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, 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-Bromosuccinimide, Lead tetra acetate, Osmium tetraoxide, 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: 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, Interpritation 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 (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.: 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, 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, 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: Phosphorusindustries: 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 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).

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: Kinametic viscosity by Redwood viscometer and Saybolt's Viscometer, Open cup Fash& 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 conjeling 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 (Di Chlorodiphynyltrichloroethane), 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 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-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.

REFRENCE 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