

COURSE STRUCTURE**FOR****T. Y. B. Sc. (SEMESTER – V) INDUSTRIAL CHEMISTRY**

SEMESTER – V			
Principal Subject	Course Code	Paper Title	Credits
INDUSTRIAL CHEMISTRY	US05CICH01	ORGANIC CHEMISTRY-II	3
	US05CICH02	UNIT PROCESS IN ORGANIC MANUFACTURE	3
	US05CICH03	PETROLEUM TECHNOLOGY	3
	US05CICH04	BUSINESS ORGANISATION	3
	US05CICH05	MECHANICAL OPERATIONS	3
	US05CICH06	FLUID MECHANICS AND HEAT TRANSFER	3
	US05CICH07	PRACTICAL ORGANIC CHEMISTRY	2
	US05CICH08	PRACTICAL PETROLEUM TECHNOLOGY	2
	US05CICH09	PRACTICAL	2

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*- nitroacetanilide.

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, Oxiding 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.

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/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. 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).

SEMESTER-V
PAPER NO.: US05C1CH04. (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.).

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)

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 Banchero (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)

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.

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

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.