**E Text-for Under graduate-B.Sc 2nd Year Botany**

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**Timber yielding trees of India and their products**

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## A Learning out-come

By studying this topic students will be able to

1. Define timber scientifically and logically
2. Identify timber producing trees of India
3. Correlate various types of timber available in the area with the industries around themselves
4. Identify various industries utilizing timber and its byproduct.
5. Give valuable inputs towards conservation of ecologically important timber yielding trees.

B- Text

# 1. Introduction

Timber is associated with human civilization from the beginning of civilization of itself. It was used for making shelters which later developed into huts & houses, boats & ships, railway sleepers, railway tracks, tools and other instruments and equipments of daily needs. Although modern civilization is heavily dependent on plastics, metals and other synthetic materials, but these all only supplements the use of timber. For furniture, paper, sound proof paneling, doors musical instruments certain chemicals like … timber is the main choice.

Botanically timber is a collection of specific cells known as secondary xylem. Xylem tissues are conductive tissues specifically designed for conduction of water from roots to all other areal parts. Primary Xylem and primary phloem are present on either side to cambium. During secondary growth cambium divides reportedly to give rise to secondary Xylem on inner side and phloem on outside. Secondary xylem is made up three basic tissues , vessels, trachieds and xylem parenchyma in perennial angiosperms. Vessels are absent in gymnosperms.

The activity of cambium is guided by seasons. There is variation in the form of size of lumen and quantity of tissues formed. This can be seen as annual rings visible in a cross section of a trunk.

Secondary growth also occurs in roots leading to the formation of wood. All aerial part of perennial trees and their sub aerial parts are woody but all wood is not timber. Timber is a wood which due to its density and secondary metabolite (resins/ tannins etc) contents becomes resistant to natural decay. For obtaining timber a tree is cut and all its living parts are removed, the resultant long cylindrical rod formed is called LOG. So in some countries of the world timber is also called as lumber.

## 2. Types of Timber

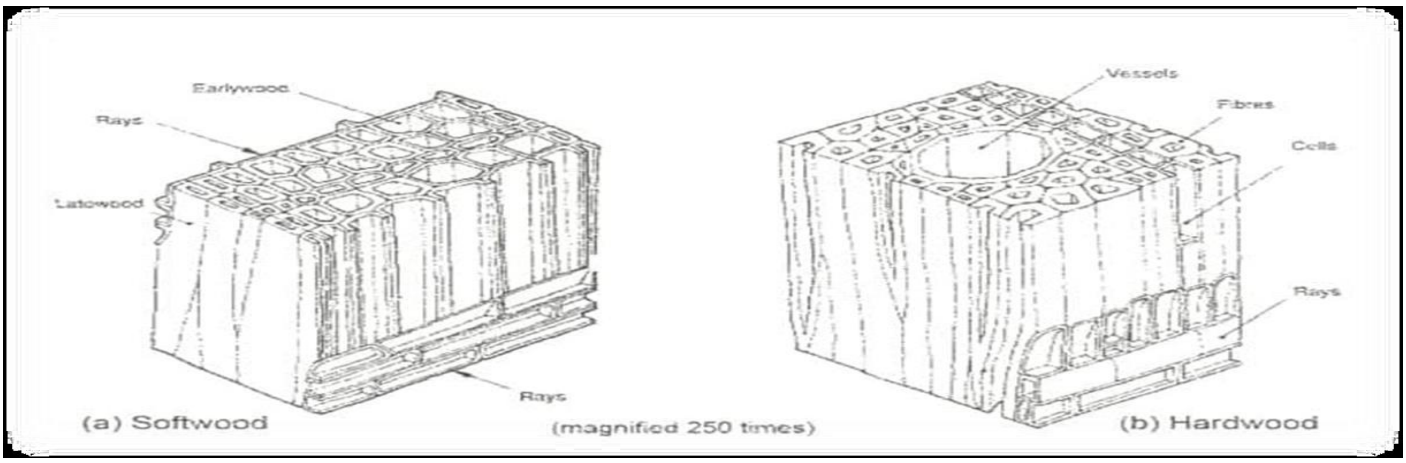
The timber used in industries is obtained both from Angiosperms and gymnosperms. Depending upon its density it divided into two major types.

2.1 Hard wood/porous wood-

Hard wood is derived from angiosperms trees, mostly deciduous these have broad leaves that fall every autumn. A cross section of hard wood shows distinct annual rings. These woods have vessels which gives it a characteristic texture of pores so it is also called porous wood. These trees grow comparatively slow as compared to gymnosperous trees, sometimes it takes 150 years to mature and ready for harvest. It is mainly composed of vessels, fibers and parenchyma. Tracheids are either absent or less than 5% of total tissue.

2.2 Soft Wood/Non porous wood-

Soft wood is derived from gymnosperms commonly known as conifers. These trees are evergreen and grow all round the year. Distinct annual rings are not found in soft wood. These lack vessels so they do not have pores. These trees grow faster and are ready to harvest in 40-50 years. It is mainly composed of tracheids ( up-to 85% ) and medullary rays. The wood simpler and more homogeneous in structure than hardwood.




2.3 Manufactured wood

Apart from soft and hard wood now a third type of wood is also available. This is known as manufactured wood. Manufactured wood, also known as engineered wood, is a composite material made from wood fibers, chips, or sawdust that are bound together with adhesives and compressed under heat and pressure. It's designed to look and feel like natural wood, but it's stronger and more durable.

How it's made

- Wood fibers, chips, or sawdust are combined with adhesives
- The mixture is compressed under high heat and pressure
- The result is a strong, consistent material that resembles natural wood

Types of Manufactured wood available are many some of them are-

- Plywood
- Veneer
- Oriented standard boards
- MDF
- Chipboard

Uses

- Manufactured wood is used in construction, including in homes, commercial buildings, and industrial products
- It can be used for joists and beams, and can replace steel in many building projects
- It can also be used to make furniture, doors, and panels

Benefits

- Manufactured wood is strong and durable
- It can be designed to be resistant to moisture
- It can be used to replace non-renewable construction materials
- It is a good example of best out of waste.

## 3. Difference between Hard Wood and Soft wood

| S.No | Property | Hard wood | Soft wood |
|---|---|---|---|
| 1 | Annual rings | Very prominent | Less prominent |
| 2 | Cellular composition | Xylem vessels, fibers and parenchyma | Xylem tracheids and medullary rays |
| 3 | Density | Very dense | Comparatively lighter |
| 4 | Colour | Dark woody | Lighter Woody |
| 5 | Harvested from | Angiosperms | Gymnosperms |
| 6 | Fire resistance | More resistant to fire | Less resistant to fire |
| 7 | Strength | No easy to cut | Easy to cut |
| 8 | Growth | Slow | Fast |
| | Wastage in harvesting | Trees are branched so large quantity of waste is generated | Trees grow straight so less quantity of waste is generated |
| | Price | Costlier of the two | Comparatively cheaper |
| 9 | Maturity | Takes approximately 150 yrs to mature or ready to harvest | Takes approximately 150 yrs to mature or ready to harvest |
| 10 | Examples | Teak, Sal, Sissoo | Cedar, Pine |

## 4. Properties of Timber

Identification and selection of timber is done on the basis of its physical and chemical properties. On the basis of its properties it is selected for any specific industrial use.

4.1 Physical properties.

1. Tensile strength - "Tensile strength" in the context of timber refers to the maximum amount of pulling force a piece of wood can withstand along the grain before it breaks, essentially measuring its resistance to being pulled apart; it's one of the key strength properties used to assess the structural integrity of timber in construction applications. It depends upon-

- Grain direction matters: Timber is strongest when pulled along the grain, meaning the fibers are aligned with the pulling force.
- Species variation: Different wood species have varying tensile strengths, with hardwoods generally exhibiting higher tensile strength than softwoods.
- Moisture content impact: Higher moisture content can significantly reduce a timber's tensile strength.

2. Shearing strength - Timber shearing strength refers to the resistance of a piece of wood to forces attempting to slide its fibers apart, essentially measuring how much shear stress a piece of wood can withstand before failing, and is considered a critical property when designing timber structures, particularly in areas where wood pieces are joined together .It depends upon the species of wood, moisture content, grain orientation, and presence of defects all influence the shear strength.

3. Crushing or Compression strength- Timber crushing or compression strength refers to the maximum load a piece of wood can withstand before failing when force is applied directly along the grain, essentially measuring how much pressure it can take before being crushed; it's a key indicator of a wood's structural integrity when used in construction applications where compression forces are present, like posts or beams. It is governed by following factors

- Timber is strongest when compressed parallel to the grain, meaning the force is applied along the wood fibers, and significantly weaker when compressed perpendicular to the grain.
- Different wood species have varying compression strengths, and factors like moisture content also play a role, with drier wood generally being stronger.
- Compression strength is measured by applying a compressive load to a wood sample until it fails, allowing engineers to determine its maximum resistance to crushing.

4.Bending strength- Timber bending strength is the ability of timber to resist bending without breaking. It's also known as flexural strength. Timber bending strength is an important measure of the load-bearing capacity and stiffness of wooden components. Factors that affect timber bending strength are-

- Direction of the load -Timber is stronger when the load is applied parallel to the grain, rather than perpendicular to it.
- Size -The size of the stressed volume affects the timber's bending strength.
- Span-depth ratio-The ratio of the span length to the specimen depth affects the timber's bending strength.
- Annual ring orientation -Whether the annual rings are parallel or perpendicular to the load direction affects the timber's bending strength.

5.-Stiffness - The stiffness coefficient of timber is a measure of the timber's ability to return to its original shape after being subjected to a force. It's used to calculate the stiffness of timber panels and walls. A higher stiffness coefficient means the timber is less likely to deflect under load. It is related to its density.The width of the annual growth rings in timber can indicate its strength.

6. Toughness- Timber toughness is the ability of wood to withstand sudden shocks and blows. It's also known as impact strength. It is important factor for timber components that absorb shocks, like tool handles and ship hulls, toughness helps timber resist breaking and splitting.

7. Density and Porosity- The density and porosity of wood depend up on its cell size, cell shape, thickness of cell wall presence or absence of air spaces or

intracellular spaces. The density of woods ranges from 0.04 to 1.4. Wood up to 0.5 is light wood, 0.5-0.7 is medium wood and 0.7 and above is called hard wood.

8. Flexibility -Timber flexibility is the ability of wood to bend and curve without breaking. It's a natural property of wood that can be enhanced through various techniques. Timber flexibility allows for the creation of shapes and structures that would be difficult or impossible with conventional wood. Timber can be easily adjusted or expanded to meet changing needs. Timber is lightweight and strong, so it's safer to work with than heavier materials. Products can be shaped and machined on-site, which can save time and money.

9. Cleavability- Timber cleavability is the ease with which wood can be split. It's a mechanical property of wood that measures how well it resists splitting when forces are applied across the grain. Knots can weaken timber and make it more likely to crack and warp. The position, size, and number of knots can affect how much they weaken the timber. Woods with long, knotty fibers are more likely to split.

10. Hardness- Timber hardness is a measure of how resistant a timber is to indentation, dents, dings, and wear. The Janka hardness test is the industry standard for measuring timber hardness. Timber hardness is important for determining if a timber is suitable for flooring.

11. Durability- Timber durability refers to how long a piece of timber will last in a given environment. It depends on the timber's natural durability and how it's treated and used.

- Treatment: Whether the wood has been treated with preservatives or to a minimum hazard grade
- Location: Whether the wood is used above ground or in the ground
- Manufacturing: How the wood was milled and manufactured
- Maintenance: How the wood is maintained
- Species: The natural durability of the wood species

12. Moisture- "Moisture content" within timber refers to the percentage of water present in a piece of wood, calculated as the weight of water divided by the

weight of the completely dry wood, expressed as a percentage; essentially, how much water is contained within the wood compared to its dry mass. Moisture content is always expressed as a percentage. A freshly cut tree can have a moisture content ranging from 40% to 200%.The ideal moisture content for timber depends on its intended use, with indoor applications usually requiring lower moisture levels than outdoor applications.

## 4.2 Chemical properties of Timber

Chemical substances which are found in wood and whose quantity and quality defines the difference between wood and timber are described below. These substances are the components of cell wall, intercellular spaces and/or are present in the lumen of hollow of dead cells. The Higher percentage of cellulose and hemicelluloses is responsible for hardness of the timber. Lignin and tannin is responsible for its durability. It has Cellulose -45 to 70%, Hemicellulose-15 to 30%, Lignin -20-35%, Tanin, Phenolic substances and Oils.

## 5. Timber yielding trees of India-

More than 150 trees have been identified in India which yield Timber. The most common and economically important trees are as under-

| S.No | Common Name | Family | Botanical Name | Density in $Kg/m^3$ |
|---|---|---|---|---|
| 1 | Sal | Diptetocarpaceae | *Shorea robusta* | 880-1050 |
| 2 | Indian rose wood | Fabaceae | *Dalbergia latifolia* | 850 |
| 3 | Teak | Verbinaceae | *Tectona grandis* | 639 |
| 4 | Iron wood | Calophyllaceae | *Mesua ferrea* | 960-1060 |
| 5 | Toon | Meliaceae | *Cedrella Toona* | 450 |
| 6 | Indian kino | Fabaceae | *Petrocarpus marsupium* | 785 |
| 7 | Tesu/ palash | Fabaceae | *Butea monosperma* | 600 |
| 8 | Indian Laurel/ Anjan | Combretaceae | *Terminalia tomentosa)* | 730 |
| 9 | Mango | Anacardiaceae | *Mangifera indica* | 560-720 |
| 10 | Babool | Mimosoideae | *Acacia nilotica* | 835 |
| 11 | Neem | Meliaceae | *Azardirecta indica* | 580-740 |
| 12 | Deodar | Pinaceae | *Cidrus deodara* | 560 |
| 13 | Pinus | Pinaceae | *Pinus latifolia* | 400-800 |
| 14 | Black catechu | Fabaceae | *Acacia catechu* | 880-1000 |
| 15 | Satin wood | Rutaceae | *Chloroxylon swietenia* | 960 |
| 16 | Mahogany | Meliaceae | *Switennia mahogany* | 720 |
| 17 | Arjun | Combretaceae | *Terminalia arjuna* | 870 |

## 6. Converting wood into timber- seasoning

At the time of harvest wood consists of water in high quantity upto 40 to 80%. Due to which it is not suitable for use as

1. This wood is liable to biological degradation i.e rotting
2. Sensitive to the attacks of insects like termite.
3. It's size changes in presence of moisture.

So the wood harvested is subjected to some treatment to make it suitable for commercial use. This process is called seasoning of wood. Seasoning is the process of removing moisture from wood to improve its strength, durability, and stability. Seasoned wood is less likely to crack, warp, or split, and is more resistant to rot and pests.It is done by two basic methods

### 6.1 Air seasoning / Natural process

The traditional method of seasoning wood-logs are stacked and left to dry in the open air. The stack is slanted to allow rain to drain, and stickers are used to separate the boards so air can circulate.

6.2 Kiln seasoning /artificial process

An artificial method of seasoning wood- the wood is placed in a kiln and smoke/hot air is circulated at a controlled temperature.

After seasoning following changes are seen in wood.

- Strength: Seasoned wood is stronger, stiffer, and harder than unseasoned wood.
- Durability: Seasoned wood is more resistant to decay, warping, cracking, and twisting.
- Stability: Seasoned wood is less likely to shrink, split, or check.
- Workability: Seasoned wood is easier to handle and transport.
- Preservation: Seasoned wood can be treated with preservatives to protect it from insects and fungi.

## 7. Identifying Characters of given Timber Yielding Trees and their Products

### 1) Teak

- **Botanical Name** -*Tectona grandis*

- **Common name**- Saka, Yun, Sagin, Sagun, Jadi, **Indian Oak**

- **Family**- Verbinaceae

- **Area & Distribution**- 72,76,000 hectare area is under teak forest cover in India. In states Kerala, Andhra Pradesh, Karnataka, Orissa, Madhya Pradesh, Maharashtra, Tamil Nadu, Gujarat, Rajasthan, Uttar Pradesh, Manipur it grows naturally

- **Botanical Characters** – Teak trees are deciduous and can grow up to 131 ft tall. They are known for their high-quality wood, which is hard, durable, and resistant to decay. The botanical characteristics of the teak tree is as under.

- **Trunk-** Scaly gray to gray-brown bark
- Straight but often buttressed
- Dark yellow wood that turns brown when exposed to sunlight and air

- **Root system-**Superficial, often no deeper than 50 cm
- Roots may extend laterally up to 15 m from the stem

- **Leaves-** Large, ovate-elliptic, and rough
- Green in color, but can appear silvery below
- Covered in gray-green hairs
- Opposite or whorled in young trees
- About 1.5 ft long and 9 in wide

- **Flowers-** Fragrant, white, and finely pubescent
- Small, about 8 mm across
- Arranged in large panicles

- Bloom in summer, from June to August
- Insect-pollinated, but can also be wind-pollinated

- **Fruit**-Globose, finely pubescent, and about 2/3 in diameter
- Enclosed in egg-shaped calyxes
- Mature from September to December
- Each fruit may contain 0 to 4 seeds

**Wood Characteristics**

- **Strength**: Teak wood is strong and durable due to its dense, coarse structure and high mineral content
- **Weather resistance**: Teak wood is resistant to rotting and weather extremes
- **Dimensional stability**: Teak wood has good dimensional stability
- **Oil content**: Teak wood has a high oil content
- **Grain**: Teak wood has a tight grain

Industrial uses

- **Furniture**: Teak wood is used to make outdoor furniture, garden furniture, and indoor furnishings
- **Decking**: Teak wood is used for marine decking, residential decking, and decking tiles
- **Siding**: Teak wood is used for siding
- **Boatbuilding**: Teak wood is used for shipbuilding and boat decks
- **Construction**: Teak wood is used for exterior construction, bridges, wharves, cooling-tower louvers, and railway cars
- **Flooring**: Teak wood is used for indoor and exterior flooring
- **Paneling**: Teak wood is used for interior and exterior paneling
- **Veneer**: Teak wood is used as a veneer for indoor finishing

2) Deodar

- **Botanical Name**- *Cidrus deodara*
- **Common Name**- Diar: ,Devdaar, Beyar, Devadaram, Devadaru
- **Family**- Pinaceae
- **Area & Distribution**- Deodar trees grow at elevations of 1,500–3,200 meters (5,000–10,000 ft) above sea level .They are commonly found in

mountainous areas with cool, moist climates. They grow on moderate to precipitous slopes as well as on level ground.They are often seen in mixed conifer forests alongside other coniferous species like blue pine and spruce.

- **Botanical Characters-** The deodar tree (*Cedrus deodara*) is a **large evergreen conifer native to the Himalayas**. It has needle-like leaves, a conical crown when young, and a rounded crown when older.

**Leaves**

- Acicular, stiff, and sharp-pointed
- Silvery or silvery-blue in color
- About 25–37 mm long
- Arranged spirally on long shoots

Branches-

- Branches Horizontal or slightly ascending or descending,
- Irregularly arranged from the stem, and Drooping at the end.

**Bark**

- Greyish brown, dark, or almost black in color
- Has vertical and diagonal cracks

**Cones**

- Female cones are barrel-shaped, 7–13 cm long, and 5–9 cm broad
- Male cones are 4–6 cm long
- Cones are solitary or in pairs
- Cones are bluish when young and reddish-brown when ripe

**Wood**

- Hard and aromatic
- Light yellowish-brown to brown in color
- Marked annual rings and white lines of medullary rays

**Flowers**

- Male flowers are pale green to yellowish green with purplish tinge
- Female flowers are pale glaucous green

Wood characteristics of Deodar wood

- **Appearance:** Light yellowish brown color with a straight grain pattern.
- **Strength:** Considered one of the strongest Indian coniferous woods.
- **Durability:** Highly resistant to rot and insect damage, making it long-lasting.
- **Workability:** Can be easily worked with, taking a high polish.
- **Aroma:** Distinctive pleasant fragrance.

Common Industrial uses of Deodar wood in India:

- Construction: Building houses, temples, public buildings, bridges, and barracks.
- Railways: Railway sleepers
- Furniture making: Doors, windows, cabinets, and other furniture pieces
- Carpentry: General carpentry works
- Houseboats: Building traditional houseboats in Kashmir
- Ornamental use: Planting as a decorative tree due to its attractive appearance

3) Babool

- Botanical Name- *Vachellia nilotica / Acacia nilotica**:***
- Common Name- Babbuula, Babbuuri, Baavari, Aabhaa, Shuulikaa, Shitaka,
- Family- Fabaceae
- Area & Distribution- *Acacia nilotica* (babul or gum arabic tree) is found in most of India, except for some states in the north and northeast It is found in Rajasthan , Punjab, Haryana, Delhi , Sourashtra , Kerala , Uttar Pradesh ,Madhya Pradesh, Jammu and Kashmir etc.

**Botanical Characters**

**Habitat**

- Acacia nilotica grows in semi-arid and arid areas, and is restricted to elevations below 450 meters.

- It's found in areas with annual rainfall of 500–1250 mm, and can't grow in areas with more than 1500 mm of rainfall.
- It can grow in saline and alkaline soils, but not in hard soils.
- It can tolerate long periods of water logging, so it's planted along the foreshores of lakes.

Botanical Characters:

- **Habit:** A medium-sized tree, reaching heights of up to 15 meters.
- **Habitat:** Widely distributed across India, particularly in dry, arid regions.
- **Bark:** Rough, dark grey bark.
- **Thorns:** Prominent, sharp thorns on branches.
- **Leaves:** Bipinnate, with small, green leaflets.
- **Flowers:** Small, bright yellow flowers arranged in dense, spherical heads.
- **Inflorescence:** Axillary, with pedunculate heads.
- **Fruit:** Flat, brown pods.

**Wood Characteristics**

- **Color**: The bark is rough, fissured, and can be blackish, grey, or brown
- **Density**: Acacia wood is very dense and tough.
- **Hardness**: Acacia wood is hard, with a hardness of 2,300 lbf (10,230 N).
- **Weight**: The average dried weight of acacia wood is 45.2–49.9 lbs/ft**3**
- **Crushing strength**: Acacia wood has a crushing strength of 10,142 p**si.**

**Industrial uses**

- Acacia wood is used in construction.
- Acacia wood is used as fuelwood.
- Acacia wood is used to make charcoal.
- The tree also produces gum arabic, which is used in food, pharmaceuticals, and cosmetics.
- The wood of *Acacia nilotica* is used for agricultural implements, such as ploughs.
- The gum and resin extracted from the pods are used for dyes and inks.
- The leaves and stems are eaten by sheep, cattle, goats, and camelids.

**Indian rose wood**

- **Botanical Name**- Dalbergia *latifolia*
- **Common Name**- Shisham, Sisu, Tahli, Tali, Irugudujava, North Indian rosewood, Himalaya raintree
- **Family-** Fabaceae
- **Area & Distribution**- Indian rosewood is found in various parts of India, including the sub-Himalayan region, the Western Ghats, and the southern tip of India. It is also found in neighboring countries like Nepal, Bangladesh, and Pakistan. Found in the northern plains and sub-Himalayan regions of India .Grows along riverbanks, near streams, and in moist soils. Can grow in slightly saline soils .Can withstand droughts of three to four months
- **Botanical Characters**-
- **Habit**- Indian rosewood is native to the Indian subcontinent, Myanmar, and possibly neighboring countries.
- **Habitat-** Rosewood is a hardwood that is hard, tough, strong, and dense. It is used for making furniture, doors, windows, ship floors, musical instruments, and more. It is a versatile tree that can be used for timber, firewood, fodder, and more. It can also be planted as an ornamental tree in gardens and along roadsides.
- It is a deciduous tree with the following botanical characteristics:
- **Bark**: Light brown, with crooked trunks
- **Leaves**: Compound, imparipinnate, and alternate, with 3–5 leaflets
- **Flowers**: Small, white to pink, fragrant, and arranged in axillary panicles
- **Fruit**: Flat, thin, and papery pods that are pale brown in color
- **Growth**: Can grow up to 30 meters tall and 2.4 meters in girth
- **Crown**: Spreading, with thick branches
- **Young shoots**: Downy and drooping
- **Taproot**: Long, with numerous surface roots that produce suckers

**Wood characteristics-**

- **Color**: Heartwood can range from golden brown to deep purplish brown, with darker streaks. It darkens with age.
- **Grain**: Interlocked grain, medium texture, and good natural luster
- **Hardness**: Very hard, with a Janka hardness rating of around 10,440 N
- **Density**: Heavy, with an average dried weight of 855 kg/m3
- Can blunt cutting edges quickly
- Turns, sands, screws, and glues well

- Can be polished or waxed to an excellent finish
- Resistant to rot and insects
- Resistant to damage from impact, abrasion, and compression
- Dimensional stability

**Industrial uses**

- Indian rosewood is a high-end material for luxury furniture
- It is used for high-class furniture and cabinetry
- Indian rosewood is used for marine-grade plywood
- It is also used for high-grade plywood
- Indian rosewood is used for guitar bodies and fretboards
- It is used for the back and side boards in guitars]
- Indian rosewood is used for railway sleepers, building materials, and wooden machine tools
- It is used for poles, posts, and tool handles
- Firewood Indian rosewood is used as firewood.
- Indian rosewood is used for erosion control and as a windbreak
- It is used for ornamental work, ordinance work, and agricultural implements
- It is used for making cart wheels and gun carriages

## Sal

- **Botanical Name**- *Shorea robusta*
- **Common Name**- Sāla, Shala, Sakhua, Sarai, Indian Dammer, Yellow Balau, Salboom
- **Family-** Diptetocarpaceae
- **Area & Distribution**- The sal tree (*Shorea robusta*) is native to southern Asia and is **distributed across India, Nepal, Bangladesh, and Myanmar**. In India, sal forests cover nearly 11 million hectares. Sal trees are found in the plains, lower foothills of the Himalayas, and along valleys. They are found in Chhattisgarh, Assam, Bengal, Odisha, and Jharkhand, and west to the Shivalik Hills in Haryana.

**Botanical Characters**

- **Habit-** The sal tree is a large, deciduous tree that grows in tropical regions. It has a taproot system, tough stem, and large leathery leaves. The Sal tree

can grow up to 40 meters tall and 2 meters in diameter. It grows moderately to slowly.

- **Habitat-** The sal tree is a keystone species in tropical forests. It is also the state tree of Jharkhand and Chhattisgarh. Sal forests are climate-controlled, but local distribution is influenced by geographical and soil conditions. Sal forests can be deciduous, semi-deciduous, or evergreen.al forests are often dominated by Sal trees.

- **Stem-** Erect, It has a thick, dark brown bark with longitudinal fissures
- It has a spreading and spherical crown
- Root-
- It has a long taproot

**Leaves-** Simple, shiny, and glabrous

- Delicate green, reddish when new
- Broadly oval at the base, with a long point at the apex
- About 10–25 cm long
- **Flowers** Yellowish-white in color
- Arranged in large terminal or axillary racemose panicles.

**Fruit -**Ovoid in shape

- About 1–1.5 cm in size
- Surrounded by segments of the calyx that have five unequal wings

**Wood Characteristics**

- **Color**: Light in color when freshly cut, but darkens to a reddish brown with age
- **Texture**: Coarse-grained
- **Grain**: Close-grained
- **Pores**: Moderately large to medium, evenly distributed
- **Growth rings**: Not very distinct or absent
- **Resistance**: Resistant to water, termites, and fungi

**Industrial Uses**

- Sal wood is a valuable hardwood timber
- Used to make door and window frames, plywood, furniture, veneer, and boat-building

- Sal wood is also used for railway sleepers, boats, and telephone and electrical poles
- Sal wood is used for paper production
- Sal resin is burned as incense in Hindu ceremonies and used as an astringent in Ayurvedic medicine
- Sal seeds and fruit are a source of lamp oil and vegetable fat.
- Sal seed oil is used in soap, cocoa butter equivalent (CBE), and other products.
- Dry sal leaves are used to make leaf plates called patravali and dona.
- Sal is also known for its antibacterial and anti-diarrheal properties

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## C. Important questions

1. What is the importance of the cellular structure of timber ?

2. Write an essay on the physical properties of timber.

3. Write a short note on chemicals found in timber.

4. What is seasoning of wood?

5. Write a short note on engineered wood.

6. Write an essay on industrial applications of timber.

7. How will you differentiate between hard and soft wood.

8. Give a detailed account of industrially important timber found in Madhya Pradesh.

9. Give a detailed account of an industrially important timber tree not found in Madhya Pradesh.

10.Give a detailed account of soft wood.

## D. Multiple choice questions

1. Pine wood is a
a. Hard wood
b. Soft wood
c. Engineered wood
d None of the above

2. Tracheids are absent in
a. Hard wood
b. Soft wood
c. Engineered wood
d None of the above

3. Delibrgia *latifolia* is
a. Deodar
b. Sal
c. Indian rose wood
d. Semal

4. *Shorea robusta* Tree is
a. Deodar
b. Sal
c. Shesham
d. Semal

5. Seasoning of wood is done basically to
a. Increase moisture content
b. Decrease moisture content
c. Increase protein content
d. Increase cellulose content

6. *Tectona grandis* belongs to the family
a. Meliaceae
b. Pinaceae
c. Verbinaceae

d. Malvaceae

7. Soft wood is obtained from
a. Gymnosperms
b. Angiosperms
c. Both of the above
d. None of the above

8. Babool timber is best for making
a. Railway sleepers
b. Paper
c. Handle of farm tools
d. Match box.

9. From seeds of which tree cocoa butter equivalent is obtained.
a. Tesu
b. Anjan
c. Sheesham
d. Sal

10. Timber industry also provides us
a. Carbohydrates
b. Proteins
c. Oil
d. Vitamin

11. Annual rings are formed due to
a. Seasonal activity of the cambium
b. Daily activity of the cambium.
c. Monthly activity of cambium
d. None of the above

12. Bright orange flowers are found in

a. Tesu
b. Anjan
c. Sheesham
d. Sal

13. The Following tree belongs to the family Rutaceae
a. Indian kino
b. Mango
c. Satin wood
d.Toon

14. Dona-pattal are made from the leaves of

a. Toon
b. Anjan
c. Sheesham
d. Sal

15. Oil obtained from this tree is used as lamp oil
a. Teak
b. Sal
c. Anjan
d. Satin wood

16. Plywood is
a. Soft wood
b. Hard wood
c. Engineered wood
d. PVC

17. Following trees belong to Gymnosperms
a. Pine & Deodar
b. Pine & Teak

c. Deodar & Catechu
d. None of the above

18. Deciduous trees
a. are ever green
b. Shed leaves seasonally
c. both of the above
d. none of the above

19. *Acacia catechu* belongs to the family
a. Fabaceae
b. Verbinaceae
c. Meliaceae
d. None of the above

20. This is used as a veneer for indoor finishing
a. Teak wood
c.Tesu
b. Anjan
d. Satin wood

## E- Reference


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**F --Keys to MCQ**

1-b, 2-a, 3-c, 4-b,5-b, 6-c, 7-a, 8-c, 9-d, 10-c, 11-a, 12-a, 13-c, 14-d, 15-b, 16-c, 17-a, 18-b, 19-a,20-a