

SUGAR TECHNOLOGY

UNIT 1

GENERAL CHEMISTRY

Colligative Properties: Definition and examples of vapor pressure, Raoult's law, elevation of boiling point, elevation in boiling point due to brix and hydrostatic head. Crystallization: Laws of crystallization, kinetics of crystal growth; rate of growth, concentration, temperature, stirring, mechanism of growth (diffusion, viscosity, colloids, crystallographic considerations) impurities, dissolution & re-growth Colloids: Preparation, types and properties of colloids, isoelectric point, zeta potential, colloids in cane juice, elimination of colloids in clarification process. Adsorption: Definition and types of adsorption, adsorption of coloring matter, use of active carbons in refineries, regeneration of active carbons. Ion Exchange Resins and their applications in sugar industry. Electrochemistry: Conductance measurements: Cuitometer, EMF measurements, Corrosion and its control in sugar factory.

UNIT 2

BIOCHEMISTRY

Carbohydrates: Stereochemistry of Carbohydrates (hexoses). Monosaccharides, Di & oligosaccharides; classification, properties, structure of maltose, lactose, sucrose & raffinose. Physical & chemical properties of Sucrose, Polysaccharides: structure and properties of cellulose, starch and dextran. Coloring Matter: Nature of coloring matter present in sugarcane juice and their role in sugarhouse products. General characteristics of micro-organisms, growth and reproduction, sterilization and disinfection; Brief survey of microbes as friends and foes. Brief study on Lactic acid bacteria and *Leuconostoc mesenteroides* and their significance in Sugar Industry. Industrial fermentations – alcoholic, amino acids, antibiotics, and other secondary metabolites. Primary and secondary metabolism; Over production of metabolites – amino acids, taste enhancers, vitamins, toxins, etc; Applications of enzymes in industrial process.

UNIT 3

SUGAR CHEMISTRY

Optical methods of sugar analysis: Optical Activity, specific rotation of sugars, principle of polarimetry, international sugar scale, normal weight of sugar; methods of simple polarization, double or invert polarization, Clerget constant and factors affecting it. Estimation of Reducing Sugars: Sugar Processing Chemicals: Specifications of lime, sulphur & other chemicals, application of antiscalent, descalents, viscosity reducers, mill sanitizers and flocculants. Water Treatment:Boiler Feed Water: Mineral salts in water, demineralization, internal treatment and water conditioning, Quality of feed water, corrosion, de-aeration, caustic embrittlement. Treatment of sugar factory and distillery effluents, norms of various constituents. Sanitation: Microbial contamination in sugar factory - control methods. *Leuconostoc mesenteroides* - effect of dextran on sugar processing & its removal, lactic acid bacteria

UNIT 4

SUGARCANE AGRICULTURE

Sugar producing plants, origin of sugarcane, major sugar producing countries, sugarcane cultivation in India. Taxonomy & anatomy of sugarcane - the stem, leaves, root system & the flower. Cultivation of Sugarcane; Preparation of land, period of sowing, planting, irrigation, fertilizer application, growth and maturity of crop, harvesting, cane transportation, ratoon crop, sugarcane pests and deceases, cane payment system.

UNIT 5

SUGAR TECHNOLOGY

Sugar Industry in India, flow chart of sugar manufacture; general description of machinery and equipments, Crushing of sugarcane, composition of juice, juice heating, Liming & Sulphitation, Lime slacker, Sulphur burner, sedimentation in clarifier, filtration of mud, evaporation, syrup sulphitation, pan boiling, 3-boiling scheme, concept of brix, pol and purity, crystallization, centrifugation, drying,

grading and bagging of sugar, storage in godown, sugar standards. By products of sugar industry, Role of sugar industry in the social and economic growth of society.

UNIT 6

CHEMICAL ENGINEERING

Introduction, Heat Transfer, Flow of fluids, Pressure & Flow Measurement, Pumping of Fluids, Combustion, Unit operations: Size Reduction, Screening, Leaching and Extraction, Mixing and Agitation, Sedimentation, Filtration, Centrifugation, Membrane Separation Process, , Heat, Momentum and Mass Transfer, Humidification & Water Cooling, Gas Absorption, Evaporation, Crystallisation, Drying & Conveying

UNIT 7

ALLIED SUGAR MANUFACTURE

Beet Sugar: Introduction to beet sugar industry, agro-climate condition for cultivation of sugar beet; distribution of sugar in beet, harvesting, transport, dirt removal, beet handling, fluming, beet feeders, trash catchers, tail separators, beet washers, diffusion, clarification and other manufacturing processes. Raw Sugar: Specification of raw sugar, process of clarification, process of boiling and boiling schemes, storage, transport of raw sugar, keeping quality. Refined Sugar: Refining quality of raw sugar – evaluation, calculation of raw value. Affination, clarification, decolorisation, evaporation and pan boiling, centrifugation, sugar drying and conditioning, packing, storing. Refined sugar products – cubes & tablets, granulated sugar, liquid sugar. Jaggery: Juice extraction, clarification and boiling, moulding and packing, composition, advantages & disadvantages due to jaggery production.

UNIT 8

CO-PRODUCTS

Bagasse: Composition of bagasse, fuel value, use of bagasse for - paper, fibreboard, furfural. Use as cattle feed, agriculture mulch and for bio-compost. Filter Cake: Characteristics of filter cake, use of filter cake as manure, for production of cane wax. Molasses: Classification, Composition, alcoholic

fermentation -manufacture of alcohol, uses of alcohol, Electric Power: Power as a co-product of sugar industry, Economics of power generation, By products and its application.

UNIT 9 STATISTICS

Introduction: Importance of statistics, applications in finance, production, marketing, management & economics, limitations of statistics. Collection of Data: Classification, elements, variables & observations, methods of collection, data sources. Statistical Methods: Measures of central tendency (location): - definition, arithmetic average, mean, median, mode percentiles & quartiles - exercises. Measures of Dispersion (variability): - definition, range, mean deviation, standard deviation - exercises. Skewness, Moments & Kurtosis - definitions, measures of Skewness, exercises. Correlation - definition, types, methods of studying - exercises. Regression - definition, methods of studying - exercises. Interpolation & Extrapolation - definition, significance, methods of interpolation - exercises.

UNIT 10 INDUSTRIAL MANAGEMENT

Management Theory, Forms of Business Organisation, Administrative & Management Structure in sugar Factory, Purchase & Sales, Personnel Department: Functions, recruitment procedure, training, discipline, motivation, safety, welfare, personnel administration. Production & Productivity: Definition, factors affecting productivity, improvement of productivity, product quality, total quality management (TQM). Quality Control program. Finance Management: Elements of cost - calculation of different costs, calculation of indirect expenses. Depreciation - definition, obsolescence methods of calculating depreciations - interest on capital, idleness, maintenance - equipment replacement policy, loss & profit, budgetary control. Industrial Acts.