/electronic – electronic devices, electrical systems, electrical energy, etc.

Note: Given the number of potential applications, Electrical Engineering is a very broad discipline.

Primary Areas of Specialization:

1. Communications (transmission and processing of information via various means – wires, cable, fiber optics, radio, satellite, etc.)
2. Computer Engineering (see separate entry)
3. Digital Systems (digital-based communication and control systems)
4. Electric Power (generation, transmission, and distribution of electric power)
5. Electronics (electronic devices and electrical circuits for producing, detecting, and controlling electrical signals for a wide variety of applications)
6. Robotics and Control Systems (machines and systems that perform/control automated processes)

Industrial Engineering (IE)

Overall Focus: Efficiency, or, more precisely, how to design, organize, implement, and operate the basic factors of production (materials, equipment, people, information, and energy) in the most efficient manner possible. The typical focus is on optimizing industrial manufacturing operations, although the skills learned can be applied to other non-manufacturing settings.

Primary Areas of Specialization:

Ergonomics / Human Factors Engineering (designing the workplace to better accommodate "human factors" (human abilities and behaviors), thereby yielding more efficient operations and fewer accidents or injuries).

Facility Design (aimed at operational efficiency)

1. Management Decision Making / Operations Research (using statistics and other forms of data analysis to aid in making management decisions)

2. Manufacturing Engineering (concerned with all aspects of manufacturing operations – materials, parts, equipment, facilities, labor, finished products, delivery, etc.).
3. Quality Control (using sampling, statistical analysis) is and other techniques to assess and maintain the quality of products or services provided by a business or other organization)
4. Work Design (defining jobs that individual workers do in performing the overall work of the organization, with the typical focus being on optimizing manufacturing operations).
5. Worker Productivity (conducting time and motion studies, setting work performance standards, and proposing new/improved work methods)
6. Material Engineering
7. Material Science and Engineering (reflecting the heavy emphasis on studying materials science that such programs often entail)
8. Overall Focus: Development and application of "advanced materials" – ceramics, polymers, metallic alloys/specialty metals, electronic materials, composites, etc.
9. **Note**: While Materials Engineering is concerned with developing and applying advanced material, commercial-scale production of such materials is the realm of Chemical Engineering – see separate entry).

Mechanical Engineering (Me)

1. Overall Focus: Machines, structures, devices, mechanical systems, and energy conversion systems.
2. **Note**: Mechanical Engineering is often considered the broadest of engineering disciplines, with overlap into many of the other existing engineering disciplines, including Civil, Electrical, and Chemical Engineering.
3. Primary Areas of Specialization:
4. Solid Mechanics (analyzing the behavior of solid bodies subjected to external loads, stress, and/or vibrations and using that information in the design and manufacture/construction of such bodies)
5. Fluid Mechanics (analyzing the behavior of liquids and gases and using that knowledge in the design and development of machinery and systems that can and/or do influence that behavior – pumps, fans, turbines, piping systems, etc.)
6. Thermodynamics (analyzing the conversion one form of energy into another and using that knowledge to design and develop energy conversion devices and systems – power plants, engines, Heating, Ventilation, and Air Conditioning (HVAC) systems, etc.)

7. Mechanical Design (covering the full range of mechanical-based products and systems)

Nuclear Engineering (Nuce)

1. Overall Focus: All engineering applications of nuclear/radioactive materials.
2. Primary Areas of Specialization:
3. Nuclear Power (including both nuclear power plants and nuclear-driven engines in submarines and spacecraft).
4. Nuclear Weapons Systems.
5. Radiation Sciences / Radiological Engineering (use of radioactive materials for medical or industrial applications)

Petroleum Engineering (Petroe)

Overall Focus:

The identification, extraction, storage, and transportation of crude oil and natural gas.

Note: Processing (refining) crude oil is in realm of Chemical Engineering

Primary Areas of Specialization:

1. Identification and Estimation of Crude Oil and Natural Gas Reserves
2. Land-Based Well Drilling Equipment/Facilities and Operations
3. Offshore Well Drilling Equipment/Facilities and Operations
4. Storage and Transportation Equipment/Facilities and Operations

Systems Engineering (Syse)

Overall Focus:

Ensuring the successful development and operation of large and complex engineered systems (such as transportation, communication, water/food distribution, and defense systems)

What are the Steps to Becoming a Professional Engineer?

Now that you have expressed interest in engineering, what are the steps to achieving your dream?

Step One: Good grades in Mathematics and the Sciences in Secondary School

As mentioned above, engineers use their knowledge of mathematics and the basic sciences (Physics, Chemistry and Biology) to solve problems. You must therefore ensure that you earn

good grades in Mathematics, Physics, Chemistry at the Senior Secondary School Examinations or ordinary-level examinations conducted by Nigerian Examination Council (NECO), General Certificate Examination (GCE) or any other qualification approved by the university you are interested in attending.

Step Two: Engineering Programmes in University

This involves gaining admission into an accredited engineering programme by the National University Commission (NUC) as well as the Council for the Registration of Engineering (COREN). 'Accredited engineering programme' means that the programme has been evaluated by both National Universities Commission (NUC) and Council of Registered Engineers in Nigeria (COREN) and found to meet the standards set by the engineering profession. This process ensures that the students who graduate from an accredited programme have the technical, design and requisite hands-on skills to begin a career in engineering.

Assessment

Basic Technology JSS 3 (1st Term –)

Week 2

Topic: Processing of Materials – Wood (contd.)

Outline:

— Conversion

— Seasoning

Conversion

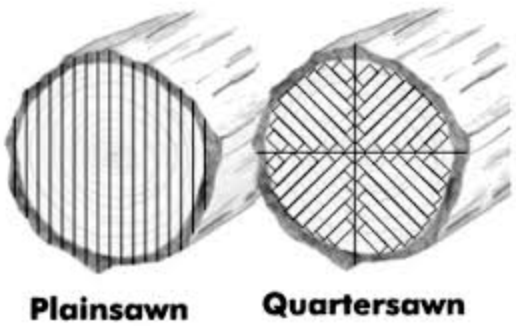
Wood is obtained from trees that grow all around us. However, wood cannot be used to produce the materials needed domestically and industrially, if the wood does not pass through the necessary stages of being processed.

Wood conversion is the process of splitting the log at sawmill with sawing machines into commercial and/or marketable sizes. The two popular methods of conversion are: 'plain sawn' and 'quarter sawn'.

In the plain sawn method also commonly called flat sawn, is the most common type of lumber cut you will find. Many operators prefer this method because it is a simple, cheap and fast way to convert logs into planks suited to various needs. The annular rings are generally 30 degrees or less to the face of the board; this is often referred to as tangential grain. The log is converted into planks by cutting more attention than the plain sawn method because the log has to be turned. The planks produced by this method have stripe figures.

Quarter sawn is more expensive than plain sawn timber, it has an amazing straight pattern that lends itself to design. Quarter sawn lumber is defined as wood where the annular growth rings intersect the face of the board at a 60 to 90 degree angle. When cutting this lumber at sawmill, each log is sawed at a radial angle into four quarters, hence the name.

Quarter-sawn boards have greater stability of form and size with less cupping, shrinkage across the width, shake and splitting, and other good qualities. In some woods, such as oak, the grain produces a decorative effect which shows a prominent ray fleck and sapele is likely to produce a ribbon figure.



Seasoning

Freshly cut wood contains a lot of water or moisture, which makes it heavy. Seasoning is the process of reducing the water (moisture) in the wood. The reasons for seasoning or drying wood are:

1. It makes wood more stable
2. It makes wood lighter in weight and therefore easier to transport
3. It generally makes wood stronger
4. It makes wood more durable because insects and fungi usually attack the starch in the wet sapwood.
5. It makes wood absorb paints, polishes, etc., more easily
6. It makes wood absorb preservatives more easily
7. Wood may be seasoned either by air drying or kiln drying. Air drying involves stacking planks one on top of the other with pieces of wood called stackers used to separate them. The stack can either be in open air or under a roof. Air drying takes a few days, this is because in kiln drying, the stack of timber is placed in a specially heated chamber. The air is therefore hotter and dries the timber faster.

Assessment

- State five reasons for seasoning wood

Basic Technology, JSS 3,

Week: 3

Topic: Production of Materials – Metals

Meaning of Metal

Metals are materials used in producing some equipment used in everyday life. Metals are usually solid but a few ones are in liquid or powder form. They are made from raw forms called ores. We will discuss how metals are produced from ores and metal alloys are formed. Metals come in different forms such as rods, tubes, plates, wires, bars liquid (e.g. mere) ferrous metals contain iron but non ferrous metals do not.

This topic has three units:

1. Production of metals: smelting and casting, etc.
2. Carbon properties of steel
3. Metal alloys:

Metal: Production of metals: smelting and casting, etc.

Most metals do not occur in pure state. They are usually combined with other metals and earthly impurity to form what is called mineral ore. When the ore is mined, the required metal is extracted from it. Some of the impurities removed from the ores are manganese, phosphorous, silicon, etc.

Stages of producing metals

Stage 1: Extraction Stage

The rock containing the metal is dug from the soil with drilling and excavating equipment. The rock and the metal mixed together is called the metal ore (the impure metal).

Stage 2: Smelting Stage

The metal ore is heated in a furnace until the metal melts into liquid form. This process is called smelting. It is then separated from other impurities that have mixed with it.

Stage 3: Casting Stage

The hot molten (liquid) metal is poured into containers of different lengths and sizes called moulds. It is left there to cool and solidify to take up the shape of the mould. This is called casting. This is round bars, square bars, wire and others are produced.

Section 2: **Carbon Properties of Steel**

Steel is a strong metal that is made up of the mixture of iron and carbon. This raw and impure iron is called pig iron. From pig iron, other forms of steel (iron) are produced.

1. **Cast iron**

This is produced by refining pig iron in a furnace called cupola it contains 2% to 5% of carbon. The pig iron scraps and some limestone are put in the furnace and burnt together with coke fire. The molten pig iron is then put into moulds to form either white cast iron (in form of iron carbide) or grey cast iron (in form of graphite).

Cast iron is brittle, and can easily break is given a hard blow.

1. **Wrought iron**

This is produced by removing the impurities that come with the pig iron. As it melts in the furnace, it is stirred with a puddling pole so that the carbon content escapes as carbon (II) oxide gas.

Wrought iron has fibrous nature. It is able to withstand sudden shock. It can resist corrosion. It is used for making couplings, chain, gates, railings, etc.

1. **Tool Steel**

The strength of steel depends on the quantity of carbon it contains. When the carbon content of steel is increased beyond 0.8%, it means it can be hardened by heating. Such steel is called tool steel or cast steel. It is produced by high induction furnace.

Mild steel

This is classified by its carbon content. Some are low carbon steel having 0.05% to 0.15% carbon. Medium carbon steel contains 0.2% to 0.5% carbon. They are also produced from pig iron in an open furnace. They could be black or white.

Section 3: **Metal Alloys**

An alloy is a metal that is obtained by mixing two or more metals together

1. Brass: is an alloy. It is made up of a combination of copper and zinc. It can easily be worked on hand tools. If the copper content is up to 65%, brass can be ductile and can be bent when cold. It resists corrosion. It is therefore used for taps, valves, pipes, screws, etc.

2. Duralumin: is an alloy of aluminium. It contains 4.5% copper, 0.5% manganese, 0.5^ magnesium, and 94.5% aluminium. It becomes hardened with age. It is used to make aircraft and sheets.
3. Gilding metal: is also an alloy of copper and zinc; here copper takes as much as 90% while zinc takes 10%. It is used for making bowls, jugs, ashtrays and jewelry.
4. D. Bronze: is an alloy of copper 80% and tin 20%.

Assessment

- State the stages of producing metals
- Mention four types of metal alloys

Basic Technology, JSS 3,

Week 4

Topic: Production of Materials – Clay, Ceramic and Glass

Content

- **Methods of making clay**
- **Stages in producing Ceramics and glass materials e.g. Shaping, blowing etc.**

Ceramic and glass are non-metallic materials used to mould different shapes and items needed for domestic and commercial applications. The moulds are produced through different processes and methods.

Section 1: Method of Making Clay

Mud (clay is dug from the earth. This is then pounded with little water until it forms a paste (becomes malleable). The soft mud is then used to from different shapes before it solidifies.

It can be used to make different by putting the mud in moulds representing the object one intends to make. School children can use it to mould objects like pressing iron, cars, human beings, reptiles, etc.

The soft mud can also be used to make bricks by sharpening it with rectangular moulds. These moulds are removed after one or two minutes. The shape or the object formed is then put in the sun to dry.

Section 2: Stages in Producing Ceramics

Ceramics are products made from clay and dried to hardness. This follows certain stages which are:

1. Clay preparation
2. Clay moulding
3. Firing of ceramic articles

Clay Preparation

Clay must be prepared before use in pottery. Any trace of sand is removed. The clay is mixed with water and pounded. This is to remove the air bubbles and also to make the clay more plastic so that it becomes easier to mould and shapen. If sand and air bubbles are not removed, any articles made from such clay may explode later when heated.

Clay can be used to mould different articles using the pinch pot method or the potter's wheel. The pinch pot method is the easiest way to make a pot. A hollow is first formed with the thumb in a small

ball of clay. By carefully pressing between the fingers, the wall is gradually made thinner as the form develops. The final form, containing some cracks, is then smoothed by using fingers and a small quantity of water. The pinch pot method does not involve any apparatus. However most pottery articles are made by using what is called the potter's wheel. A potter's wheel is a device with a rotating horizontal disc upon which clay is moulded by a potter.

Firing of Ceramic Articles

Any article just moulded from clay is soft. To harden the moulded article, it is baked in fire. One simple way of baking is by using fire wood. A more sophisticated way of heating is called a kiln. A kiln is an oven or furnace for baking finished articles. Different kilns use different fuels to produce fire for baking. Such fuels include wood, coal, oil and gas. An example is a kiln using gas. The hot air transfers heat to the finished piece as it travels through the chamber.

Decoration of Ceramic Articles

An article can be decorated before or after firing. When the clay is partially dry and somewhat hard, different patterns may be drawn on it.

Assessment

- Mention stages in producing ceramics

Basic Technology, JSS 3 First Term,

Week 5

Topic: Production of Materials – Plastics and Rubber

Contents

1. **Methods of Producing Plastics**
2. **Methods of producing Rubber**

There are many ways from many ways of making plastics from molten materials. The choice of methods depends on the plastics product to be made and its use. A popular method of making thermoplastics is injection moulding. The resins in required colours, are fed into the hopper. The resins are heated in the heating chamber between the hopper and the mould. The right amount of the molten material is then forced by the plunger into the mould. The plastic article is formed as it is forced into the mould. The article stays in the mould until it is completely cool; then it is removed. Plastic products such as valve and the air-make grill of an air conditioner nylon hair comb are made by the injection moulding method.

Method of Producing Rubber – Natural and Chemical

We already know that there are two types of rubber – natural rubber and synthetic rubber. Natural rubber is made from the latex obtained from rubber trees, while synthetic rubber is obtained from petroleum products. In each case the resulting high quality rubber is too hard to be processed easily. So, the first step in processing rubber is to break it down, to make it smoother and more malleable, in order to get an even mixture, we blend the rubber with certain chemicals and softeners. Carton black (fine carbon obtained from wood, bones or plants) is added in order to make the rubber product stronger. After thorough mixing, the rubber is then ready to be formed. Rubber products are formed by processes similar to those used in making plastics.

Assessment

- Briefly explain two types of rubber

Basic Technology, JSS 3 First Term,

Week: 6

Topic: Isometric Drawing

Contents:

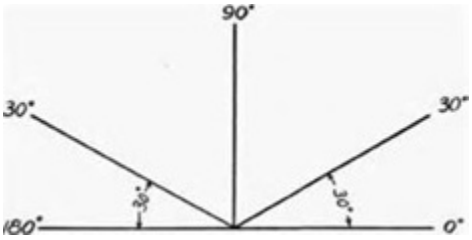
1. **Meaning of Isometric Drawing**
2. **Isometric Axes**
3. **Isometric Drawing of Simple Shaped Blocks**
4. **Drawing Isometric Blocks with Freehand**

Meaning of Isometric Drawing

Isometric drawing is a pictorial method of drawing which shows the three faces of an object together. It is a clear way of presenting information about the physical outlook of an object. An isometric drawing is constructed by using a pair of set-squares. The receding lines (Isometric lines) are drawn at 30° to the horizontal plane or x – y line while the other lines are vertical. Isometric drawings help students to develop their imagination.

Isometric Axes

An isometric drawing is built around three lines called isometric axes, this comprises a vertical axis and two receding axes. Note that the two axes of 30° and there is 120° between the three axes, they are called the isometric axes and on them the drawing is built up.



Isometric axis

Isometric Drawing of Simple Shaped Blocks

Step 1: Draw with set-squares; place the set-square and make sure that both the face and side are inclined at 30° to the horizontal plane.

Step 2: Draw the isometric box that contain the object first. The box must have the overall size of the length, the breadth and the width of the desired object. (Note that this must be drawn with very thin lines)
Step 3: Draw the desired shape with faint lines inside the box using the correct dimension.
Step 4: Draw the correct shape of the object with thick continuous line (i.e. outline.)
Step 5: You may rub off the construction lines or you may not if they are very neat and faint.
Drawing Isometric Blocks with Freehand
Freehand sketching is a method of drawing object without the use of drawing materials except a pencil. Students should try as much as possible to attempt drawing isometric blocks with freehand. It may seem difficult in the beginning but with constant practice, good results will be achieved.
In technical drawing, a freehand sketch is made in exactly the same way as drawing done with instruments. AOX is drawn first, then, the measurement is transferred; constant practice will also help you to achieve good proportion.

Assessment

- Briefly define the following terms; isometric drawing and isometric axes.

Basic Technology, JSS 3 First Term,

Week: 7

Topic: Oblique Drawing

Contents:

- **Definition**
- **Oblique drawing**

This is also a pictorial method of drawing, in oblique projection, the object is drawn with one of its faces true to dimensions i.e. a face is parallel to its horizontal plane. The receding lines (oblique lines) may be drawn at angle 30°, 45°, or 60°, but 45° is mostly used. One disadvantage of oblique drawing is that it distorts the drawing and can never look natural. Therefore in order to prevent this distortion, the receding axes (widths) are usually drawn half-size.

Cabinet oblique drawing

Method of Oblique Projection

Cavalier oblique projection: In this projection the receding axes (width) are drawn half-size to reduce distortion, but they are dimensioned full size. This was used to draw furniture i.e. cabinets.

Cabinet oblique projection

Assessment

What do you understand by Oblique drawing

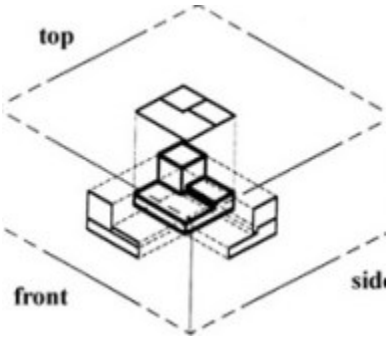
Basic Technology, JSS 3

Week: 8

Topic: Orthographic Projection

Orthographic projection is a method of drawing an object be means of plane views. While isometric drawing looks at all the three views (or faces) of an object together, orthographic looks at the same three views separately but linked together. In orthographic projections, we can look at each view and see its "correct or true shape".

Orthographic projection is the only drawing that shows the shape, angles and size of each part of the article to be constructed as they really are. Because of this peculiar characteristic, it is one of the universally accepted drawings in the construction industry, therefore the drawing is usually used for production purposes. Ordinary pictorial drawing is not sufficient to build a house or fabricate parts of a machine. What is most needed is orthographic projection of the article. Therefore, technical drawing students must be able to read and interpret this drawing correctly. It requires a lot of practice, patience, time and mental alertness to be able to visualize readily the given pictorial drawings and draw the item in orthographic projection. The students should be able to visualize direct projection i.e. to see clearly from the 'minds' eyes'.



The block suspended in a glass box

Principal Planes of Orthographic Projection

Orthographic projection uses two main planes called the principal planes of projection, they are the vertical plane planes and the horizontal planes. These two planes intersect, producing four quadrants. The object to be drawn is imagined to be drawn is imagined to be placed in one of these quadrants, and orthographic views of it are projected on to the planes, the object is normally positioned so that its main faces are parallel to them. This ensures that views of the faces are true sizes and shapes.

Principal planes of projection

1. Vertical Plane: The views on the vertical plane are front elevation and end elevation (side elevation).
2. Horizontal plane: This shows the plan in the quadrants in the figure above. The quadrant 0-90° contains the first angle and quadrant 180°-270° contains the third angle. Since the second and fourth quadrants would combine the two systems, we do not use them.

Angles of Projection

There are two main methods or orthographic projection as earlier said, they are:

1. First angle projection
2. Third angle projection

The principal views are the front elevation side (end) elevation and the plan.

Principal Views

1. Front elevation: This is the main view, it is obtained by looking at the given front of the object to be drawn. The front elevation is seen in the vertical plane.
2. End (side) elevation: This is obtained by looking by looking at the given side of the object. The end elevation is also seen in the vertical plane [i.e. auxiliary/side vertical plane (S.V.P)].
3. Plan: This view is obtained by looking vertically down on the given object from the above. The plan is seen on the horizontal plane (H.P).

First Angle Projection

This method in developed in the United Kingdom. In first angle projection, the elevations at the front are the horizontal plane placed below the x and y above the plan. The hidden detail is shown by short dashes. It should be noted that the left side elevation is usually placed at the right hand side.

Assessment

Briefly explain the principal views of orthographic projection

Basic Technology, JSS 3

Week: 9

Topic: One Point Perspective Drawing

Content

1. Definition
2. Principles
3. Practise

Definition

One point perspective can be defined as:

"...a mathematical system for representing three-dimensional objects and space on a two-dimensional surface by means of intersecting lines that are drawn vertically and horizontally and that radiate from one point on a horizon line..."

Although this definition sounds complicated, the concept is relatively simple. One point perspective is a drawing method that shows how things appear to get smaller as they get further away, converging towards a single 'vanishing point' on the horizon line. It is a way of drawing objects upon a flat piece of paper (or other drawing surface) so that they look three-dimensional and realistic.

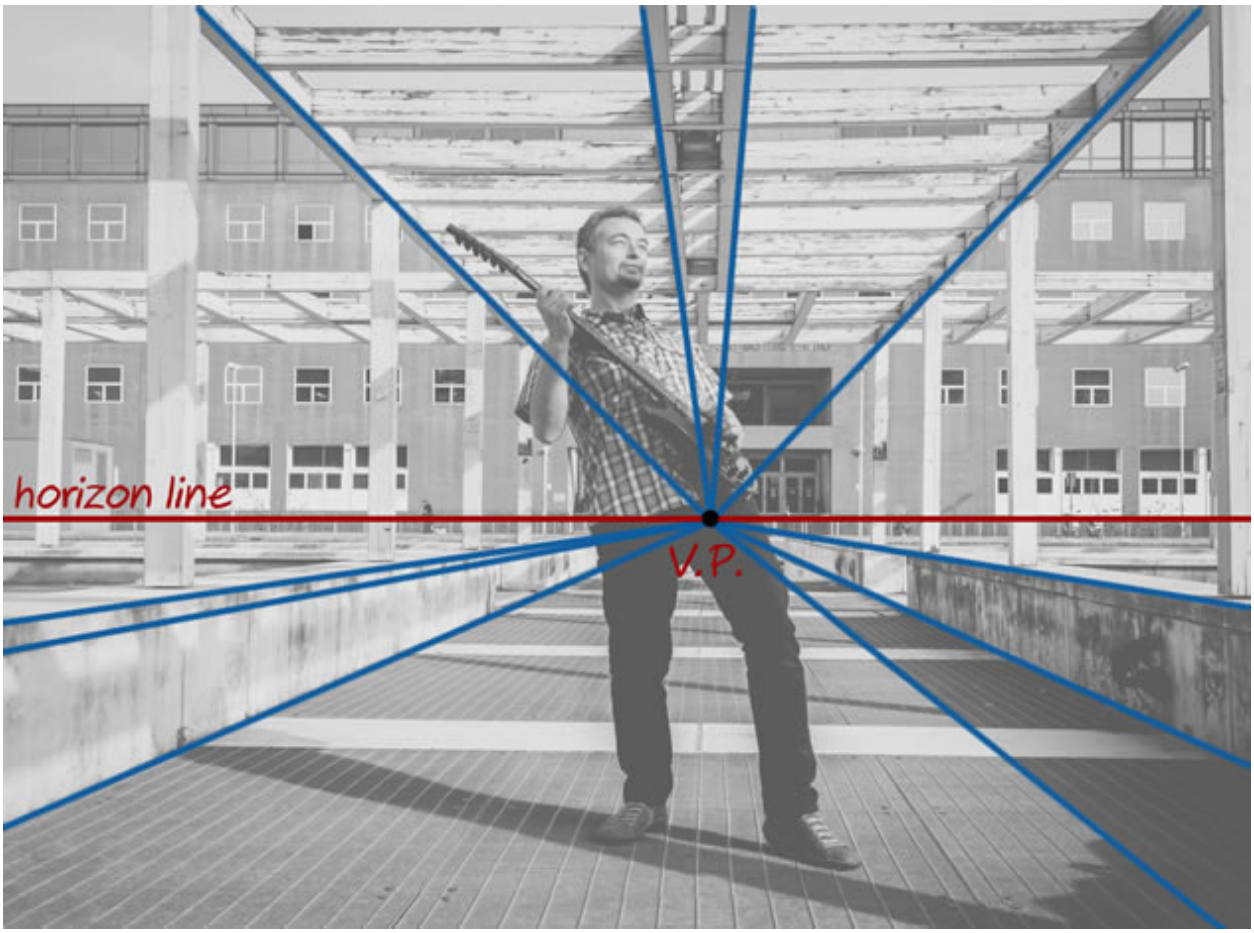
Drawing in one point perspective is usually appropriate when the subject is viewed 'front-on' (such as when looking directly at the face of a cube or the wall of building) or when looking directly down something long, like a road or railway track. It is popular drawing method with architects and illustrators, especially when drawing room interiors.

Principles

In one point perspective, surfaces that face the viewer appear as their **true shape**, without any distortion. They are drawn using primarily horizontal and vertical lines, as illustrated by the diagram below:

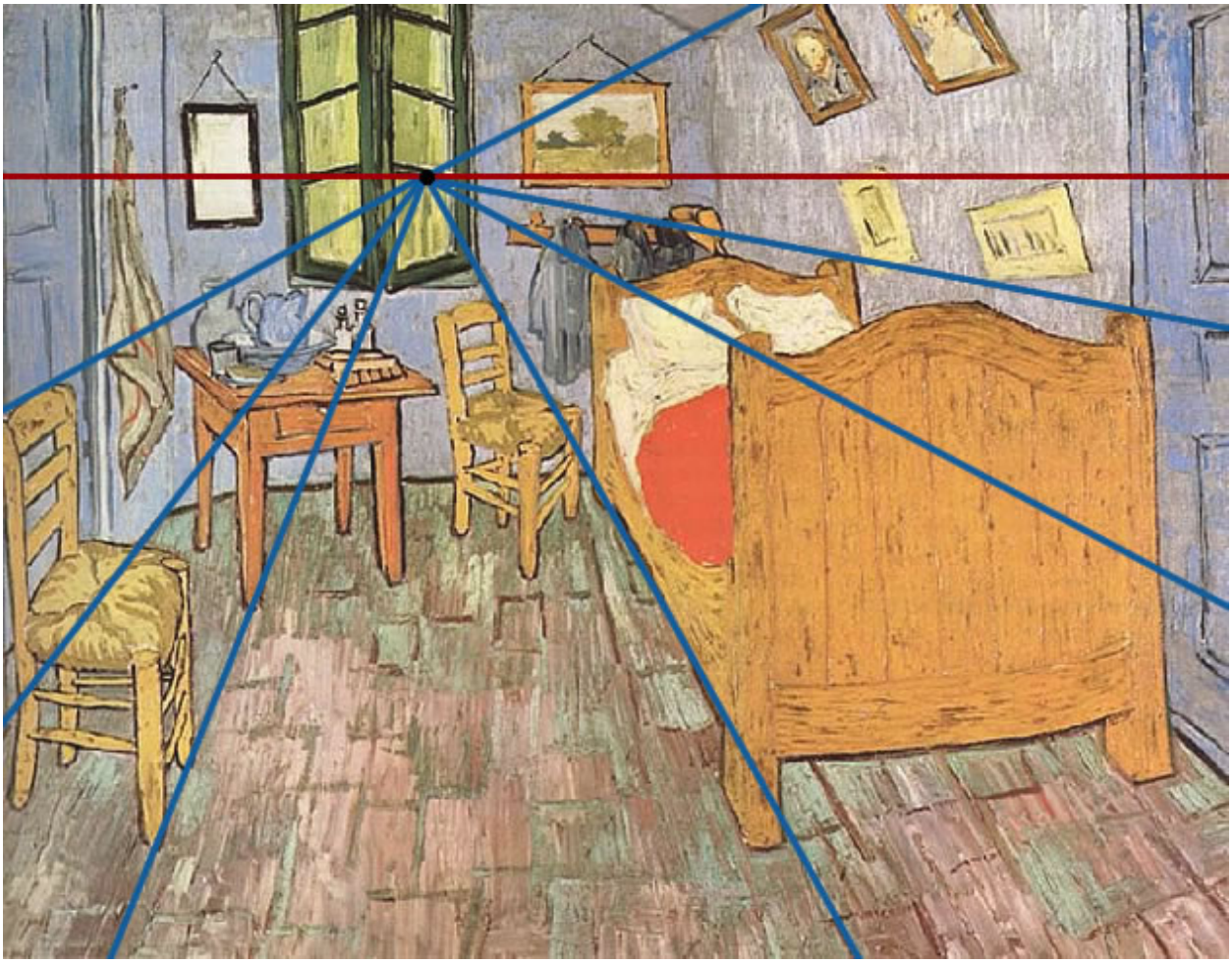
In this one point perspective photo, surfaces facing the viewer are undistorted and show their true shape. For example, we see the side of the bath, window and facing surfaces as ordinary squares and rectangles. Their sides are parallel with the edges of the photograph.

Surfaces that travel away from the viewer, on the other hand, converge towards a single '**vanishing point**'. This is a point that is located directly in front of the viewer's eyes, on a '**horizon line**' (also known as an 'eye level line'), as illustrated in the photo below:



All receding edges of the buildings in this one point perspective photo angle towards the single vanishing point. The position of the vanishing point tells us that the photographer was crouching down, with his eye level lowered.

It is possible to draw over photographs to identify vanishing points, horizon lines and true shapes. Studying the work of famous artists can also help you gain an understanding of one point perspective, as shown in the example by Vincent van Gogh below.



‘Bedroom in arles’ by Vincent van Gogh – identifying perspective lines

Key Points:

- Surfaces that face the viewer are drawn using their true shape
- Surfaces that travel away from the viewer converge towards a single vanishing point

Principal planes of projection

1. Vertical Plane: The views on the vertical plane are front elevation and end elevation (side elevation).
2. Horizontal plane: This shows the plan in the quadrants in the figure above. The quadrant 0-90° contains the first angle and quadrant 180°-270° contains the third angle. Since the second and fourth quadrants would combine the two systems, we do not use them.

Assesments

Briefly explain the principal planes of projection

.

JSS 3

BASIC

TECNOLOOGY

SECOND TERM

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JSS3 BASIC TECHNOLOGY SECOND TERM

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Topic: REVISION OF LAST TERM'S EXAM

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Revision

JSS3 BASIC TECHNOLOGY SECOND TERM

Week 2

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 used in woodwork 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 clothing, 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

State Safety Hints in Using the Woodwork Machines

JSS 3 BASIC TECH SECOND TERM

Week 3

Topic: SIMPLE WOODWORK PROJECTS

INTRODUCTION

Wood can used to fabricate many items that are used in homes, offices and industries. There are certain operations that must take place in the process of constructing or fabricating items for domestic use. These operations include cutting, joining and finishing. There are five sections in to be examined here:

1. Common joints
2. Classification: framing, widening, etc.
3. Uses of joints
4. Woodwork projects
5. Adhesives and abrasives

Section 1: Common Joints

Rebated Butt or Plain Lap Joint

This joint is also called angle-lap joint. The end of one piece is lifted into a rebate worked across the end of another piece. It is an improvement on the butt joint as it provides two nailing faces and more gluing areas.

Uses

It is used in the construction of boxes, cheap cabinets, book shelves, cheap drawers, carcasses for veneer work. It is used mainly where the strength of joint is not important.

Halving or Half Lap Joint

a. Halving Joint

This name is given to joints, where the pieces of wood to be joined are to be halved in their thickness or width so that the faces of the assembled members are flushed. These members, joined end to edge, usually meet at a slope or right angles. There are several examples of halving joint, e.g. corner, cross, and tee joints. They are frequently used for paneled doors, tables, chairs, pictures, frames, etc.

Half lap

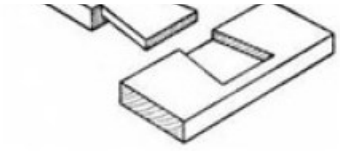
b. Corner Halving Joint

This has other names, e.g. edge lap. In corner halving joint, the end and the edge of the pieces to be joined usually meet to form an angle, often at right angles. It is used for the construction of small cabinet doors, frames for cores of cheap flush doors.

The Halving Joint

This name is given to a joint where the end of one of the pieces of wood to be joined or assembled is fixed or mortised to the middle of the other piece. The joint may be right across the wood or stop halfway. It is used for frames and can be nailed to the stile away from the end.

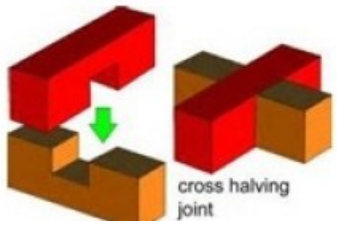
Tee halving joint



Tee halving joint

Cross Halving Joint

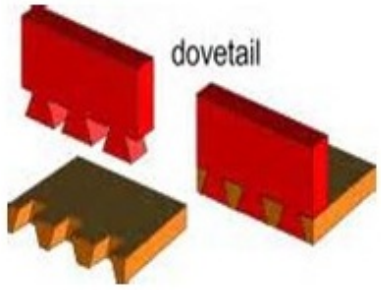
The cross halving joint is the name used where two pieces of wood are let into one another in form of a cross or diagonal rails or small table legs. It is used for early woodwork such as that of a stud wall or for divisions in a box or drawer. The joint may also be used to join the parts of a framework such as that of a shed or to join divisions of a box or drawer.



cross halving joint

Dovetail Tee Halving Joint

When the parts of a frame have to be made in such a way that they do not pull apart, that is, where outside strain occurs, sometimes the socket is stopped to hide the end of the pin. The joint is sometimes slope on one side only, and is called bare face tee halving joint. (This joint can only be separated in one direction).



Dovetail Tee halving joint

Face and Side of wood

Every piece of wood has two faces, sides and ends, the faces are wider than the sides while the ends are at the extremes. Once the face side has been selected a face mark is marked on it, pointing to the face edge.

Bridle Joints

The bridles are simplified forms of mortise and tenon joints with increased bearing surfaces. The joints are sometimes used in place or mortise and tenon joints where a stronger joint than halving joint is required.

Plain Tee Bridle Joint

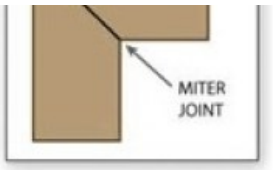
This sis used in place of common mortise and tenon joint. It is used principally for bracing rails of skeleton framing, gallows and brackets and so on. Dowels can be used to strengthen the joint. This joint is used between rail and leg runs through a decorative end treatment.

Corner Bridle Joint

This joint is often referred to asopen mortise and tenon joint. It can be used in corners of frame construction work. It is used in place of haunched mortise and tenon. Care must be taken to see that the tenon fits the socket without splitting apart the cheeks of the socket, thus causing loosening of the joint.

Mitre Corner Bridle Joint

It is also called mitred mortise and tenon joint. One or both sides of the groove may be mitred as required. It is used when a stronger joint than mitre half joint is required, e.g. mirror frames for decorative appearance.



Mortise and Tenon Joint

The mortise and tenon joint, in its many forms, is one of the most common joints used in wood work construction. It is the strongest form of joint in wood construction. Some of the various forms of mortise and tenon joints are:

a. Common or through mortise and tenon joint

b. Haunched mortise and tenon joint

c. Bare face mortise and tenon joint

Haunched Mortise and Tenon Joint

Haunched mortise and tenon joint is usedon corners of stool, and in the construction of frames, such as paneled doors, cases and some table leg framimg. When the tenon is made, a small portion at the base tenon is left to form a haunch. This fits into the groove called haunchingon the end of the stile. The length of the haunch is usually the thickness of the tenon. The main use of the haunch is to prevent movement of the tenon and to strengthen the joint when shrinkage takes place. Wedge may be used to strengthen the joint.

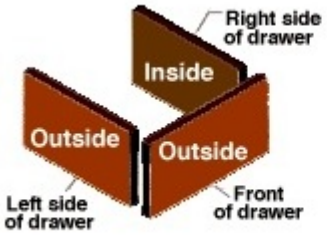
Bare face Mortise and Tenon Joint

This joint is used when the rail is of thinner materials than the stile of legs of ordinary tables.The tenon has only one shoulder, which is usually ¼ to ½ the thickness of the rail. It can be haunched or it may be full width. It is necessary to mitre the ends of the tenons if the two rails meet at opposite faces of the leg of a table. The bare face mortise and teneon is commonly used where the leg and rail faces are flushed when assembled.

Dovetail Joints

The dovetail joint is possibly the best joint that you can use to join two pieces of wood together at a right angle. Not only is it a very strong joint, but it also adds to the appeal of the woodworking project. Even better; everyone “knows” that a dovetail joint is hard to do, and so people will be even more impressed with your handiwork!

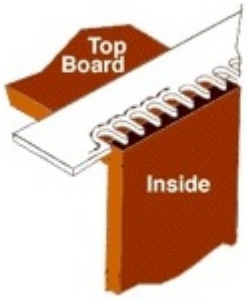
While creating a traditional dovetail joint is not too difficult, it does take quite a long time; using a router speeds up this process considerably.



The simplest way to create dovetail joints is to use a router and a dovetail template jig. The latter is available from any good home improvement store and can cost as little as $70. It’s well worth the investment if you plan on doing many dovetail joints in the future.

Arrange the three pieces of the drawer or box as shown in the first diagram and mark the inside and outside of each piece. In addition, mark the ends of each piece as it is imperative that when cutting the dovetails the correct two ends are cut at one go.

Clamp the front of the drawer and one side into the dovetail machine as follows: the left side of the drawer should be clamped under the front clamp (pointing upwards towards the template) with the inside of the drawer pointing out; the front of the drawer – again with the inside pointing out -should be clamped under the top clamp so that it butts up against the left drawer.



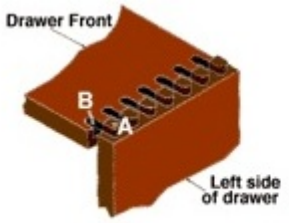
These two pieces should be staggered slightly, rather than being aligned exactly. The precise measurement will depend upon the particular dovetail machine that you are using, and this

distance will be supplied with its manual. However, it should be roughly in the region of 7/16 inch.

Once everything is tightly clamped in place, use the router to cut around the template, following the direction of the arrows in diagram two.

Once this is complete, the end result should look like diagram three. Dovetail A should be matched with slot B and so on.

It is well worth practicing with scrap wood before trying the above procedure on any project as it will take a while to get the exact measurements (such as the depth of the router cut) perfect.



f the joint is too loose, slightly increase the depth of the router cut. If the joint is too tight (remember that you still have to squeeze some glue into the joint), slightly decrease the depth of the cut.

Classification of Joints

Joints used in cabinet work may be classified into three main groups.

a. Widening joints

b. Angle or box joints

c. Framing joints

Widening Joints: This includes butt joints, dowelled joint, tougued joint, tongued and grooved, rebated as well as slot-screwed joint. We have discussed three of these above.

Angle or Box Joints: These are joints generally used for fixing together pieces which have their faces at right angle and edges flushed. Examples are simple butt, rebated butt, tongued or dado joint, dovetailed joints, plain mitred joints, etc.

Framing Joints: Framing joints are those used in frame-like constructions where the members are usually are usually jointed end to edge with their edges at right angles. Examples are halving or or half-lap joints, mortise and tenon joints, bridle joints, dowelled joints.

Assessment

1. State the classification of joints
2. List the types of common joints

JSS 3 SECOND TERM BASIC TECH

Week 4

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 maching 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 workpiece, 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. List the types of Machines
2. What is a lathe machine used for?
3. What is another name for cutting fluids and what are they used for?
4. List the three classes of coolants

JSS 3 SECOND TERM BASIC TECH

WEEK 5

Topic: PRINCIPLES OF MEASUREMENT AND MEASURING

CONTENT:

- **Principles of measurement and measure**
- **Tools and Cutting**
- **Files and Filling**
- **Drills and Drilling**
- **Bending and folding**

Design in Metalwork

The projects in metalwork involve construction and application of shaped figures on thin gauges of sheet metal. Attempt is made here to give guideline to enable each student to produce a useful item. The main basic operations in metalwork (i.e. cutting and filling) are put into consideration, and all the acknowledged gained in geometrical construction is the basis of metal works, students are expected to produce the try-square, using necessary hand tools. The various items are expected to be made of thin gauged metal folded to shapes, students are exposed to more useful items which are aimed at giving full confidence in practical work which gives us the average sizes of different furniture items as a guide for both woodwork and metalwork projects.

Step 1: Draw a circle large enough for a centre table (e.g. 1 metre).

Step 2: Divide the circle into three equal parts

Step 3: Find the centre of each radius.

Step 4: With these centres and radius AO, draw areas to form semi-circles which will represent a large end of each stool.

Step 5: Round up the edges at the main circle.

Step 6: Ensure that the height of the leg is 350mm.

Tools

Cutting Tools

In sheet metalwork, we use a tool that does the work of scissors. It is called tin snipes.

Types of Tin Snips

It is important to use the correct tool and the correct method of cutting to ensure that maximum efficiency is achieved. As mentioned earlier, tin snips and shears are the commonest tools used in cutting sheet metal. The following types of tin snips are used for various types of job.

i. Straight Snips: This types is used for straight cuts and for trimming surplus metals. It is also used for cutting out joint allowance at fold lines.

Straight snips

Another cutting tool used in sheet metalwork is the bench shears. It is called bench shears because they are usually mounted on a bench.

Straight snips

ii. Bent Snips: As the name suggests, this type of snips is bent. It is used for cutting circular shapes and internal curves.

iii. Universal Snips: This type is a combination of the straight and curved snips. The handles are offset, thereby allowing cuts to be made in any direction with a minimum effort. The universal snips are used to cut sheet metals into various shapes.

Other Tools Used in Sheet Metalwork

Other tools used in sheet metalwork are the marking out and measuring tools such as scriber, try-square, steel rule, dividers, outside calipers, inside calipers, odd-leg calipers.

Bending Sheet Metals

Bending and folding are very necessary process in sheet metalwork. Before we discuss the tools used for these processes, let us first all know what they means. Bending in sheet metalwork means causing the flat material.

Assessment

Discuss the type of tools used in sheet metalwork

JSS 3 SECOND TERM BASIC TECH

WEEK 6

Topic: SOLDERING AND BRAZING

Content:

- **Definition of soldering and brazing**
- **Metal joining**

INTRODUCTION

There are four major ways of joining metal pieces together. They are by soldering, welding, riveting and mechanical fasteners like bolts, nuts and screws. We will treat only the soldering process in this chapter.

Soldering

What is soldering? Soldering is the process of joining metal surface by means of an alloy called which has a lower melting point than the metals being joined.

There are two types of soldering namely: Soft soldering and hard soldering. When the solder melts below red heat, it is called soft soldering, but when it melts at or above, red heat, it is called soldering or brazing. What determines the type of soldering to be applied is the nature of the metal being joined. Lighter and softer metals require soft soldering, while thicker and harder metals require hard soldering or brazing.

Soft Soldering

The type of soldering makes use of low temperature solders. Soft soldering is applied to small parts were strength is not important. Examples are soldering of wire terminals in radio,

television sets and other kinds of electrical work. Soft soldering is also applied on articles made of tin-plate materials and some other kinds of metal having low melting points.

i. Soft Soldering Temperature

In all types of soldering, the basic rule is that the melting point of solder being used should be well below the melting point of the metals being soldered.

ii. Composition of Soft Solder

Basically, soft solders are alloys of tin and lead in varying proportions. Sometimes, little percentages or a proportion of a metal called antimony is added to provide strength and hardness. It is possible to produce different types of solder by varying the proportions of tin and lead, with each type having different melting points and behaviour making them suitable for different kinds of jobs. The higher the proportion of tin a solder has, the softer it is and the lower its melting point. On the other hand, the higher the proportion of lead in the mixture, the harder the solder and the higher its melting point.

iii. Kinds of Soft Solder

There are three major kinds of soft solder namely:

Tinsmith solder (melting point 188°c used in radio and T.V. works).

Blow pipe soldier (melting point 230°c used for general bench work).

Plumber's soldier (melting point 250°c used for soldering plumbing joints).

iv. Tools and materials used in Soldering

a. soldering bit; also called copper bit

b. Solder

c. Flux

d. Source of heat e.g. stove, blow lamp, charcoal, furnace, or electricity for electric bits

e. Enemy cloth or file.

Soldering Bit

The soldering bit is used for applying heat and soft solder to the metal. It is a solid square piece of copper pointed at one end and fastened to a steel bar with a wooden handle on the other end. Soldering bits are made in different weights.

Electric soldering bits are also available. They are heated by electricity, by connecting them to any electric light socket. They are mainly used for fine work like soldering wire terminals in radio and television sets.

Tinning the Bit

The faces on the point of the soldering bit must be heated, cleaned and coated with solder before it can be used for soldering. This is called ‘tinning’.

Assessment

Define Soldering and state its types

JSS 3 SECOND TERM BASIC TECH

Week 7

Topic: MECHANICAL ENERGY TRANSMISSION SYSTEM (FRICTION)

Content:

- **Friction and its effects**
- **Friction between two surfaces sliding on each**
- **Advantages and disadvantages of friction**
- **Uses of lubricants and bearings to reduce friction**

Friction

Mechanical energy is a very useful form of energy. It is used to move objects from one place to the other. There are different ways of generating mechanical energy. Energy is converted from one form to the other. Through combustion the chemical energy in petrol fuel is converted into mechanical energy in the engine of a vehicle. In such a case, the mechanical energy exists in the form of kinetic energy of the moving pistons in the cylinders of the engine. Through a transmission system, the mechanical energy of the piston is transmitted to the tyres of the vehicle and use to rotate them. The friction between the rotating tyres and the road surface helps to propel the vehicle along the road.

Another example of mechanical energy transmission is seen in a bicycle. The mechanical energy generated from pedaling is transmitted to the rotating tyres. The friction between the rotating tyres and the road surface also helps to propel the bicycle along the road.

Here, we are interested in transmission systems that allow mechanical energy to be transmitted from one point the other. Mechanical energy transmission systems of interest are friction, belts and gears.

Friction and its effects

Frictional forces occur between any two surfaces which are in contact and move relative to each other, so that rubbing of the surfaces occur. The forces of friction tend to prevent motion; hence, work has to be done to overcome friction in order that motion may take place, for instance a bicycle rider while riding is working against friction as he pedals his bike.

Also one dragging something on the floor is working against friction, which occurs between the box and the floor. There is friction between your buttocks and your seat, between the sole of your shoes and the ground on which you stand, and so forth. Thus, friction is always present between any two surfaces which are in contact. It exists as a force that tends to stop movement between any two surfaces which are moving over each other. A force just sufficient to overcome friction must be applied to initiate or maintain motion. That is to say friction is a force that acts like a brake when a body moves relative to another body.

The magnitude of friction between any two surfaces in contact depends on the nature of the surfaces. It is difficult to slide on a highly smooth surface than it is on a rough surface. This is because friction is greater between two rough surfaces than between two smooth surfaces.

We reduce friction by lubricating the surfaces concerned. Friction is also reduced significantly by ensuring that the two surfaces roll over each other as opposed to sliding. To illustrate, consider the force it require to move a book across the table. The force required to cause sliding, is higher than that required to roll the book over round pencils. The force is reduced further if the book rolls over smooth steel balls as in bearings which are used in machines to reduce frictional force. For example, your bicycle has ball bearings at the wheel axles, the pedal cranks, and the steering column. Notice that the bearings are placed in areas where there are moving parts. Atypical ball bearing is shown below

Some of the properties of friction can be illustrated quite simply and interestingly. Bring both the palms of your hands together and rub them against each other slowly for about ten ties. Notice that they become warm. After a minute or two, bring the palms together again, but this

time press them very firmly together while rubbing, also about ten times. Observe that they are much warmer than before, sometimes indeed hot.
Now smear both the palm with grease or any oil and repeat the experiment. What do you find? The palm tends to rub freely, and they do not generate any significant amount of heat. These and other findings lead us to the next important section.

Advantages of Friction

1. It enables us to walk without slipping. To enhance friction, it is advisable to use shoes with rough sole while walking on slippery floors. For a similar reason, crutches are provided with rubber tips at their bottom to provide sufficient friction.
2. The breakers and tiers of our cars and bicycles depend on friction to function properly.
3. The ridges in the skin of our fingers and palms enable us to grasp and hold objects due to friction.
4. To prevent patients being uncomfortable in bed rubber sheets with spongy under surfaces are placed over mattresses. The friction between the spongy under surfaces and the mattress prevents the rubber sheet from slipping and wrinkling.
5. We cannot fix nail in the wood or wall if there is no friction. It is friction which holds the nail.

Disadvantages of Friction

1. Production of heat, noise and wear in machine parts rubbing against one another.
2. Heat produce by friction may be sufficient to cause the abrasion of the skin, resulting in friction burn. Rubber tubes such as gastric and duodenal tubes, rectal tubes and catheters may burn or irritate the membrane over which they pass unless measure are taken to prevent friction.
3. Friction reduces the efficiency of engine and other machines.
4. Due to friction, engines of automobiles consume more fuel which is a money loss.

Lubrication

In a motor car, for example, there are many mating and moving metal surfaces. If these moving surfaces are not prevented from direct contact, a lot of heat will be generated. The surface will also wear themselves off easily and fast. To prevent these, we use lubricants. A lubricant is any substance, whether in form of oil or grease. It forms a very thin film between the mating metal

surfaces so that the metal surfaces do not rub together. This prevents excessive heat generation. It also reduces the wearing of the metal surfaces.

Assessment

State the advantages and disadvantages of Friction

JSS 3 SECOND TERM BASIC TECH

Week 8

Topic: MECHANICAL ENERGY TRANSMISSION SYSTEM

Content:

- **Belt and chain drives**
- **Use of belt drives where slip is not important**
- **Use of chain drives where slip is not allowed**
- **Use of belt drives where drive shafts are separated by large distance**
- **Comparison with gear drives**

Belt Drives

Belts and chains are also used to transmit mechanical power like gears.

Belts and Pulleys

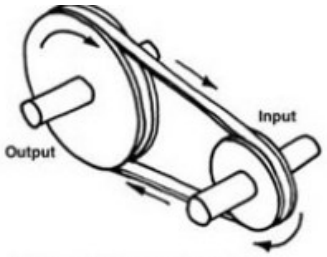
Belts and pulleys are used to transmit power and to provide a way of changing speeds. The simplest belt-driven device is two pulleys connected with a belt.

Simple belt pulley drive

A pulley mounted on the shaft of an engine is the driver pulley. Driven pulleys are belted to the driver pulleys to operate small machines like the pulley in a pepper-grinding machine. In pulleys, the relationship between size and speed and between the driver and the driven is same as for gears. Try to observe the belt and pulleys used in a pepper grinding grinders.

Kinds of Belts and Pulleys

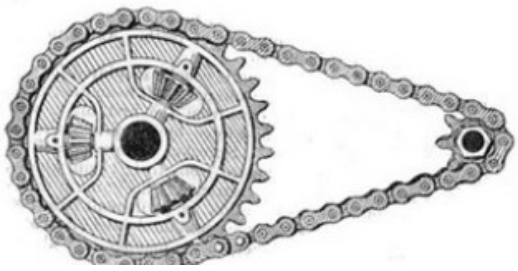
There are three kinds of belts and pulleys in common use. ***They are flat belts and pulleys***, ***vee belts and pulleys*** and ***variable speed pulleys*** which use vee belts also. With a variable speed between the driver and the driven without stopping the engine. In fact, the speed should be changed only when the engine is running.



Pulleys rotate in the same direction.

Chain Drives

Chains are often used to do the same work as a belt. It is a reliable and efficient method of transmitting power. Unlike in belt drive where pulleys are used to drive the belt, gears are used to drive the chain.



A common example of the use of chain drive in transmission of power is found in bicycles and motorcycles. Thus, in a bicycle, the power being applied on the pedals by the rider is transmitted to the back wheel by means of a chain linked to two gears. The chain drive has a major advantage over a belt drive. The belt slips in the event of an excessive load, but the chain does not. For this reason, the chain can drive for a much longer period of time than the belt without attention, provided the chain and the gears are well lubricated. The speed ratio between the shafts of a chain drive depends on the number of teeth in each of the gears or chain wheels \9as they are often called) used. They are determined in the same way as we discussed for pulleys.

Assessment

Briefly explain the different kinds of belts and pulleys

JSS3 SECOND TERM

Week 9

Topic: **MECHANICAL ENERGY TRANSMISSION SYSTEM (Gears)**

Content:

- **Gears, gearing and related calculations**
- **Types of gears**
- **Uses of gears**
- **Gear ratios and speed ratios**
- **Friction between meshing gears and functions of Lubricants**

Gears

A gear is a drive mechanism used to transmit mechanical power from one point to the other. It is a wheel fixed in machines to make different parts move at different speeds or in different directions. Gears have toothed edges that help them to engage or mesh with one another. When two gear-wheels are fitted, engaged or meshed, one wheel turns one way, while the other turns the other way that is, in the opposite direction.

If you take two corks and arrange them in such a way that each tooth enters into each space, you have arranged a simple gear. Notice that the teeth will mesh properly if they are equally spaced.

You must have noticed that when the engine of a vehicle is turned on, the vehicle does not start moving immediately. To move the vehicle, the driver engages the gear system. The gear is used to transmit the power being developed by the engine to the road being developed by the engine to the road wheels. Nowadays, some bicycles also have gears to help make pedaling as relaxing as possible. You should perform the simple illustrative experimental described below.

Get a bicycle that has gears. Turn it upside down so that it rests on the saddle and the handlebars. Locate the gear wheels attached to the pedals. Notice that the small gear wheel on the back road-wheel is driven by wheel of a chain drive, this shall be discussed later. Now, turn the pedals with your hands and watch the back road-wheel move. Take note of the engaged gears. Change gear, turn the pedal again and watch the back road-wheel move. Take note of the engaged gears. Change gear, turn the pedal again and watch the back wheel move. Repeat this experiment until all the gears are used in turn. You can easily feel the difference in the effort required to keep the wheel moving at speed. Greater effort is required to move at speed with bigger gear than with smaller gear. Hence, When going down a hill at speed, the cyclist selects a higher gear(this means that the cyclist engages a smaller gear wheel), which provides a high speed in turn for slower pedaling. For climbing hills, the cyclist changes to a lower gear (this means that he selects a bigger gear wheel), which makes pedaling easier in turn for a lower speed. It should be pointed out that this situation is less tasking as it requires less effort to turn the pedals, thereby enabling the cyclist to climb through the hill without getting tired soon.

The principle described above forms the basis for gear change in motor vehicles.

You select a low gear, for example, gear No. 1 when you are moving slowly from rest. As the vehicle gains speed, a higher speed, say gear No. 2, is selected. At top the highest gear, gear No. 4 or 5 depending on the make of the vehicle, is selected. From the explanation given above, it can readily be appreciated that the selection of gear No. 1, 2, 3, and 4 means the engagement of the highest gear wheel to the lowest gear wheel of the gear box shown below. The system of gears such as that below is called a "gear train".

Gears are not only used for changing speed of rotation of connected shafts, they can also be used to change the direction of rotation.

The system of gears in the back axle of a motor vehicle is shown below. The shafts connected to the road wheels are at 90 degree angle to the transmission shaft from the engine. The bevel

gears shown below are used to transmit mechanical energy from the transmission shaft from the engine to the road wheel shafts.

When two gears mesh with one another, one usually drives the other. Hence, one is called the driving gear while the other is called the driven gear. If the driving gear has fewer teeth than the driven gear will turn more slowly than the smaller gear will turn more slowly than the smaller gear driving it. On the other hand, if the driving gear has more teeth than the driven gear will turn more rapidly than the driving gear. To put it in another way, if gear wheel A has to teeth and gear wheel B has 20 teeth, the smaller gear wheel B will turn twice to everyone rotation of the bigger wheel B. Therefore, the ratio of gear A to gear B is said to be 2:1 (i.e. 40:20).
This property of gears (gear ratio) is made use of in the design of gear mechanisms for different uses. For example, clocks have different sized gear wheels arranged such that they move the clock hands at different speeds. The number of teeth on the various gears is arranged in such a way that the minute hand travels round the clock once an hour while the small “hour” hand goes round the clock face in twelve hours. As an exercise, draw the gear system that will operate a clock that the second hand as well as the minute and hour hands.

Gear train for clock

Reducing Friction Effects between Meshing Gears

As mentioned earlier, when two surfaces move relative to one another, friction comes into play. When two gear teeth are engaged as described above, they rub against one another, frictional effect generates heat and the wearing of the surfaces. In order to reduce wear and loss of power in transmission, friction between the meshing teeth must be reduced. This is achieved

by lubricating the gears with suitable oil often called “gear oil”. You can now appreciate why it is necessary for motorists to check their gear oil levels regularly.

Assessment

1. How do you reduce the friction effect of gears?
2. List uses of gears

JSS 3 SECOND TERM BASIC TECH

Week 10

TOPIC: MECHANICAL ENERGY TRANSMISSION SYSTEM (Linear Motion)

Content:

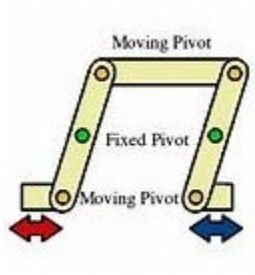
Linear Motion

Lever arrangement to produce linear motion

Use of slides and slots in mechanical systems

Linear Motion

Shows a push-pull link mechanism, which executes basically linear motion. Arms A and B have pivots as shown below. If for example, we push the driving arm A to the right, the driven arm B will also be pushed to the right. If we pull arm A to the left, the driven arm B will also be pulled to the left. Hence, we refer to the mechanism as a "push-pull" linkage.



Mechanical Systems Performing

Rotary Motion

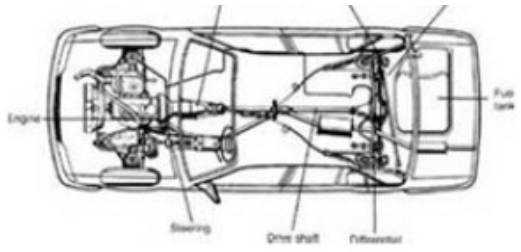
The two images below show systems executing pure rotary motion. The hand-drill performs reversible rotary motion. This means the handle and the drilling bit can move clockwise or anticlockwise as may be required. The same thing applies to the worm gear shown in fig 2. This is a device which has a threaded shaft (worm) that meshes with a gear wheel (worm wheel). It is used to transfer rotary motion between shafts that are right angles to one another.

Hand drill (Fig 1)

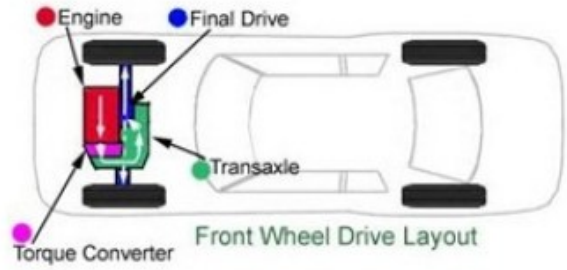
Worm and wheel gear (fig 2)

Transmission of Motion

Power for the propulsion of a car is derived from the engine. The generated power is usually available at the crankshaft as a combination of speed (2,000 to 4,000 crankshaft revolutions per minute for a petrol engine) and torque.



(a) Front-engine rear-wheel drive



(b) Front-engine front-wheel drive

The figures above showing different arrangement of engine and transmission.

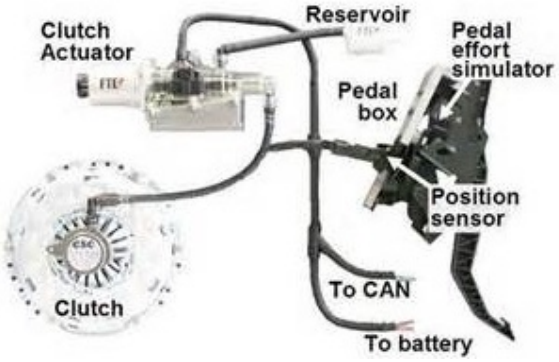
The power must be made available to the road wheels. The figure above show different transmission systems for vehicles. The transmission system for a vehicle with a front-engine, rear-wheel drive (a) of the figures above consists of a clutch, a gearbox, a propeller shaft and a rear axle. This arrangement is very popular. However, most cars are now coming with front-engine front-wheel drive (b) of the images above. Rear-engine rear-wheel drive (c) above is found in a typical Volkswagen Beetle car. In the transmission system of the Range Rover, torque splitter splits the torque generated by the engine between the rear axle and the front axle. Hence, it is referred to as .a four-wheel drive vehicle.

It is worth noting that the transmission system in figures (b) and (c) above do not have propeller shafts as in the case of others. The elimination of propeller shaft gives more space for a compact like the Volkswagen Beetle.

Common to all transmission systems are the gearbox and the clutch. The gearbox is placed between the engine crankshaft and the driving road wheels.

It is however, practically impossible to engage a rotating gear which is transmitting torque, with a stationary or slower-running gear as is often required during gear change. Such as attempt can only damage the gears. The main function of a clutch is to interrupt the transmission of a crankshaft torque to the gearbox. The clutch is designed to join together or disconnected two shafts running at different speeds. In the case of a motor vehicle transmission, the two shafts are the engine crankshaft and the gearbox shaft.

(a) of the figures above shows a mechanical clutch control system. The hydraulic system consists a clutch pedal, a master cylinder, a slave cylinder, flexible hose and piping.



Mechanical clutch control system

The control arm is rotated clockwise or anti-clockwise to disengage or engage the clutch. This is achieved by a release mechanism operated by the driver pressing the clutch pedal. The fig above shows a mechanical system consisting of a clutch pedal and linkages to increase and

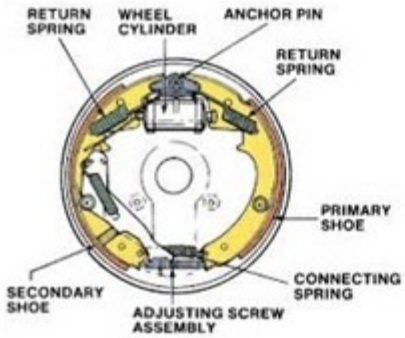
transmit the pedal force. The hydraulic fluid transmits and increases the pedal force exerted by the driver. The increased force is then used to turn the control arm.

Control of Rotary Motion – Brakes

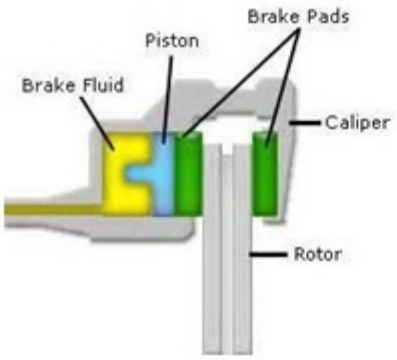
A moving vehicle and its occupants or a moving bicycle and its rider possess some kinetic energy. When a moving vehicle is brought to a stop, the kinetic energy is reduced to zero. Where has the original kinetic energy gone? In a vehicle or bicycle, it is the brakes, which absorb the energy by friction, convert it into heat, which is then dissipated to its surrounding. Energy is continually absorbed as the vehicle slows down until it finally comes to a stop. In addition the brakes must bring the vehicle to a stop in a smooth manner and also in a straight line. There must be no skidding.

How do Brakes Work?

There are basically two types of friction brakes in use, namely the drum brakes and the disc brakes. The drum brakes consist of two brake pads or linings which can be forced outwards against the inner surface of the rotating rum fixed to the wheel. The shoes are mounted on a back plate rigidly attached to a non-rotating part of the axle. The disc brakes as shown below, consists basically of a caliper that houses friction pads which are loaded inwards against each side of a rotating disc, fixed to the wheel. The brake system for a bicycle is shown (b) below



Drum brake system



Disc brake system

Fig (b) Bicycle brake system

Flexible connecting pipes, a servo-unit and wheel cylinder assemblies. The wheel cylinders operate the shoes and linings or the pads. When the driver presses the brake pedal, the force applied to the pedal is magnified by a simple linkage mechanism. The force is then transmitted by the hydraulic system through pipelines and flexible hosing to each brake.

It functions properly provided there is no air in the connecting pipes and the flexible hosing. This is because when air is compressed, it does not transmit the pressure as in the case of brake fluid. Such air must be expelled by “bleeding the system”. Next time you go to a motor vehicle repair garage, ask the mechanic to show you how a hydraulic braking system is bled.
In case the primary hydraulic braking system fails, a secondary independent system is usually provided for the driver to fall back on. The secondary system is usually referred to as the hand brake or parking brake. Generally, it uses the same pads and linings as the primary system, but the pads and linings are pushed by a mechanical linkage operated by hand. This works essentially like the bicycle brakes down shown in fig (b) above.

Assessment

Briefly explain the following;

- Linear Motion
- Rotary Motion
- Transmission of Motion

JSS 3 SECOND TERM BASIC TECH

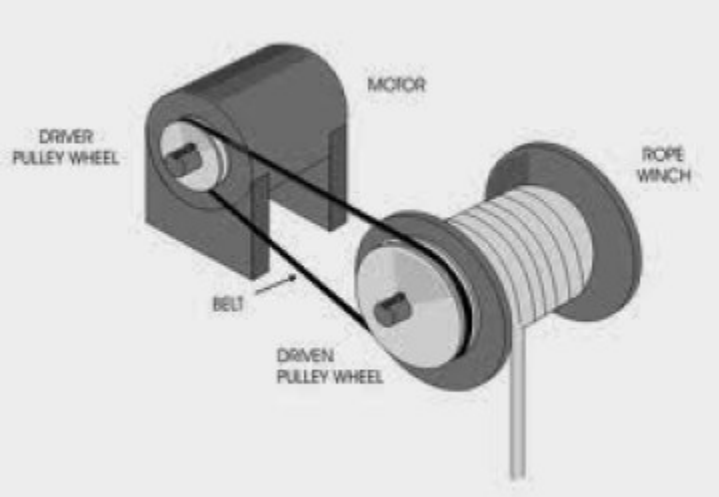
Week 11

Topic: MECHANICAL ENERGY TRANSMISSION SYSTEM (Rotary Motion)

Content:

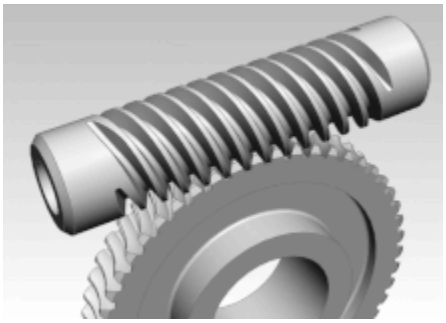
- **Types of Rotary Motion**
- **Principles of Application**

Rotary Motion: This is motion of a body moving in a circular form. Examples of circular motion is the rotation of a fan, vehicle tyres, the handle of the clock, etc. e.g.



Types of Rotary Motion

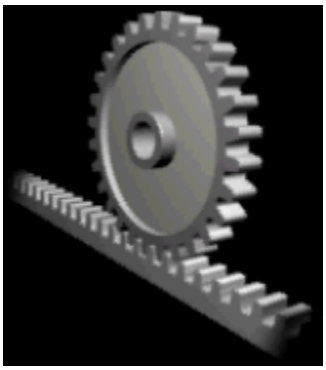
- A worm drive is an example of rotational motion.



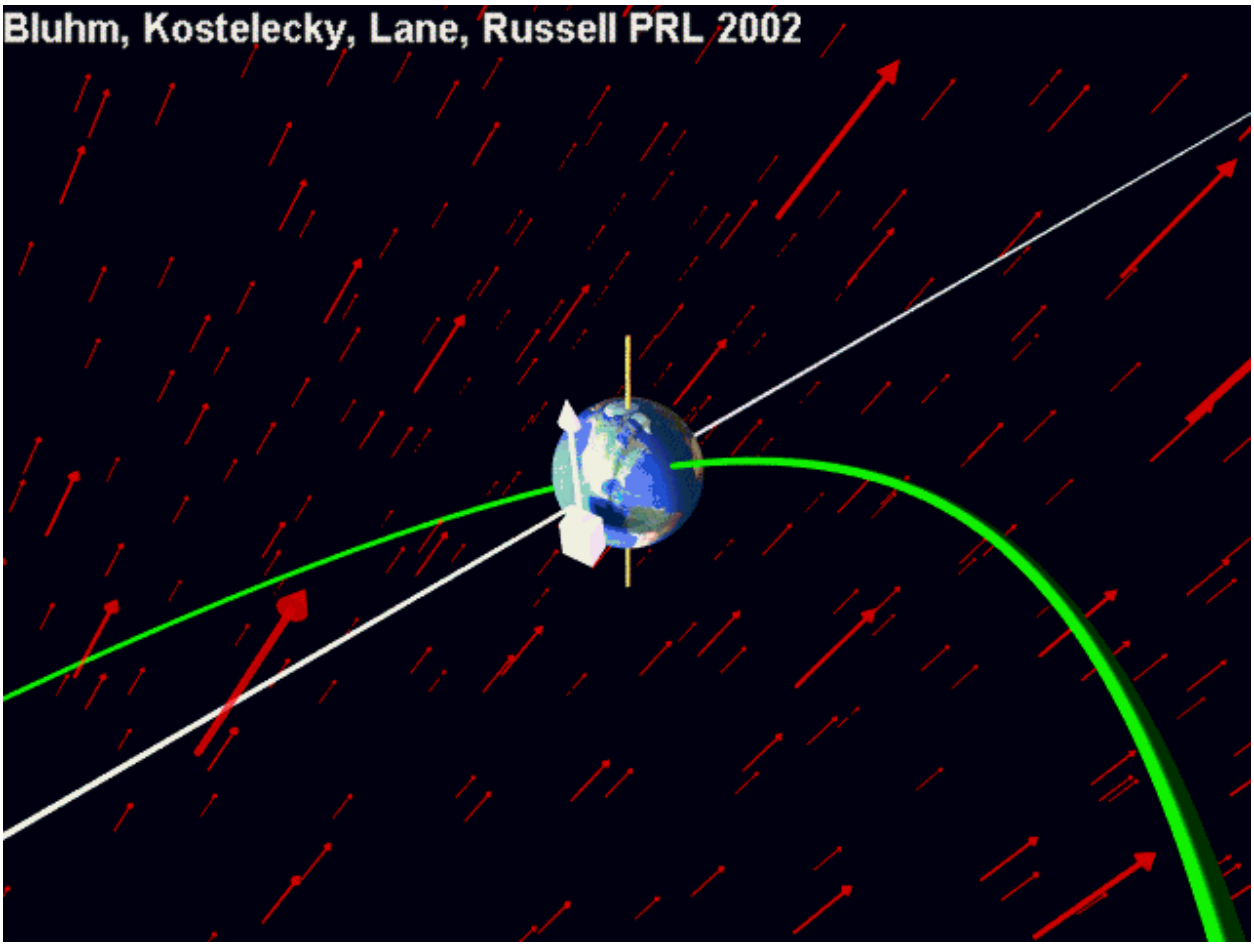
A worm drive

- Both the worm and the worm gear—is rotating on its ***own axis***.

Another example:



- In below image consider the motion of sphere which is blue colour ,



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- It has both circular and rotational motion.Because it completes a circular path while rotating around it's axis.
- In below image a person is performing Somersault

img.sparknotes.com.

- This is also an example for rotational motion, because he is rotating about his axis.

Principles of Application

Conversion of Rotary Motion to Linear Motion

There are many instances when it is required that one type of motion, e.g. rotary motion at one point be converted to linear motion at another point, and vice-versa. Household sewing machines, motor vehicle engine and transmission systems, motor-cycles, screen wipers in motor vehicles, printing machines, etc., have several mechanisms which convert one type of motion at one point to different or similar type of motion at another point.

The up and down (reciprocating) motion of the piston and its mechanical energy inside an engine cylinder must be converted into the rotary motion and mechanical energy of the rotating crankshaft of the engine. The slider-crank mechanism shown below is utilized to accomplish this task. It consists of the piston (referred to as con-rod), and the crankshaft (referred to as crank). The piston slides up and down or reciprocates inside the cylinder. The crankshaft performs pure rotary motion. The connecting rod connects the crank to the piston. Its complex motion is such that at the connecting point A to the crank, it performs pure rotary motion as the crank while at the connecting point B to the connecting rod, it performs pure linear motion.

Piston-crank mechanism of an engine

In the rack and pinion system shown below, the rotary motion given to the steering wheel by the driver is transmitted to the rotary motion of the pinion. The rotary motion of the pinion is converted into the linear motion of the rack which turns the tyres. The (a) fig below shows the steering system while (b) fig shows the details of the steering box containing the rack and pinion mechanism.

When the screw jack image below is secure placed under a vehicle for jacking, the rotary motion of the nut of the jack is converted to the upward or downward linear motion of the screw to lift or bring down the vehicle. In this mechanism, the screw has a square thread which engages the interval thread of the nut to achieve the above motions.

The metalworker's vice, the woodworker's vice, the pipe vice, and the G-clamp, which are all, work on the same principle as the screw jack described above.

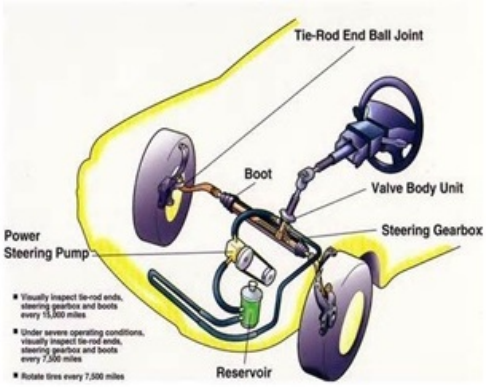
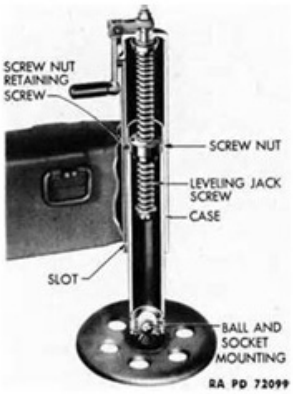


Fig (a) Steering system

Screw jack



Screw jack

Metalworker's vice

Woodworker's vice

G-clamp

Pipe vice

Assessment

1. Define rotary motion
2. Briefly explain the types of Rotary Motion

JSS 3

BASIC TECHNOLOGY

THIRD TERM

TABLE OF CONTENT

JSS 3 THIRD TERM BASIC TECH

WEEK 1

Topic: **Simple Electrical Wiring**

Content

- **Electrical Circuit**
- **Wiring Tools**
- **Accessories**

Electric Circuits

An electric is a complete path through which electrons or current flows. The path is made up of cable or wire which connect all the components of the circuit.

Components of an electric circuit include:

(i) **Battery or generator**: This is referred to as the power source.

(ii) **Conductor:** This is the cable or wire used in connecting other components. The conductor is made of copper.

(iii) **Load**: This includes the lamp and the other electrical appliances connected to the circuit e.g. radio and T.V. sets, fan, etc.

(iv) **Control:** This refers to the electric component that is used to switch "on" and "off" current. Fuses are included as control since they cut off in case of excess voltage.

V = voltage, I = current, and R = Resistance

Mathematical relationship between voltage, current and resistance is expressed as follows

V = IR, I = V/R and R = V/I

Example:

(i) A current of 0.5A flows in a circuit with resistance 60 ohms. Calculate the potential difference within the circuit.

Solution

(i) V = IR

Current (I) = 0.5A, Resistance (R) = 60Ω

Voltage (V) = 0.5 x 60 = 30 volts

Wiring Tools and Materials

Hand tools used in the process of electrical installations are referred to as wiring tools. They are common tools such as pliers, hammer, screwdrivers, small knives, punches, cutters, hand gloves e.t.c. Wiring materials includes, black sole tape, clips, wooden block, cable, screws, etc.

Uses of Wiring Tools and Materials

Pliers: These are used in holding, cutting and joining conductor or cables. The pliers are coated or insulated with rubber materials.

Hammer: It is a tool used to drive in nails inside the walls to hold some of the wiring accessories such as wooden blocks. Clips are held on the walls with nails driven in the hammer.

Screwdriver: This is specially used to drive screw nails inside the socket and lamp holders to fasten them on the wooden block. Most screwdriver used in wiring (electrical installation) are equally used as testers i.e. used to determine the presence of current in the live cable. There are three types: Star, flat and ratchet screw drivers.

Small knives are used to peel the rubber coatings of the cable for joining. Punches are used to make holes on walls to allow the passage of the cables from one apartment to another.
Cutters are used to cut the wires where necessary.
Hand gloves are used to protect the hand from electric shock etc.

Black sole tapes are used to cover exposed conductors.
Metal clips are used to hold the cables firm on the walls while the screws hold the lamp holders etc.

Wiring Accessories

An electrical accessory is any device other than luminaries (lighting fittings) associated with the wiring and current utilizing appliances of an installation. Examples of electrical accessories include: tumbler switches, lamp holders, ceiling switches, ceiling roses, joint boxes, fuse boxes, socket outlets/plugs, lamp holder, adaptors, connector, etc.
Accessories are related for the maximum voltage, and in some cases rated for the maximum current they are designed to withstand without undue overheating or failure. Some accessories

are coated or covered with protective substance to make them suitable for a particular or various possible environment hazards.

The consumer's equipment begins with the main switch gear, fuse box or consumer unit to which the accessories are connected through surface or embedded wiring systems for lighting and power points. All socket outlets have their earth terminals connected to the consumer's so that appliances and consumers are protected against dangerous earth leakage by the use of the three-pin plug which allows connection to earth.

Wiring circuit for lightening and power points: In simple electric wiring, two electric circuits are observed: series circuit and parallel circuits.

Generally, all house wiring is done so that points of lights are connected in parallel, except for special cases like ceremonial lightings, photo studios and dark rooms which utilize series of lighting for increased brightness. Each circuit has its beginning connected to the fuse-way in the fuse box or splitter unit, then to a switch then separately to switches ; or looped by switch feeds then to the lamp holders or lighting fittings (through the lamp feed0 and back to the neutral terminal of the fuse box (through the neutral conductor). Multi-core cables e.g. twin or three core- insulated and sheathed cables are used on surface wiring in connection with joint boxes, but single insulated core cables are used in conduit to permit easy branching with less jointing; however the basic circuits are the same.

Assessment

A current of 0.8A flows in a circuit with resistance 80 ohms. Calculate the potential difference within the circuit.

JSS 3 THIRD TERM BASIC TECH

WEEK 2

Topic: BUILDING (Foundation)

Content:

- **Definition and function of foundation**
- **Types of foundation**

Foundation

The foundation in its widest sense can be said to be expanded base of a wall or a column in addition to the ground or sub-soil, which the building stands is the natural foundation, and the expanded base which is constructed with concrete or masonry materials like rocks, stone, or bricks is called the artificial foundation. However, when the word 'foundation' is used ordinarily, it means artificial foundation. In a swampy and waterlogged area, foundation also embraces the long concrete poles driven, or concrete cast into bored holes for purposes of carrying the structure above it.

Function of Foundation

The foundation, acting as a large flat-heeled shoe worn by the building, bears the total weight of the building and ensures that the weight is evenly distributed over the surface area of the foundation in such a manner that eliminate unequal settlement.

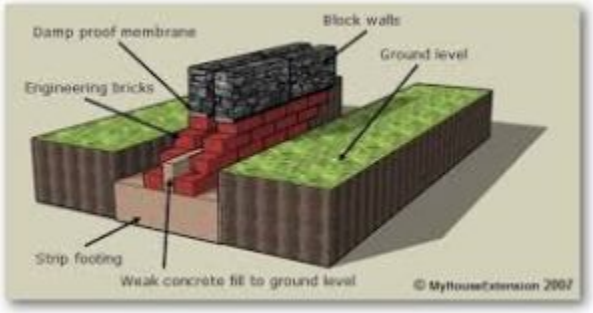
1. It receives and supports the loads (weight) of the building and transmits them to the solid part of the ground.
2. It ensures that the weight of the building is evenly distributed over the surface area of the foundation to avoid unequal settlement.

Types of Foundation

There are five major types of foundation:

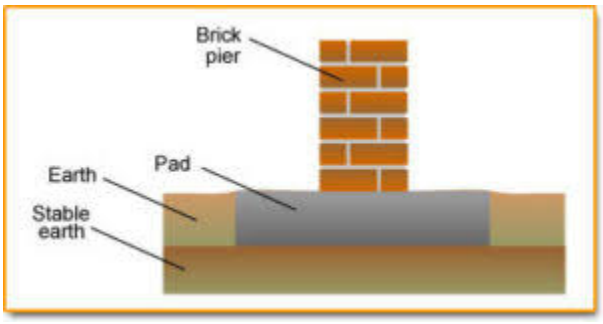
1. Strip foundation
2. Raft foundation
3. Pad foundation
4. Pile foundation
5. Stepped foundation

1. **Strip foundation:** This is a continuous strip of concrete under walls. It carries a uniformly distributed load. It is the most common in Nigeria.

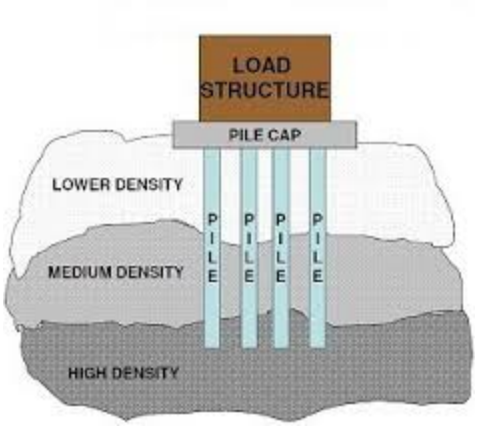


2. Raft foundation: This is a continuous concrete base under the whole building. The concrete here in reinforced with iron bars. This type of foundation is usually used where the bearing capacity of the soil is very low e.g. clay soil, marshy or water logged area.

3. Pad foundation: This is an isolated concrete base under the columns. The area of the foundation will depend on the load it is going to carry. The depths of the reinforcement are supplied by the structural engineer.



4. **Pile foundation:** This is the type of foundation used to transmit load through soft oil, streams or rivers. In this type, the concrete or timber is driven down until it reaches a hard surface underneath. The properties of soil should be known to determine the type of use.



5. **Stepped foundation:** This is a strip foundation constructed on a sloppy ground. Also where the nature of the soil in a building site is not the same, for instance, if some parts of the ground is sandy and other part is clayey, stepped foundation will be incorporated.

Assessment

Briefly explain the types of foundation

JSS 3 THIRD TERM BASIC TECH

WEEK 3

Topic: BUILDING (Walls)

Content:

- **Materials foe wall making**
- **Types of walls**
- **Bonding materials**

Wall

Walls are continuous vertical structure of a building which are built primarily to perform any or a combination of these functions:

i. Enclose space, as in the external walls of a building, boundary or fence wall, reservoirs, and so on.

Ii. Divide space as in partition and compartment walks.

iii. Carry load and provide support for other elements and fitments for the building structure like the load of the floor and the roof above, windows, electrical fittings, air conditioners, sanity and water supply fitments.

Walks in the building can, in addition, be used as a shield against bad weather; some are used for screening spaces from view, and yet some are also used for decoration. Walls may or may not be constructed to carry any load.

Materials for making Walls

There are variety of materials for the construction of walls in Nigeria, walls are with any or combination of these materials – grasses, leaves, tree branches, tree trunks, timbre, stone, mud, bricks of clay, sand, concrete blocks, metal sheets, concrete, timer products (manufactured wood), synthetic materials and glass, curtain, zinc. Some of these walls are shown.

Types of Walls

Walls may be classified according to the materials for which they are made of or according to the purpose they serve.

Classification of walls according to their materials

i. Block wall/masonry

ii. Stone wall

iii. Mud wall

iv. Timber wall

v. Zinc wall

vi. Brick wall

vii. Glazed wall

viii. Concrete wall

ix. Metal wall

Classification of walls according to their functions

i. This wall supports or carry load from the upper floor or roof.

ii. Non-load bearing wall: This wall does not support other loads apart from its own.

iii. Partition wall: This wall divides space inside building g into rooms or compartments.

iv. Parapet wall: This is a wall above the roof plane. It is used in concrete roof. Also, it is used to guide the edge of a roof or balcony. It is usually protected with coping.

Parapet wall

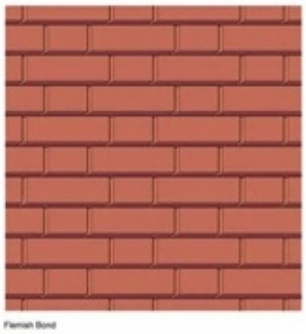
Cavity wall: This is a twin wall built of two thick leaves of block separated by small gap. The purpose is to avoid moisture penetration through walls.

Bonding

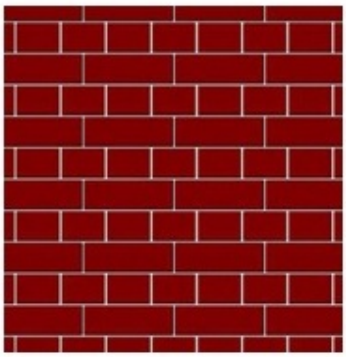
Bonding is a process of laying blocks or bricks so that the blocks or bricks lap or project beyond those immediately above or below them. Masonry walls have little tensile strength compared to their great weight, therefore whenever there is a slight settlement especially near a corner or joint, the walls tend to crack. Bonding or otherwise tying together of the units of masonry is the best practical way of preventing these cracks. An unbounded wall which is easily identified by the presence of continuous vertical joints is a very weak structure. When a load is transmitted to the unbonded wall, it is practically concentrated on the portion between the continuous vertical joints with the result that the portion may end to “drop” and the wall shears along the joint. The unbounded wall therefore has little strength and stability. The same load transmitted to a bonded wall is distributed and borne by a larger number of flocks or bricks and therefore over a larger area.

Types of Bond

1. Flemish bond
2. English bond
3. Stretcher bond



Fleming bond



English bond

Assessment

List the types of bond you know

Basic Technology – JSS 3 ,1st Term

Week 4

Processing of Materials (Wood) – contd.

Outline:

— Concepts of Wood processing – growth, felling

Wood processing is an engineering discipline comprising the production of forest products, such as pulp and paper, construction materials, and tall oil. Wood is obtained from trees that grow all around us. However, wood cannot be used to produce the materials needed domestically and industrially, if the wood does not pass through the necessary stages of being processed. Wood processing also produces additives for further processing of timber, wood chips, cellulose and other prefabricated material.

Wood/Timber growth:

Timber is a piece of wood used for various domestic and industrial woodwork. Timber is obtained from trees especially the trunk and branches. Trees that provide timber are usually trees with big trunk, these types of trees are grown in the Southern part of Nigeria in Rain Forest vegetation. These trees grow fast in the southern region of Nigeria because of the heavy rains and the long period of rain in that region annually. Common examples of such trees are mahogany, obeche, teak, oak, etc. The entire process of processing of timber can be summarized in the chart below:

Wood Conversion → Felling of trees → Wood seasoning → Wood preservation

Felling of Trees:

Felling is the process of downing individual trees, an element of the task of logging. The person cutting the trees is a *feller*. Felling of trees is done with the aid of chain saws as shown in the image below. The tree is then cut and arranged neatly.

Felling of a tree

Felling can be fell either by hand felling or by feller buncher. Hand felling processes is the using of an axe or saw, used to fell a tree. Feller buncher is a motorized vehicle with an attachment which rapidly cuts and gather several trees in the process of felling them.

Assessment

- Briefly explain the following terms; Wood processing, Timber, felling of trees.

Basic Technology JSS 3 ,1st Term
Week 5

Processing of Wood Contd.

Outline:

— **Manufactured board – defects, preservations**

Introduction:

Various abnormal conditions and features of wood which permanently reduce the economic value of wood are termed as defects. However, defect caused by fungal attack and decay in wood is known as Unsoundness. The term is generally applied to the discontinuity of tissues and abnormal fibre development in wood, and unsoundness to some form or stage of decay in wood. These defects and or unsoundness in wood may either just reduce its utility or render it entirely valueless.

Wood preservation is the process of adding chemical to wood so as to prevent termites, insects, weevils and fungi from attacking the wood. These chemicals are called preservatives, it can be applied to wood through spraying or brushing. Example of wood preservatives are creosote, coal-tar, solignum, chlorinatephenol, paints etc.

Defects in Wood

Defects are faults or irregularities in wood caused either naturally or during processing of the wood which reduces the value or quality of the timber.

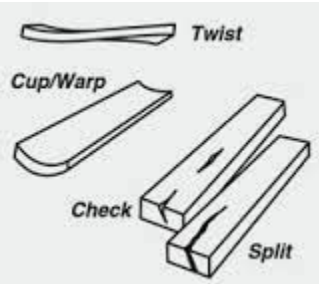
- Natural defects: these are defects which occur during the growth of a tree, they include the following:

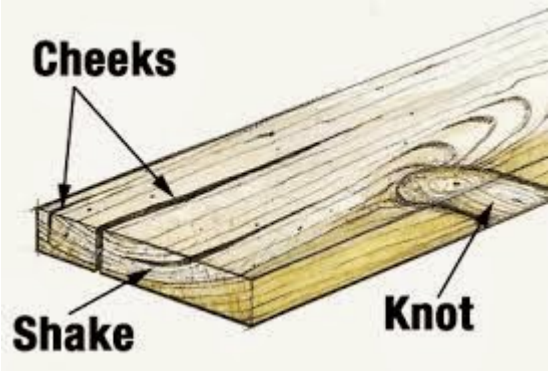
1. Heart shake: these are visible splits on the cross-section of the centre of the log extending along the rays
2. Star shake: this is similar to heart shake, but with more shakes are observed in the star formation
3. Cup shake: these are visible cracks that go part ways around the growth ring
4. Knot: this is a defect that occurs at the branch of a tree, it is enclosed within a growing tree and if it falls to the ground from the tree, it may leave a knot hole on the tree.

5. Cross-grain: this is the condition which occurs when the wood fibre is not aligned parallel to the axis of the piece of wood, it is caused by the manner the tree grew and it gives pant ow strength.

- Artificial Defects: this is also referred to as processing defects, they are caused by careless handling and faulty seasoning and preservation of wood. There are different types –

1. Cup: this is a concave curvature across the face of the timber. It is caused by bad stacking during drying. Plain sawn planks are more are more affected than quarter sawn.
2. Bow: this is either concave or convex curvature along the length of a plank
3. Twist: this is a spiral form of distortion along the length of a plank
4. Check: this is the separation of wood along the grain of a board
5. Insect attacks: These are visible minute holes seen on the surface of boards. The sapwood is more readily attacked than the heartwood. Dry planks are more readily attacked.





Assessment

- List five Natural and Artificial defects of wood

Basic Technology, JSS 3 First Term

Week: 6

Topic: Isometric Drawing

Contents:

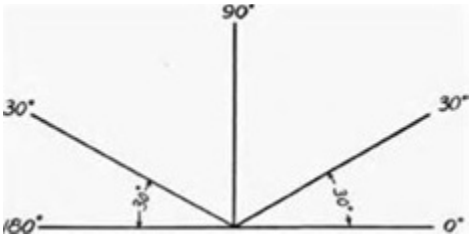
1. **Meaning of Isometric Drawing**
2. **Isometric Axes**
3. **Isometric Drawing of Simple Shaped Blocks**
4. **Drawing Isometric Blocks with Freehand**

Meaning of Isometric Drawing

Isometric drawing is a pictorial method of drawing which shows the three faces of an object together. It is a clear way of presenting information about the physical outlook of an object. An isometric drawing is constructed by using a pair of set-squares. The receding lines (Isometric lines) are drawn at 30° to the horizontal plane or x – y line while the other lines are vertical. Isometric drawings help students to develop their imagination.

Isometric Axes

An isometric drawing is built around three lines called isometric axes, this comprises a vertical axis and two receding axes. Note that the two axes of 30° and there is 120° between the three axes, they are called the isometric axes and on them the drawing is built up.



Isometric axis

Isometric Drawing of Simple Shaped Blocks

Step 1: Draw with set-squares; place the set-square and make sure that both the face and side are inclined at 30° to the horizontal plane.

Step 2: Draw the isometric box that contain the object first. The box must have the overall size of the length, the breadth and the width of the desired object. (Note that this must be drawn with very thin lines)

Step 3: Draw the desired shape with faint lines inside the box using the correct dimension.

Step 4: Draw the correct shape of the object with thick continuous line (i.e. outline.)

Step 5: You may rub off the construction lines or you may not if they are very neat and faint.

Drawing Isometric Blocks with Freehand

Freehand sketching is a method of drawing object without the use of drawing materials except a pencil. Students should try as much as possible to attempt drawing isometric blocks with freehand. It may seem difficult in the beginning but with constant practice, good results will be achieved.

In technical drawing, a freehand sketch is made in exactly the same way as drawing done with instruments. AOX is drawn first, then, the measurement is transferred; constant practice will also help you to achieve good proportion.

Assessment

Briefly define the following terms; isometric drawing and isometric axes