Industrial Chemistry

B.Sc. Part-I

Paper-I Unit-1 Nomenclature Generic names, Rade names. Raw Materials for Organic compounds Petroleum, natural gas, Fractionation of Crude oil.

Unit-2 Petrolutri :- Cracking, reforming Hydroforming isomerisaton Coal - Types, Structure, Properties, distillation of coal, chemicals derived there from.

Unit-3 Renewable natural resources :- Cellulose, starch, properties, modification, important industrial Chemicals derived from them, Alcohol and alcohol based chemicals, Oxalic acid, Furfural. Basic metallurgical operations- PuIverisation, calcination, Roasting, refining.

Unit-4 Physico chemical principles of extraction of,:- Iron, Copper, Lead, Silver, Sodium, Aluminium, Magnesium, Zinc, Chromium.

Unit-5 Inorganic materials of Industrial Importance - Their availablility, forms, structure arid modification. Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites.

Paper – II Unit-1 Surface. chemistry and Interfacial Phenomena Adsorption lsotherm, Sols, Gels, Emulions, Micoemulsions,.micelles, Aerosols, Effect of surfactants, Hydrotropes.

Unit-2 Calalysts - Introduction, Types, Homogeneous and Heterogeneous, Basic Principles, Mechanisms factors affecting the performance, Introduction to phase transfer catalysis

Unit-3 Enzyme catalysed reactions - Rate model, Industrially important reactions.Material Balance without chemical Reactions:- flow diagram for material balance, simple material with or without recycle or by-pass for chemical engineering operations such as distillation, crystallisation, evaporation, extraction, etc.

Unit-4 Dimensions and Units :- Basic. chemical calculations -Atomic weight, molecular, weight, equivalent weight, mole composition of (i) liquid mixture & (ii) gaseous mixture.

Material balance involving chemical reaction :- concept of limiting reactant, con-version, yield liquid phase reaction, gas phase reactions with/without recycle or by-pass.

Unit-5 Energy Balance - Heat capacity of pure gases and gaseous mixtures at constant pressures. Sensible heat changes. in liquids, Enthalpy changes.

Paper – III Unit-1 .Distillation - Introduction; Batch and continuous distillation, separation of azeotropes, plate columns & packed,columns. Absorption - Introduction, Equipments- Packed columns, spray columns, bubble columns, packed bubble columns, mechanically, agitated contractors.

Unit-2 Evaporation - Introduction, Equipments - short tube (standard) evaporator, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators, wiped (agitated) film evaporator.Filtration - Introduction, filter media and filter aids, Equipments- Plate and frame,filter press, nutch filter, rotatory drum filter, spartkler filter, candle filter, bahgfifter, cen-trifuge.Drying - Introdunction, free moisture, bound. moisture,drying curve, Equipments tray dryer, rotatory dryer, flash drater, fluid bed dryer, drum dryer, spray dryer.

Unit-3 Utilities in chemical IndustryFuel - Types of fuels -advantages and disadvantages, combustion of fuels, calortific value. specification for fuel oil.Boilers - Types of.-boilers and their functioning.Water - Specifications fof industrial use, various water treatments

Unit-4 Fluid Flow : Fans, blowers, compressors, vacuum pumps, ejector. Pumps :- Reciprocating pumps,, Gear pumps,. centrifugal pumps.

Unit-5 Heat Exchangers -: Shall and Tube type; finned tube heat exchangers, plate heat ex-changers, refrigeration cycles.

B.Sc. Part- II

Paper– I Unit-I Metals and Alloys : Important metals & alloys; iron, copper, aluminium lead, nikel, titanium and their alloys- Mechanical and chemical properties and their applications.
Cement : Types of cement,composition,manufacturing process,setting of cement.Ceramics : Introduction, Types, Manufacturing process, Applications.
Refractories.

Unit-II Polymeric Materials-Industrial polymer and composite materials- Their constitution, Chemical and physical properties, Industrial applications.

Unit-III Glass : Types, composition, manufacture, physical and chemical properties Applications. Corrosion- Various types of corrosion relevant to chemical Industry- Mechanism, Preventive methods.

Unit-IV Pollution : Air, Oxygen, nitrogen cycle, water, Biosphere, flora and fauna, Energy, soil. Pollutants and their statutory limits, pollution evaluation methods.

Unit-V Air pollution-various pollutants. water pollution-organic/inorganic pollutants, Noise pollution, sewage analysis, pesticide pollution, Radiation pollution, green house effect, future.

Paper – II Unit-I Unit processes in organic chemicals manufacture -Nitration : Introduction - Nitrating agents, Kinetics and mechanism of nitration processes such as nitration of :i Paraffinic hydrocarbons ii) Benzene to nitrobenzene and m-dinitrobenzene iii) Chlorobenzene to o and p nitrochloro benzenes.iv)Acetanilide to p-nitroacentanilide v)ToluneContinous vs batch nitration

Unit-II Helogenation: Introduction-Kinetics of halogenation reactions reagents for halogenation, Halogenation of aromatics-side chain and nuclear halogenations, commercial manufacture of chlorobenzene, chloral, monochloroacetic acid and chloromethanes, dichloro fluormethane.

Unit-III Sulphonation : Introduction-sulphonating agents, chemical and physical factors in sulphonation, Kinetics and mechanism of sulphonation reaction, commercial sulfonation of benzene, naphthalene, alkyl benzene, Batch vs continous sultphonation.

Unit-IV Effluent Treatment and waste Management : Principles and equipments for aerobic, anaerobic treatment, adsorption, filtration, sedimentation.

UNIT-V Bag filters, electrostatic precipitator, mist eliminators, wet scrubbers, absorbers, solid waste management, industrial safety.

Paper – III Unit-I Oxidation : Introduction-Types of oxidation reactions, oxidizing agents, kinetics and mechanism of oxidation of organic compounds liquid phase oxidation, vapor phase oxidation, commercial manufacture of benzoic acid, maleic anhydride, phthalic anhydride, acrolein, acetaldehyde, acetic acid.

Unit-II Hydrogenation : Introduction-Kenetics and thermo-dynamics ofhydrogenation reactions, catalysts for hydrogenation reactions, hydrogenation of vegetable oil manufacture of methanol from carbon monoxide and hydrogen, hydrogenation of acids and esters to alcohols, catalytic reforming. Alkylation: Introducton; Types of alkylation, Alkylating agents, Thermodynamics and mechanism of alkylation reactions, manufacture of - alkyl benzenes (for detergent manufacture), ethyl benzene, phenyl ethyl alcohol, N-alkyl anilines (mono and dimethyl anilines)

Unit-III Esterification : Introduction; Hydrodynamics and kinetics of esterification reactions, Esterification by organic acids, by addition of unsaturated compounds, esterification of carboxy acid derivaives, commercial manufacture of ethyl acetate, dioctyl phthalate, vinyl acetate, cellulose acetate. Amination By reduction **:** Intoduction, Methods of reduction-metal and acid, catalytic, sulfide, electrolytic, metal and alkali sulfites, metal hydrides, sodium metal, concentrated caustic oxidation, reduction, commercial manufacture of aniline, m-nitroaniline, p-amino phenol. by aminolysis **:** Introduction, aminating agents, factors affecting. Hydrolysis **:** Introduction; hydrolysing agents, kinetics, thermodyanics and mecha- nism of hydrolysis.

Unit-IV Procees Instrumentation : concept of measurement and accuracy Principle, construction and working of following measuring instruments.

Temperature : Glass thermometers, bimetallic thermometer pressure spring thermometer, vapour filled thermometers resistance thermometers. radiation pyrom-eters. Pressure : Manometers, barometers, bourdon pressure gauge ; bellow type diaphragm type pressure gauges, macleod gauges, pirani gauges, etc.

Unit-V Liquid level : Direct-indirect liquid level measurement, Float type liquid level gauge, ultrasonic level gauges; bubbler system, density mesurement, viscocity measure- men reduction, polymerization, reactions of diazonium salts. Instrumental methods of analysis **:** Use of colourimeter pH meter, potentiometer, conductometer, refractometer, polarimeter

Materialtesting**:** Testing of alloys identification of plastics/rubber estimation of yield point, young's modulus, flaredness; Optical, thermal mechanical and electrical properties.

Process Instrumentation Transducers of different types. use of Tranducer for measuring flow control. Determinatiaon of flash point and ignition points of liquids.Water analysis **:** Solid contents, Hardness, COD and other tests as per industrial specifications.

Flow measuring devices **:** Floats Monographs of representative raw materials such as sulphuric acid, toluene, sodium, carbonate, sodium hyroxide, carbon tetrachloride benzoic acid (5-6 compounds). Limit tests for heavy metals Pb, AS, Hg, Fe and ash content.

B.Sc. Part-III

Paper – I Unit-I Factors involved in project cost estimation, methods employed for the estimation of capital investment. Capital formation, elements of cost accounting.

Unit-II Interest & investment cost, time value of money equivalence. Depreciation, method of determining depreciation, taxes. Some aspects of marketing, pricing policy.

Unit-III Profitability criteria, economics of selecting alternatives. Variation of costs with capacity, Break-even point, optimum batch sizes, Production, scheduling etc. Sampling of Bulk materials, techniques of sampling of solids, liquids and gases.Collection & Processing data. Particle size determination. Rheological properties of liquids, plastics and their analysis

Unit-IV 1. Concept of scientific management in industry. Functions of management, decisionmaking, planning, organising. directing & control. Location of industry.

Unit-V.Materials management. Inventory control. Management of human resources-selection, incentives, welfare & safety.

Paper – II Unit-I Historical Background & development of pharmaceutical industry in India in brief. Pharmacopoeias - Development of Indian pharmacopoeia & introduction ot B.P., U.S.P., E.P.,N.F. & other Important Pharmacopoeias. Introduction to various types of formulations & roots of administration. Aseptic conditions, need for sterilisation, various methods of sterilisation.

Unit-II Various types of pharmaceutical excipients their chemistry, process manufacture & quality, specifications Glidants, lubricants, diluants, preserva-tives, antioxidants, emulsifying agents, coating agents, binders, coloring agents, flavouring agents geletin & other additives, sorbotol, mannitol, viscosity builders etc. Surgical dressing, sutures, ligatures with respect to the process, equipments used for manufacture, method of sterlilization and quality control.

Unit-III Pharmaceutical packaging introduction, package selection, packaging materials, ancillary materials, packaging machinery, quality control of packagingmaterials. F.D.A., Important schedules & some legal aspects of drugs. Pharmceutical quality control (other than the analytical methods covered under core-subject) - sterility testing, pyrogenic testing, glass testing, bulk density of power

Unit-IV Evaluation of crude drugs-Moisture content, extractive value, volatile oil content, foreign organic matter, quantitative microscopic exercises, including starch, leaf content, (palisade ratio, stomatal number & index vein, islet number & vein termination number), crude fiber content, introduction to chromatographic method of dentification of crude drugs. Chromatography, Paper chromatography, TLC, HPLC, GLC. Ion chromatography.

Unit-V.UV-Visible spectroscopy.IR-Spectroscopy non-dispersive IR. NMR Spectroscopy. Atomic Absorption & Flame photometry. Neutron diffraction. X-Ray Fluorescence. Ion Selective Electrodes.

Paper -III

Unit-I Phyto-chemicals-Introduction to plant classification & crude drugs, cultivation, collection, preparations for the market & storage of medicinal plants.Classification of various types of drugs with

examples.Raw meterials, process of manufacture, effluent handling, etc. of the following bulk drugs :-
(i) Sulpha drugs-sulphaguandine, sulphamethoxazole.

Unit-II Chemical constitution of plants including carbohydrates, amino acids, proteins, fats, waxes, volatile oils, terpenoids, steroids, saponins flavonoids, tanins, glycosides, alkaloids. 2. Various isolation procedures for active ingredients with examples for alkaloids, reserpine one for steroids sapogenin, diosgenin, diogron.

Unit-III 1. Antimicrobial :- Chloramphenicol, Furazolidne, Mercurochrome, Isoniazid, Na-PAS.

2. Analgesic-AntiInflammatory :- Salicylic acid and its derivatives, Ibuprofen, Mefenamic acid.

3. Steroidal Harmones :- Progesterone, Testosterone, Methyl testosterne.

Unit-IV Vitamins :- Vit.-A,Vit.-B6,Vit.C.BarbituratesPentobarbital.

Blockers :- Propranolol, Atenolol.Cardiovascular Agent :- Methyl dopa.

2. Antihistamins :- Chloropheneramine Maleate.

Unit-V Products based of fermentation processes :- Brief idea of micro-organisma, their structure, growth & usefulness. Enzyme systems useful for transformation, microbial products.General principles of fermentation processes & product processing.Manufacture of antibiotics - Pencillin-G & semi synthetic pencillines, Rifamycin, Vitamin-B12.Bio-transformation process for prednisolone, 11-hydroxylation in steroids.Enzyme catalysed transformation, manufacture of ephidrine