

SARDAR PATEL UNIVERSITY

Syllabus for B. Sc. (Semester-III) Industrial Chemistry

Effective from Academic Year 2012-2013.

PAPER NO.	PAPER TITLES	CREDIT – HRS.
US03CICH01	HEAVY AND FINE CHEMICALS	03 – 03
US03CICH02	CHEMICAL PROCESS PRINCIPLES	03 – 03
US03CICH03	LABORATORY	
US03CPHY01	PHYSICS THEORY	03 – 03
US03CPHY02	PHYSICS THEORY	03 – 03
US03CPHY03	LABORATORY	
US03EICH04	ORGANIC CHEMISTRY	02 – 02
US03EICH05	BASIC ANALYTICAL CHEMISTRY	02 – 02

Sr. No.	Courses	Credits			Teaching Hours		
		Theory	Practical	Total	Theory	Practical	Total
1	Core courses	12	06	18	12	12	24
2	Elective courses	04	--	04	04	--	04
3	Foundation	02	--	02	02	--	02
	Total			24	18		30

Note: Nomenclature of Subject of code: U S 03 C ICH 01

U=Undergraduate, S=Science Faculty, 03/04=Semester three/four, C=Core Course, F=Foundation Course, E=Elective course, ICV=Industrial Chemistry Vocational, PHY=Physics, GCH=General Chemistry, 01/02/03=Paper 01/02/03.

SARDAR PATEL UNIVERSITY

BACHLOR OF SCIENCE INDUSTRIAL CHEMISTRY SEMESTER-III

PAPER NO.: US03CICH01 (3 CREDITS, 70 MARKS)

TITLE: HEAVY AND FINE CHEMICALS

Unit-1:

Acids: Manufacture, Properties and uses of Nitric acid, Sulphuric acid, Phosphoric acid, Hydrochloric acid

Industrial Gases: Hydrogen, Nitrogen, Oxygen, Carbon dioxide and Sulphur dioxide.

Unit-2:

Alkali: Sources, uses and preparation of sodium chloride, Manufacture and uses of Sodium hydroxide, Sodium carbonate, Sodium bicarbonate and sodium hypochlorite.

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.

Electrochemical industries: Anhydrous magnesium, Magnesium chloride, Magnesium oxide, hydrogen peroxide, Potassium permanganate, Hydroxyl amine.

Unit-4:

Speciality industrial solvents : Synthesis, properties and uses of Dimethyl-formamide (DMF) ,Dimethyl sulfoxide (DMSO), Tetrahydrofuran (THF), Dioxane, Diethyl ether and sulfolane.

REFERENCE BOOKS:

1. Chemical process industries by Shreve R. N. , McGraw Hill
2. Industrial chemistry by B.K. Sharma 7th edition
3. Introduction to material science and engineering by K.M. Rells, T. Courtney and J. Wulff, Wiley Dastern Pvt. Ltd. New Delhi
4. Unit process in organic synthesis by P.H Groggine, McGraw Hill Kogakusin Ltd.
5. Outline of chemical technology by G.E. Dryen, East West Press, New Delhi
6. Industrial chemicals by Faith et. al. Wiley Interscience, New York
7. Heavy organic chemicals by A. J. Saile, Pargaon Press U.K.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-III
PAPER NO.: US03CICH02 (3 CREDITS, 70 MARKS)
TITLE: CHEMICAL PROCESS PRINCIPLES

Unit 1:

Units and dimensions, Basis of calculation, Units to express composition of systems, Ideal gas equation, Behavior of gaseous mixtures.

Vapor pressure of liquids and solution, Critical properties.

Unit 2:

Elementary concept of unit operations and unit processes, Flow diagram preparation, Concept of mass balance and types of mass balance problems, Strategies and Guidelines for mass balance calculation, Mass balance calculations for processes-without and with chemical reactions, Recycle operation and purge operation, Bypass operation.

Unit 3:

Concept of Energy balance, Forms of energy, Energy balance for batch and continuous processes, Heat capacity and specific heat, Combustion and Calorific value of fuels, Combustion calculations, Flue gas analysis.

Unit 4:

Humidification and saturation, Saturated and unsaturated vapor gas mixture and units to express its composition, Psychrometric chart,

Adsorption: Adsorbent and adsorbate, Chemisorptions and physical adsorption, Adsorption isotherms, Application of adsorption.

REFERENCE BOOKS:

1. Chemical Process Principles: (Part I), Haugen, Watson and Regatz (Asia Pub. House).
2. Stoichiometry : B. L. Bhatt & Vora S. M. (Tata McGraw- Hill Publication).
3. Basic Principles & Calculation in Chemical Engineering, David M Himmelblan (Prentice Hall Inc.)
4. Chemical Process Calculation (Stoichiometry), K. A. Gavhane (Nirali Prakashan-Pune)
5. Fuels and combustion, S. P. Sharma and Chandra Mohan Tata Mc Graw.
6. Fuels and Combustion, Samir Sarkar, Orient Longniur Ltd.

INDUSTRIAL CHEMISTRY
SEMESTER-III
PAPER NO.: US03CICH03 (3 CREDITS, 70 MARKS)
LABORATORY

1. Preparation and Standardization of solution.
2. Analysis of raw material, intermediate and finished products with respect to purity, specification etc.
3. Water Analysis.
4. Organic Spotting.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-III
PAPER NO.: US03EICH01 (2 CREDITS, 70 MARKS)
(TRADITIONAL METHODS OF ANALYSIS)

Unit I : (A) Titrimetric Methods in Analysis [08 Hrs.]

Introduction, Definitions: Standard solutions, Equivalence Point, Indicators, End point, Titration General Aspects of: Primary standards, Desirable properties of standard solution. Volumetric calculations: Molarity, Normality, percentage concentration, parts per million.

(B) Neutralization Titration

Standard solution and acid-base indicators. Titration curve for strong acid-strong base Systematic equilibrium concentrations for SA-SB titration. Acid-Base indicators, colour change range of an indicator, Indicator error. Determination of Acetic acid in vinegar. Determination of Alkalinity of soda ash.

UNIT II : Complexometric Titration [07 Hrs.]

Introduction, terms involved in titration: complex, ligand, buffer solution, chelating agents, chelates, Some Chelating agents, Stability of complexes: stepwise formation constants. Complexometric titration curve. Equilibria involved in EDTA titration, Indicators for EDTA titrations. Hardness of water. Ca in Calcium Gluconate Sample. Numericals based on this titration.

UNIT III : Redox Titration [08 Hrs.]

Introduction, Terms involved: oxidation, reduction. Single electrode potential, formal potential, Nernst Equation, Titration curve for Iron(II) and cerium (IV). Types of redox indicators and their selection. Structural chemistry of redox indicators. Numericals: Calculation based on emf of electrode/cell, end point calculations, equation constants.

UNIT IV : Water pollutant Analysis [07 Hrs.]

Water pollution: Introduction. Classification of water pollutants, Sources of water pollution. Origin of waste water, Effect of water pollutants, Water analysis: colour, turbidity, total dissolved solids, conductivity, acidity, alkalinity, hardness, chlorides, sulphates, fluorides. Drinking water standards.

Reference Books :

1. Fundamentals of Analytical Chemistry, 7th Edition by Skoog, West, Holler.
2. Quantitative Analysis 6th Edition - R.A. Day, Jr., A.L. Underwood.
3. Analytical Chemistry –Dr. Alka Gupta, Pragati Prakashan.
4. Analytical Chemistry : Principles, 2^{Ed} –John H. Kennedy.
5. Analytical Chemistry –VIth Ed. Gary D. Christian.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-III
PAPER NO.: US03EICH04 (2 CREDITS, 70 MARKS)
TITLE: ORGANIC CHEMISTRY

UNIT-1

FUNDAMENTAL ASPECTS IN ORGANIC CHEMISTRY

Hybridization, Sigma and pi bonds, Hydrogen bond, Inductive effect, Electronic effect, Resonance effect, Hyperconjugation, Steric effect, Acid and bases, Definition, Structure and stability of free radical, Carbocation, Carbanion and Benzene, Energy profiles.

UNIT-2

PHENOLS, ALCOHOLS, ETHERS AND EPOXIDES

Structure, Nomenclature, Preparation, Physical properties, Salts of phenol, Acidity of phenols, Reactions.

Alcohols- Structure, Classification, Nomenclature, Preparation, Physical properties, reactions, Alcohols as acids and bases, Synthesis using alcohols, Formation of 1,2-diols, Analysis of 1,2-diols, Oxidation cleavage of polyhydroxy alcohols.

Ethers- Structure, Nomenclature, Preparation, Physical properties, Reactions, Cyclic ethers.

Epoxydes- Preparation and reactions.

UNIT-3

ALDEHYDES, KETONES, CARBOXYLIC ACIDS AND THEIR DERIVATIVES

Structure, Classification, Nomenclature, Preparation, Physical properties, Nucleophilic addition reactions, Base promoted halogenation of ketones, Acid catalyzed halogenation of ketones.

Structure, Nomenclature, Preparation, Physical properties, Salts of carboxylic acids, Acidity of carboxylic acids, Effect of substituents on acidity, Reactions, reactions of acid chloride, Acid anhydrides, Amides and esters. Preparation of malic acid and tartaric acid from maleic acid, preparation of citric acid from glycerol.

UNIT-4

AMINES AND DIAZONIUM SALTS

Amines- Structure, Nomenclature, Preparation, Hoffman rearrangement, Physical properties, Salts of amines, Basicity of amines, Effect of substituents on basicity, reactions, Hoffman elimination, Analysis of amines, Phase transfer catalyst.

Diazonium salts- Synthesis, reaction and characteristics.

REFERENCE BOOKS

1 Organic Chemistry by M. K. Jain and S. C. Jain (Shoban Lal Nagin Chand & Co. Educational Publishers, Jalandhar).

2 Organic Chemistry by Robert T. Morrison and Robert T. Boyd (VIth Edition, Prentice Hall of India Pvt. Ltd. New Delhi)

3 Organic Chemistry by R. K. Bansal (Tata McGraw – Hill Publishing Co. Ltd. New Delhi)

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-III
PAPER NO.: US03EICH05 (2 CREDITS, 70 MARKS)
TITLE: BASIC ANALYTICAL CHEMISTRY

Unit-1

Data Analysis: Analytical data evaluations: Errors, Accuracy and precision, Normal distribution curve, Mean and standard deviation, Comparison of results (students-t-test, f-test) paired t-test, Linear regression and correlation coefficient.

Unit-2

Titrimetric Methods of Chemical Analysis, General principle of titrimetry, Types of reactions in titrimetry, Standard solution, Basic requirements of titrimetry, Equivalence point and end point., Aqueous Acid Base Titrations. Concept of acid base titration, Titration curves, Acid-base indicators, Titration Feasibility and its applications., Non-aqueous Acid-base Titrations. Role and properties of solvents, Titrations in non-aqueous solvents.

Unit-3

Redox Titrations

Introduction, Redox systems, Redox potential, Nernst equation, Equilibrium constant, Titration curve & Feasibility, Redox indicators, Iodometric and iodimetric titrations., Complexometric Titrations: Introduction, Stability constant, Ways of detecting end point, Titration curves, Equilibrium involved in EDTA titration, Types of EDTA titrations, Titration of mixture; Selectivity, Masking and demasking, Metallochromic indicators, Applications.

Unit-4

Precipitation Titrations: Introduction, Feasibility and end point detection, Indicators, Volhard, Fajan and Mohr's methods, Factors affecting solubility of precipitates., Gravimetric Methods of Analysis: Principle of gravimetry, Requirements of precipitates, Formation and properties of precipitates, Coagulation & peptization, Co-precipitation and occlusion, Washing, drying and ignition of precipitates.

REFERENCE BOOKS

1. Analytical Chemistry: Principles-by J.H.Kennedy, Saunders college publishers, 2nd edition, 1990
2. Introduction to Chemical Analysis-by R.D.Braun, Mc-Graw Hill Book Co. 2nd edition 1995
3. Vogel's Textbook of Quantitative Chemical Analysis- by G.H.Jeffory, J.Mendham, R.C.Denney, 5th edition, 1998
4. Analytical Chemistry-by G.D.Christian, John Wiley & Sons, 3rd edition,
5. Quantitative Analysis-by R.A.Day, Prantice hall of India(P) Ltd., New Delhi, 6th edition, 1993
6. Modern Analytical Chemistry, By David Harvey, Mc Graw-Hill (USA).
7. Principles of instrumental analysis-by D.A.Skoog & F.J.Holler & T.A.Nieman Saunders college Publishers, 5th edition, 1998.

SARDAR PATEL UNIVERSITY

Syllabus for B. Sc. (Semester-IV) Industrial Chemistry effective from

Academic Year 2012-2013.

PAPER NO.	PAPER TITLES	CREDIT – HRS.
US04CICH01	ENGINEERING MATERIALS	03 – 03
US04CICH02	CHEMICAL PLANT UTILITIES	03 – 03
US04CICH03	LABORATORY	
US04CPHY01	PHYSICS THEORY	03 – 03
US04CPHY02	PHYSICS THEORY	03 – 03
US04CPHY03	LABORATORY	
US04EICH05	INDUSTRIAL POLLUTION, IT'S CONTROL AND INDUSTRIAL SAFTY	02 – 02
US04EICH06	INSTRUMENTAL METHODS OF ANALYSIS	02 – 02

Sr. No.	Courses	Credits			Teaching Hours		
		Theory	Practical	Total	Theory	Practical	Total
1	Core courses (i)	12	06	18	12	12	24
2	Elective courses	04	--	04	04	--	04
3	Foundation	02	--	02	02	--	02
	Total			24	18		30

Note: Nomenclature of Subject of code: U S 04 C ICH 01

U=Undergraduate, S=Science Faculty, 03/04=Semester three/four, C=Core Course, F=Foundation Course, E=Elective course, ICV=Industrial Chemistry Vocational, PHY=Physics, GCH=General Chemistry, 01/02/03=Paper 01/02/03.

SARDAR PATEL UNIVERSITY

BACHLOR OF SCIENCE INDUSTRIAL CHEMISTRY SEMESTER-IV

PAPER NO.: US04CICH01. (3 CREDITS, 70 MARKS)

TITLE: ENGINEERING MATERIALS

Unit-1:

Material Sciences: Introduction of material sciences, Classification of engineering materials, Engineering requirements of materials, Level of structures, Structure – properties relationship in materials, Plan for selection of materials, Miscellaneous materials, Thermal electrical and Sound insulating materials.

Unit-2:

Ceramic industries: Raw materials, White wares, Structural clay products.

Refractory: Classification, Properties and manufacture of important refractory, Their selection and failure.

Cement: Portland cement, Other cements, Setting and hardening of cement, Manufacture and uses of ordinary cement.

Glass: Raw materials, Types of glasses, Manufacture and uses.

Unit-3:

Metals and Alloys: Need, preparation, Mechanical & chemical properties, Applications, Composition of important metals and alloys- iron, copper, aluminium, lead, nickel, titanium and their alloys

Unit-4:

Corrosion: Theories of corrosion, Corrosion reactions, Special corrosions, Factors affecting corrosion rate, Protection against the corrosion, Protective coatings and surface preparation, Metallic, Inorganic and organic coatings, Paint manufacture, Characteristics of oil and pigment

REFERENCE BOOKS

1. Material sciences by G.B.S. Narang, Khanna Publications, New Delhi.
2. A text book of Material sciences and metallurgy by O.P. Khanna, Dhampat Rai & Sons.
3. Chemical process industries by Shreve R. N., McGraw Hill.
4. Chemistry of engineering materials by C.V. Agraval, Tara Publications.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV
PAPER NO.: US04CICH02 (3 CREDITS, 70 MARKS)
TITLE: CHEMICAL PLANT UTILITIES

Unit 1:

Water- Impurities and hardness of natural water, Water for steam making and industrial processes, Boiler water treatments, Calculations on water treatments.

Unit 2:

Fuels-classification, advantages and disadvantages, Analysis of fuels, Heating media
Air- Specification for industrial uses of air. Industrial applications of CO₂, O₂, N₂ and H₂ .

Unit 3:

Compression equipments, Reciprocating compressor, Work of single stage reciprocating compressor, Effect of clearance, Volumetric efficiency, Multistage compression, Refrigeration, COP & refrigerating effect, Industrial refrigerants, Carnot and other refrigeration cycles.

Unit 4:

Internal combustion engines and external combustion engine, Steam power plant, its working and thermodynamic analysis, Otto engine and Diesel engine.
Steam boilers – Their classification, Steam generation, Conditions of steam, Steam table.

REFERENCE BOOKS.:

1. Chemistry of Engineering Materials by C. V. Agrawal (Tara Publication)
2. Introduction to Chemical Engineering Thermodynamics (IV edition) by J. M. Smith & Vanness, (McGraw-Hill Co.)
3. Chemistry in Engineering and Technology,(volume I & II) JC Kuriacose & J.Rajarah (Tata McGraw Hill).
4. Chemistry of Engineering Materials By Jain & Jain.(Dhanpairai Publishing Co.)
5. Shreve's Chemical Process Industries by George T. Austin (McGraw-Hill Publication, New Delhi)

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV
US04CICH03
LABORATORY

1. Cement Analysis, Inorganic Qualitative Analysis (Semi Micro)
2. Alloy Analysis
3. Analytical Instruments
4. Instrumental methods of Chemical Analysis.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV
PAPER NO.: US04EICH01 (2 CREDITS, 70 MARKS)
(INSTRUMENTAL METHODS OF ANALYSIS)

UNIT I : Chromatography [07 Hrs.]

Introduction, Classification of chromatographic techniques. Paper chromatography: Introduction, principle, Migration parameter, Types of paper chromatography, Experimental details for qualitative analysis, applications. TLC : Introduction, superiority of TLC over other chromatographic methods, Experimental Techniques, General applications.

UNIT II : [A] Adsorption Chromatography [08 Hrs.]

Introduction, adsorbents, solvent (Eluting agents), Column, theory of development, factors affecting column efficiency, detectors, applications.

[B] Ion-exchange chromatography

Introduction, ion-exchange resins, techniques, packing of column, analysis of the elutes, applications.

UNIT III : Visible and UV Spectroscopy [08 Hrs.]

Introduction, fundamentals of absorption spectroscopy, Lambert's and Beer's Law, Deviation from the law, theory of UV absorption, transitions associated to UV absorption spectra. Instrumentation for UV/Visible radiations: spectrophotometer, source, filter, monochromators, sample holder, slits, detector, recorder. Applications, Numerical based on Lambert-Beer's Law.

UNIT IV : Food Analysis [07 Hrs.]

Introduction, Reasons for analyzing food, Food safety. Adulteration and contamination: definition. Analysis of moisture of vegetable oils, butter and ghee, honey. Analysis of ash content in spices, honey. Analysis of fat in butter. Analysis of protein content in milk, butter. Analysis of reducing. Sugar of honey. Standard content of some food material.

Reference Books :

1. Analytical Chemistry –Dr. Alka Gupta, Pragati Prakashan.
2. Instrumental Methods of Chemical Analysis-Chatwal and Anand.
3. Instrumental Methods of Chemical Analysis-B. K. Sharma.
4. Instrumental Methods of Chemical Analysis- Skoog, west, Holler.
5. Instrumental Methods of Chemical Analysis- Willard Merriett and Dean.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV
PAPER NO.: US04EICH02 (2 CREDITS, 70 MARKS)
US04EGCHE02 (ENVIRONMENTAL SCIENCE)

UNIT: I AIR POLLUTION [07Hrs.]

Introduction/origin, Environmental Pollution disasters, Mediterranean: A dead sea, Classification of pollutants. Air pollution, Composition of air, Chemical reaction in air due to sun light, Reactions in Troposphere, Stratosphere and mesosphere. Smog formation in air. Major sources of air pollution, Other sources of air pollution, Units of measurement of air pollutant. Classification of air pollutants. Sulphur compounds as pollutants (a) Reaction of SO₂ in atm. (b) Effect of SO₂ on plant (c) Effect of SO₂ on corrosion of Fe, Zn, Cu, Al.

UNIT: II WATER POLLUTANTS AND THEIR PROPERTIES [07 Hrs.]

Introduction, Sources of water, Chemistry of water, Definition of water pollution, Types of water pollution including main point, Types of water pollution (four types), Types of water pollution based on sources and storages (Five types). Ground water pollution, Factor affecting the ground water pollution, Effect of ground water pollution on man and soil, Surface water pollution, Factors affecting the surface water, Sources of surface water pollution, Lake water pollution, Sources of pollutants in lake water.

UNIT: III SOIL POLLUTION [08Hrs.]

Introduction, Importance and formation of soil, Composition of soil, Salt affected to soil, Sources of soil pollution, Soil erosion and its types, Agents of soil erosion, Mechanism of soil erosion, Factors affecting to soil erosion, Detrimental effects of soil erosion, Measures of soil erosion, Preventing soil erosion, Chemical method of SEWAGE Treatment, Control of soil pollution, Sources using wastes.

UNIT: IV RADIOACTIVE POLLUTION [08Hrs.]

Introduction, How radioactive pollution differs from other pollution. Types and unit of radiation, Radiation chemistry, Interaction of ionising radiation with matter, Principal Types of radiation, Chemical change, Effect of ionising radiation on water and aqueous solution, Effect of radiation on organic compound, Auto radiolysis, Natural sources of radiation, Anthropogenic sources of radiation, Classification and effects of radiation, Effect of ionizing & non-ionizing radiation.

Reference Books

1. Environmental studies by S.V.S Rana Second reprint (F. Edi):2007.
2. Environmental Chemistry by B. K. Sharma, H.KAUR, Third revised and enlarged edition -1996-97.

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV

PAPER NO.: US04EICH05 (2 CREDITS, 70 MARKS)

TITLE: INDUSTRIAL POLLUTION, ITS CONTROL AND INDUSTRIAL SAFTY

Unit1:

Atmosphere, Eco-System and Air Pollution, Sources and Effect of Air Pollutants, Green House Effect, Air Pollution control Technique.

Unit 2:

Water Pollution and its source, Types of water pollutants and their adverse effects, Waste water treatment, BOD and COD tests, Pesticide Pollution and sound pollution.

Unit 3:

Solid Waste Management, Collection and Disposal of solid waste, Radio activity and Radiation Pollution, Pollution Statutory limits.

Unit 4:

Industrial hazards, Safety consideration in chemical industries, Chemical, Electrical and mechanical hazards, Fire and explosion hazard, Health hazard, Laboratory Safety, Safety Practice, Factory acts.

REFERENCE BOOKS:

1. Environmental Chemistry, B. K. Sharma (Krishna Prakashan Media (P) Ltd., Meerut).
2. Environmental Pollution Control Engineering, C. S. Rao (Wiley Eastern Ltd., New Delhi)
3. Engineering Chemistry, Jain and Jain (Dhanpat Rai and Sons)
4. Introduction to Environmental Engineering and Science, G. M. Masters
5. Environmental pollution, H.N.DIX (J.W & Sons).
6. Chemical technology, Vol I, D.Venkateshwaraly (C.Chand & co)

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-IV
COURSE NO.:US04EICH06 (2 CREDITS, 70 MARKS)
TITLE: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Unit-1:

pH metry: Introduction and determination of pH, applications. Potentiometric titrations: Introduction, Types of titrations, Advantages of potentiometric titrations. Conductometric measurements: Introduction, Some important laws, Definition and relations, Effect of dilution, Applications of conductance measurements, Types of titrations, Advantages and disadvantages.

Unit-2:

Chromatography: Introduction, Classification and application

Paper chromatography: Experimental details for qualitative analysis, Experimental details for quantitative analysis. Thin layer chromatography: Superiority of TLC over the other techniques, Experimental techniques, Limitations, Scope.

Column chromatography: Introduction, Experimental details, Theory of development, factors affecting column efficiency.

Unit-3:

HPLC and GC: Introduction, Instruments involved, Sampling methods, Experimental details and applications.

Unit-4:

Visible spectrophotometry and Colorimetry: Introduction, Theory of spectrophotometry and colorimetry, Deviation from Beer's Law, Instrumentation, Applications. Ultra Violet Spectroscopy: Introduction, Origin and theory of ultraviolet spectra, Choice of solvent, instrumentation, Applications.

REFERENCE BOOKS

1. Instrumental methods of chemical analysis by Chatwal – Anand, Himalaya Publishing House.
2. Instrumental methods of chemical analysis by B.K. Sharma, Krishna Publication Media (P) Ltd., Meerut.
3. Organic spectroscopy by William Kemp, Macmillan Press Ltd., London.
4. Analytical chemistry by Gray D. Christian, 4th edition, Wiley & Sons, Inc.
5. Instrumental methods of analysis by Willard Merritt, Dean Settle, CBS Publishers & Distributors, New Delhi.
6. Principles of instrumental analysis by Skoog, Holler, Nieman, Thomson Asia Pvt. Ltd., Singapore.
7. Basic concept of analytical chemistry by S.M. Khopkar, New Age International Publishers.
8. Instrumental methods of chemical analysis by Galen W. Ewing, McGraw – Hill Book Company.

SARDAR PATEL UNIVERSITY

Syllabus for B. Sc. (Semester-V) INDUSTRIAL CHEMISTRY
Effective from Academic Year 2012-2013

PAPER NO.	PAPER TITLES	CREDIT – HRS.
US05CICH01	ORGANIC CHEMISTRY - II	03 – 03
US05CICH02	UNIT PROCESS IN ORGANIC MANUFACTURE	03 – 03
US05CICH03	PETROLEUM TECHNOLOGY	03 – 03
US05CICH04	BUSINESS ORGANISATION	03 – 03
US05CICH05	MECHANICAL OPERATIONS	03 – 03
US05CICH06	FLUID MECHANICS AND HEAT TRANSFER	03 – 03
US05CICH07	LABORATORY	02 – 04
US05CICH08	LABORATORY	02 – 04
US05CICH09	LABORATORY	02 – 04

Courses	Credits			Teaching Hours		
	Theory	Practical	Total	Theory	Practical	Total
Core courses	18	06	24	18	12	30

Note: Nomenclature of Subject of code: U S 06 C ICV 01

U=Undergraduate, S=Science Faculty, 06=Semester six, C=Core Course,
ICV=Industrial Chemistry Vocational, 01/02/03...09 = Paper 01/02/03...09.

SARDAR PATEL UNIVERSITY

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V

PAPER NO.: US 05 C ICH 01 (3 CREDITS, 70 MARKS)
(ORGANIC CHEMISTRY-II)

UNIT: 1

Nomenclature of heterocyclic systems (Five and Six member only), five member heterocycles- structure, source and electrophilic substitution reaction in Pyrrole, Thiophene and furan, saturated five membered heterocycles. Six membered heterocycles- structure and source of pyridine compounds, nucleophilic and electrophilic substitution reaction in pyridine, basicity of pyridine, reduction of pyridine. Skraup synthesis of Quinoline and Bischler-Nspierlaski synthesis of isoquinoline.

UNIT: 2

Introduction, Nomenclature, Structure, Preparation and Reactions of Naphthalene, Anthracene and Phenanthrene.

UNIT: 3

Reactive intermediates: Formation, Structure, Stability of carbocation, carbanion, types of reactions, Types of Mechanism, Meerwein-Ponndorf-Verley Reduction, Aldol condensation, Diels-Alder Reaction.

Rearrangements: Introduction, Types of Molecular Rearrangement: Pinacol – Pinacolone Rearrangement, Benzilic Acid Rearrangement.

Reagents of Synthetic Importance: Preparation and uses of Aluminiumisopropoxide, N-Bromosuccinimide (NBS), Lead tetra acetate, Osmium Tetraoxide, and Selenium dioxide.

UNIT-4

Spectroscopy: Introduction, Theory, Instrumentation and Applications of Infrared (IR) Spectroscopy, Proton Nuclear Magnetic Resonance (NMR) Spectroscopy and Mass Spectroscopy. Problems pertaining to the structure elucidation of organic compounds using UV, IR, Mass and PMR spectroscopy.

REFERENCE BOOKS

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

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V

PAPER NO.: US 05 C ICH 02 (3 CREDITS, 70 MARKS)
(UNIT PROCESS IN ORGANIC MANUFACTURE)

UNIT: 1

Unit Process, Unit Operation, Nitration: Introduction, Nitration agents, Continuous v/s batch nitration, Kinetics and mechanism of nitration processes such as nitration of Paraffin hydrocarbons, Benzene to Nitrobenzene, Acetanilide to *p*- nitroacetanilice.

Amination: By Reduction : Introduction, Methods of reduction, Metal and acid, Catalyst sulfide, electrolytic, Metal and alkali sulfites, Metal hydrides, Sodium metal, concentrated caustic oxidation, Reduction, Reduction commercial Manufacture of Aniline. By Aminolysis: Introduction, Aminating agents, Factors affecting.

Unit: 2

Sulphonation: Introduction Sulphonating agents, Chemical and Physical factors in Sulphonation, Kinetics and mechanism of Sulphonation reaction, Commercial Sulfonation of Benzene.

Oxidation Reaction: 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 and Acetic acid.

Unit: 3

Halogenation: Introduction, kinetics of halogenation reactions, Reagents for halogenation, Halogenation of aromatic side chain and nuclear halogenation, Commercial manufacturing Chlorobenzene and Monochloro acetic acid.

Hydrogenation: Introduction, kinetics, Catalysts for hydrogenation reactions, Hydrogenation of vegetable oil, Hydrogenation of acids and esters to alcohols.

Unit: 4

Esterification: Introduction, Hydrodynamics and kinetic of Esterification Reactions, Esterification by organic acids, Esterification of carboxy acid derivatives, Commercial manufacture of Ethyl acetate.

Hydrolysis: Introduction, Hydrolysis agents, Kinetics, Thermodyanics and mechanism of hydrolysis.

Alkylation: Introduction, Types of alkylation, Alkylating agents, thermodynamics and mechanism of alkylation reactions, Manufacture of alkyl benzene.

REFERENCE BOOKS

1. Unit process in Organic synthesis, P. H. Groggins, Mcgraw- Hill Book Co., New York.

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V

PAPER NO.: US 05 C ICH 03. (03 CREDITS, 70 MARKS)

TITLE: PETROLEUM TECHNOLOGY

Unit: 1

Theories of petroleum formation, composition of petroleum, refining and rectification process of petroleum. Cracking and reforming process, reaction taking place in cracking, cracking catalyst, cracking plants.

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 from Benzene.

Unit: 4

Manufacture of Petrochemicals by following unit process: Dehydrogenation: Butadiene from butane/butene, 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. A Text on Petrochemicals by BhaskarRao (Khanna Publishers - New Delhi)
2. Modern Petroleum Refining Process by BhaskarRao (Oxford & IBH Publishing Co. Pvt. Ltd. – New Delhi)
3. Advanced Petrochemicals by Dr. G. N. Sarkar (Khanna Publishers)
4. Advanced Petroleum Refining by Dr. G. N. Sarkar (Khanna Publishers)
5. Chemicals from Petroleum by A. L. Waddam(ELBS edition, London.)
6. Shreve's Chemical Process Industries by Austin (MacGrow- Hill Publication, New Delhi)
7. Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors - New Delhi).

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V
PAPER NO.: US05CICH04. (03 CREDITS, 70 MARKS)
TITLE: BUSINESS ORGANISATION

Unit: 1

Forms of legal ownership, Ideal form of an organization, Feature, Advantages and disadvantages of Sole proprietorship, Partnership, Co-operative.

Unit: 2

Joint Hindu Family Organisation and Joint Stock Company. Entrepreneurship decision, Launching of a new enterprise, Principle of management.

Unit: 3

Function of management I. Planning, Directing and Decision making.

Unit: 4

Function of management II. Staffing, control, organization.

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.).

BACHLOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V
PAPER NO.: US 05 C ICH 05 (03 CREDITS, 70 MARKS)
TITLE: MECHANICAL OPERATIONS

Unit 1: Filtration, Rate equation, Filter media and filter aid, Industrial Filters-Sand filter, Plate & frame filter, Leaf filter, Rotary filter and Centrifugal Filtration.

Unit 2: Sedimentation- Batch and continuous sedimentation ,Thickeners,Separation of solids based on specific properties. Clarification equipments. Cyclones. Froth flotation and Jigs.

Unit 3: 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.

Unit 4 : 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.

REFERENCE BOOKS

1. Unit Operations : Volume I & II, by K. A. Gavhane (Nirali Prakashan- 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
SEMESTER-V

PAPER NO.: US 05 C ICH 06 (03 CREDITS, 70 MARKS)

TITLE: FLUID MECHANICS AND HEAT TRANSFER

Unit 1 : Fluids & their classification, Viscosity, Newtonian and non Newtonian fluids, Static pressure, Manometer, Mechanism of fluid flow, Types of flow, continuity equation, Bernaulli's theorem, friction factor & friction head

Unit 2: Fluid moving machineries, Equipments, Pipes and pipe fittings, Pumps Classification and Performance, Reciprocating and Rotary pumps, Centrifugal pumps, Blower, Compressors, Vacuum pump.

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

Unit 4 : 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.

REFERENCE BOOKS

1. Unit Operations : Volume I & II, by K. A. Gavhane (Nirali Prakashan- 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
SEMESTER-V
PAPER NO.: US 05 C ICH 07 (2 CREDITS, 70 MARKS)
(ORGANIC CHEMISTRY)

Preparation of Intermediates and Drugs based on Unit Process.
Quantitative Organic Analysis: Estimation and Analysis of intermediates and finished drugs.

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V
PAPER NO.: US 05 C ICH 08. (02 CREDITS, 70 MARKS)
(PETROLEUM TECHNOLOGY)

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 Conradson's method, % moisture determination by Dean & Stark method, consistency of wax and grease determination by cone and needle penetration method and congealing point determination.

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-V
PAPER NO.: US 05 C ICH 09. (02 CREDITS, 70 MARKS)
(LABORATORY)

1. 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.

SARDAR PATEL UNIVERSITY

Syllabus for B. Sc. (Semester-VI) Industrial Chemistry
Effective from Academic Year 2012-2013

Paper No.	PAPER TITLE	Credit – Hrs.
US06CICH01	SYNTHETIC DYES AND INTERMEDIATES	03 – 03
US06CICH02	PHARMACEUTICALS	03 – 03
US06CICH03	POLYMER TECHNOLOGY	03 – 03
US06CICH04	MANAGEMENT, COSTING AND PLANT DESIGN	03 – 03
US06CICH05	INDUSTRIAL INSTRUMENTATION AND PROCESS CONTROL	03 – 03
US06CICH06	MASS TRANSFER OPERATIONS	03 – 03
US06CICH07	LABORATORY	02 – 04
US06CICH08	LABORATORY	02 – 04
US06CICH09	LABORATORY	02 – 04

Courses	Credits			Teaching Hours		
	Theory	Practical	Total	Theory	Practical	Total
Core courses	18	06	24	18	12	30

Note: Nomenclature of Subject of code: U S 06 C ICV 01
U=Undergraduate, S=Science Faculty, 06=Semester six, C=Core Course,
ICV=Industrial Chemistry Vocational, 01/02/03...09 = Paper 01/02/03...09.

SARDAR PATEL UNIVERSITY

BACHELOR OF SCIENCE INDUSTRIAL CHEMISTRY SEMESTER-VI

PAPER NO.: US 06 C ICH 01 (3 CREDITS, 70 MARKS)
(SYNTHETIC DYES AND INTERMEDIATES)

UNIT: 1

Introduction to the Dyes, Natural to synthetic dyes, Theories of colour, Classification of Dyes on the basis of structure and the mode of application to the fibers and Chemical constitution of dyes.

UNIT: 2

Chemistry of the following dyes with respect to general structural features, chemistry mode of application to fibers and classification: Azo dyes, Acid dyes, Basic dyes and Mordant dyes.

UNIT: 3

Anthraquinone (VAT) dyes, Indigoid dyes. Reactive dyes and Disperse dye: Introduction, Classification and applications.

UNIT: 4

Analysis of dyes and dye intermediates: Nitrite value determination, Coupling value, Titanous chloride reduction, Halogen content determination, Metal Estimations: Cu, Ni, Cr, etc.

REFERENCE BOOKS

1. LUBS Chemistry of synthetic dyes and pigments, R.E. Krieger Publishing Company. Chemistry of dyes and intermediates, Cain, Thorpe and Linstead. 1969.
2. Dyeing and Chemical technology of textile fibres, E.R. Trotman.
3. Development in the Chemistry and Technology of Organic Dyes, J. Driffths, Society of Chemicals Industry, Blackwell Scientific Publications
4. The chemistry of Synthetic Dyes, K. Venkataraman, Academic Press, Vol. I-III.
5. The analytical Chemistry of Synthetic Dyes, K. Venkateraman, John Wiley, New York.
6. A Laboratory Course in Dyeing, C.H. Gites, The society of Dyes and Colourists.
7. The Dyeing of Synthetic polymers and acetate fibres, D.M. Nunn, Dyers Company Publishing Trust.
8. Dyes and Their Intermediates, H.A. Abraham, Pergamon Press.

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI
PAPER NO.: US 06 C ICH 02 (3 CREDITS, 70 MARKS)
(PHARMACEUTICALS)

UNIT: 1

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.

UNIT-2

The life saving drugs: Introduction, Sulfadruugs, Antipyretics and analgesics, Antifungal and Anti-inflammatory drugs.

UNIT-3

Vitamins and Hormones: Introduction, origin of Vitamins, Classification, Deficiency and Disease. Hormones- Adrenaline, Thyroid gland hormone and sex Hormone.

UNIT- 4

Fermentation: Brief idea of microorganisms, their structure, growth and usefulness. Enzyme systems useful for transformation, microbial products. General principle of fermentation process and product processing. Manufacture of Antibiotics Penicillin and semi-synthetic Penicillins, Vitamin B₁₂.

REFERENCE BOOKS

1. Organic Chemistry of Drugs Synthesis, Daniel Lednice and L.A. Mitsouhar, Wiley Interscience.
2. An introduction to synthetic Drugs, P.P.Singh and D.W.Rangnekar, Himalaya Publication, Bombay.
3. Synthetic Drugs by Gurdeep R. Chatwal (Himalaya Publishing House).
4. Principles of medicinal chemistry, W.O.Foye: Lea and Febigen, Publication, Philadelphia.
5. Text book of organic medicinal and pharmaceutical chemistry Milson, Gisvold, Derge, Lippinett Toppan.

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI
PAPER NO.: US06CICH03. (03 CREDITS, 70 MARKS)
TITLE: POLYMER TECHNOLOGY

Unit-1

Polymerization – classification, nomenclature of polymers, mechanism of chain polymerization, free radical polymerization and its kinetics, ionic polymerization, coordination polymerization. Polycondensation- Introduction, Mechanism and effect of various parameters.

Unit-2:

Raw material manufacture, polymerization, properties and application of PF, UF, MF, PU, Epoxy resins.

Unit-3:

Raw material manufacture, polymerization, 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.

REFERENCE BOOKS

1. Shreve's Chemical Process Industries by Austin (MacGraw- 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. H. 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)

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI
PAPER NO.: US06CICH04. (03 CREDITS, 70 MARKS)
TITLE: MANAGEMENT, COSTING AND PLANT DESIGN

Unit-1:

Financial management(source of finance, working and fixed capital). Interest and Depreciation, Taxes and Insurance.

Unit-2:

Marketing management (core concepts of marketing), Pricing policy,Break Even Analysis, Profitability criteria and selection of alternatives.

Unit-3:

Project cost estimation, Plant location, Inventory management(methods for calculating economic order quantity), Welfare and Safety.

.Unit-4:

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. Finance Management by I. M. Pandey (Vikas Publishing House Pvt. Ltd. – New Delhi)
2. Marketing Management by Philip Kotler. (Prentice Hall of India Pvt. Ltd. – New Delhi)
3. Plant Design Economics for Chemical Engineers by Peter and Timmerhouse. (McGraw-Hill, Inc. – New Delhi)
4. Chemical Engineering Plant Designing By Vilbrandt& Dryden (McGraw-Hill Co.)

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI

PAPER NO.: US 06 C ICH 05. (03 CREDITS, 70 MARKS)

TITLE: INDUSTRIAL INSTRUMENTATION AND PROCESS CONTROL

Unit 1: Concept of measurement and accuracy, Principle ,construction and working of temperature measuring instruments, Expansion thermometer, Thermoelectric temperature measurement, Resistances thermometers, Pyrometers.

Unit 2 : 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 3: Flow measurement – classification of instruments, Differential pressure and differential area meters, Open channel flow measurement.

Unit 4: 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.

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 (Nirali Prakashan – Pune)
4. Process Instrumentation & Control Handbook – Douglass M Considine. (McGraw-Hill, Inc., New Delhi)
5. Instrumentation Technology(volume iii)E.B. John

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI

PAPER NO.: US 06 C ICH 06. (03 CREDITS, 70 MARKS)

TITLE: MASS TRANSFER OPERATIONS

Unit 1: 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, Equipments for Distillation .

Unit 2: 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.

Unit 3: Crystallization- approaches for crystallization, Batch and continuous crystallization, Theory of crystallization. Gas absorption, Solvents for gas absorption,

Batch and continuous type equipments for gas absorption.

Unit 4: Leaching and liquid liquid extraction, Factors affecting rate of leaching and extraction, Industrial extractors, Leaching of cellulose material and fine solids, mechanical agitators. Batch and continuous type equipments liquid extractor,Solvents for extraction.

REFERENCE BOOKS

1. Unit Operations : Volume I & II, by K. A. Gavhane (Nirali Prakashan- 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
SEMESTER-VI
PAPER NO.: US 06 C ICH 07 (2 CREDITS, 70 MARKS)
(DYES AND DRUGS)

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).

BACHELOR OF SCIENCE
SEMESTER-VI
PAPER NO.: US06CICH08. (02 CREDITS, 70 MARKS)
TITLE: POLYMER TECHNOLOGY

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 formaline, Benzoyl peroxide & Hydrogen peroxide. Determination of acid value, Saponification value and Hydroxyl value

BACHELOR OF SCIENCE
INDUSTRIAL CHEMISTRY
SEMESTER-VI
PAPER NO.: US06CICH09. (02 CREDITS, 70 MARKS)
TITLE: MASS TRANSFER OPERATIONS

1. 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.