

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

