BACHELOR OF SCIENCE - Industrial Chemistry – Sardar Patel University - Semester-V - PAPER NO - US05CICH51 - TITLE: Advance Organic Chemistry - (04 Credits, 4 Hours/week; 70 External Marks & 30 Internal Marks) - (Effective from June 2023)

COURSE OUTCOMES: In this paper of organic chemistry, students will learn about the concepts of stereo chemistry and isomerism. They will also learn about various name reaction and reagents utilized for chemical reactions having direct applicability in the industries. Also, students will get exposed to the basics of spectroscopy and its application in organic chemical analysis.

UNIT-1 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-2 Some Reagents of Synthetic Importance: Aluminium isopropoxide, Diazomethane, N-Bromo-succinimide, Lead tetra acetate, Osmium tetraoxide, Selenium dioxide, $LiAlH_4$ and $NaBH_4$. 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-3 Ultraviolet (UV) and Visible Spectroscopy: An Introduction, electronic transitional 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. NewDelhi)
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 (ShobanLAlNagin 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.: US05CICH52 - TITLE: Petroleum and Petroleum Products - (04 Credits, 4 Hours/week; 70 External Marks & 30 Internal Marks) - (Effective from June 2023)

COURSE OUTCOMES: This paper will inculcate knowledge of petroleum industry. The source of petroleum, process of rectification of crude and obtaining petroleum fractions and various fuels. Additionally, students will learn the manufacturing of various chemical entities derived from petroleum source. Also, they will learn the analytical aspects of petroleum raw material, fuels and products derived thereof.

UNIT-1Theories 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 combinedtechniques.

UNIT-3 Manufacture of HCN, CS_2, 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, Sulponation: benzene sulfonic acid from benzene

REFERENCE BOOKS

1. Modern petroleum refining processes, vth addition, B KBhaskara.
2. A Text on Petrochemicals by Bhaskar Rao (Khanna Publishers - NewDelhi)
3. Modern Petroleum Refining Process by BhaskarRao (Oxford & IBH Publishing Co. Pvt. Ltd. – NewDelhi)
4. Advanced Petrochemicals by Dr. G. N. Sarkar (KhannaPublishers)
5. Advanced Petroleum Refining by Dr. G. N. Sarkar (KhannaPublishers)
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 - NewDelhi).

BACHELOR OF SCIENCE - Industrial Chemistry – Sardar Patel University - Semester-V -PAPER NO.: US05CICH53 - TITLE: Chemical Process Industries - (04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks) - (Effective from June 2023)

COURSE OUTCOMES: This paper will help students to understand various chemical process industries like nitrogenous products, chloro alkali based, phosphorous based and electro thermal industries. They will also learn various manufacturing processes of chemicals based on nitrogen, chlorine, phosphorous etc. Also, they will learn the application of various chemicals as raw materials.

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

UNIT-2: Chloro alkali 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, NewDelhi)
3. Riegel's Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors – NewDelhi).

BACHELOR OF SCIENCE - Industrial Chemistry – Sardar Patel University - Semester-V - PAPER NO.: US05CICH54 - TITLE: Fluid Mechanics & Mechanical Operations - (04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks) - (Effective from June 2023)

COURSE OUTCOMES: By studying this paper, the students will learn the core concepts related to fluids, types of fluids, their movement and their flow properties as well as engineering related to the equipment used for transporting fluids and controlling their flow. The students will also get exposed to various mechanical operations employed in chemical industries and will gain knowledge about the use and application of such mechanical concepts at various levels of chemicalprocesses.

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 Banchero (McGraw-Hill BookCo.)
3. Unit Operation of Chemical Engineering by Warreh L Mc Cabe&Jullian C Smith (McGraw-Hill BookCo.)
4. Chemical Engineering (volume I & II) by J. M. Coulson & K. F. Richardson (Asian Books Pvt. Ltd., NewDelhi).

BACHELOR OF SCIENCE - Industrial Chemistry – Sardar Patel University - Semester-V - SUBJECT CODE: US05CICH55 - TITLE: Practical (All Core Courses) - (08 Credits, 16 Hours; External Marks-140, Internal Marks-60) - (Effective from June 2023)

COURSE OUTCOMES: This paper of practical will provide hands on exposure to students towards preparation and estimation of Intermediates and Drugs based on various Unit Process. Also, it will help students to learn analysis of petroleum and petroleum (as per ASTM testing procedure). Also, it will help will learn about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc. Also, they will learn the calculations related to process parameters used in chemicalindustries.

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)

Preparation and purification and estimation of fine chemicals such as Tetra amine copper (II) sulfate, Tetra thiourea copper (I) sulfate,Sodium thiosulfate,Hexathiourea Lead Nitrate,Chrome Red,Magnesium Hydroxide,Magnesium Carbonate, Magnesium Trisilicate,Magnesium Stearate, Zinc Stearate etc., Preparation of various industrial metal supported catalyst., Extraction and purification of industrial solvent., Physical and performance parameter of coating.

Part: IV (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 onworkingoflaboratorycentrifuge.9.Studyonsolidliquidmixingandsolid-solidmixing.,

10. Study on heat transfer by conduction and convection.