BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

(Diploma 3RD sem)

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Rocks

Introduction:-

The engineering structure are compose materials. This materials are known as engineering materials or Building material or materials of construction. It is necesity for engineeri to become convergently - properties of such material

The service conditions of building divid a wild range of materials & various properties such as water resistant, stength, durablity, temp resistant, appearence, permiability etc. are to be properly study before making final selection of any build -ing material for a particular

Stone has a building material:-

Stones are obtained from rocks. A rock repre -sent a definte portion of earth's surface. It has no definte chemical composition and shape. Rocks are known as Manominearlics, if it con -tains only one minearls and it is known as poly minearalic if it contains sevetal minearals. like magnasite, ~~Zeptaye~~ Gaysum are the ex of monominea -ralic rocks. The basalt and granite are the example of poly minearalic rocks.

Classification of rocks

Rocks are classified into 3 ~~types~~ groups.

1) Geological
2) Physical
3) Chemical classification.

Geological classification:-

Acc to this classification rocks are classified into 3 groups

1) Igneous rocks 2) sedimentary rocks.
3) Metamorphic rocks.

Igneous rocks.

The inside portion of earth surface as high temp so as to cause fusion by heat at even ordinary pressure. The molten or paste rocky materrals is knows as Magma. And this magma accertionaly tried to come out through cracks or in week portion. The rocks which are formed by cooling of magma as known as igneous rocks.

The igneous rocks are recongize or of the following 3 classes.

1) Plutonic rocks.
2) Hypobyssal rocks.
3) Volcanic rocks.

*Plutonic rocks:-

Such rocks are form due to cooling of Magma at a considerable depth of earth surface. The cooling is slow and rocks posses comrily grained crays Crystalline Structure. The igneous rocks are used in building industries are of plutonic rocks.

Granite is leading example of this type of rocks

*Hypobyssal rocks:-

Such rocks are form due to cooling of Magma at a relativily shalow depth from the earth surface. The cooling is equik & hence this rocks passes grained Crystaline structure.

Dalerite is a best exa for this type of rocks

*Volcanic rocks:-

Such rocks are form due to pouring of magma at earth surface. The cooling is vary rapid as compare to the perfiesus 2 case.

hence, this rocks are found fine grained is structure. They frequently containt same quantity of glass which is a non-crystaline material.

Basalt is an ex of this type of rock.

10/8/2021

*Sedimentary rocks:-

This rocks are form by the depositon of products of wheathering on pre-existing rocks. All the products of weathering are ultimately carried away from the place of origin by the agence of transport. Such agence are frost, rain, wind etc

Following 4 types of deposits are

*Residual deposition.
2) Sedimentary deposition.
3) Chemical deposition
4) Organic deposition.

1) Residual deposition:- Some position of produ deposition of weathering remains at site of origin. such deposite is known as a residual deposite.

2) Sedimentary deposition:- The insoluable products of weathering are carried away in suspension or when such product deposite a gives raise to a sedimentary deposite.

3) Chemical deposite:- Some matterial, that is carried alway in solution may be deposite by physico chemical process. Such as evaparation and precepitation. It gives raise to chemical deposite.

4) Organic deposite:- Some position of the product of weathering gets deposite through the agency of organism such deposite called as organic deposite.

Example:- Sedimentary rocks are gravel, sand stone, lime stone, gypsum, lignite etc.

Metaphic

Metamorphic rocks:-

This rocks are formed by the change in chara -cter of the pre-existing racks. Igneous as well as Sedimentary rocks are changed in character when they are subjected to heat and pressure thes process will change is metamorphism.

Physical Classification:-

This Classification is based on general Struct -ure of rocks. According to this classification are rocks are following types.

1) Stratified rocks.
2) Un Stratified rocks
3) Foliated

Stratified rocks:-

This rocks posses plates of stratification, such rocks can easily be split are along this plans. Sedimentary rocks are destinatly stratified rocks.

Unstratified rocks:-

This rocks are unstratified, the structure may be crystaline or Granular or Compact granular. The igneous rocks are valconic agency of Sedimen -tary rocks affected by the movemoment of the earth.

Foliated rocks:-

This rocks have a tendency to be split up in a definite direction own.

Foliated structure is very common in case of meta -morphic rocks.

Chemical Classification:-

According to this chemical classification the rocks are in 3 types

1) Siliceous rocks
2) Argillaceous rocks
3) Calcareous rocks.

Silicious rocks:-

In this rocks silica is predominate. The rocks are very hard and durable but they are not easily affected by weathering.

Silica, however in combination with weeker minearals may this integrate easily.

Argillaceous rocks:-

In this rocks clay is predominate. Such rock may be dense and compact or they may be soft.

Calcareous rocks:-

In this rocks, Calcium Carbonate is the predominate chemical. The duablity of this rock will depends of constituents present in surrounding atmosphere.

ex:- Lime stone and morbles.

12/3/2017

Qualities or Requirements of a good building Stones:-

*) Following are the qualities or requirement of good Building Stones are,

1) Crushing strength.
2) Apperance.
3) Durability.
4) Facility of Dressing.
5) Fracture.
6) Hardness.
7) Percentage wear.
8) Resistance to Fire.
9) Seasoning.
10) Specific Gravity.
11) Texture.
12) Toughness index

13) Water absorption.

14) Water weathering.

Crushing strength:-

1) For a good structural stone, crushing strength should greather than 1000kg/cm²

2) Appearance:- The stones which are to be used for face work should be desent in appearance & They should be capable of preserving their colour is uniformly for a long time.

3) Durability:- A good building stone will be durable, the various factor contribute into durability of stone or chemical composites, resistance atmosphere, texture and other influen-ces, location in structure. etc.

For making stone durable, their natural beds carefully noted. stone should be arranged in a sturdure that natural bed is 1ar or nearly 1ar so as the direction of pressure.

4) Facility of Dressing:- Stone should be such that they can be dress easily and economically.

5) Fracture:- For a good building stone, it fracture should be sharp, even & clear.

6) Hardness:- The Co-efficient of hardness as worked out in hardness test. It should be greater than 17 for this stone should be used in road work. It is blw 14 & 17 the stone is said to be medium. If it is less than 14 the stone is said to be very poor hardness & such stones should not be used in road work.

7) Percentage wear:- In attrition test, if wear is more than 3% then the Stone is not satisfactory. If it's equal to 3%. it is just tallerable. For a good building stone wear should be equal to less than 2%.

8) Resistance to Fire:- Minearals composite stones should be such that shape of stone is preserve when a fire occurs. Failure of stone in case of fine is due to various regions such as rapid raise in temp, sudden cooling, diff co-efficient of linear expansiove of minerals. The sand, stone and silicate has binding material can resist a fire in better way. Argellious stones are poor in strength. But they cann't resist fire quite well.

14/9/2019

9) Seasoning:- Stone should be well seasoning before coating into use. stone obtained freshly before quarry contain some moisture contant which is known a quarry sap. Presence of this moisture makes the soft. Hence, freshly quarried stones contain quarry are easy to work. it is therefore, desired to do design or carving etc.

When stone contains quarry sap. stone should be desired or seanson before they are used in structural work.

10) Specific Gravity:- For a good building stone the specific gravity should be greather than 2.7.

S.G = Hg of - 1, Hg → 13.6

11) texture:- A good building stone should have crystaline structure. The stones with such sturèture the stones with such texture are strong or durable.

12) Toughness index:- In impact test, if the value of toughness index comes below 13 the stone is not tough. If it's comes blw 13 to 19. the stone is said to be modar-tly tough. If it's exceeds 19 the toughness of stone is said to be very high.

13) Water absorption:- For a very good stone, % absorption by weight after 24 hr should not exceed 0.6.

14) Weathering:- A good building stone should posses better weathering quality. It should be capable of withstanding, advance effects of various atmospheric or external ageney such as rain, frast, wind etc.

Purpose of Dressing of Stone:-

Stones, after being quarry are to be cut into suitable sizes & width suitable surface. This process is known as dressing of stone & it is carried out for the following perposes.

* To get the desired appearance from stone work.
* To make the transport from quarry easy & economic.
* To suit the requiredments of stone masonary
* To take advantage of local man near to quarry who are trained for such type of work etc.

16/8/2019 Following are the varities of finishes obtained by dressing of stone.

1) Axed Finish:-

The surfaces of hard stones such as granites are dressed by means of an axed. Such a finish is termed as An Axed finish.

2) Boasted or Droved finish:-

In this type of finish Boast is used to make a non-continuous line marks on the stone surface as shown in fig. This marks are line, inclined or verticle. A boaster is a chisel having an edge of width about 50mm.

3) Chisel - Draughted margins:-

In order to obtained uniform joints in stone works, margine are placed which may be square or pitched or charmform

4) Circular - Finish:-

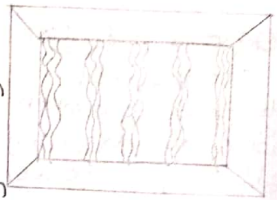
In this type of finish, surface of stone is made round or circular as in case of a column.

5) Dragged or Combed finish:-

In this type of finish, a drag or a comb, which is a piece of steel with a no of teeth is rubbed on the surface. In all directions and the surface is shown in fig. is obtained. This finish is suitable for stft stone only.

6) Furrowed Finish:-

In this type of finish, a morgin of above 20mm width is sunk on all the edges of stones & the central position is made to project about 15mm a no of vertical & parallel grooves about 10mm while or form on this projected position



7) Moulded - Finish:-

The surface of the stone can be moulded in any desired shape so has to improve the appearence of the work. The mould-ing can be matle either by hand or machine.

8) Hammer-Dressed Finish:-

In this type of finish, stones are made roughly square, rectanglelar may means of waller's hammer are shown in figure.

9) Plain - Finish:-

In this type of finish, surface of the stone is made approximately is more with a saw or with a chisel

10) Polished - Finish:-

The surface of the stones such as marbels, granite etc can be polish either with hand or with machine

11) Punched - machine:-

On the stone surface, depressions are made by using a punch. Surface of the stones take the form of a series of hallows or ridges.

12) Scabbling Finish:-

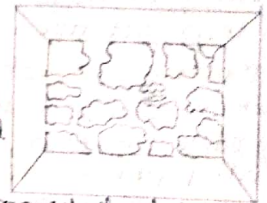
In this type of finish, regular projections are removed with a scabbling hammer & this way. The stones are roughly dressed.

13) Rubbed Finish:-

This type of finish is obtained by rubbing a piece of stone with a surface or by rubbing surface by using suitable machine. Water & sand are freely used axialate the process of rubbing

14) Reticulated Finish:-

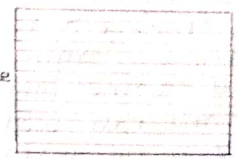
This type of finish present a net like appearence as shown fig. A morgine about 20mm above white is marking is made the edges of stones & irregular sinking is made on the enclosed



A morgine about 10mm while is pro-vided arround a regular shape is provided at is use Put a marks on such that surface so as to present a peacock appearence.

15) Tooled - finish:-

Is fished by means of chisel and parallel continuous marks either line or inclined or verticle or left on the surface as the shown in fig.



16) Self - Faced or Rock faced Finish:-

The stones are obtained by the quarry posses smooth surface & they can be directly placed on the work. Such a stone surface is terrd as self-farce

17) Sunk - Finish:-

This finish is obtained by sinking the surface below the original level in the form of wild grooves, chamfers, inclined surface or etc

18) Vermiculated Finish:-

This finish is similar to recticulated type except the sinking are more curved this finish present a worm eaten appearence.

Deterioration:- of Stones:-

Stones which exposed faces or acted upon by various atmospheric and external agency, so as to cause they Deteriration.

Following are a causes of Decay of stone.

1) Alternate wetness and Drying:- The stones are may wet by a veries agency such as rain, frost. etc such wet surface is dried by sun shine. It is faund that stone subjected to such alternate wetness & Drying were out quickly.

2) Frost:- In hills stations or very cooled places, moisture presents in the atmosphere is deposited in poreis of stones. At freezing point, this moisture freezes and indoing so it expands in volume & cause the spliting of stone.

3) Impurities in atmosphic:- The atmosphere contains various impurities which have adress effect on stone for instance acids & flums are predominate in indurstrial towns. This impurities are act as carborate of lime & cause the deterior ation of stones.

4) Living organism:- Some living organism like warms & bacteria act upon stones & deteriorate them.

5) Movement of chemicals:- If stones of different varity such as lime stone & Stand stone are used side by side in the same structure, the chemicals formed by the action of atmpspheric agency of one varity may move on the other & cause the deteriorration of stone.

6) Rain water:- Action of rain water on stones is two fold physical & chemical, the rain wets the surface of the stone & it is dried by sun shine. Such alternative wetness & drying relsults in the deberioration of stane. This is the physical action of rain water.

The rain water as it desends through the atmosp-here to the surface of earth absorb carbon dioxide (CO_2), hydrogen sulphide (H_2S) other gases present in the atmosphere This gases act as adversly on stones & they cause decay of stone. This is the chemical action of ston rain.

7) Temperature variation:- Raise of temp resultson an expansion of Stone. Fall of temp cause contraction of Stone. If raise or fall of temp or fricent of temp stones are easily deteriorate.

8) Vegetable Growth:- Certain trees & creeper of stone surface with their roots joints blw the stones. Such root attact moisture & keep the Stone surface damp At a same time they tried to expand such action the accelerates the decay of stones.

9) Wind:- The wind contains fine particles of dust. If it's growing with high velocity, such particles are strike against to stone surface such stone will be decay.

Preservation Of Stones:-

Decay of building stones of interior quality is to some extant, prevented, if they are

For this perpose preservatives are applied on the stone surfaces.

An ideal preservative as the following properties.

* It doesn't allow moisture to pentrate stone surface.
* It doesn't subject objectionable colour.
* It hardness saffiently, so has to resists effects due to various atmospheric agents.
* It is easily penetrated in Stone surface.
* It is economical
* It is non corrosive & arm less
* It remains effective for a long time after a drying.
* It is application of stone surface is easy.

Following are the preservative commonly adapted to preserve stone.

1) Coal-Tar:- If coal tar is applied on stone surface it preserve stone but the colour of coal-tar produces objectionable appearence.

2) Linseed-Oil:- This preservative may be used either as bare raw linseed oil or Boil linseed oil but it required frequent relewent usually one in a year.

3) Paints:- An application of paint on stone surface Surves as a preservative. The paint change original colour of the Stone.

4) Paraffin:- This preservative can used atone it may be desolve in Netha and then applied on stone surface

5) Solution of Alum and Soap:- Alum and soft Soap are taken in proportion about 75 gm & 50gm resp-ectivily & dissolve in liter of water. This solution is applied in a Stone surface acts like a preservatives.

Bricks:- The common brick is the one of oldest buildi -ng material & it extendncely used a leeding material of corstruction. bcz. of the aviable, relability, lowcast and easy aviable.

The bricks are obtained mouldableclay in rectangular blocks of uniform size & then by drijing & bruning this blocks. Thus, ~~in~~ places where the stones are not easily aviabla -ble, but there is planty of clay bricks replace stones.

21/8/2013

Manufacturing of Clay-Bricks:-

In the process of manufacturing bricks the following 4 operations are involved.

1) Preparation of Clay.
2) Mollding.
3) Drying.
4) Burning.

Preparation of Clay:-

The clay for brick is prepared in the following order.

1) Un soiling.
2) Digging
3) Cleaning.
4) Weathering.
5) Blending.
6) Tempering.

1) **Unsoiling:-** The top layer of soil, about 20cm in depth is taken out & thrown allway. Clay in top layer is full of impurities and hence it is to be rejected for the perpose of preparing bricks.

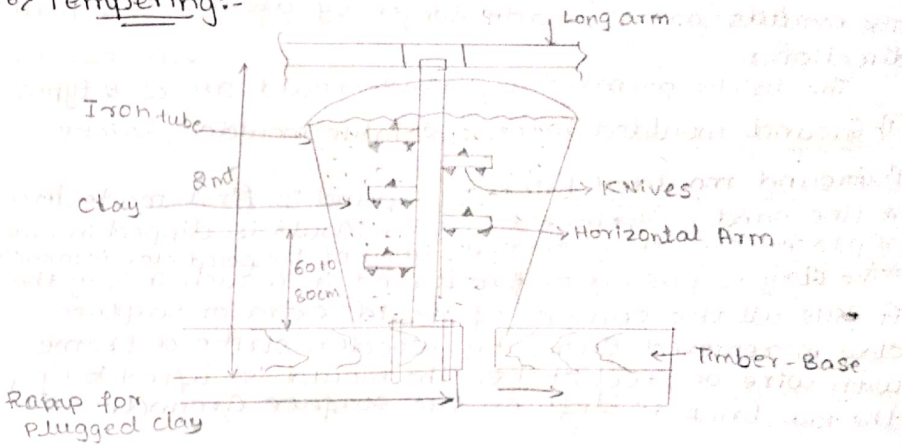
2) **Digging:-** The clay is than dug out from the ground it is spread on the level ground. The height of heaps. If clay is about 60-120cm.

3) **Cleaning:-** The clay is obtained from the perpose of digging should be cleaned stones, pebbels, vegitable, matter etc. The lumps of clay should be converted into powder form.

4) **Weathering:-** The clay is then exposed to atmosphere for safting. The period of exposure veries from five week to full seasion.

5) **Blending:-** Clay is made loose and any ingredient to be added it is spreaded out at its top. The blending indicates mixing. It is carried out by taking small postion of clay every time by turn -ng it up & down in vertical direction. Blending mades fitting for next stage tempering.

6) **Tempering:-**



In the process of tempering, clay is brought to a proper degree of hardness & it is made next operation are moulden. The H_2O required quantity added to a clay & ~~b~~ hole mass is needed knives are pressed under the feed of man or cattle. The tempering is ~~as~~ should be done exha

For manufacturing of good bricks on a large scale tempering is usully done in pug mill. ~~this~~ is shown in fig.

Moulding:- The clay which is prepared as above the -n is send for next operation of moulding following are the 2 types of moulding.

1) Hand moulding. 2) Machine moulding.

Hand moulding:- The moulds are rectangular boxes which are open at top & bottom. They may be wood or steel.

The typical wood mould is as shown in fig. It is prepared by well season wood.

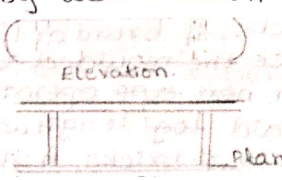


fig. 1

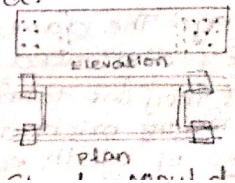


fig. 2

Steel mould as shown in fig. 8.

It is prepared from combination of steel plates & channels. They are used for manufacturing of bricks on large scale. The steel moulds are durable than wooden & they turn of bricks of uniform size.

Bricks shrink during dry & burning, hence moulds are to be made larger than size of fully brunt bricks. The moulds are ∴, made longer by about 8-12% in all directions.

The bricks prepared by hand mould are of 2 types.

1) Ground moulded bricks. 2) Table moulded bricks.

1) Ground moulded bricks:- Ground is first made level & fine sand is sprinkled over it. Mould is dipped in water & placed over the ground. The lump of tempered clay is taken & it is thrashed in the mould. The clay is passed or forced in a such a way that it fills all the corners of mould extra or surplues clay is removed either by wooden strike or frame with wire or steel strike. The mould is lifted up & the raw brick is left on the surface. ground.

NOTE:- FROG is a mark about 10-20mm which is placed on raw brick during moulding. It surve 2 perpose.
1) It indicates the trade name of manufactor.
2) In bricks work, bricks are laid with frog upper most. Thus it offerds a key for molten when next brick placed over it.

2) Table moulded bricks:- The process of moulding, this bricks is jest similar to above method. But in the case the moulds stands inner the table of size about 1m x 8mt. Clay mould, water pot, stand board, strikers. and pallets boards are placed on this tables. The bricks are moulded on the table & sent for further process of drying.

Machine Moulding:- The moulding may also be achived by machine. It pross to economical, when bricks is huge quantity are to be manufacture at the same spot. It is also helpful for moulding hand & strong clay.

Drying:- The damb bricks, if brunt or likely to be crack & distorated. Hence the moulded bricks are dryed before they are taken for next operation of bruning. For Drying bricks are laid longitudinally in staks in alternate layers all bricks are placed a

The important facts to be remember in connected in drying of

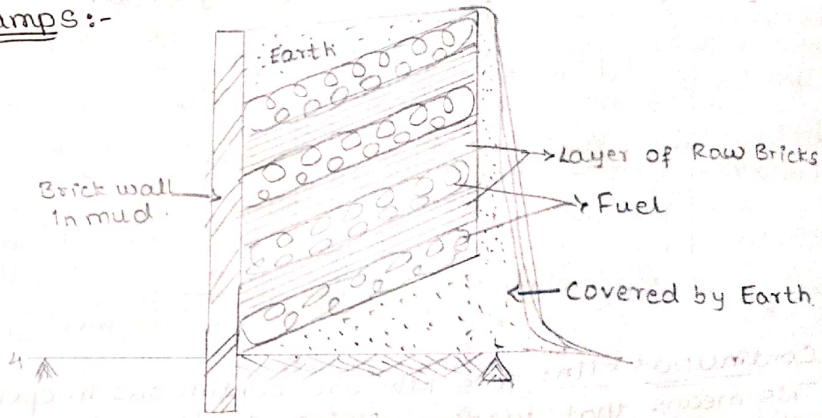
1) Artificial drying.
2) Circulation of air drying.
3) Drying yard.
4) Period of Drying.
5) Screens.

23/8/2017

Bruning:- This is very important operation in the manufacture of bricks. It imparts hardness & strength to bricks & makes them dense and durable, the bricks should be brunt properly. If bricks are over brunt, they will be brittle and hence break easily. If they are under burn they will be soft. and hence can't carry load.

The bruning of bricks is done either in clamps or kilns. The clamps are temperrary structure & They are adaped to manufacture of bricks in small scale. Kilns are parmanent structure & They adapted to manufacture of bricks in large scale.

Clamps:-



Advantages of clamp bricks.

* Bruning & cooling of bricks are gradual in clamps.
* Bruning of bricks by clamp prove to be cheap & economical.
* There is considerable saving of fuel.
* No skilled labour and supervision are required for the construction of clamp.

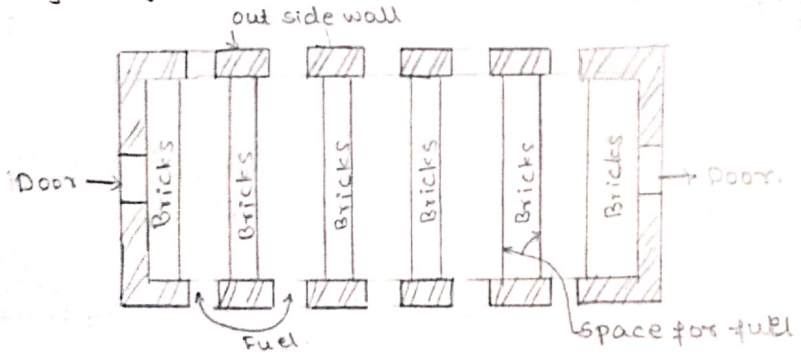
Disadvantages:-

* Bricks are not in regular shape, this may be due to shelter bricks when fuel near is to brun & turn to ashes.
* It is very slow process.
* It is not posible to regulate fire in a clamp.
* Quality of bricks is not uniform. The bricks near the bottom is over brun. Those near sides and top are under brun.

Kilns:- Is a large oven which is used to brunt the bricks. The kilns which one used in manufacture of bricks of are of the following 8 types.

1) Intermetent kiln.
2) Continuous kiln.

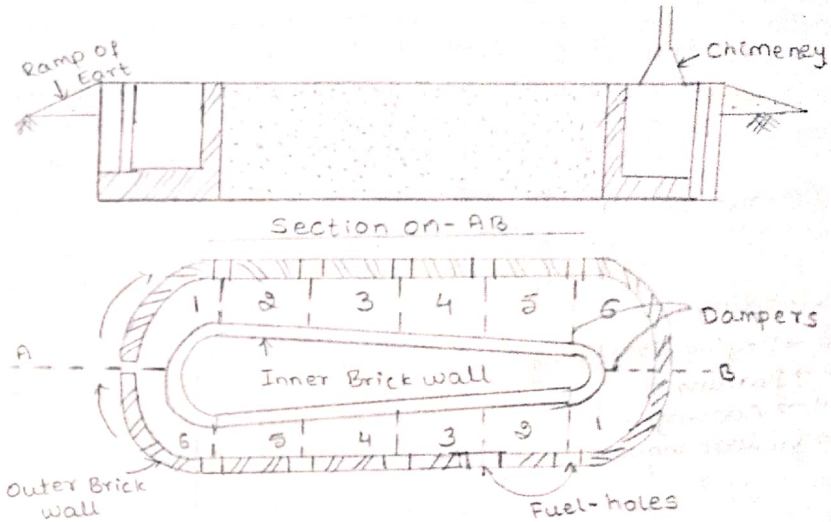
Intermittent kiln:- This kiln are intermitent in operation which means that they are loaded, cooled or unloaded. Such kiln may either be rectangle or circular in plan. They may be over ground or under ground.



Continuous kiln:- This kiln are continuous in operation. This means that loading, firing, cooling and unloading are carried out continuously in this kiln. There are various types of continous kiln. The following 2 varity are discuss below.

1) Bull's - Trench kiln.
2) Hoff - Man's kiln
3) Tunnel kiln.

1) Bull's - Trench kiln:-



PLAN

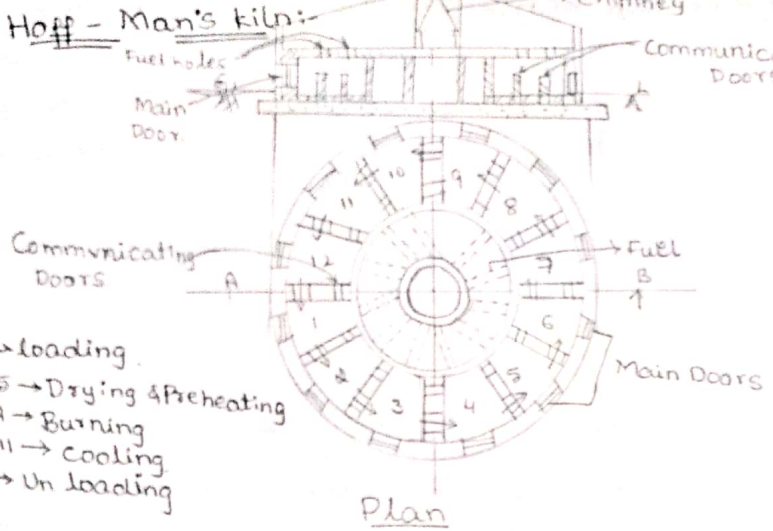
This kiln may be rectangula, circular or It is contracted a trench excauated in ground. It fully underground or partially projecting above the ground. In later case ramps of earth should be provided on outside the wall. Outer & inner walls are to be contracted of bricks. The opening are gener-ally provided in the outer wall to acts as fuel holes The dampers are in the form of iron plates and they are used to devide the kiln in suitable planes.

03/8/2013 The bricks are arranged in section, fuel is place-d in flues & it is ignited through flue holes after cover-ing top surfaces with earth and Ashes to prevent excape of heat. Usually two moveable iron chimeney ar employed to form draught. This chimeney are placed in advance the section being fired. Hence, hot gase-s leaving the chimeney warm up the bricks in next section. Each section required 1 day to burn when a section has been burnt, flue holes are closed & it is allowed to cool down gradually.

Fire is advance to next section & chimeney are moved forward as shown by arrows.

Bull's trench kiln is working continuous as all the operation loading, burning, cooling or unloading are carried out Simitanously. The section wise process mention above of index.

2) Hoff - Man's kiln:-



Plan

Hoff-Man's kiln

This kiln is constructed on over ground & hence it is some time known as flame kiln. It's shape is circulare in plan & it's dived into no of compartment a chamber. The fig. shown plan & section of haff-Man's kiln with 12 chamber. Each chamber is provided due to following.

1) A main door for loading & unloading of bricks.

2) Communicate door which is act as fuels in open condition.

3) A radial flow connected with central chimney.

4) Fuel hole covert with drop fuel, which may be in the form of powder into the burning chamber.

12 chamber shown in fig may be functioning as fallow

1 → loading
2-5 → Drying & Preheating.
6-7 → Burning
8-11 → cooling
12 → Un loading.

The initial cast of instaling this kiln is high but it posses the following advantage.

1) Bricks are burn equally & evenly. hence brick are good quality are produce.

2) It is possible to regulate the heat inside the chamber through fuel holes.

3) Supply of bricks is continuous

4) There is considerable saving in fuel due to pre heating of raw bricks by flue gas.

The capacity of the kiln is deperds upon If each chamber is about 12m length, 4-5m average width & 2.5m in height. It will contain above 25000 bricks. Hence if it is should be arrange that one chamber will be unloaded daily such a kiln will manufacture about 25000 bricks every day about 8-9 million bricks annually.

3) Tunnel Kiln:-

This type of kiln is in the form of tunnel which may be straight, circular or

It contaiint a stationary zone of 5. The raw brick are place on trolleyers which are then moved from one end to other end of tunnel. The raw bricks get dried and pre-heated as they approch zone of fire In the zone of fire, bricks are burn to requlred degree & they are pushed to cooling. When the bricks are suffiently cool this bricks are known unloading This kiln prooves to be economical, when bricks are to be manufactured on a large tscale.

As temp is under control unfform bricks are better quallty are produced.

Comparision between clamp burning & kiln burning

Item	Clamp Burning.	Kiln Burning.
1. Capacity	About 20000-1 lak brick can be prepared at a time.	Average 25000 bricks can be prepared per day
2. Cast of fuel	Low as grass, litter etc may be used	Generally high cold dust is to used.
3. Initial cast	Very low, as no stru are to be build.	More as permanett stru are to be constructed.
4. Quality of bricks.	% of good quality bricks is small about 60%	% of good quality bricks is very high upto 90%. & above
5. Regulation of fire.	It is not possible to controll(or) Regulate fire during the process of burn.	Fire is under control throughout process of burning.
6. Skilled Supervission	Not necassarily thro ughout the process of burning	continuous skilled supervision is necassar

7. Structure	Tempravary	Parmanet.
8. Suitability	It is suitable, when bricks are to be manufacture in a small scale.	It is also suitable when bricks are to be manufacture in a large scale.
9. Type of burning & Cooling	It required 2-6 month for burning & cooling of bricks.	The actual time for burning of 1 chamber is about 24 hrs & only about 12 month required to cooling.

Quality of Good Bricks:-

The good bricks which are used for construction & important structure should posses the following quality.

- The brick should be table moulded, well burnt in kiln. upto copper colour, Free from cracks and with Sharp & and square shape.
- The bricks should be uniform in shape and should be of Standard size. [without mortan 9cm x 9cm x 19cm, with mortan 10 cm x 10 cm x 20cm].
- Bricks should be give clear ringing sound when strack with eachother.
- Bricks breaken & should be homogenous & compact structure
- Bricks should not absorb water more than 20% by weight for first class bricks & 22% by weight for 2nd class bricks. Where the bricks are soaked in a cooled water for a period of 24 hrs.
- The bricks should be sufficiently hard, no impression should be left on bricks surface when it is scratched with finger knail.
- The brick should not break when droped flat on hard surface ground from a height of 1meter.
- The brick should have low thermal conductivity & they should be Sound proof.

Test for bricks (or) Field and Laboratory test for bricks:-

The following are the field & laboratory test are conducted for bricks.

1) Compression strength test. (or) Crushing strength.
2) Water absoption test
3) Efflorescence test.
4) Dimension and warpage test.

Compression Stregth test:-

Crushing strength of bricks are found out by placed in it in compression test machine. It is loaded / pressed compressed till it is break. As per IS:1077:1970, the min. crushing strength of brick is 3.5 N/mm². The brick with a crushing strength 7 N/mm² upto 14 N/mm² are graded as class A. Brick. And those the bricks having above 14 N/mm² are graded a CLASS-"AA".

Water absoption test:-

A brick is taken & it weigh and Dry. It is can immersed in water for a period of 60 hrs - 24 hrs. It is weighted again & the diff in weight indicate the amount of water absorb by the brick. It should not exsied 20% by the weight of brick

Efflorescence test:-

If soluble salt if present in bricks, will cause efflorescence on the surface of the bricks. For finding out the presents of soluble salts in brick, it is immerse in water in 24 hrs. & it is taken out allowed to Dry in shade. The absence of grey or white

If the white deposite above 10% surface area, the efflorescence said to slight. If it's 50% it is said to be moderate. & if it's more than 50% it is said to heavy & it is treated as seriously. When such deposites are converted into powder form.

Dimension & Warpage test:-

In this test the brick is closly inspected & it should be as standard size & it's shape should be truely rectanglular with shape edges. For this perpose 20 bricks of Standard size: 90 mm x 90 mm x 190 mm. are selected at randomly & they are stacked length wise along the width & along the height. For good quality

bricks, the results can be within the following permissible limits.

Length → 3680mm to 3920mm.

Width → 1740mm to 1860mm.

Height → 1740mm to 1860mm.

Classification of Bricks:-

Bricks can be divided into 2 catagery

1) Unburnt or ~~Shine~~ Sun Dryed Bricks.

2) Burnt bricks.

Unburnt bricks:- This bricks are dryed with the help of heat received from sun after the process of moulding. This bricks can be used in the construction of temparary structure.

Burnt Bricks:- The bricks are used in construction are burnt bricks & they are classified into following 4 catagaries.

1) 1st class bricks.

2) 2nd class bricks.

3) 3rd class bricks.

4) 4th class bricks.

First class bricks:- This bricks are table moulded & standard shape. The surfaces & edges of the bricks are sharp, square and straight. They comfortably completly with all the qualities of good quality which are mention earlier. This bricks are used for superior quality of permanet structure or nature.

Second Class bricks:- This bricks are ground moulded, this burnt in kilns. The surface of the bricks is rough & shape is also slightly irregular. This bricks are used in a placed a bricks works to be provided with a coat of plastic.

3rd class bricks:- This bricks are ground moulded & They are burnt in clamps. This bricks are not hard & They have rough surfaces & with irregulate & distrated. This bricks are use for unimportant contstruction

4th class bricks:- This are over burnt bricks with irregular shape & dark in colour. This bricks are used as aggregate for concreate fundation floors and roads etc

31/8/2017

Cement Concrete blocks:- The concrete offe flexibility in production which is not their in brick mansion. The brick manufacture come to a granding art during the mansoon, white concrete blocks making carried out through out the year. The investment needs by the way of land & capital is much less for concrete black manufacture compare to bricks making.

Classification of Concrete blocks.

1) Hollow concrete blocks [Open & closed cavity type]

This blocks are classified by IS into a fallo -wing 3 grades.

a) Grade A:- This blacks are used for load barring walls, They should have min. specific compressiv Strength of 7.0 N/mm² in 28 days & they should have a mini density of 1500 kg/m³.

b) Grade B:- These are also used for load barring walls. They should have min. Specified compressive strength of 3.0, 30. . . . 5.5 N/mm² in 28 days. & Should have a density below 1500kg/m³.

c) Grade C:- These are used for non load barring walls. They are made for specified strength of 1.5 N/mm in 28 days & its density should not be less than 1000kg/m³.

2) Soild Concrete blocks:- This blocks are used as load barring walls. They manufactored for a Specific compressive strength of 4.0 to 5.0 N/mm² in 28 day. They should have density not less than 1800kg/m³.

3) Paver blocks:- These blocks are soild concreate blacks of various shape specially made for ~~exterior~~ ground pavement, ~~dry use~~ drive way, parking lots, Industrial floors, petrol pumps etc

Manufacturing Of Concrete blocks.

1) The concrete mix for concrete block shell not be richer than 1 part of cement 1 part of volume of aggregates.

2) Beero of indian standard recomends a finer modulus of the combined aggregates blw 3.6 to 4.

3) 60% of fine aggregate, 40% of course aggregates is the mixed recomended and course aggregates of 6:1 is generally used.

4) Blocks can be man made or machinery made. or a simple machine can be made upto 1600 block in at 8 hrs shift.

5) The cast blocks are cured in a water tank for atleast 14 days. when immersed in tank the H_2O shall be change atleast for every 4 days.

6) After the curing the blocks are dried for a period of 4 days before being used on work. The blocks can also be steel cured & dried. This process allows the complete shrinkage of the block to take place before they are laid on the wall.

7) Freshly made & uncured concrete blocks cann't be used for construction.

4/9/2013

Dimension and Tollerence:-

Normal size of concrete blocks are,

Length: 400, 450, 500 or 600mm.

Height :- 100 to 200 mm.

Width :- 50, 75, 100, 150, 200, 250 or 300mm.

The actual size will be less by 10mm, that is mortar thickness. The maxi. variation allowed is ± 5mm in length and ± in height and width.

Advantages of Concrete blocks:-

1) The concrete blocks usually made large in size, so that the block work is faster & consumes less cement in joints than the brick work.

2) The spacial made hallow blocks are used for load bering walls, such works are usefull in reducing the dead load of mastiory in building.

3) Manufacturing of blacks can be carried out throu-ghout the year.

4) The infest needed by the way of land & capital is much less where cap compare to bricks

Disadvantages:-

1) The main disadvantage of concreate block is shrinkage due to movement of moisture which is absent in bricks.

2) Blocks are much larger in size than bricks any fundation movement will cause block work to crack more than bricks works.

3) Blocks which are in cured for 14 days & dried for 4 weeks can only be used for construction works.

4) Ordinary unrefined block work in wall is very Week for resisting lateral load.

Stabilized Mud Blocks:-

The block manufacture by stabilized mud [soil] is called as stabilized mud blocks.

Concepts:-

When a soil or soils are compacted using exter-nal energy. The density of soil reaches a max. value of moisture content known as the optimum moistur content [omc].

The value of OMC & max. density depends on the energy input during compaction. The compressive strength of soil in dry state depends on the density. Thus the process of machanical compaction can lead to densifi-cation & strengthing of a soil. A stabilized mud blocks technology. The stabilization is actived by a compaction of densification & mixing of stabilizing additiv A varity of stabilized material can used for stabiliz-ation may be cement, lime, bitumen.

Raw materials used:-

The soil containing 10-15% of clay & 65-75% of sand is satistifactory. The cement may added to a tune of 6-8% by weight of soil. In case of soil having high clay content sand or sandy addetive like "Quarty material" or Quarry dust may be added to correct the grading of the soil. A combination of cement or lime can also be used as a stabilizer.

Manufacturing

1) Sieve the soil in 4mm sieve to remove stones & lumbs of clay.

2) Mix sand of quarry dust to correct clay sand % in the soil.

3) Add cement or cement & lime or cement in appropriat propotion & mix thouraughly in the dry condition.

4) Sprinkle moisture of the mixture & further mix throug -hly & the mixture is ~~ton~~ homogenous. Test for optimum moisture by trying to make a wall of the, soil in hand.
If ball can be made without the said sticking to the hands the moisture content is rise.

5) weigh the correct amount of moisted soil such that A fresh density of 2.05g/cc can be achived the weight depends on the volume of the finished block.

6) The weighed soil is pored into a soil compraction press like mardini

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6) The weighing soil is know pored into a soil compact -ion test like mardini.

7) The block is how pressed by operating the toggle liver after closing the lid.

8) The led may be open & the blocks are ejected by again using the same lever.

9) The ejected blocks is then staked in a fine or 6 Six blocks high stak for curing.

10) The blocks are sprinkal with water & presued upto 21 days. To complete the block making process

The typical size of blocks are
230 x 190 x 100mm
(or 80- 305 x 143 x 100mm.

Requiredments of Good blocks:-

1) The blocks should have suffient compresisive strength to with stand the load.

2) It should have standard size & dimension.

3) It should be cheep & economical.

4) The block should have required density.

5) The block should be adiquately cure & cool.

Mortor:-

The mixture of binding material &, fine aggregat & water will required proportion is called a morte The mortor can be classified on the following bases.

1) Bulk - Density.

2) Kind of Binding material.

3) Nature of Application.

4) Special mortor.

Bulk - Density:- According to the bulk density of mortor in dry state or condition. There are 2 types.

1) Heavy mortor.

2) Light weight mortor.

1) **Heavy mortor:-** The mortor having bulk-density of 15 KN/m³ and more are known as heavy morta The fine aggregates of this type of mortor is manufacture from heavy quartz & other sand.

2) **Light weight mortor:-** The mortor having bulk density less than 15 KN/m³ are known as light weight mortor. They are prepared from pumice & other fine aggr -gates having less density.

Kind of Binding materials:-

It can be classified into 1) lime mortor 2) Surki mortor 3) Cement mortor 4) Gauge mortor 5) Gypsum mortor.

1) **Lime mortor:-** In this type of mortor lime is used as a binding material. It may flat lime or hydrolic lime. The lime mortor has a high plasti city & it can be placed easily. It posses high cohessionness with other surfaces & sprinches is very little. It is suffiently durable but it harden slowly. It is generally used for lightly loaded above ground parts of the building

2) **Surkhi mortor:-** This type of mortor is prepare by using fully surkhi instead of sand or by replac -ing of half of sand. The Surkhi mortor is used fo ordinary massonary work of all kinds in fundati -ion & super structure. But it cannot be used for

pointing & plastring, since it is likely to disintegr -ate after some time.

3) Cement mortor :- In this type of mortor cement used as a binding material. It should be noted Surkhi & Binder are not chemical inert substance & hence cannot be used with cement. Thus, sand only can be used in cement mortor. Cement mortor is used, where mortor of high strength & water resisting properties is required.

4) Gauge mortor :- To improve the quality of lime motor & active early strength of the cement is some times added to it. This process is known as Gauge. It makes the lime water economical, stronger & Denser. The usual proportional of cement to lime by volume is above 1:6 or 1:8. It is also known as composite or lime cement mortor.

5) Gypsum mortor :- This mortor are prepared from Gypsum binding material such as building gypsum.

Nature of Application :- According to the Nature of application mortor is classified into 2 categories. i.e.,
1) Brick laying mortor 2) Finishing mortor.

1) Brick laying mortor :- The mortor for Brick laying are intendent to use for brick work & walls.

2) Finishing mortor :- This mortor include common plastring work & mortors for developing archectect -ual or ornamental effects & aestetic views.

Special mortor :- Is can be classified into
1) Fire resistance mortor 2) Ligh weight mortor.
3) Packing mortor 4) Sound absorbing mortor.
5) X-Ray Shielding mortor.

1) Fire resistance mortor :- This mortor eare perpared by adding alumineous cement to the finely crushed & powdered fired bricks. The use of proportion is one part of alumineous cement to 2 parts of powder of fire bricks. This type of mortor is used along with the fire bricks for lining furnace fire places, Oven etc

2) Light weight mortor :- This mortor is prepared by adding material such as wood powder, jute fibres coils etc. This mortor are used in the Sound & heat proof of construction.

3) Packing mortor :- To pack oil wells the special mortor possesing a high homogencity, water resi -stance, ability to form solid water proof in pluges in cracks & voids of rocks etc are to form. The varities packing mortor includes Ceme -nts & loam, cement loam & sand.

7/12/2017

4) Sound Absorbing mortor :- To reduce the noise level the sound absorbing plastre is form. The density of such mortor varies from 6 - 18 KN/m³. The binding materials employed by port land cement, lime, gypsum etc. The aggregates are formed from light weight porous materials such as pumice, Sindres etc

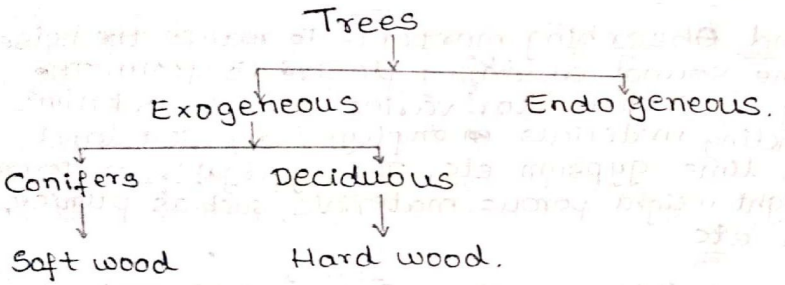
5) X-Ray sheilding mortor :- This type of mortor is used for providing the plaistering coat to walls & seelings of x-ray cabinates. It is a heavy type of mortor with bulk density over 22 KN/m³. The aggreg -tes are obtained from heavy rocks & suitable ad -mixtures are added to enhance the protective property of such mortor.

Requirement of good mortor :-
* It should be capable of developing goood adhes -ion with the building such as
* It should be capable of resisting penetration of rain water.
* It should be cheep & economical.
* It should durable.
* It should be easily workable.
* It shouldn't effect the durablity of materials with which is comes into contact
* It should set quickly so that speedy construction is achived.
* The joints formed by mortor shouldn't develop any cracks.

Timber :-

The timber denotes wood which is suitable for building or carpentaryng or various other engineering work purposes and it's applied to the trees meas -uring not more than 6mm "grith" or circumference of the "trunck"

The classification of timber is as shown in fig.



Exogeneous :- This trees are increases in bulk by growing outwards & distinct conjugative rings are form in the horizontal section of such a tree. This this rings are known as "annual rings," because one such ring is added every year. & This rings are useful in predicting age of the tree. Most of the trees are used in enggi purpose is obtained from this category of tree.

This exogeneous trees feurther sub divided into 2 groups. 1) Conifers 2) Deciduous.

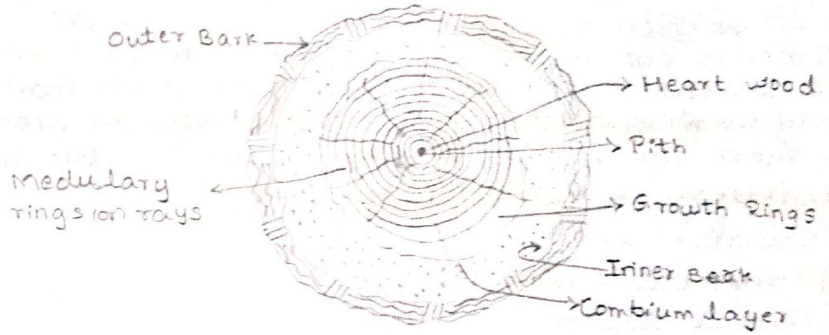
Conifers :- This trees are also known as evergreen trees. As these trees bear cone shapes fruits, It's called as conifers. This trees yields soft woods which are generally light in weight & week. They show distinct annual ring.

Deciduous :- This are also known as the broagh leave trees. The timbers for engg. purpose is most derived from deciduous trees. These tree yeild hard wood which are usually closed grained, strong, heavy & durable. They donot show distinct annual rings.

Softwood and hard wood :-

The wood obtained from Conifer class of tree is soft wood & that obtained from broad leave tree as called as hard wood. It is quikely like some varity of soft wood may prou to be stronger than some varity hard wood.

Structure of Exogeneous trees :-



Processing of timber :-

Following are the 4 stages of processing of timber.

1) Felling of trees.
2) Seasoning of timber.
3) Conversion of timber.
4) Preservation of timber.

1) Felling of trees :- The trees have to fell on to th ground in order to obtained the timber. The tree should be felled when they have reached near to the maturity. The heart of the wood starts decaying if it is felled after maturity & sap wood would be in excess, if felled before attainment of maturity. The age for felling of good trees varies from 50-100 years. The trees should be feld the sap is at rest

2) Seasoning of timber :- when is newly felled tree it containts about 50% or more of its own dry weight of water. The water is to be removed before the timber is use for any Enggi. purposes. This process of dring of a timber is known as seasoning of timber. The moisture should be extracted in season -ing under the controled condition as nearly as

possible at a uniform rate from all parts of timbers. The natural seasoning is carried out by natural air & hence it is some times refered as air sea-soning. And for this purposes the timber is stop-ped under roof with open spaces & free air is allowed to circulate. The various methods of artificial seasoning are boiling, kiln seasoning, water seasoning, Chemical seasoning and Electrical seasoning.

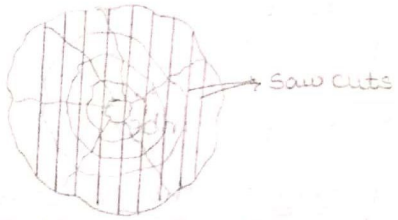
3) Conversion of timber:- The process by which the timber is cut & saw into suitable section is known as conversion. For this purpose the power machines may be employed at different stages of process.

There are 4 types of Sawing are as following

a) Ordinary or flat or slab sawing.
b) Quarter sawing.
c) Tangential Sawing.
d) Radial Sawing.

13/9/2019

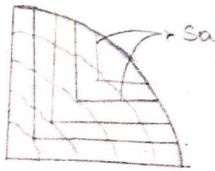
a) Ordinary or flat or slab Sawing:-



Ordinary - Sawing

In this type the saw cuts are tangential to the angular rings and cut through the cross section of the timber piece. This is very quickly & easy method of sawing and widely adapted in our country. It is also the most economical method & the wastage is minimum.

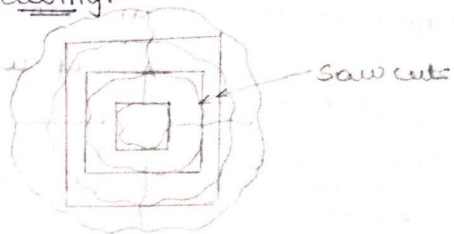
b) Quarter Sawing:-



Quarter Sawing

The saw cuts are at right angles to each other. It produces fine figures when adapted in case of timber having distinct medulary rays.

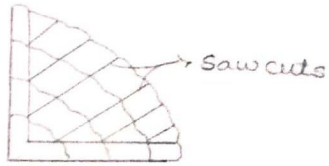
c) Tangential Sawing:-



Tangential Sawing:

The saw cuts are tangential to the annual rings and they meet each other at right angle. This meth-od is adopted when the annual rings are very distinct and medulary rays are not clearly defined.

d) Radial Sawing:-



The saw cuts are made radially in a para-llel direction to the medulary rays. This method is used for the conversion of hard timber. It gives wood with decorative effects. The timber obtained by this method shrinks and waps to be less degree and it is distorated to the minimum, but the wastage is maximum & the cast sawing proove-s to be higher.
and cast sawing prooves to be higher.

4) Preservation of timber:-

In order to increase the life of the timber it as to be protected from the attack of fungi, insects etc. This process is known as preservation of timber. The most commonly used preservatives are coal tar, oil paint etc.

Market forms of timber:-

The following are the various forms of converted timber.

1) Batten:- This a piece of timber in which breath & thickness don't exceeds 5cm.

2) Board:- It is a plank, the timber of pieces with parallel size. It's thickness is less than 50mm & width exceeds 150mm.

3) Plank :- It is a timber pieces with parallel sides It's thickness is less than 50mm.

4) Pole :- It is a long log of wood. It's diameter don't exceed 230mm.

5) Scantling :- It is a timber piece whose breath & width is not exceeds 500mm. but the length of is less than 200mm

6) Quartering :- It is a square piece of timber, the length of the side being 50mm to 150mm.

MODULE -2

Foundation.