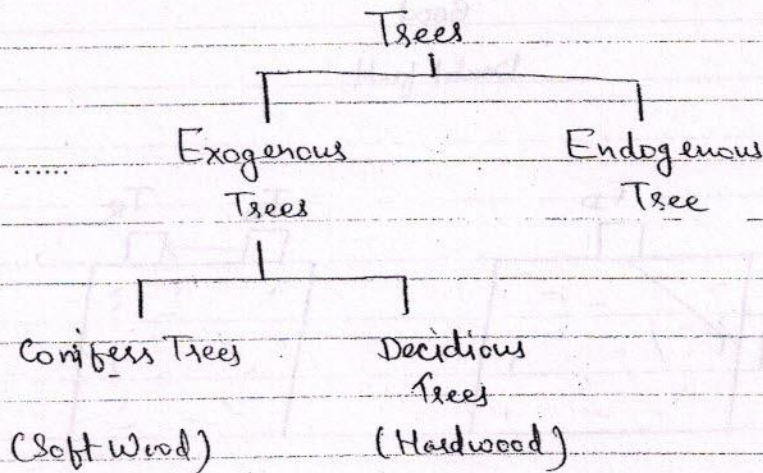


Timber

Timber used for construction activities is derived from the trees that are generally are of two type.



- Exogenous Trees :-
- (i) These are the type which grow in bulk by increasing in outward direct.
 - (ii) These trees consist of circular rings along their horizontal section which is added up each year hence are been termed as annual rings and are being used to ascertain the age of the trees.
 - (iii) Timber used in Engg. activities are mostly derived from these trees only.
 - (iv) These ~~the~~ Trees are further of two type

" Conifers and Deciduous Tree "

(A) Conifer Trees :- These are the type of trees which never shed their leaves untill new ones are grown hence are also been termed as Evergreen trees

(i) These trees bear cone shaped fruits.

(Hence are termed as Conifer trees)

(ii) These trees possess distinct annual rings and indistinct medullary rays.

(iii) The wood obtained from these trees is soft, light, weak, resinous and light in colour.

{Hence also termed as Soft wood Trees}

Example:- Chir, Deodar, Pine, Spruce.

(B) Deciduous Trees:- These trees are also termed as broad leaved trees.

(i) They shed their leaves in autumn that again grow back in springs.

(ii) These trees possess ⁱⁿ distinct annual rings but distinct Medullary Rays.

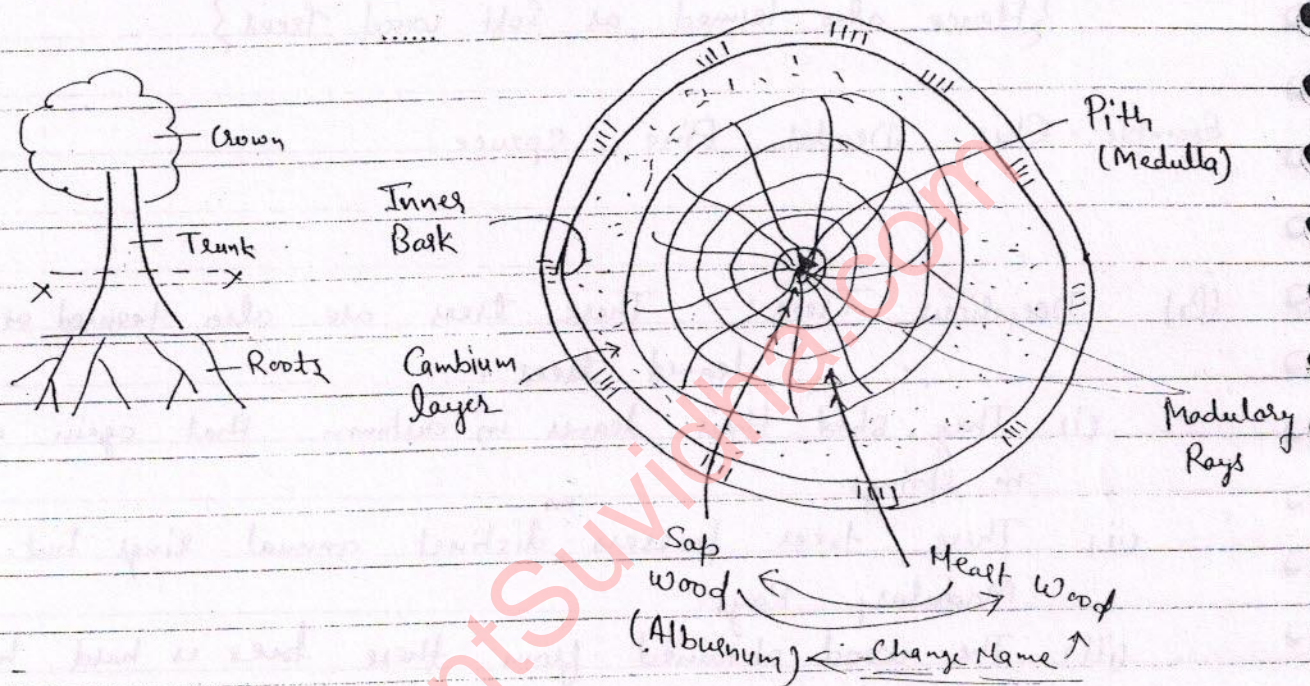
(iii) The wood obtained from these trees is hard, heavy, strong, non-resinous and dark in colour, Hence are termed as Hard wood trees.

(iv) Timber used in Engg. activity is mostly derived from these trees only.

Sal, Teak, Oak, Babul, ~~Bamboo~~, ~~Cane~~, ~~Palm~~

Endogeneous Trees:- These are the trees which grow in bulk in inward directⁿ and consist of fibrous mass throughout their longitudinal c/s. Hence have limited legg. application.

Bamboo, Cane, Palm.



- (ii) The innermost central portion of trees is termed as Pith it entirely consist of the cellulose that nourishes the tree in it's young age.
- (iii) The darkness portion of trees that signifies it doesn't take any active part in growth of tree.
- (iii) As the trees grow old with ceases to be active and represents the decay of wood.

Heart Wood :- The inner annual rings surrounding the pith constitutes the heart wood. It's colour is also comparatively dark that represents the dead portion of the tree. i.e. it also doesn't take any active part in growth of trees but imparts strength and rigidity to it. From Engg. point of view heartwood is most suitable for constructⁿ activity.

Sap Wood (Albumen) :- The outer annual rings in b/w the heart wood and Al Cambium layer constitutes the Sap wood.

- (i) This portion of the tree takes the active part in it's growth and it's colour is comparatively light that that of hard wood and pith.

Cambium layer :- Cambium layer consist of sap that is still not been converted into Sap wood. Hence it represents the future growth of the tree.

- (i) If due to any reason bark of tree is removed, exposing the cambium layer, the cells of the wood ceases to be active that finally results in the death of the tree.

Medullary Rays :- These are the radial fibre that extends from pith to the cambium layer and holds the annual rings of Heartwood and Sap wood together in position thereby impart strength to the timber section in transverse direction.

Bark :- It is the protective covering provided around the cambium layer in order to safeguard the future growth of the tree.

Processing of Timbers :- Processing of timber is carried out in 4 distinct operations.....

- (1) Felling of Trees.
- (2) Seasoning of Timber.
- (3) Conversion of Timber.
- (4) Preservation of Timber.

(1) **Felling of Trees :-** (1) Felling of the trees should be done when it attains sufficient maturity as if under matured tree is cut it would yield soft wood, and if over matured tree is cut it would yield decay wood in either of the cases wood can't be used for engineering activities.

(2) Optimum age for felling of trees varies b/w 50 to 100 years.

(3) The trees should be cut such that the max^m proportion of wood is obtained from it for which the cuts are made at the section just above the ground.

(4) The felling of the trees should be carried out in the season when the movement of the sap is min^m.

(5) Hence it is generally avoided in Aut Autumn and Spring when sap is in vigorous motion.

(6) In hilly region the cutting of trees is done in mid summer as in winter rain occurs.

In plain area cutting of trees is done in mid winter as in summer excessive loss in water (moisture) may result in cracking.

(2) Seasoning of Timber:- Newly felled trees contains Approx 50% of water by wt. hence it is dried before using it as construction material, this process of drying of the timber to make it suitable for engg. purpose is termed as seasoning.

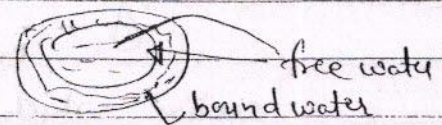
(i) This water in timber is generally present in two forms:-

In form of sap

& In form of moisture.

Viscosity $\uparrow\uparrow$ - Greater time for Evaporation

(ii) This water is either present in voids or in cell walls. The former water is termed as free water and the later is termed as bound water.



(iii) During the seasoning of timber free water is removed. And the point at which it is completely removed is termed as fibre saturation point.

(iv) Seasoning of timber is carried out either by Naturally
or by Artificially.

Methods of Artificial Seasoning :-

- (a) Boiling
- (b) Electrical Seasoning
- (c) Kiln
- (d) Water
- (e) Chemical

(a) Boiling :- It is the process in which logs of suitable size is immersed in water temp. of which is raised upto the boiling point and is maintained upto 3-4 hrs. Logs are removed from water and are seasoned naturally. Due to increase in temperature of log the rate of evaporation increases that drastically reduces the seasoning period. It is the one of the quickest method of seasoning but is comparatively more costly.

(b) Electrical Seasoning :- In this method of seasoning alternating current is passed through the timber section which resists its movement as bad conductor of electricity. Due to which heat is developed which raises the temperature of the timber section thereby reduces the duration of seasoning.

(c) Kiln Seasoning :- It is the method of seasoning in which timber section is placed in air tight chamber and fully saturated air is forced into it at temperature of $40-35^{\circ}\text{C}$.

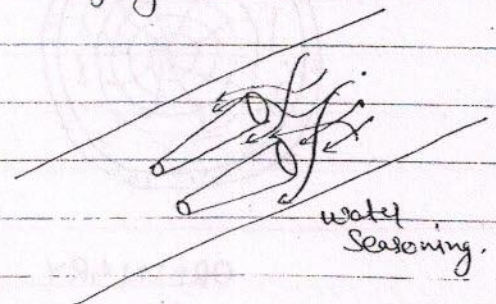
The temperature inside the kiln is raised then due to which heating of timber section takes place without evaporation, relative humidity of the air then reduced that carries out the evaporation of the timber uniformly.

(d) Water Seasoning :- (i) It is the mtd of seasoning in which timber section of suitable sizes is immersed completely in water and is subjected to the stream of flowing water.

(ii) The larger portion of the section is placed on the upstream side in order to create the turbulence and to carry out the removal of sap after which it is seasoned naturally. Water that replaces sap is removed comparatively faster thereby bringing down the seasoning duration.

(e) Chemical Seasoning :-

(i) It is the mtd of seasoning in which timber section is immersed in the solution of suitable salts that increases the rate of evaporation.



(3) Conversion of Timber :- The process of giving desired shape and size to the timber section is referred as processing of timber.

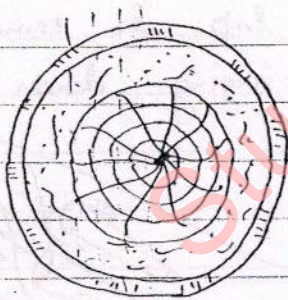
(i) Processing of timber can be carried out by any of following Mthd :-

(a) Ordinary Sawing :- It is the mthd of sawing in which sockets are made tangential to the annual rings of timber.

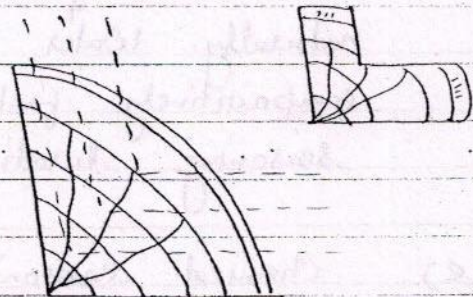
(i) It is the most general, economical, and easiest mthd of sawing.

(ii) Timber section obtained by this Mthd is lieble to twist and warp due to unequal shrinkage in sap wood and hard wood.

(iii) The wastage of timber in this mthd of sawing is min^m hence this mthd is found to be economical than other mthds of sawing.



ORDINARY
SAWING

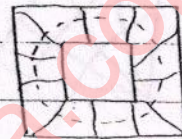
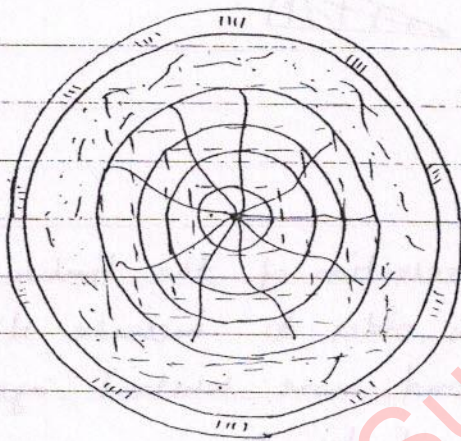


QUATER
SAWING.

(b) Quater Sawing :- It is the method of sawing in which the cuts are made at Right angles to each other.

- (i) This method is generally adopted in section having indistinct medullary rays.
- (ii) Sections obtained by this method, are liable to bent in transverse direction.

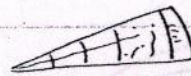
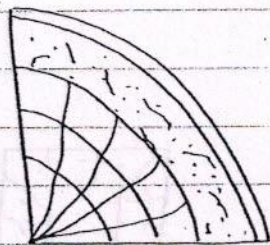
(c) Tangential Sawing :-



It is the method of sawing in which the cuts are made tangential to the annual rings which meet each other at right angles. This method is also adopted for the section which has indistinct Medullary Rays.

- (i) Section obtained by this method is weakest among all in case. As in this case Medullary rays are also being cut which holds the Annual rings together in position.

- (d) Radial Sawing :- (i) It is the mthd of sawing in which cuts are made parallel to the medullary rays in radial direction that imparts decorative effect to it.
- (ii) Sections obtained by this mthd is strongest among all but wastage in this case is comparatively more.



- (4) Preservation of timber :- Preservation of the timber is carried out in order to increase its life make it more durable and more resistant against the attack of fungus, insects and termites.

- (i) Preservation of timber can be carried out by any of the following mthds :-

- (1) Aseu Treatment :- $(As_2O_5 \cdot 2H_2O, CuSO_4 \cdot 5H_2O, K_2Cr_2O_7 / Na_2Cr_2O_7)$
Mthd of preservation in which timber surface is coated, with the solution prepared by the addition of Arsenic penta oxide, copper sulphate, Potassium dichromate or Sodium dichromate.

- (i) This process increases the resistance of timber section against the attack of white ants

(b) (2)

(b) Application of Chemical Salts:- Chemical salts like copper sulphate, zinc chloride, mercuric chloride and sodium fluoride increases the durability of timber section. By making it more resistant against cracking, shrinkage and warping.

(c) Coal Tar:- In this method of preservation timber surface is coated with hot tar which makes it resistant against the fire.

(i) The process of application of coal tar on timber section is known as Tarring.

(ii) Application of tar gives unpleasant smell and reduces its aesthetic importance.

(d) Creosote Oil:- Creosote oil is obtained from the distillation of tar.

(i) Application of creosote oil on timber section almost doubles its life.

(ii) The method of application of creosote oil on timber section is called as "Creosoting" in which logs of timber are placed in an air tight chamber and creosote oil at pressure of $0.7 \text{ to } 1 \text{ N/mm}^2$ and temperature of 50°C is pumped into the chamber. that results in uniform application and penetration of oil over the surface of the timber section.

$$\{ 0.7 \text{ to } 1 \text{ N/mm}^2 \}$$

(e) Oil Paints and Solignum Paste :- These increases the resistance of timber section against the penetration of water

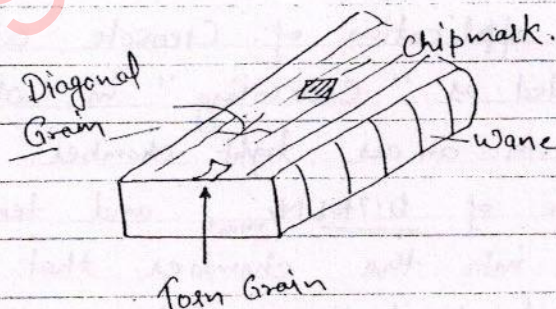
* Defects in timber :-

- (1) Defects due to conversion.
- (2) ————— Attack of fungi.
- (3) ————— Natural forces.
- (4) ————— Seasoning.

(1) Defects of timber due to conversion :-

{ Chip mark, Diagonal Grain, Torn Grain, Wane }

(a) Chip mark :- It is identified by marks of chips over the surface of finished timber section that is left by the parts of planing machine.



(b) Diagonal Grain:- (i) This defect is identified by the diagonal mark over the straight grain structure of timber surface that is left due to improper sawing.

(c) Torn Grain:- This defect is identified as small depression over the finished surface of timber section i.e. formed due to the falling of tools during the conversion.

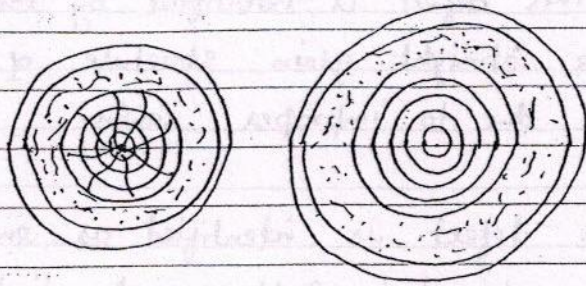
(d) Wane:- This defect is identified by the presence of original grounded surface over the finished timber section.

(2) Defect due to attack of fungi:- Timber section is attacked by fungi if and only if moisture content in it is more than 20%, and there is availability of air surrounding that section.

(3) Blue stain, Sap stain, Brown Rot, White Rot, dry Rot, Wet Rot.

(a) Blue stain:- A certain type of fungi carries out the decomposition of timber section leaving behind blue coloured spots resulting in the disease termed as "Blue stain".

(b) Sap stain:- There are certain type of fungi which don't carry out the decomposition of entire wood but feeds on its sap, resulting in change of its colour and leading to disease termed as "Sap stain".



(c) Brown Rot :-

It is the disease of the timber that is caused due to the removal of cellulose from it by a certain type of fungi that leads to the development of reddish brown stains over its surface. Hence the disease is termed as brown Rot.

(d) White Rot :- It is just opposite to that of Brown Rot in which lignin is removed by particular class of fungi from the timber section fibre.

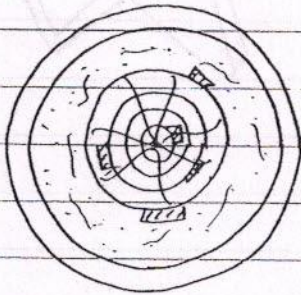
(e) Dry Rot :- It is found when there is no free circulation of air around the timber section which results in the growth of certain type of fungi that carries out the decomposition of wood and converting it into dry powder form.

(f) Wet Rot :- This is found when timber section is subjected to alternate wetting and drying. due to which, a particular type of fungi grows which carries out the chemical decomposition.

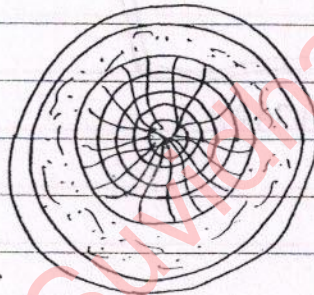
of timber section, resulting in development of greyish spot over the timber section.

- (3) Defects due to Natural forces :- The cracking of timber section that results in the separation of the fibres either partially or fully is termed as cracks. Shakes.
- Cup
 - Heart Shakes
 - Ring
 - Star

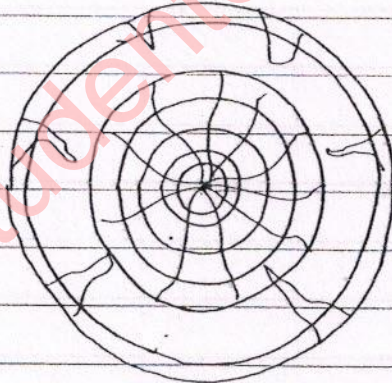
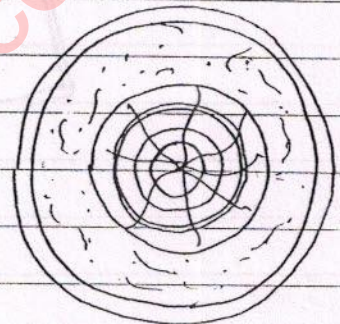
"Cup Shakes"



"Heart Shakes"



Ring Shakes.

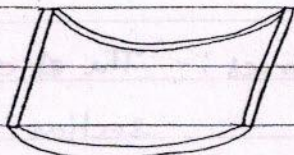


Star Shakes.

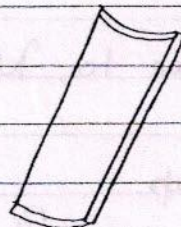
(4) Defects due to seasoning :-

{ Bow, cups }

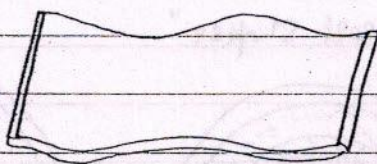
{ Twist, warp }



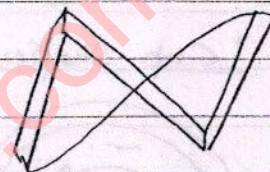
..... -! Bow !-



-! Cup !-



-! WARP !-



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