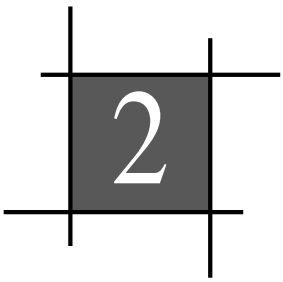

Timber

The word timber refers to the wood used for construction. This word derives from old English word 'timbrian' which means 'to build'. Living tree yielding good timber is called *standing timber.* After felling and separating branches, it is known as *rough timber.* when bark its removed and stem is roughly converted into pieces of suitable length for transportation is known as *log.* After the log is seasoned and converted into commercial sizes like planks, battens, posts and beams, it is known as *converted timber.*

Learning Objectives

After studying this chapter, the student will be able to:

- know the properties of timber, and
- select suitable timber for building works.

2.1 ENGINEERING ASPECT OF TIMBER

Timber was used as a building material even by primitive man. Many ancient temples, palaces and bridges of can be seen even today. Wide use of timber for engineering aspects is due to its special properties as given below:

- It is a naturally available, ready to use material. The rough timber is used for temporary works like scaffolding, centring shoring and strutting
- It can be converted to any size and shape easily and hence used for doors, windows, flooring and roofing.
- Timber has good strength and hence used for making load bearing members like beams, columns, trusses and piles.

Outer bark: It is the outermost skin of the tree. It consists of wood fibres. Fissures and cracks may be present in this layer.

Medullary rays: These are thin radial fibres, extending from the pith to the cambium layer. They hold the annual rings together.

Table 2.1 shows the difference between soft wood (coniferous) and hard wood (deciduous) trees.

Table 2.1 *Comparison between soft wood and hard wood*

Soft wood	*Hard wood*
Annual rings are distinct, medular rays are not distinct	Annual rings are not distinct medular rays are distinct
Light in colour	Dark in colour
Light in weight	Heavy
Resinous structure	Close grained structure
Strong in resisting direct tension but weak in resisting compression or shear	Equally strong in resisting tension, compression and shear

Endogenous tress

These trees grow inwards. In these trees fresh fibrous mass is in the innermost portion. These trees do not yield good timber for structural works.

Example: Bomboo, cane

Classification based on durability

The Forest Research Institute of India conducts durability tests on specimens of size 600 × 50 × 50 mm by burying them in the ground upto half their length and observing them over several years. On the basis of durability it classifies trees into the following three classes:

1. ***High durability:*** If the average life is more than 10 years.
2. ***Moderate durability:*** If the average life is 5-10 years.
3. ***Low durability:*** If the average life is less than 5 years.

Classification Based on Grading

Based on permissible stresses, defects and so on, IS:12326-1976 classifies timber into three grades: Special Grade, Grade-I and Grade-II.

Classification Based on Availability

Based on availability, IS: 339-1963 classifies timber as:

X – Most common, 1415 m^3or more per year.

Y – Common, 335 m^3 to 1415 m^3 per years.

Z – Less common, less than 335 m^3 per year.

2.3 SEASONING OF TIMBER

Seasoning is the process of reducing moisture content in a freshly cut tree to the desired level.

Objects of seasoning

The objects of seasoning are to:

1. increase the durability by protecting it from fungi, insects and other causes related to moisture content;
2. impart hardness, stiffness, strength and resistance to electric shocks;
3. maintain shape and size;
4. make it workable;
5. make it fit to receive painting;
6. make it suitable for gluing;
7. reduce the tendency of cracking and warping;
8. decrease weight and save transportation cost and
9. allow to burn easily, if used as fuel.

Methods of seasoning

Methods of seasoning may be broadly grouped into:

(a) Natural seasoning

(b) Artificial seasoning

(a) Natural Seasoning

This type of seasoning may be in the form of:

(i) Air seasoning

(ii) Water seasoning

(i) Air Seasoning: In a shed with a platform of height 300 mm timber is stacked as shown in Fig. 2.2. Care is taken to see that air can circulate around each timber balk. Moisture content decreases over a period of time. Well seasoned timber contains only 15 percent moisture. This process is slow but it is the best method of seasoning.

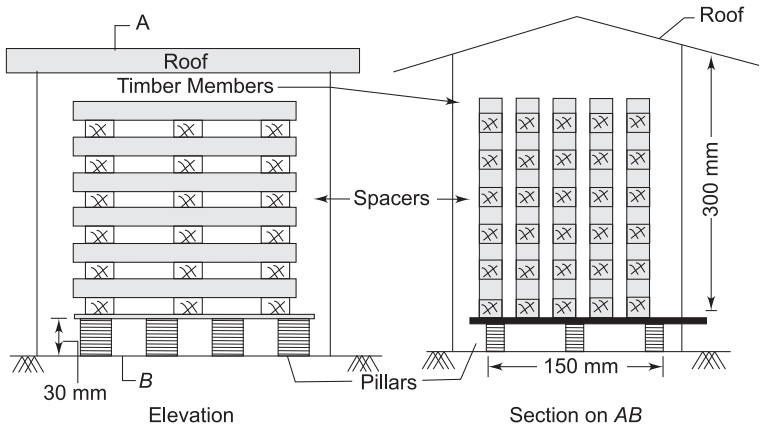

Fig 2.2 *Air seasoning*

(ii) Water seasoning: In this method logs are placed in a river with thicker ends pointing upstream. A number of logs are tied together and the group is anchored to a standing tree or to rock to see that it is not carried away by the river. The sap contained in the timber is washed out over a period of 2-4 weeks. The timber is then stacked in a dry place. Compared to air seasoning this method takes less times.

(b) Artificial Seasoning

The various methods of artificial seasoning are:

(i) Boiling
(ii) Kiln seasoning
(iii) Chemical seasoning
(iv) Electrical seasoning

(i) Boiling: In this method timber is immersed in water and then water is boiled for 3-4 hours. Instead of boiling hot steam may be passed over the timber. Them it is dried slowly. This process of seasoning is fast but costly. It reduces the strength of timber to some extent.

(ii) Kiln seasoning: A kiln is an airtight chamber. In this timber to be seasoned is placed and hot air is pumped in. After moisture content is brought down, the temperature is reduced and the chamber is allowed to cool.

The kiln used may be progressive type also. In such a kiln, carriages carrying timber moves from one to the other end slowly. Hot air is pumped from discharging end so that temperature is higher at that end compared to at the charging end. As timber comes out at discharging end sufficient moisture is removed.

This method is suitable if seasoning is required on large scale, since in this case investment is high.

(iii) Chemical seasoning: It is also known as salt seasoning. In this method, the timber is dipped in a solution of sodium chloride or sodium nitrate. The surface salt draws out inner moisture. This preliminary treatment by chemicals ensures uniform seasoning across the section. It is then taken out and seasoned in the ordinary way.

(iv) Electrical seasoning: In this method, high frequency alternating current is passed through the timber. Heat is introduced internally and the timber starts drying. As the moisture content reduces resistance to electricity increases. The measure of resistance may be used to stop seasoning at appropriate level. This method is fast and uniform. Many plywood companies adopt this method. It is a costly technique.

Advantages of natural seasoning

- It requires low investment.
- It does not require skilled labour.
- It is ideally suited, to low and non-uniform market demand.

Disadvantages of Natural Seasoning

- It needs larger space for seasoning.
- The process is very slow, usually takes 2-4 years.
- As the process depends on natural air, there is no control on it.
- Ends may dry fast and split. Interiors may remain moist while exteriors dry fast.
- The moisture content may not be brought down to the desired level.
- Chances of fungi and insect attack cannot be ruled out during the seasoning period.

Advantages of artificial seasoning

- Drying is uniform, hence defect such as shrinkage, cracks and wrapping are minimum.
- Drying process is fast, hence economical.
- Moisture content can be reduced to the desired level.
- Chances of fungi and insects attack are low.
- Wood becomes more suitable for painting.

Disadvantages of artificial seasoning

- It needs high investment.
- Skilled supervision is required.
- If demand is low and intermittent, it is uneconomical.

2.4 CONVERSION OF TIMBER AND MARKET FORM

Conversion of timber is the process of cutting and sawing timber into suitable sizes required by the users. This process is carried out in timber yards. Market names of converted timber are battens, plank, pole, scantling, etc. The preferred length is 0.5 m and onwards in 0.1 m steps The nominal size varies from 10, 15, 20,

25, 30, 40, 50, 60 mm and then onward increasing by 20 mm, going up to 200 mm.

The width of cut sizes are:

10 mm thick: 40, 50, 60, 80, 100 and 120 mm wide

15 mm thick: 140, 160, 180 mm wide

20 mm thick: 200, 220, 240 mm wide

More than 20 mm thick: 260, 280, 300 mm wide.

Method of sawing

Sawing is a skilled job. About 3-6 mm allowance should be made for shrinkage and loss during planing. The saw cuts should be tangentially parallel to the annular rings and practically parallel to the direction of medullary rays. The pith should be avoided in the final section. Cut should be taken so as to keep wastage to a minimum. The following are different types of sawing:

- Ordinary sawing
- Quarter sawing
- Tangential sawing
- Radial sawing

Figure 2.3 shows the different types of sawing

The method of sawing depends upon several factors, some of them are:

- The size of the log
- The condition of the log
- Timber species
- Size of sawing machine
- End use of converted timber
- Minimizing wastage

Ordinary sawing: In this case sawing is tangential to the annual rings. All cuts are parallel to each other. In this case wastages is minimum but each plank contains the portions of different moisture content, hence the chances of warpage are high.

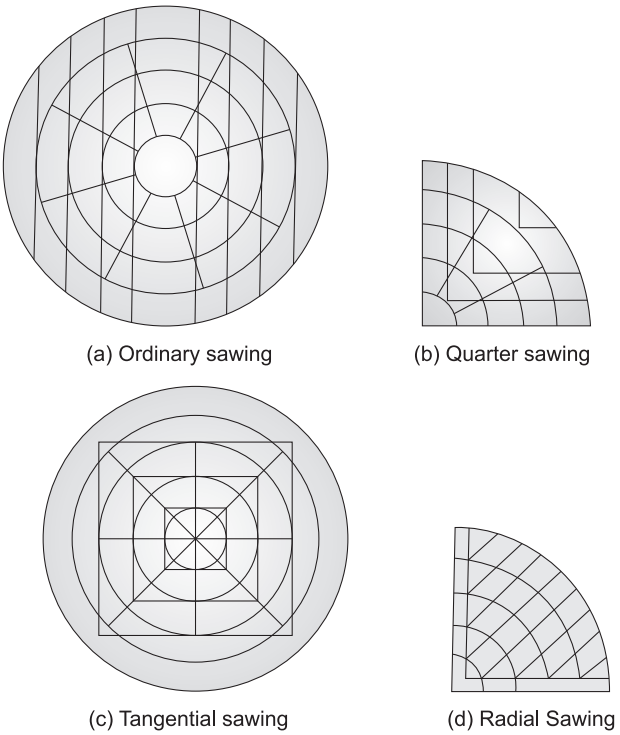

Fig. 2.3 *Methods of sawing*

Quarter sawing: It produces sections of more uniform moisture content and hence warpage is less. However, there is tendency to bend in transverse direction.

Tangential sawing: The sawing is at right angles to medullary rays. This method is adopted when medullary rays are not distinct. As medullary rays imparting strength are cut the planks obtained are weak.

Radial sawing: In this method cuts are radial and parallel to medullar rays. In this case shrinkage and warpage are minimum. However, there is more wastage and it needs more labour. This method is more suitable for hard wood.

2.5 DEFECTS IN TIMBER

The various defects likely to occur in timber may be grouped in the following divisions:

- Due to natural forces
- Due to attack by fungi
- Due to attack by insects
- Due to erroneous seasoning

Defects due to natural forces: The following defects are caused by natural forces:

1. Knots
2. Shakes
3. Rind galls
4. Upsets
5. Twisted fibres
6. Wind cracks
7. Burls
8. Dead wood
9. Foxiness
10. Stain

1. Knots: Knots are the stumps of broken branches of the tree during the growth of the tree. Grains are distorted in this portion. These are dark and hard pieces. Figure 2.4 shows two varieties of knots, namely, live knot and dead knot. In the live knot, fibres are firmly held by the surrounding wood, whereas fibres are not held firmly in a dead knot.

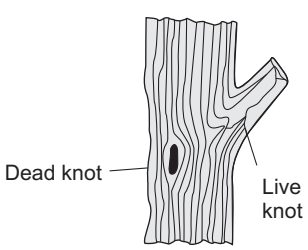

Fig. 2.4 *Knots*

2. Shakes: Shakes are cracks in timber due to excessive heat, wind or frost during the growth of the tree. Depending upon their shapes and positions, shakes are classified as cup shakes, heart shakes, ring shakes, star shake, etc. (Fig. 2.5).

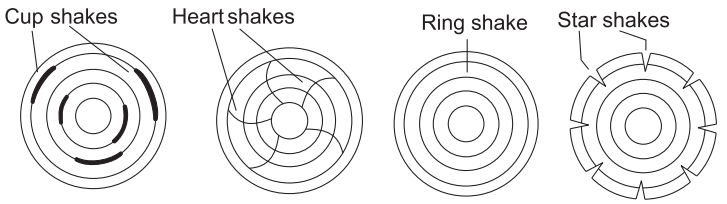

Fig 2.5 *Shakes*

3. Rind gall: Due to imperfect cutting of branches during the growth of tree, the tree may be wounded. To heal the wounds. curved swelling takes place. This defective portion is called rind gall (Fig. 2.6).

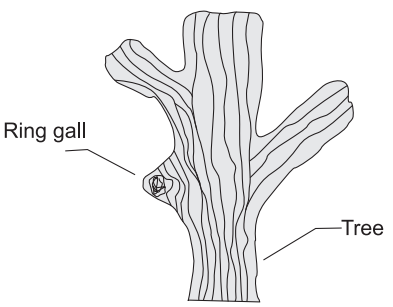

Fig 2.6 *Rind gals*

4. Upsets: It is injury due to crusting during the growth of the tree. Figure. 2.7 shows this type of defect. It is also known as rupture.

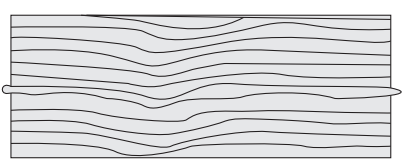

Fig. 2.7 *Upsets*

5. Twisted fibre: Heavy winds cause young trees to get permanently twisted. It can be used as a pole, since twisted fibres add to the strength of a pole. Figures 2.8 shows such defect.

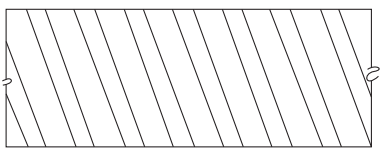

Fig 2.8 *Twisted fibre*

6. Wind cracks: These are tracks on the exterior surface due to excessive shrinkage. Figure 2.9 shows this types of defect.

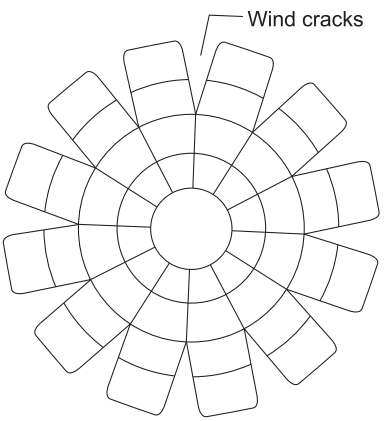

Fig 2.9 *Wind carcks*

7. Burls: If a tree receives a shock when it is young the growth is completely upset and irregular projections appear this types of defect is known as burl.

8. Dead wood: A standing aged tree contains dead wood. This portion is light in weight and reddish in colour.

9. Foxiness: This defect is indicated by red or yellow tinge in wood. It is due to poor ventilation during storage or due to growth of tree in a marshy soil

- Shocks received by tree during its growth
- Use of timber without proper seasoning
- Bad storage or stacking
- Fungi attack
- Attack by insects
- Contact of dampness during storage

2.7 PRESERVATION OF TIMBER

Except teak all other timber need treatment with preservation to protect it from attacks of fungi, insects and the weather.

Requirements of wood preservative

- It should effectively resist fungi, insects and the action of weather
- It should possess good penetration and spreadability.
- It should be durable.
- It should give good appearance.
- It should should not affect the strength of timber.
- It should be free from unpleasant smell.
- It should be non-inflammable.
- It should be cheap and easily available.
- It should cover large area with small quanitiy.

Widely used preservatives

The following are widely used preservatives

- Coal tar
- Solignum paints
- Chemical salt
- Creosote
- ASCU

1. Coal tar: By applying hot coal tar with a brush, timber can be protected from attack by fungi and insects. Since it spoils the appearance, this treatment is mainly restricted to unimportant structures likes fence posts, electric pole, etc.

2. Soligmum paint: It is a special paint which protects timber from termite attack. After thorough cleaning two to three coats of paint are applied on the wood. Painting is necessary time to time.

3. Chemical salt: Copper sulphate, zinc chloride and sodium fluoride are dissolved and are used as preservative. After treatment with these chemicals, paints are applied on timber to improve appearance.

4. Creosote: Creosote is oil obtained by the distillation of coal tar. Timber is kept in a chamber and creosote is pumped in at higher temperature. A temperature of 50°C is maintained for 2-3 hours. It gives good protection to timber.

5. ASCU: This is a special preservative developed by the Forest Research. Institute, Dehradun. It consists of 1 part of hydrated arsenic pentoxide, 3 parts of copper sulphate and 4 parts of potassium dichromate or sodium dichromate. This is also available in powder form. By mixing 6 parts of its with 100 parts of water, the solution is prepared and sprayed on the surface of timber. Then the surface is painted.

2.8 PROPERTIES OF GOOD TIMBER

A good timber has the following properties:

- It is free from serious defects like knots, shakes and cracks.
- It has uniform colour.
- Its texture is fine and even.
- It has close grains.
- It has pleasant odour when freshly cut.
- It has higher density.
- It is hard.
- It has higher strength.
- It has higher modulus of elasticity.
- Its fire resistance is high.

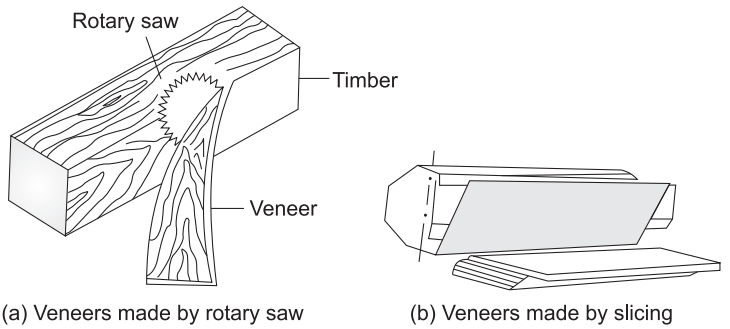

Fig. 2.10 Cutting wood to get veneers

Plywoods of the following types are manufactured:

- Ordinary grade, used as packing material.
- Exterior grade, made of good quality wood and bonded with waterproof glue.
- Marine grade, in which core and exterior are of superior quality.

The thicknesses of plywood boards are as given below:

- 3 ply – 3, 4, 5, 6 mm
- 5 ply – 5, 6, 8, 9 mm
- 7 ply – 9, 12, 15, 16 mm
- 9 ply – 12, 15, 16, 19 mm
- 11 ply – 19, 22, 25 mm
- More than 11 ply – as per order

3. Fibre board: Wooden chips and vegetable fibres are placed in boiling water till fibres separate. These fibres are blended with resin and steam under pressure. After releasing pressure, fibres are allowed to flow out and cleaned. Then fibres are spread in the form of sheets and pressed under controlled heat and pressure. Thus fibre boards are manufactured.

The thickness of these boards varies from 25 to 32 mm and in size 1.8 × 1.2 m, 2.4 × 1.2 m, 2.4 × 1.8 m. These boards are suitable for wall panelling, ceilings and flush doors.

4. Particle boards: These boards are manufactured from chips of wood, rice husk and bagasses obtained after crushing sugar cane. First moisture content in these materia is reduced to 15 percent by drying. Then gluing material like formaldehyde is sprayed and spread in three layers along with a resin mix. The outer layers consist of fine particles and richer resin content. The mat is pressed with hydraulic presses.

Particle boards are heavier. They have reasonable strength. They are used as partitions and for making furniture. Figure 2.11 shows a typical board. The dimensions of boards available are as given below:

Thickness: 6, 9, 12, 15, 18, 22, 25, 27, 30, 35, 40 mm

Width: 450, 600, 900, 1000, 1200, 1500, 1800 mm

Length: 900, 1000, 1200, 1500, 1800, 2100, 2400, 2750, 3000, 3600, 4800 mm

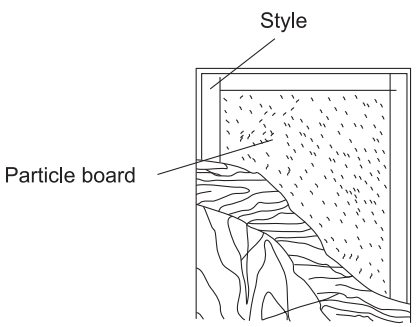

Fig. 2.11 *Particle board*

5. Block boards: Block boards are known as batten boards also. The core of these boards consists of strips of wood of width 25-80 mm, glued together. Veneers are glued on either side of the above mat. Thickness of the veneer used is 0.5-1.5 mm while total thickness is 18 mm and above. These boards are used for making bodies of buses, railway coaches, partitions and furniture.

6. Hard board: Hard board is made from wood and wood waste, which is pulped and mixed with paraffin wax and formaldehyde.

2. Bamboo: It is a woody grass. It is flexible, strong and durable. Bamboo is used for scaffolding.

Location: AP, TN, and Karnataka.

3. Casurina: It is reddish brown in colour and its density is about 7.65 kN/m^3. It has strong straight fibres. It is used for scaffolding.

Location: AP, TN, and Karnataka.

4. Deodar: It is yellowish brown in colour and its density is 5.60 kN/m^3. It is moderately strong, can be worked easily and possesses distinct annual rings. It is used for making packing material, cheap furniture and railway sleepers.

Location: UP, Punjab, Himalayan range.

5. Jack: Its colour is yellow and darkens with age. Density is 5.95 kN/m^3. It is even grained, moderately strong, easy to work, maintains shape and is used for making furniture, door panels, musical intrumemts and boats

Location: Karnataka, TN, Kerala and Maharashtra.

6. Mahogany: It is reddish brown and its density is about 7.20 kN/m^3. It takes good polish, is easy to work and durable under water. It is commonly used for making furniture and cabinets

Location: Karanataka, TN, Kerala and Maharashtra.

7. Mongo: Its colour is deep grey and the specified gravity is 5.6–7.20 kN/m^3. It maintains shape. It is moderately strong and easy to work. It is used for making cheap furniture, packing boxes and cabinets.

Location: Throughout India

8. Rosewood: It is dark in colour and its density is 8.5 kN/m^3. It is strong, closed grained and takes good polish. It is used for making furniture of good quality and for ornnamental works.

Location: Kerala, Karanataka, TN, Maharashtra, MP and Orissa.

9. Sandalwood: It is white or red in colour and its density is 9.3 kN/m^3. It is hard, strong and gives pleasant smell. It is used for making incense sticks and temple doors.

Location: Kerala, TN, Karanataka, West Bengal and Assam

10. Sissoo: It is dark brown and its density is 7.7 kN/m^3. It is strong, tough, durable, takes good polish and has good appearance.

It is used for making quality furniture, bridge piles, railway sleepers and for carvings.

Location: Karanataka, Maharasthtra, Orissa, UP, West Bengal and Assam.

11. Teak: Its colour varies from deep yellow to dark brown and density is 6.39 kN/m^3. It is moderately hard, durable, fire resistant, Takes good polish and is not attacked by white ants and rot. It is used for all superior works.

Location: Central and South India.

Summary

1. Timber refers to the wood used for construction.
2. After log is sawed and converted into commercial sizes like planks, battens, posts and beams is known as converted timber.
3. There is wide use of timber in engineering works.
4. On the basis of mode of growth trees are classified as exogenous and endogenous.
5. Medullar rays are thin radial fibres extending from the pith to the cambium layer. They hold the annual rays together.
6. Seasoning of timber is the process of reducing moisture content in a freshly cut tree to desired level.
7. Various methods of artificial seasoning are: boiling, kiln seasoning, chemical and electrical seasoning.
8. Various methods of sawing are ordinary, quartery, tangential and radial sawing.
9. Defects in timber are due to natural forces, fungi attack, attack by insects and due to erroneous seasoning and conversion.
10. Except teak all other timbers need treatment with preservatives.