

WOOD SCIENCE & TECHNOLOGY

Wood Physics

Physical, thermal, electrical and acoustic properties of wood, Comparison of properties of solid wood with composite wood, Wood water relationships, Chemical constituents of wood, Extraction of chemicals from wood, Industrial utilization of wood extractives, Spectroscopic techniques with special reference to characterization of chemical constituents of wood and bark

Wood Anatomy

Microscopic features of important timber species, Identification of wood using a hand lens-characteristics features. Microscopic features of soft wood and hard wood. Characteristics, diagnostic features used in wood identification of five soft wood species (*Pinus roxburghi*, *P. wallichiana*, *Abies pindrow*, *Pecia smithiana*, *Cedrus deodara*) and twenty hardwood species (*Acacia nilotica*, *Albizia lebeck*, *Adina cardifolia*, *Anogeissus latifolia*, *Bombax ceiba*, *Colophyllum* spp., *Dalbergia sissoo*, *Dalbergia latifolia*, *Diptocarpus* spp., *Lagerstromia lanceolata*, *Mangifera indica*, *Morus alba*, *Palaqcium elipticum*, *Pterocarpus marsupium*, *Shorea robusta*, *Tectona grandis*, *Terminalia tomentosa*, *Toona ciliata*, *Holoptelia integrifolia*, *Michilia champaca*) of forest origin and their economic importance and end uses. Wood quality in plantation grown timber. Anatomical and utilization aspects of fibrous material

Timber Mechanics

Basic solid mechanics, Theory of creep including creep in lignocellulosic panels, Suitability coefficients and indices of Indian timbers, Timber defects, Timber grading

Wood Seasoning

Importance of wood seasoning, Seasoning defects, Air seasoning, Seasoning schedules for Indian timbers, Kiln design and specifications

Wood Preservation

Wood durability, Marine wood bio-deterioration and control measures, Wood preservatives, Permeability and treatability of timber, Treatment processes

Composite Wood

Adhesives and adhesive science, Natural and synthetic glues, Plywood and its manufacturing, Plywood treatment, Particle board manufacturing, Properties of particle board & its testing Laminated wood, Parameters of LVL manufacturing Modified woods

Saw Milling and Saw Doctoring

Saw milling equipment, Economics of sawn material, Saw blade doctoring

Wood Working and Finishing

Basic joinery, Wood machining defects, Finishing operations, Wood finishing equipment, Performance tests on wood finishes and test methods

Timber Engineering

Timber components for structural purposes, Mechanical properties and national building codes

Product Design and Fabrication

Product design and carving, Product behaviour in application, Fasteners

Nano Technology

Basics of nano-science and its utility for forest and forest products sector.

Forest Certification

Forest certification: Forest and forest products certification – basics and importance; Schemes of forest certification; Environmental certification and eco-labeling. Climate change: Carbon sequestration and climate change –introduction, Carbon credits and possibilities in timber, timber products and processes.

Physics

Amorphous and crystalline materials. Lattice translation vectors. Unit cell. Reciprocal lattice. Crystal diffraction: Bragg's law. X-rays diffraction of crystals. Lattice variations. Linear monoatomic and diatomic chains. Acoustical and optical phonons. Qualitative description of

the phonon spectrum in solid. Brillouin zones. Dielectric properties of matter: Electric susceptibility, polarizability, Clausius-Mosotti equations, classical theory of electronic polarizability Viscosity, Poiseuille's equation; Van der Waal's interaction, hydrophobic interactions.

Atoms in electric and magnetic fields: Electron spin, Spin and orbital angular momentum, space quantization and Larmor's theorem, Stern-Gerlach experiment, Magnetic moment of the atom, Gyromagnetic ratio and Bohr Magneton. Atoms in external magnetic fields: Zeeman effect (Normal and anomalous).

Thermodynamic description of system: Zeroth law and thermodynamic temperature; First law and internal energy, conversion of heat into work, reversible and irreversible processes. Second law and entropy, Carnot's cycle and theorem, entropy changes in reversible and irreversible process, Entropy diagrams and equations, Unattainability of absolute zero, third law of thermodynamics; Joule-thomson effect-production of low temperature. Claius-Clapeyron Equation .

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path; Law of equipartition of energy and its application to specific heat of gases; monoatomic and diatomic gases; Transport Phenomena: viscosity, conduction and diffusion .

Mode of heat transfer, Searle's and Lee's experiment, black body radiation, Planck's law, Rayleigh Jean's Law, Wein's displacement law, Stefan-Boltzmann law.

Micro and Macro states, energy states, energy levels, degenerate energy levels, degenerate gas, phase space, concept of entropy and thermodynamic probability. Classical statistics Maxwell-Boltzmann distribution law, thermodynamics of an ideal monoatomic gas, classical entropy expression, Gibb's paradox.

Ideas of Bose Einstein Statistics and Fermi Dirac Statistics.

Simple Harmonic motion Simple Harmonic Oscillator, motion of simple and compound pendulum (Bar and Kater's pendulum), loaded spring, energy in simple harmonic motion. Superposition of two SHM: (i) collinear SHM of same frequency (ii) collinear SHM of different frequencies – phenomenon of Beats (iii) SHM of same frequency but perpendicular to each other and (iv) Lissajous figures.

Equation of motion, Dead beat motion, critically damped system, lightly damped system: relaxation time, logarithmic decrement, quality factor.

Equation of motion, complete solution, steady state solution, resonance, sharpness of resonance, quality factor.

Degrees of freedom, coupled oscillator with two degrees of freedom;

General method of finding normal modes for a system of two degrees of freedom.

One dimensional plane wave; Classical wave equation; Superposition principle; standing wave on a stretched string (both end fixed).

Chemistry

General principles of Metallurgy: Method of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn); electrolytic, oxidative refining.

Periodicity in s- and p- block element, w.r.t. electronic configuration. Compound of s- and p- Block Elements, Concept of multicentre bonding (diborane). Hydrides of nitrogen (NH₃, N₂H₄,

Borazine, silicates and silicones transition elements (3d series): General group trends with special reference to electronic configuration, variable valency, ability to form complexes and stability of various oxidation states. Oxidation states, Magnetic properties.

Oxidation states displayed by Cr, Fe, Co, Ni and Cu.

Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). IUPAC system of nomenclatures.

Addition reactions, Alkenes and alkynes (upto four carbon atoms): Hydrogenation, halogenation, hydrohalogenation, hydration. Aromatic hydrocarbon, Aldehydes and ketones – addition reaction .

Alcohols, phenols and amines. Carboxylic acid and derivatives: hydrolysis.

Reduction of aldehydes and ketones by catalytic hydrogenation, Reduction of aromatic nitro compounds by electrolytic reduction. Fries rearrangement

Definition of monomers and polymers, Classification of polymers. Natural rubber. Development of biodegradable polymer viz., polylactic acid and polyhydroxybutyric acid. Amino acids, peptides and proteins: Amino acids, peptides and proteins, Natural amino acids and essential amino acids.

Classification, nomenclature of carbohydrates. Determination of configuration of monosaccharides. Structure of glucose, fructose and cellulose Alkaloids

Liquids: Surface tension and its determination using Stalagometer, Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer, Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Solutions thermodynamics of ideal solutions, Partial miscibility of liquids, Immiscibility of liquids, Principle of steam distillation, solvent extraction; Colligative properties of dilute solutions thermodynamics of dilute solutions, Colligative properties of electrolytic solutions, van't Hoff factor and its applications.

Chemical equilibrium Van't Hoff equation, Calculation of equilibrium constants from thermodynamics measurements.

Reversible and irreversible cells, Measurement of EMF of a cell, Nernst equation and its importance. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations- qualitative treatment (acid-base and oxidation-reduction only). Atomic structure, Chemical bonding and molecular structure Ionic equilibria Ionization of weak acids and bases, pH scale, common ion effect, Buffer solution. Solubility and solubility product of sparingly soluble salts- applications of solubility product principle. Qualitative treatment of acid-base titration curves theory of acid-base indicators.

Concept of hybridization of carbon. Cleavage of a covalent bond; homolysis and heterolysis. Intermolecular and intramolecular hydrogen bonding. Effect of intermolecular and intramolecular forces on properties such as solubility, vapour pressure, melting and boiling points of organic compounds.

Optical isomerism: Optical activity, plane polarized light, specific molar rotation, chirality, enantiomerism, diastereoisomerism, racemic mixtures and their resolutions by salt formation method; Geometric isomerism: Cis- and trans- system for geometrical isomers. E- and Z-

notations for geometric isomers; Qualitative treatment of stability of chair and boat conformations of cyclohexane.

The concept of reaction rates, effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction.

Lambert-Beer law, Laws of photochemistry, Quantum efficiency and reasons for high and low quantum yield. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions.

Adsorption by solids. Langmuir theory of adsorption of a gas on a solid. Langmuir adsorption isotherm.