

CHEMICAL TECHNOLOGY

(PG DEGREE STANDARD)

SUBJECT CODE: 290

UNIT- I: PROCESS CALCULATIONS AND THERMODYNAMICS

Properties of liquids, solids and gases - Gas laws - Material and Energy balance, Material balance involving recycle by-pass and purge

Thermodynamics functions - Chemical and Phase Equilibrium - Laws of Thermodynamics - Ideal and non-ideal gases and solutions, fugacity, correlation of activity coefficient, partial molal properties.

UNIT- II: FLUID MECHANICS AND MECHANICAL OPERATIONS

Newtonian and non-Newtonian fluids, compressible and non - compressible fluids, flow through pipeline systems, flow in closed ducts, packed beds and fluidized bed. Continuity and conservation equations. Macroscopic energy balance, Bernoulli equation and its applications, Dimensional analysis, flow meters, pumps and compressors.

Size reduction and size separation; laws of size reduction, Gravity settling, hindered settling sedimentation; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; thickening, elutriation, conveying of solids.

UNIT - III: REACTION ENGINEERING, HEAT AND MASS TRANSFER

Rate equation, elementary and non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors.

Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, The residence time distribution, basic models for non-ideal flow; conversion in non-ideal reactors.

Fourier's law of heat conduction, convection and radiation, Heat transfer with phase change, heat exchangers, evaporation, Heat transfer in extended surfaces, Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds. Radiative heat transfer – Black body radiation, Emissivity, Stefan - Boltzman law, Plank's law, radiation between surfaces.

Diffusion, Theories of mass transfer, Analogy, inter-phase mass transfer. Distillation, absorption, leaching, liquid-liquid extraction, crystallization, adsorption, drying, humidification, de-humidification.

UNIT - IV: PROCESS CONTROL AND INSTRUMENTAL METHODS OF ANALYSIS

Laplace transformation, application to solve ODEs. Dynamics of process elements, open loop and closed loop systems, principles of pneumatic and electronic controllers, Instrumentation: Sensors for Pressure, Flow, Temperature, Control valves, Computer Control of Processes, Analysis of control systems. Micro processor –based control.

Spectroscopic analysis: Absorption spectroscopy, emission spectroscopy, mass spectroscopy, x-ray diffraction, color measurement by spectrometers, Gas analysis by thermal conductivity Moisture (humidity analysis) p^H measurements, Chromatography - H.P.L.C.

UNIT – V: CHEMICAL PROCESSES

Nitration, Sulphonation and Sulfation, Hydrogenation, Halogenation & Oxidation, Kinetics and mechanism, the derivative reactions, Industrial applications, Raw material and manufacture of Soda ash, Sodium bicarbonate, Chlorine and Causticsoda, Bleaching powder, Calcium Hypochlorite; Sodium Hypochlorite; Sodium chloride or common salt, sodium sulfate, sodium bisulfate, or Nitercake, Sodium Bisulfite; Sodium Sulfite, Sodium Hydrosulfite; Sodium sulfide, Sodium Hydrosulfide, Sodium Thiosulfate; Sodium Nitrite; Sodium Silicates; Sodium peroxide, Sodium perborate; Sodium amide; Sodium cyanide and Ferri cyanide.

Industrial alcohols, Beer, Wine, Butyl alcohol. Raw Materials, Manufacture of phosphoric acid, nitric acid, Sulfuric acid and HCL & the occurrence, Purification of all acids.

Occurrences of oils, fats and waxes, classification, chemical composition, Extraction and refining oils and fats. Manufacture of edible oil.

Surfactant : Concept of surface activity, Hydrophilic-lypophilic balance; Mechanism of detergency. Classification of surfactants; Biodegradation of surfactant; application of surfactants.

Soap and Detergent: Soap, detergent, Glycerine: spentlye, synthetic glycerine manufacture and their applications

Origin, Occurrence, exploration and classification of crude oils, Hydrocarbon, composition of petroleum and petroleum products (liquid and gas); Refining of crude oil, Catalytic cracking, thermal cracking; reforming. Chemical conversions, Extraction of Aromatics.

UNIT - VI: PULP AND PAPER, AGROCHEMICALS AND FERTILIZERS

Classification and manufacture of Insecticides and pesticides, Plant derivatives, Pyrethrin, Nicotine, Rotenone, attractants and repellents, Fumigants, Nematocides, Acaricides, Fungicides, Industrial Biocides, Plant growth regulators, Herbicides.

Raw material for fertilizers; Synthesis of ammonia, Ammonium nitrate, ammonium sulfate, Ammonium Phosphates; Urea, Super phosphates, Mixed fertilizers, organic fertilizers.

Raw material for pulp, manufacture of pulp and paper. Hydrolysis of wood, Wood extractives. Cellulose; Hemi cellulose, lignin and associated materials. composition of cell walls. Physical and Chemical properties of cellulose and derivatives.

UNIT- VII: PHARMACEUTICALS, POLYMERS, PLASTICS AND RUBBERS

Types of polymers, Thermoplastics and thermosetting plastics, Polymerization Types. Degradation of polymers through thermal, mechanical and chemical methods. Raw materials for polymers and resins. Chemistry of Natural resins and polymers such as lac, rosin, cellulose, rubber, proteins, fossil resins, etc. Preparation and applications of phenolics, amino resins, polyesters, polyamides, epoxides, polyurethanes, vinyls. Raw materials, manufacturing processes of plastics.

Composites: Raw materials, Comparison of different materials with composite; advantages and disadvantages of Natural rubber, synthetic rubber, rubber compounding, rubber fabrication; latex compound, rubber derivatives.

Alkylations, Carboxylation and Acetylation; Condensation and Cyclization; Dehydration; Halogenation; Oxidation; Sulfonation; Amination; Complex Chemical Conversions. Fermentation and Life processing for antibiotics, Biologicals, Hormones and Vitamins, Biologicals, Steroids Hormones; Isolates from Plants and Animals.

UNIT - VIII: COAL CHEMICALS AND INDUSTRIAL CARBON AND EXPLOSIVES

The destructive distillation of coal; Coking of coal; Distillation of coal tar; coal to Chemicals. Methods of manufacture and applications of Lampblack; carbon black; activated carbon; Natural graphite; Manufactured graphite and carbon; Industrial diamonds.

Nuclear reactions: uranium and Thorium fission; Uranium as an energy source; nuclear fuels and processing. Types, Characteristics & Uses of explosive, Industrial Explosives.

UNIT - IX: CERAMIC, GLASS, CEMENT AND LIME

Basic raw Materials; Chemical conversions, Including Basic Ceramic Chemistry; White wares: Structural Clay products; Refractories; Specialized Ceramic products: Vitreous Enamel; Kiln, Composition, manufacture of specialty glasses.

Portland cement: Raw materials & Manufacture of Portland cements; Setting and Hardening of cement; Manufacture and use of Lime and Gypsum.

UNIT - X: FOOD AND FOOD BY- PRODUCTS

Classification and structure of carbohydrates, Physical and chemical properties of sugar, starch, pectin substances, gum and other polysaccharide, Functional properties of carbohydrates in foods, Definition and classification of lipids, chemistry of fatty acids and glycerides.

Functional properties of lipids in foods, structure and chemistry of amino acids, peptides and proteins, Source and distribution of proteins, Isolation, identification and purity of proteins.

Texture of fruits and vegetables, Plant pigments, Effects of cooking on texture and composition of fruits and vegetables Animal proteins, Structure and chemical composition of muscles .Composition of milk, Physical and chemical properties of milk proteins and effects, chemistry of milk products like cheese, cream, butter, ghee, etc.