

Sardar Patel University
Syllabus for B. Sc. Semester-V Industrial Chemistry Vocational
Effective from Academic Year 2020-2021.

Courses	Course Code	Title Of Paper	Credit
Core courses-I	US05CICV21	Organic Chemistry	04
Core courses-II	US05CICV22	Technology of Petroleum & Petroleum Products	04
Core courses-III	US05CICV23	Heavy & Fine Chemicals	04
Core courses-IV	US05CICV24	Mass Transfer	04
Practical	US05CICV25	Practical (All Core Courses)	06
Discipline Specific Elective	US05DICV26	Specialty Chemicals – I	02
Discipline Specific Elective	US05DICV27	Occupational Health & Industrial Hygiene - I	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US05CICV21	04	70	3 Hrs	30	100
Core courses – II	US05CICV22	04	70	3 Hrs	30	100
Core courses – III	US05CICV23	04	70	3 Hrs	30	100
Core courses – IV	US05CICV24	04	70	3 Hrs	30	100
Practical	US05CICV25	06	105	12 Hrs	45	150
Discipline Specific Elective Any One	US05DICV26 US05DICV27	02	50	2 Hrs	--	50

Note: Nomenclature of Subject of code: U S 05 C ICV 21: U=Undergraduate, S=Science Faculty, 05=Semester three/four, C=Core Course, D= Discipline Specific Elective, ICV=Industrial Chemistry Vocational. 21...22... = Paper number.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
PAPER NO.: US05CICV21
TITLE: Organic Chemistry
(04 Credits, 4 Hours/Week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Heterocyclic Chemistry: Nomenclature of heterocyclic systems (Five and Six membered only), Five membered heterocycles- structure, source and electrophilic substitution reaction in Pyrrole, Thiophene and furan. Six membered heterocyclic compounds: structure and source of pyridine compounds, nucleophilic and electrophilic substitution reaction in pyridine, basicity of pyridine, reduction of pyridine. Fused ring heterocycles- Skraup synthesis of Quinoline, Bischler-Nspierlaski synthesis of isoquinoline, Fischer indole synthesis.

Unit: 2 Stereochemistry: Stereoisomerism, Polari meter, specific rotation, chirality, enantiomers, Racemic modification, optical activity, configuration, specification of configuration: R & S, diastereomers, meso compound, conformational isomers, reactions involving stereoisomers.

Unit: 3 Some Reagents Of Synthetic Importance: Aluminium isopropoxide, Diazomethane, N-Bromosuccinimide, Lead tetra acetate, Osmium tetroxide, Selenium dioxide, LiAlH₄ and NaBH₄. Reaction Mechanism:, Hoffmann- Loffler Reaction, Baeyer Villiger Oxidation, Hunsdiecker Reaction, Favorskii Rearrangement, Benzoin Condensation ,Concept of rearrangement - Beckman Rearrangement, Benzilic acid Rearrangement and Pinacol-Pinacolone rearrangement.

Unit: 4 Ultraviolet (UV) and Visible Spectroscopy: An Introduction, electronic transitional definition of some terms and designation of UV absorption bands. Infrared Spectroscopy: An introduction, Instrumentations, Applications of IR spectroscopy, Interpretation of IR spectra-characterization of functional groups and structural diagnosis. NMR Spectroscopy: PMR spectroscopy, shielding and deshielding , chemical shift, spin-spin splitting and coupling constant, area of signal, interpretation of PMR spectra of various simple organic molecules, Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and PMR spectroscopy.

REFERENCE BOOKS

1. Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. New Delhi)
2. Organic Chemistry by R. K. Bansal (Tata McGraw – Hill Publishing Co. Ltd. New Delhi)
3. Organic Chemistry by M. K. Jain and S. C. Jain (ShobanLAINagin Chand & Co. Educational Publishers, Jalandhar).
4. Spectroscopy of Organic Compounds by P. S. Kalsi (New Age International Publishers)
5. Spectroscopy (Atomic & Molecular) by GurdeepChatwal (Himalaya Publishing House)



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
PAPER NO.: US05CICV22
TITLE: Technology of Petroleum & Petroleum Products
(04 Credits, 4 Hours/Week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit -1

Introduction - Nomenclature Generic names, Trade names, Theories of Formation, Composition and its testing methods. Refining and Rectification process of Petroleum.

Unit - 2

Manufacture of the following compounds: Methane, ethylene, acetylene.
Preparation of the following from methane, methanol, hydrogen cyanide, carbon disulphides.

Unit – 3

Preparation of the following from ethylene. Ethyl chloride, ethanol, ethylene oxide, ethylene glycol, acetic acid, styrene, vinyl acetate.
Manufacture of the following compounds: From propylene: Isopropanol, Cumene, glycerine, acrylonitrile.

Unit - 4

Manufacturing from C-4 hydrocarbons: Butadiene, Isobutene, Isobutane, Butandionols.
Production of Benzene, Toluene, Xylene, Naphthalene, linear alkyl benzenes sulphonates.
Various catalysts used in petrochemical industry: Preparation, applications and selectivity.

REFERENCE BOOKS

1. Handbook of Petroleum Refining Process R. A. Meyers, McGraw Hill, Book Com. New York.
2. From Hydrocarbons to petrochemicals, L.F. Hatch Gulf Publishing company, Houston.
3. Petrochemicals – The rise of an industry, Spitz, Wiley.
4. Introduction to petrochemicals by SukumarMati, IBH.
5. Introduction to petroleum chemicals, M. Steiner, Pergamon Press.
6. Catalysts in petrochemical refining, Trima.Billmeyer.
7. A Text on Petrochemicals by BhaskarRao (Khanna Publishers - New Delhi)
8. Modern Petroleum Refining Process by BhaskarRao (Oxford & IBH Publishing Co. Pvt. Ltd. – New Delhi)
9. Advanced Petrochemicals by Dr. G. N. Sarkar (Khanna Publishers)
10. Advanced Petroleum Refining by Dr. G. N. Sarkar (Khanna Publishers)
11. Chemicals from Petroleum by A. L. Waddam. (ELBS edition, London.)
12. Shreve's Chemical Process Industries by Austin (MacGrow- Hill Publication, New Delhi).



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
PAPER NO.: US05CICV23
TITLE: Heavy & Fine Chemicals
(04 Credits, 4 Hours/Week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

UNIT-1: Synthetic nitrogen products – Ammonia, ammonium nitrate and ammonium sulphate, nitric acid, Phosphorous chemical – phosphorus, phosphoric acid, ammonium phosphate, super – phosphate, triple superphosphate. Industrial carbon – carbon black, manufacture of graphite and carbon, lime, gypsum, silicon, calcium carbide, silicon carbide.

Fluorine, Bromine, Iodine, Inter-halogen compound. Sodium chloride, sodium sulphate, sodium sulphite, sodium thiosulphate. Industrial catalysts – Raney nickel, other forms of nickel, palladium and supported palladium, copper chromate, vanadium, platinum based catalyst, titanium tetrachloride, and titanium dioxide.

UNIT-2: Fine and speciality chemicals – sodium carbonate, sodium bicarbonate, potassium dichromate, oxalic acid, perchloric acid, fehling solution, Karl-Fischer reagent, sodium borohydrate, sodium ethoxide, sodium methoxide and lithium aluminium hydride.

Biochemical reagents: Ninhydrin, tetrazolium blue, 1,2-naphthaquinone – 4 – sulphonate manufacture of following fine chemicals. Chromatographic materials and HPLC Solvents: Coating materials, precoating of plates, spectroscopy grade chemical. Methanol, ethanol, potassium bromide, carbon tetrachloride, Nujol, chloroform.

UNIT-3: Fischer-tropsch synthesis- Examples, Chemicals derived from acetylene, propargyl alcohol, 1, 4-butanediol, acrylates, vinyl esters, vinyl chloride. Pyridine picolines, phenol, acetone, resprcinol, phthallic anhydride.

Raw materials, flow chart, effluent management, kinetics and uses of Triphenyl phosphine, alkyl phosphates, Glycerol, sorbitol, melamine, formaldehyde, formic acid.

UNIT-4: Chlorination of methane: Methyl chloride, dichloromethane, chloroform, carbon tetrachloride. Ethanolamine, mono, di, and tri- ethanolamines, dialkylaminoethanols (dimethyl, diethyl). Alkylamines: Methylamine, ethylamine, di, tri - alkylamine (methyl, ethyl), butylamines, propyl amines Specialty & industrial solvents: DMF, DMSO, Sulfolane, Alkylpyrrolidone, THF, Dibutyl ether, diethyl ether, dimethoxyethane, dioxane.

REFERENCE BOOKS:

1. Chemical process industries, Shreve RN, McGraw Hill.
2. Introduction to material science and engineering, K M RELLS and T. COURTNEY, Wiley Eastern Pvt. Ltd. New Delhi.
3. Outline of Chemical Technology, G E. Dryden, East West Press, New Delhi.
4. Industrial Chemicals, Faith et. al. Wiley Interscience, New Delhi.
5. Applied Organic Chemistry, Kilner E. and Samuel.D.M.MacDonald and Evans Ltd.,
6. Unit process in Organic Synthesis. P.H. roggGine, McGraw Hill Kogakusin Ltd.
7. Heavy organic chemicals, A.J.Saite, Pargaon Press, U.K.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
PAPER NO.: US05CICV24
TITLE: Mass Transfer
(04 Credits, 4 Hours/Week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1:

Characterization, uses and selection of separation process – Distillation, Types of distillation, McCabe Thiele method for calculating Number of Theoretical plates, Importance of Reflux Ratio, Types of trays.

Unit 2:

Concept of Mass Transfer Operations, Fick's Law, Gas absorption, Equipment's for Gas absorption, Solvents for Gas absorption, Importance of packing in packed towers and Types of packing, Liquid Extraction & Equipment's of liquid Extractions.

Unit 3:

Crystallization- Methods of crystallization, Batch & Continuous crystallization, Theory of crystallization, Mechanism of crystallization, Mass & Enthalpy Balance calculations. Leaching, Factors affecting leaching, Industrial leaching examples.

Unit 4:

Drying, Classification of dryers, Compartment dryer, Tunnel dryer, rotary dryer, Drum dryer, Spray dryer etc., Types of moisture, Theory of drying.
Evaporation- batch and continuous type evaporators, Multiple effect evaporator, Capacity of evaporator, Accessories of evaporator.

REFERENCE BOOKS:

1. Unit Operations : Volume I & II, by K. A. Gavhane (NiraliPrakashan- Pune)
2. Introduction to Chemical Engineering by Walter L Badger and Juline T Banchemo (McGraw-Hill Book Co.)
3. Unit Operation of Chemical Engineering by Warreh L Mc Cabe&Jullian C Smith (McGraw-Hill Book Co.)
4. Chemical Engineering (volume I & II) by J. M. Coulson & K. F. Richardson (Asian Books Pvt. Ltd., New delhi)



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
SUBJECT CODE: US05CICV25
TITLE: Practical (All Core Courses)
(06 Credits, 12 Hours; External Marks-105, Internal Marks-45)
(Effective from June 2020)

Part-I: (02 Credits, 04 Hours, 35 External 15 Internal marks)

Preparation and Estimation of Intermediates and Drugs based on various Unit Process.

Part: II: (02 Credits, 04 Hours, 35 External 15 Internal marks)

Asper ASTM testing of petroleum and petroleum products : Characteristics of Petrol, Kerosene, Diesel, Furnace Oil, with respect to Flash point, Viscosity, Surface Tension, Distillation Fractions.

Part: III: (02 Credits, 04 Hours, 35 External 15 Internal marks)

Demonstration of various Pharmaceutical Packaging materials quality control tests of some materials. Aluminium strips, cartons, glass bottles. Limits tests for chlorine, heavy metals, arsenic etc. of two representative bulk drugs. Demonstration of various pharmaceutical products. Active ingredient analysis of few types of formulations representing different methods of analysis acidimetry, Alkyimetry, non aqueous complexometry, Potentiometry, etc. of bulk drugs, complete I.P. Monograph of three drugs representing variety of testing methods. And estimations.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
SUBJECT CODE: US05DICV26
TITLE: Specialty Chemicals – I
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit-1

Nuclear reactions, Uranium & thorium fission, uranium as energy source, Nuclear reactor, fusion reaction, Fusion processing nuclear materials, Isotope and Isotope separation protection from radioactivity waste disposal.

Unit-2

Introduction of synthetic perfumes, Ester, alcohol, and ketone. Production of natural and flower perfumes, fruit flavor and artificial flavors.

Unit-3

Introduction of Leather, Animal skins, Manufacturing of leather, Preparation of hides for tanning, Vegetable tanning, Chrome tanning, finishing, oil tanning, by product, gelatin. Introduction Adhesives : The process of bonding, Classification of adhesive, Preparation of adhesive, other protein adhesive, Starch adhesives, synthetic resin adhesives, rubber based, cellulose and silicate adhesives use of adhesives.

Unit-4

Fermentation Introduction, Physical condition for cultivation of microorganisms, Development of inoculums, Characteristics of enzymes, Industrial alcohol, Manufacturing of beers, Wines, Distilled spirits, Citric acid from molasses by fermentation process, ethanol from sugar, Manufacturing of vinegar.

REFERENCE BOOKS

1. Environmental Chemistry by B.K. Sharma, H.Kaur (GOEL Publishing House, Meerut)
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, George Tchobanoglous (McGRAW-HILL INTERNATIONAL EDITOR)
3. Water Pollution by V.P. Kudesia (Pragatiprakashan)
4. Environment pollution control engineering by C S Rao (New Age International (P) Limited)



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-V
SUBJECT CODE: US05DICV27
TITLE: Occupational Health & Industrial Hygiene - I
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

UNIT-1

Introduction of safety & Hazards

Safety in chemical industries, Introduction of hot & cold processes, types of furnace & use of safety measures, Need of safety in industries, Indian standards, safety Terminology

UNIT-2

Hazard assessment techniques & its controls in chemical industries

Safety Appraisal Analysis & control techniques, safety work permit, permits objective & its types, standard operating procedure in the Industries, hazard & Risk management techniques,

Major accidental hazard & nits control (MAH), MAH concept, types, types of discharge and identifications

UNIT-3

Ergonomics Hazard & industrial hygiene

Introduction of ergonomics, Constituents of ergonomics, applications of ergonomics for safety & health, work station design, occupational health, occupational lung diseases, Dust control, occupational dermatitis ,occupational diseases & their Diagnostic methods , industrial hygiene.

UNIT-4

Fire & Explosion Hazard in chemical Industries.

Fire phenomena, Nature of fire, Need of fire, triangle of fire, Factors to contributing fire, Classification of fire & extinguishers, Fire prevention & Protection systems, General control measure for fire detection and alarm systems, portable fire extinguishers, Automatic water sprinklers, water spray systems.

REFERENCE BOOKS

Fundamental of industrial safety & Health –volume-1 by Dr. K.U.Mistry

Fundamental of industrial safety & Health –volume-2 by Dr. K.U.Mistry

Occupational & safety health by David H Goetsch



Sardar Patel University
Syllabus for B. Sc. (Semester-VI) Industrial Chemistry
Effective from Academic Year 2020-2021

Courses	Course Code	Title Of Paper	Credit
Core courses-I	US06CICV21	Synthetic Dyes and Drugs	04
Core courses-II	US06CICV22	Polymer Science and Technology	04
Core courses-III	US06CICV23	Industrial Management & Economics	04
Core courses-IV	US06CICV24	Separation Techniques, Plant design & Control	04
Practical	US06CICV25	Laboratory (All Core Courses)	06
Discipline Specific Elective	US06DICV26	Specialty Chemicals – II	02
Discipline Specific Elective	US06DICV27	Occupational Health & Industrial Hygiene - II	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US06CICV21	04	70	3 Hrs	30	100
Core courses - II	US06CICV22	04	70	3 Hrs	30	100
Core courses – III	US06CICV23	04	70	3 Hrs	30	100
Core courses – IV	US06CICV24	04	70	3 Hrs	30	100
Practical	US06CICV25	06	105	12 Hrs	45	150
Discipline Specific Elective Any One	US06DICV26 US06DICV27	02	50	2 Hrs	--	50

Note: Nomenclature of Subject of code: U S 05 C ICH 21: U=Undergraduate, S=Science Faculty, 05=Semester three/four, C=Core Course, D=Discipline Specific Elective, ICV=Industrial Chemistry Vocational. 21...22...= Paper number.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
PAPER NO.: US06CICV21
TITLE: Synthetic Dyes and Drugs
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Introduction, Classification of Dyes on the basis of mode of applications to the fibers and chemical constitution of the Dyes. Applications of Dyes to fibers, Color shades and fastness properties.

Unit 2: Chemistry of the following dyes with respect to general structural features and classification: Azo dyes, Acid dyes, Basic dyes and Mordant dyes, Anthraquinone (VAT) dyes, Indigoid dyes. Disperse dye and Reactive dyes.

Unit 3: Historical background and development of pharmaceutical industry in India in brief. Pharmacopeias-I.P. , B.P., U.S.P., Brief idea of Pharmaceutical Legislation, Drugs & Cosmetics Act-1940. Introduction to various types of formulation and routes of Administration. Pharmaceutical Packaging: Introduction, package selection, packaging materials, packaging machinery, quality control of packaging materials. Brief study of sterilizations. Pharmaceutical quality control: Aseptic condition, sterility testing, pyrogenic testing, glass testing.

Unit 4: Drugs, pro-drugs, biotransformation of drugs, routes of drugs administration and dosage forms, drug binding, drug toxicity, drug addiction, some important terms used in chemistry of drugs, biological and medical terms used in the study of drugs, distinctive definition. Classification of drugs, relation of chemical structure and chemical activity. The study of life saving drugs: Introduction, classification, properties and uses of followings. Sulfa drugs, Antipyretics and analgesics, and Anti-inflammatory drugs.

REFERENCE BOOKS:

1. LUBS Chemistry of synthetic dyes and pigments, R. E. Krieger Publishing Company.
2. The chemistry of Synthetic Dyes, K.Venkataraman, Academic Press, Vol. I-III.
3. A Laboratory Course in Dyeing, C.H.Gites, The society of Dyes and Colourists.
4. Dyes and Their Intermediates, H.A. Abrahert, Pergaman Press.
5. An introduction to synthetic Dyes, D.M. Rangnekar and P.P.Singh Himalaya Publication, Bombay.
6. Organic chemistry of Drugs synthesis, Daniel Lednice and L.A. Mitsohar, Wiley Interscience.
7. An introduction to synthetic Drugs, P.P.Singh and D.W.Rangnekar, Himalaya Publication, Bombay.
8. Synthetic Drugs by Gurdeep R. Chatwal (Himalaya Publishing House).
9. Text book of organic medicinal and pharmaceutical chemistry Milson, Gisvold, Derge, Lippinett Toppan.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
PAPER NO.: US06CICV22
TITLE: Polymer Science and Technology
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

UNIT: 1

Introduction, General characteristics of polymers in comparison with common organic compounds. Nomenclature and classification of polymers, Different types and method of Polymerizations.

UNIT: 2

Molecular weight and molecular weight distribution number, weight and viscosity average molecular weights of polymers. Methods of determining molecular weight, Practical significance of molecular weight distribution. Glassy state, Glass transition temperature (T_g), Factors affecting T_g, Crystallinity in polymers.

UNIT: 3

Thermosetting Polymers: Introduction, Synthesis, Chemistry, Properties and Applications of Phenol formaldehyde, Melamine formaldehyde resins, Polyurethanes, Epoxy resins, Grades of epoxy resins, Curing process and its importance with mechanism. Elastomers, Polybutadiene and Neoprene.

UNIT: 4

Detailed study of the following thermoplastic polymers with respect to Synthesis, Chemistry, Properties and Application Polyolefine Polyethelenes, LDPE, HDPE, Polypropylene, Polyvinyl chloride, Teflon, polystyrene.

Homopolymers, Copolymers such as SBR, ABS, SAN. Polyvinyl acetate and its modifications. Polyamides: Nylon-6 and Nylon-66.

REFERENCE BOOKS:

1. Textbook of Polymer Science, John Wiley and Sons, D.D. Deshpande.
2. Physical Chemistry of Macromolecules. Vishal Publications, New Delhi 1985
3. Polymer Science V. R. Gowarikar, N.V. Vishwanathan and J. Sreedhan, Wiley Eastern Ltd., 1986.
4. Polymer Science and Technology, Joel R Fried, PHI



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
SEMESTER-VI
PAPER NO.: US06CICV23 - Industrial Management & Economics
(4 CREDITS, 4 Hrs, 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

UNIT-1

Forms of legal ownership, Ideal form of an organization, Features, Advantages and Disadvantages of Sole Proprietorship, Partnership Organization, Co-Operative Organization, Joint stock companies and Joint Hindu family organization.

Entrepreneurial decision: Launching a new enterprise, ownership organization decision, Expansion of existing business.

Scale of operation and size of firm: Measure of size, Factors determining size of business, optimum size of business unit, force determining optimum size. Weakness of large firms.

UNIT-2

Concept of scientific management in industry, Function of Management, Decision making, Planning, organizing, Directing and Control.

Location of industry, Management of human resources selection, Incentives welfare and safety. Introduction to MIS, Functions of MIS, Problems with MIS, Knowledge requirements for MIS in seven areas. (GST, DSS, EIS, ES, 4GL, IT & MIS)

UNIT-3

Basic concept of Economics, Demand and Supply, Elasticity of Demand and Supply, Concept of Profit and Revenue, Concept of Equilibrium and Margin, Introduction to Micro and Macro Economics, Economics in production, Economics in management, Economics in finance.

Depreciation methods of determining depreciation, Taxes, selecting some aspects of marketing, Pricing policy, Profitability, Criteria, Economics of selecting alternatives, Variation of cost with capacity, optimum batch sizes, Production scheduling etc.

UNIT-4

Factors involved in project cost estimation, Methods employed for the estimation of capital investment, Capital information, Elements of cost accounting, interest and investment costs, Time value of money, Equivalence.

Material management, Inventory Management: Meaning, Importance, Techniques and Inventory Controls. Quality Control: Meaning, Importance, Total Quality Control and Total Quality Management Case Study on TQC and TQM

REFERENCE BOOKS

1. Fundamentals of Business organization and management by Y.K. Bhushan, Sultan Chand & Sons New Delhi.
2. Business Administration & management by S.C. Saxena.
3. Finance Management by I.M. Pandey.
4. Marketing Management By Philip Kotler.
5. MIS by T. Lucey 8th Edition BPB Publication.
6. Essentials of Inventory Management, by Max Muller, AMACOM.
7. Total Quality Management – An Introductory Text by Paul James, Prentice Hall.
8. Quality Control and Applications by Housen & Ghose.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
PAPER NO.: US06CICV24
TITLE: Separation Techniques, Plant design & Control
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1:

Development of project, Evaluation of process, Plant design factors, Process design, Choice of process, engineering flow diagram.
Selection of process Equipment's & Materials, Chemical reactors, Plant Layout.

Unit 2:

Surface chemistry & Interfacial phenomena, Absorption, Sols, Gel, Emulsion, Aerosols, Surfactants, catalysis & catalyst, Industrial important of catalyzed reaction.

Unit 3:

Advance separation Techniques: - Ion exchange resins & its Equipment's, Membrane separation process, Ultra-filtration. Reverse Osmosis, Electro-dialysis.

Unit 4:

Automatic control system Terminology, Manual & automatic control, Feedforward & feedback control system, process times lags, control actions & its types of control actions, final control element.

REFERENCE BOOKS:

1. Chemical engineering plant design, vibrant & Dryden (McGraw hill publication)
2. Chemical engineering (volume II) Coulson & Richardson
3. Mechanical and industrial measurement, R.K. Jain (Khanna Publishers)
4. Plant design and economics for chemical engineering, Piter & Pimmerhours
5. Unit operations of chemical engineering, McCabe & smith



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06CICV25 - Practical
TITLE: PRACTICAL (All Core Courses)
(06 Credits, 12 Hours; External Marks-105, Internal Marks-45)
(Effective from June 2020)

Part: I (02 Credits, 04 Hours, 35 External 15 Internal marks)

Analysis of intermediates: Nitrite titrations, Diazocoupling, titanous chloride titration, estimation of Cu, Ni, Cr, etc. Dyeing: Dyeing of various dyes on cotton. Evaluation of the fastness properties of dyes with respect to light, washing and sublimation. Preparation of various classes of dyes.

Part: II (02 Credits, 04 Hours, 35 External 15 Internal marks)

Determination of Acid value, Iodine number, Saponification value, Melting point and softening point of epoxy resin and Hydroxyl value. Synthesis of polymers and resins like Novalak Phenolformaldehyde, Resol Phenolformaldehyde, Ureaformaldehyde, Melamine formaldehyde, Glyptal resin, Saturated and Unsaturated polyester. Cellulose Acetate, Cellulose Nitrate, Polysulfone rubber and analysis of the above (viscosity, M.P., Mol.Wt. determination). Identification of polymers by simple physical and chemical tests. Analysis of raw materials phenols, formaldehyde, urea, melamine, epichlorhydrin.

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)

Quantitative Organic Analysis: Estimation and Analysis of intermediates and finished Drugs. Identification of raw drugs by TLC and Paper chromatography method for identification. Book review report writing and its submission cum presentation. A case study on selected management area of chemical industry visited.



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICV26
TITLE: Specialty Chemicals – II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit-1

White pigments, White lead, Electric method, Characteristic of pigment, use of pigment, Titanium dioxide, morden chlorine method, Physical property of TiO_2 Ultramarine blue, Cobalt blue, Red lead, Synthetic iron oxide pigment, Green pigment, Chrome green, Yellow pigment, Black pigment, Tonner.

Unit -2

Introduction detergents, principal group of synthetic detergent, Classification of surface-active agent, Anionic detergents, Non-ionic detergents, Additives, sub regulators, Binders, Biodegradability of surfactants, Ecofriendly detergents containing enzymes, Ecofriendly detergents-Zeolites, Detrimental effect of detergent, Manufacturing of Shampoos.

Unit-3

Classification of paint, Distemper, Manufacturing of paint, Setting of paint, Good paint, Important of PVC, Paint failure, Emulsion paint, constituent of emulsion paint, Latex paint, Luminescent paints, paint remover, Application of paint and Varnishes, Raw material, Manufacturing of Varnishes, enamels, Gloss finisher.

Unit-4

Introduction of Explosive and Toxic chemical Industries, Classification of Deflagrating, Characteristics of explosive, Nitrocellulose, Di-nitrobenzene, Tri-Nitrobenzene, Tri-Nitro toluene, Picric acid, Ammonium picrate or explosive, Nitroglycerin and dynamite, Gun powder, RDX.

REFERENCE BOOKS

1. Environmental Chemistry by B.K. Sharma, H.Kaur (GOEL Publishing House, Meerut)
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, George Tchobanoglous (McGRAW-HILL INTERNATIONAL EDITOR)
3. Water Pollution by V.P. Kudesia (Pragatiprakashan)
4. Environment pollution control engineering by C S Rao (New Age International (P) Limited)



BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICV27
TITLE: Occupational Health & Industrial Hygiene - II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

UNIT-1

Safety in chemical industries

Place of chemical industries in society, statutory provisions, Types of chemical hazard & its control, General safety precautions.

UNIT-2

Process Hazard & its control, Utility Hazard & its control, safety transportation of chemicals, Checklist of Routine inspections chemical factories, Types of tests, certificates & Records. Permits for vessel entry.

UNIT-3

Occupational health

Industrial hygiene & occupational health, occupational health hazard, adverse health effect & its control, Types and limits of radiation, Dangerous properties of chemicals and their health effects, Routes of entry & its toxic effects, Evaluation of health hazards, Sampling analysis in gas.

UNIT-4

Safety management

Concept of management , elements of management & principles, safety management & its responsibilities, safety organizations, department & Programme, safety education & training

REFERENCE BOOKS

Fundamental of industrial safety & Health –volume-1 by Dr. K.U.Mistry

Fundamental of industrial safety & Health –volume-2 by Dr. K.U.Mistry



Sardar Patel University
Syllabus for B. Sc. (Semester-V) Industrial Chemistry
Effective from Academic Year 2020-2021.

Courses	Course Code	Title Of Paper	Credit
Core courses – I	US05CICH21	Advance Organic Chemistry	04
Core courses - II	US05CICH22	Petroleum and Petroleum Products	04
Core courses – III	US05CICH23	Chemical Process Industries	04
Core courses – IV	US05CICH24	Fluid Mechanics & Mechanical Operations	04
Practical	US05CICH25	Practical (All Core Courses)	06
Discipline Specific Elective	US05DICH26	Specialty Chemical Industries - I	02
Discipline Specific Elective	US05DICH27	Industrial Safety & Hygiene - I	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US05CICH21	04	70	3 Hrs	30	100
Core courses – II	US05CICH22	04	70	3 Hrs	30	100
Core courses – III	US05CICH23	04	70	3 Hrs	30	100
Core courses – IV	US05CICH24	04	70	3 Hrs	30	100
Practical	US05CICH25	06	105	12 Hrs	45	150
Discipline Specific Elective (Any One)	US05DICH26 US05DICH27	02	50	2 Hrs	--	50

Note: Nomenclature of Subject of code: U S 05 C ICH 21: U=Undergraduate, S=Science Faculty, 05=Semester three/four, C=Core Course, D= Discipline Specific Elective, ICH=Industrial Chemistry, ICV=Industrial Chemistry Vocational. 21...22... = Paper number.



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
PAPER NO.: US05CICH21
TITLE: Advance Organic Chemistry
(04 Credits, 4 Hours/week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Stereochemistry: Stereoisomerism, Polarimeter, specific rotation, chirality, enantiomers, Racemic modification, optical activity, configuration, specification of configuration: R & S, diastereomers, meso compound, conformational isomers, reactions involving stereoisomers.

Unit: 2 Some Reagents Of Synthetic Importance: Aluminium isopropoxide, Diazomethane, N-Bromosuccinimide, Lead tetra acetate, Osmium tetroxide, Selenium dioxide, LiAlH_4 and NaBH_4 . Reaction Mechanism: Hoffmann-Löffler Reaction, Baeyer Villiger Oxidation, Hunsdiecker Reaction, Favorskii Rearrangement, Benzoin Condensation, Concept of rearrangement - Beckmann Rearrangement, Benzilic acid Rearrangement and Pinacol-Pinacolone rearrangement.

Unit: 3 Ultraviolet (UV) and Visible Spectroscopy: An Introduction, electronic transition definition of some terms and designation of UV absorption bands, general applications of Ultraviolet spectroscopy. Infrared Spectroscopy: An introduction, Instrumentations, Applications of IR spectroscopy, Interpretation of IR spectra-characterization of functional groups and structural diagnosis.

Unit: 4 NMR Spectroscopy: PMR spectroscopy, shielding and deshielding, chemical shift, spin-spin splitting and coupling constant, area of signal, interpretation of PMR spectra of various simple organic molecules, Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and PMR spectroscopy.

REFERENCE BOOKS

1. Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. New Delhi)
2. Organic Chemistry by R. K. Bansal (Tata McGraw – Hill Publishing Co. Ltd. New Delhi)
3. Organic Chemistry by M. K. Jain and S. C. Jain (ShobanLAINagin Chand & Co. Educational Publishers, Jalandhar).
4. Spectroscopy of Organic Compounds by P. S. Kalsi (New Age International Publishers)
5. Spectroscopy (Atomic & Molecular) by GurdeepChatwal (Himalaya Publishing House)



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
PAPER NO.: US05CICH22
TITLE: Petroleum and Petroleum Products.
(04 Credits, 4 Hours/week; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit: 1

Theories of petroleum formation, Reserves and deposits of world, Indian petroleum industries, composition of petroleum, refining and rectification process of petroleum. Cracking and reforming process, reaction taking place in cracking, cracking catalyst, cracking plants, cooking.

Unit: 2

Light petroleum products, their specifications and test methods. Chemicals derived from C1, C2, C3 and C4 fractions, separation of components of petroleum by using techniques like-compression, absorption, adsorption, low temperature distillation, special and combined techniques.

Unit: 3

Manufacture of HCN, CS₂, Maleic anhydride, Caprolactum and Phthalic anhydride, Ethyl benzene and Isopropyl benzene. Chemicals from Methane, Ethylene, Propylene and Acetylene.

Unit: 4

Manufacture of Petrochemicals by following unit process: Dehydrogenation: Butadiene from butane/butane, Esterification: vinyl acetate, Hydration: Acetaldehyde from acetylene, Hydrolysis: ethanol from ethylene, Oxidation: ethylene oxide from ethylene and phenol from cumene, Hydroformylation: Propionaldehyde from ethylene and synthesis gas, Sulphonation: benzene sulfonic acid from benzene

REFERENCE BOOKS

1. Modern petroleum refining processes, vth addition, B K Bhaskara.
2. A Text on Petrochemicals by Bhaskar Rao (Khanna Publishers - New Delhi)
3. Modern Petroleum Refining Process by BhaskarRao (Oxford & IBH Publishing Co. Pvt. Ltd. – New Delhi)
4. Advanced Petrochemicals by Dr. G. N. Sarkar (Khanna Publishers)
5. Advanced Petroleum Refining by Dr. G. N. Sarkar (Khanna Publishers)
6. Chemicals from Petroleum by A. L. Waddam(ELBS edition, London.)
7. Shreve's Chemical Process Industries by Austin (MacGrow- Hill Publication, New Delhi)
8. Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors - New Delhi).



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
PAPER NO.: US05CICH23
TITLE: Chemical Process Industries
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

UNIT-1: Nitrogenous Products: Manufacture and study of properties of synthetic nitrogen products and miscellaneous inorganic chemicals such as ammonia, Hydroamine, iodine, fluorine, fluorocarbon and various types of nitrogenous fertilizers such as urea, ammonium sulphate, ammonium nitrate, calcium ammonium nitrate.

UNIT-2: Chloroalkali industries: Manufacture of caustic soda by membrane cell method and by lime soda process, soda ash, sodium hypochlorite and chlorine.
Industrial Gases – Hydrogen, Oxygen, Nitrogen, Carbon dioxide, Sulphur dioxide.

UNIT-3: Electro thermal industries: Introduction, uses and economics of furnaces and their classification, manufacture of silicon carbide, calcium carbide, boron carbide, boron nitride, synthetic graphite, carbon electrode.
Electro-chemical Industries: Magnesium anhydrous, $MgCl_2$, MgO , hydrogen peroxide, potassium permanganate, hydroxyl amine.

UNIT-4: Phosphorus industries: Raw materials, manufacture of phosphorus, phosphoric acid, ammonium phosphate, super phosphate.
Introduction to Agrochemical industries.

REFERENCE BOOKS:

1. Industrial Chemistry by B. K. Sharma. (Krishna Prakashan Media (P) Ltd., Meerut)
2. Shreve's Chemical Process Industries by G. T. Austin (McGraw-Hill Book Company, New Delhi)
3. Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors – New Delhi).



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
PAPER NO.: US05CICH24
TITLE: Fluid Mechanics & Mechanical Operations
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1:

Fluids & their classification, Viscosity, Newtonian and non-Newtonian fluids, Static pressure, Manometer, Mechanism of fluid flow, Types of flow, continuity equation, Bernoulli's theorem, friction factor & friction head

Fluid moving machineries, Equipment's, Pipes and pipe fittings, Pumps Classification and Performance, Reciprocating and Rotary pumps, Centrifugal pumps, Blower, Compressors, Vacuum pump.

Unit 2:

Size reduction and size separation, Primary and secondary crushers, Fine grinders, Methods of operating crusher, Size separation of solids, Industrial screens, Air separation method, Size separation by laws of setting.

Unit 3:

Filtration, Rate equation, Filter media and filter aid, Industrial Filters-Sand filter, Plate & frame filter, Leaf filter, Rotary filter and Centrifugal Filtration.

Sedimentation- Batch and continuous sedimentation, Thickeners, Separation of solids based on specific properties. Clarification equipment's. Cyclones. Froth flotation and Jigs.

Unit 4:

Mixing, Types of mixing problems, Mixing liquids with liquids, mixing liquids with solids, Mixing solids with solids, Mixing viscous masses.

Conveyors and elevators-Introduction Belt conveyor, Conveyor, Screw conveyor, Pneumatic conveyor.

REFERENCE BOOKS:

1. Unit Operations: Volume I & II, by K. A. Gavhane (NiraliPrakashan- Pune)
2. Introduction to Chemical Engineering by Walter L Badger and Juline T Banchemo (McGraw-Hill Book Co.)
3. Unit Operation of Chemical Engineering by Warren L McCabe & Julian C Smith (McGraw-Hill Book Co.)
4. Chemical Engineering (volume I & II) by J. M. Coulson & K. F. Richardson (Asian Books Pvt. Ltd., New Delhi).



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
SUBJECT CODE: US05CICH25
TITLE: Practical (All Core Courses)
(06 Credits, 12 Hours; External Marks-105, Internal Marks-45)
(Effective from June 2020)

Part: I (02 Credits, 04 Hours, 35 External 15 Internal marks)

Preparation of Intermediates and Drugs based on Unit Process.

Quantitative Organic Analysis: Estimation and Analysis of intermediates and finished drugs.

Part: II (02 Credits, 04 Hours, 35 External 15 Internal marks)

Testing of petroleum and petroleum products according to ASTM for: Kinematic viscosity by Redwood viscometer and Saybolt's Viscometer, Open cup Flash & Fire point determination, Distillation characteristics, Cloud & Pour point determination, Aniline and Mixed Aniline point, Carbon residue by Ram's bottle and Calradson's method, % moisture determination by Dean & Stark method, consistency of wax and grease determination by cone and needle penetration method and congealing point determination.

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)

Study of characterization of solid particles by screen analysis. , 2. Size reduction of solids using crushers and grinders and product analysis by differential analysis by cumulative analysis, 3. Study on efficiency of separation using cyclone, 4. Study of pipe fittings, pumps and flowmeter., 5. Pressure measurement in gas line with manometer., 6 Fluid flow study- Reynolds experiment, Differential pressure meter, 7. Study on filtration operation, 8. Study on working of laboratory centrifuge. 9. Study on solid liquid mixing and solid-solid mixing., 10. Study on heat transfer by conduction and convection.



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
SUBJECT CODE: US05DICH26
TITLE: Specialty Chemical Industries - I
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit-1

Fermentation Introduction, Physical condition for cultivation of microorganisms, Development of inoculums, Characteristics of enzymes, Industrial alcohol, Manufacturing of beers, Wines, Distilled spirits, Citric acid from molasses by fermentation process, ethanol from sugar, Manufacturing of vinegar.

Unit-2

Insecticides: Introduction, Classification of insecticides, DDT (Dichlorodiphenyltrichloroethane), BHC (Benzene hexachloride), Malathion, Fumigants, Rodenticides, Fungicides, Herbicides and pesticides. Fertilizers: Introduction, classification of fertilizer, Nitrogenous fertilizer, Ammonium nitrate, Urea.

Unit-3

Introduction of synthetic perfumes, Ester, alcohol, and ketone. Production of natural and flower perfumes, fruit flavor and artificial flavors.

Unit-4

Introduction of Leather, Animal skins, Manufacturing of leather, Preparation of hides for tanning, Vegetable tanning, Chrome tanning, finishing, oil tanning, by product, gelatin. Introduction Adhesives : The process of bonding, Classification of adhesive, Preparation of adhesive, other protein adhesive, Starch adhesives, synthetic resin adhesives, rubber based, cellulose and silicate adhesives use of adhesives.

REFERENCE BOOKS

1. Environmental Chemistry by B.K. Sharma, H.Kaur (GOEL Publishing House, Meerut)
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, George Tchobanoglous (McGRAW-HILL INTERNATIONAL EDITOR)
3. Water Pollution by V.P. Kudesia (Pragatiprakashan)
4. Environment pollution control engineering by C S Rao (New Age International (P) Limited)



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-V
SUBJECT CODE: US05DICH27
TITLE: Industrial Safety & Hygiene - I
(2 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

UNIT-1

Introduction of safety & Hazards

Safety in chemical industries, Introduction of hot & cold processes, types of furnace & use of safety measures, Need of safety in industries, Indian standards, safety Terminology

UNIT-2

Hazard assessment techniques & its controls in chemical industries

Safety Appraisal Analysis & control techniques, safety work permit, permits objective & its types, standard operating procedure in the Industries, hazard & Risk management techniques,

Major accidental hazard & nits control(MAH), MAH concept, types, types of discharge and identifications

UNIT-3

Ergonomics Hazard & industrial hygiene

Introduction of ergonomics, Constituents of ergonomics, applications of ergonomics for safety & health, work station design, occupational health, occupational lung diseases, Dust control, occupational dermatitis ,occupational diseases & their Diagnostic methods , industrial hygiene.

UNIT-4

Fire & Explosion Hazard in chemical Industries.

Fire phenomena, Nature of fire, Need of fire, triangle of fire, Factors to contributing fire, Classification of fire & extinguishers, Fire prevention & Protection systems, General control measure for fire detection and alarm systems, portable fire extinguishers, Automatic water sprinklers, water spray systems.

REFERENCE BOOKS

1. Fundamental of industrial safety & Health –volume-1 by Dr. K.U.Mistry
2. Fundamental of industrial safety & Health –volume-2 by Dr. K.U.Mistry
3. Occupational & safety health by David H Goetsch



Sardar Patel University
Syllabus for B. Sc. (Semester-VI) Industrial Chemistry
Effective from Academic Year 2020-2021

Courses	Course Code	Title Of Paper	Credit
Core courses-I	US06CICH21	Synthetic Dyes and Pharmaceuticals	04
Core courses-II	US06CICH22	Polymer Technology	04
Core courses-III	US06CICH23	Business Organization & Management	04
Core courses-IV	US06CICH24	Process control for Heat & Mass Transfer Operations	04
Practical	US06CICH25	Practical (All Core Courses)	06
Discipline Specific Elective	US06DICH26	Specialty Chemical Industries - II	02
Discipline Specific Elective	US06DICH27	Industrial Safety & Hygiene - II	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US06CICH21	04	70	3 Hrs	30	100
Core courses - II	US06CICH22	04	70	3 Hrs	30	100
Core courses – III	US06CICH23	04	70	3 Hrs	30	100
Core courses - IV	US06CICH24	04	70	3 Hrs	30	100
Practical	US06CICH25	06	105	12 Hrs	45	150
Discipline Specific Elective (Any One)	US06DICH26 US06DICH27	02	50	2 Hrs	--	50

Note: Nomenclature of Subject of code: U S 05 C ICH 21: U=Undergraduate, S=Science Faculty, 05=Semester three/four, C=Core Course, D= Discipline Specific Elective, ICH=Industrial Chemistry, ICV=Industrial Chemistry Vocational. 21...22... = Paper number.



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
PAPER NO.: US06CICH21
TITLE: Synthetic Dyes and Pharmaceuticals
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Dyes: Introduction, Theory of colors, Classification of dyes, Chemistry of Azo, Anthraquinone, Reactive and Disperse dyes.

Unit 2: Application of synthetic dyes of various fabrics and Fastness properties. Analysis of dyes and dye intermediates: Nitrite value, Coupling value, Titanous chloride reduction, Halogen content determination and estimation of Cu, Ni and Cr.

Unit 3: Drugs: Introduction, Drugs, pro-drugs, biotransformation of drugs, routes of drugs administration and dosage forms, drug binding, drug toxicity, drug addiction, some important terms used in chemistry of drugs, biological and medical terms used in the study of drugs, distinctive definition. Classification of drugs, relation of chemical structure and chemical activity. Account of Sulfa drugs, Antipyretics and analgesics drugs.

Unit 4: Vitamins, Hormones, Antibiotics, Antitubercular, Antifungal and Antiinflammatory drugs: Introduction, classification and synthesis and study of selected drugs.

REFERENCE BOOKS:

1. Synthetic Dyes by Gurdeep R. Chatwal (Himalaya Publishing House).
2. Synthetic Drugs by Gurdeep R. Chatwal (Himalaya Publishing House).
3. Organic Chemistry by M K Jain and S C Sharma., (SHOBANLAL NAGIN CHAND & CO.)
4. Handbook of Synthetic Dyes & Pigments by K. M. Shah, (Multi-tech Publishing Co.)



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
PAPER NO.: US06CICH22
TITLE: Polymer Technology
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit-1

A Brief history of polymer, Classification and nomenclature of polymers, chemistry of polymerization and Polymerization methods.

Unit-2

Molecular weight and molecular weight distribution number, weight and viscosity average molecular weights of polymers. Methods of determining molecular weight, Practical significance of molecular weight distribution. Glassy state, Glass transition temperature (T_g), Factors affecting T_g, Crystallinity in polymers.

Unit-3

Raw material, manufacture, properties and application of PF, UF, MF, PU, Epoxy resins.
Raw material, manufacture, properties and application of PE, PP, polycarbonates, PTFE, PVC, PS, PVA.

Unit-4

Fiber – Natural and synthetic fiber, nylon, polyester and Rayon.
Rubber – Natural and synthetic rubbers, Polyisoprene, Butadiene, Neoprene, SBR and Thiokol.
Specialty Polymer – polyimides and related specialty polymers, ionic polymers, polyaryletherketones, Specialty polyolefins, Inorganic Polymers, liquid-crystal polymers, Conductive polymers.

REFERENCE BOOKS

1. Shreve's Chemical Process Industries by Austin (MacGrow- Hill Publication, New Delhi)
2. Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors - New Delhi)
3. Polymer Science by V. R Gowariker, N. V. Viswanathan, JayadevSreedhar, Wiley Eastern. (New Age International (P) Ltd., New Delhi)
4. Polymer Science and Technology of Plastics and Rubbers by PremamoyGhosh (Tata McGraw-Hill Publishing Co. Ltd., New Delhi)
5. Polymer Science and Technology, by Joel R Fried, PHI.



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
PAPER NO.: US06CICH23
TITLE: Business Organization & Management
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit: 1

Forms of legal ownership, Ideal form of an organization, Feature, Advantages and disadvantages of Sole proprietorship, Partnership, Co-operative.
Joint Hindu Family Organization and Joint Stock Company. Entrepreneurship decision, Launching of a new enterprise, Principle of management.

Unit: 2

Function of management I. Planning, Directing and Decision making.
Function of management II. Staffing, control, organization.

Unit: 3

Financial management (source of finance, working and fixed capital). Interest and Depreciation, Taxes and Insurance.
Marketing management (core concepts of marketing), Pricing policy, Break Even Analysis, Profitability criteria and selection of alternatives.

Unit: 4

Project cost estimation, Plant location, Inventory management (methods for calculating economic order quantity), Welfare and Safety.
Development of the project, evaluation of a process, choice of process, plant design factors, selection of process equipment and materials, reactors, plant layout.

REFERENCE BOOKS

1. Fundamentals of Business Organisation and Management by Y. K. Bhusan (Sultan Chand & Sons – New Delhi)
2. Business Administration and Management by S. C. Saksena (Sahitya Bhawan – Agra).
3. Business Organisation and Management by Shukla M C, (S. Chand & Co.).
4. Principle and Practice of Management by V S P Rao and P S Narayana. (Konark Publishers PVT LTD)
5. Organisation and Management by R D Agrawal. (Tata McGraw Hill New Delhi)
6. Principle and Practice of Management by L M Prasad. (S. Chand & Co.).
7. Finance Management by I. M. Pandey (Vikas Publishing House Pvt. Ltd. – New Delhi)
8. Marketing Management by Philip Kotler. (Prentice Hall of India Pvt. Ltd. – New Delhi)
9. Plant Design Economics for Chemical Engineers by Peter and Timmerhouse. (McGraw-Hill, Inc. – New Delhi)
10. Chemical Engineering Plant Designing By Vilbrandt & Dryden (McGraw-Hill Co.).



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI

PAPER NO.: US06CICH24

TITLE: Process control for Heat & Mass Transfer Operations
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)

(Effective from June 2020)

Unit 1: Concept of measurement and accuracy, Principle, construction and working of temperature measuring instruments, Expansion thermometer, Thermo-electric temperature measurement, Resistances thermometers, Pyrometers. Pressure Terms, Bourden pressure gauge, Bellow type and Diaphragm type pressure gauge, Vacuum measurement, Calibration of pressure gage, Direct and indirect method of level measurement, Sp. Gravity scales, Density and sp. Gravity measurement, Viscosity measurement.

Unit 2: Flow measurement – classification of instruments, Differential pressure and differential area meters, Open channel flow measurement.

Control system, Terminology, Manual and automatic control, Open and closed loop control, Process time lags, Modes of control actions, Final Control Element.

Indicators, Recorders, Control panels and Control center, instrumentation diagram, Pneumatic and electrical transmission system.

Unit 3: Modes of heat transfer, Fourier's law, Thermal conductivity, Thermal insulators, Resistance in series and parallel, Heat flow through Sphere and Cylinder, Natural and forced convections.

Natural and forced convections, Heat Transfer equipment, Types of Heat Exchanger, Shell and Tube Heat Exchanger, Double Pipe heat Exchanger, Extended surface and plate type heat exchanger.

Unit 4: Distillation- volatility and relative volatility, Boiling point diagram and equilibrium diagram, Types of distillation, Mass and enthalpy balance calculations, Calculation of number of theoretical plates, Mc-Cabe Thiel method, Importance of reflux ratio, Steam distillation, Equipment's of Distillation.

Drying, Classification of dryers, Compartment dryer, Tunnel dryer, Rotary dryer, Drum dryer, Spray dryer etc., Types of moisture, Theory of drying. Evaporation- batch and continuous type evaporators, Multiple effect evaporator, Capacity of evaporator, Accessories of evaporator.

REFERENCE BOOKS:

1. Industrial Instrumentation by Donald P Eckman (Wiley Estern Ltd.)
2. Mechanical & Industrial Measurement by R. K. Jain (Khanna Publishers)
3. Industrial Instrumentation & Process Control by Kulkarni (NiraliPrakashan – Pune)
4. Process Instrumentation & Control Handbook – Douglass M Considine. (McGraw-Hill, Inc., New Delhi)
5. Instrumentation Technology(volume iii)E.B. John
6. Unit Operations : Volume I & II, by K. A. Gavhane (NiraliPrakashan- Pune)
7. Introduction to Chemical Engineering by Walter L Badger and Juline T Banchemo (McGraw-Hill Book Co.)
8. Unit Operation of Chemical Engineering by Warreh L Mc Cabe&Jullian C Smith (McGraw-Hill Book Co.)
9. Chemical Engineering (volume I & II) by J. M. Coulson & K. F. Richardson (Asian Books Pvt. Ltd., New Delhi).



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
SUBJECT CODE: US06CICH25
TITLE: Practical (All Core Courses)
(06 Credits, 12 Hours; 50 External Marks-105, Internal Marks-45)
(Effective from June 2020)

Part: I (02 Credits, 04 Hours, 35 External 15 Internal marks)

Preparation of intermediates and dyes from different groups., Analysis and estimation of dyes., TLC of intermediates, Paper Chromatography of Dyes., Dyeing: Dyeing of the following dyes on cotton – Direct, Azoics, Acid, on wool and silk Demonstration of various pharmaceutical packaging materials quality control tests of some materials. Aluminium strips, cartons, glass bottles., Limits tests for chlorine, heavy metals, arsenic etc. of two representative bulk drugs., Demonstration of various pharmaceutical products. Identification of raw drugs (TLC method).

Part: II (02 Credits, 04 Hours, 35 External 15 Internal marks)

Synthesis of polymers and resins like Novalak Phenol formaldehyde, Resol Phenol formaldehyde, Urea formaldehyde, Melamine formaldehyde, Glyptalresin, Saturated and Unsaturated polyester. Cellulose Acetate, Cellulose Nitrate, Polysulfone rubber. % purity determination of formalin, Benzoyl peroxide & Hydrogen peroxide. Determination of acid value, Saponification value and Hydroxyl value

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)

Study of types of distillation-Simple distillation, Rectification, Steam distillation, 2. Study of yield of crystallization with seeding and without seeding, 3. To generate Mier's super saturation curve, 4. Study on evaporation with respect to temperature and surface area, 5. Study of boiling point depression, 6. Study of adsorption behavior, 7. Study of humidity parameter using DBT-WBT method and dew point method, 8. Calibration of industrial instruments.

Book review report writing and its submission cum presentation. A case study on selected management area of chemical industry visited.



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICH26
TITLE: Specialty Chemical Industries - II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit -1

Introduction detergents, principal group of synthetic detergent, Classification of surface-active agent, Anionic detergents, Non-ionic detergents, Additives, sub regulators, Binders, Biodegradability of surfactants, Ecofriendly detergents containing enzymes, Ecofriendly detergents-Zeolites, Detrimental effect of detergent, Manufacturing of Shampoos.

Unit-2

Introduction of Explosive and Toxic chemical Industries, Classification of Deflagrating, Characteristics of explosive, Nitrocellulose, Di-nitrobenzene, Tri-Nitrobenzene, Tri-Nitro toluene, Picric acid, Ammonium picrate or explosive, Nitroglycerin and dynamite, Gun powder, RDX

Unit-3

White pigments, White lead, Electric method, Characteristic of pigment, use of pigment, Titanium dioxide, morden chlorine method, Physical property of TiO_2 Ultramarine blue, Cobalt blue, Red lead, Synthetic iron oxide pigment, Green pigment, Chrome green, Yellow pigment, Black pigment, Tonner.

Unit-4

Classification of paint, Distemper, Manufacturing of paint, Setting of paint, Good paint, Important of PVC, Paint failure, Emlusion paint, constituent of emulsion paint, Latex paint, Luminescent paints, paint remover, Application of paint and Varnishes, Raw material, Manufacturing of Varnishes, enamels, Gloss finisher.

REFERENCE BOOKS

1. Environmental Chemistry by B.K. Sharma,H.Kaur (GOEL Publishing House, Meerut)
2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe, George Tchobanoglous (McGRAW-HILL INTERNATIONAL EDITIOR)
3. Water Pollution by V.P. Kudesia (Pragatiprakshan)
4. Environment pollution control engineering by C S Rao (New Age International (P) Limited)



BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICH27
TITLE: Industrial Safety & Hygiene - II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

UNIT-1

Safety in chemical industries

Place of chemical industries in society, statutory provisions, Types of chemical hazard & its control, General safety precautions.

UNIT-2

Process Hazard & its control, Utility Hazard & its control, safety transportation of chemicals, Checklist of Routine inspections chemical factories, Types of tests, certificates & Records. Permits for vessel entry.

UNIT-3

Occupational health

Industrial hygiene & occupational health, occupational health hazard, adverse health effect & its control, Types and limits of radiation, Dangerous properties of chemicals and their health effects, Routes of entry & its toxic effects, Evaluation of health hazards, Sampling analysis in gas.

UNIT-4

Safety management

Concept of management, elements of management & principles, safety management & its responsibilities, safety organizations, department & Programme, safety education & training

REFERENCE BOOKS

1. Fundamental of industrial safety & Health –volume-1 by Dr. K.U.Mistry
2. Fundamental of industrial safety & Health –volume-2 by Dr. K.U.Mistry

