

Harcourt Butler Technical University, Kanpur

Syllabus of “Leather Technology discipline” for Written Test to the Post of Assistant Professor (Contractual)

Section 1: Engineering Mathematics

Linear Algebra: Matrix algebra, systems of linear equations, eigen values and eigen vectors.

Differential Equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler-Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson’s rules; single and multi-step methods for differential equations.

Section 2: Process Calculations and Thermodynamics

Steady and unsteady state mass and energy balances including multiphase, multi-component, reacting and non-reacting systems. Use of tie components; recycle, bypass and purge calculations; Gibb’s phase rule and degree of freedom analysis.

First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.

Section 3: Fluid Mechanics and Mechanical Operations

Fluid statics, surface tension, Newtonian and non-Newtonian fluids, transport properties, shellbalances including differential form of Bernoulli equation and energy balance, equation of continuity, equation of motion, equation of mechanical energy, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, velocity profiles, flow meters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressure drop.

Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.

Section 4: Heat Transfer

Equation of energy, steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations; design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.

Section 5: Mass Transfer

Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption, membrane separations (micro-filtration, ultra-filtration, nanofiltration and reverse osmosis).

Section 6: Leather Microscopy and Skin Protein

Various fibrous and non-fibrous proteins, Non proteinous skin components. General physical and chemistry of proteins. Chemical constitution of hides and skins. Reaction of proteins with acids, bases and salts. Primary structure of collagen, effect of enzymes on collagen, Keratin, Reticulin, Elastin, histology of hides and skins-cell, tissue, fibers, muscles, glands, epidermis.

Section 7: Analysis of material of leather manufacturing

Analysis of water: Type of water – principle of analytical method employed in analysis of water effect of hardness of water on various processes in leather manufacture softening of water. Analysis of various chemicals and auxiliaries used in leather processing: Salt, Lime, Sodium sulphate, Ammonium salt, Deliming agents, Bates, Neutralizing agents, Physical test of leather, Chemical test of leather, Indicators, Quality control of leathers.

Section 8: Pre-tanning and Tanning Operations

Pre-tanning process-soaking, liming, deliming, bating, degreasing, pickling & depickling. Concept of tanning and leather, leather properties dependent on tanning, Vegetable tannins and vegetable tanning, classification of vegetable tannins, vegetable tanning materials and their properties, hydrolysable and condensed tannins, Mechanism of vegetable tanning, process of vegetable tanning, synthetic tannins, chrome complexes and their structures, method of chrome tanning, preparation of chrome liquors & powders, basicity and masking, mechanism of chrome tannage.

Section 9: Post Tanning and Finishing Operations

Study of Aluminum, Zirconium, iron, Titanium, Sodium silicate & polyphosphates. Theory of neutralization, Principle of color chemistry, classification of leather dyes, color matching, theory and mechanism of dyeing, oils, fats, and fat-liquors, classification and types of leather finishes, pigments, binders, intro cellulose lacquers, wax emulsions, silicon emulsion, Leather machinery-different machine used in leather processing.

Section 10: Processing of Leather

Processing of light leathers, Wet blue, nappa, garments, lining, suede, Nubuck, Jug grain, shrunken grain, Sole leathers, Belting leather, Chrome retanned, Bag tanning, Combination tannages, Heavy leathers, Leather auxiliaries, Tannery effluents, effluent disposal, Anatomy of human foot, closing, making of footwear, classification of leather goods, method and material for construction.