Sardar Patel University
Syllabus for B. Sc. Semester-V Industrial Chemistry Vocational
Effective from Academic Year 2020-2021.

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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.
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 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 spectro-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
5. Spectroscopy (Atomic & Molecular) by GurdeepChatwal (Himalaya Publishing House)
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, Xyelene, Naphthalene, linear alkyl benzenes sulphonates. Various catalysts used in petrochemical industry: Preparation, applications and selectivity.

REFERENCE BOOKS

2. From Hydrocarbons to petrochemicals, L.F. Hatch Gulf Publishing company, Houston.
4. Introduction to petrochemicals by SukumarMati, IBH.
5. Introduction to petroleum chemicals, M. Steiner, Pergaman Press.
7. A Text on Petrochemicals by BhaskarRao (Khanna Publishers - New Delhi)
9. Advanced Petrochemicals by Dr. G. N. Sarkar (Khanna Publishers)
10. Advanced Petroleum Refining by Dr. G. N. Sarkar (Khanna Publishers)

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 follow 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, properly alcohol, 1, 4-butanediol, acrylates, vinyl esters, vinyl chloride. Pyridine picolines, phenol, acetone, resprcinol, phthalic anhydride.

Raw materials, flow chart, effluent management, kinetics and uses of Triphenyl phosphine, alkyl phosphates, Glycerol, sorbitol, melamine, formaldehyde, formic acid.


REFERENCE BOOKS:
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 Ration, 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:

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 Banchero (McGraw-Hill Book Co.)
3. Unit Operation of Chemical Engineering by Warreh L Mc Cabe&Jullian C Smith (McGraw-Hill Book Co.)
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, Alkylimetry, non aqueous complexometry, Potentiometry, etc. of bulk drugs, complete I.P. Monograph of three drugs representing variety of testing methods. And estimations.
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

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 EDITIOR)
3. Water Pollution by V.P. Kudesia (PragatiPrakshan)
4. Environment pollution control engineering by C S Rao (New Age International (P) Limited)
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
### Syllabus for B. Sc. (Semester-VI) Industrial Chemistry
Effective from Academic Year 2020-2021

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<td>Industrial Management &amp; Economics</td>
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BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
PAPER NO.: US06CICV21
TITLE: Synthetic Dyes and Drugs
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Introduction, Classification of Dyes on the basis of mode of applications to the fibers and chemical constitution of the Dyes. Applications of Dyes to fibers, Color shades and fastness properties.

Unit 2: Chemistry of the following dyes with respect to general structural features and classification: Azo dyes, Acid dyes, Basic dyes and Mordant dyes, Anthraquinone (VAT) dyes, Indigoid dyes. Disperse dye and Reactive dyes.


Unit 4: 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. The study of life saving drugs: Introduction, classification, properties and uses of followings. Sulfa drugs, Antipyretics and analgesics, and Anti-inflammatory drugs.

REFERENCE BOOKS:

4. Dyes and Their Intermediates, H.A. Abrahert, Pergaman Press.
UNIT: 1
Introduction, General characteristics of polymers in comparison with common organic compounds. Nomenclature and classification of polymers, Different types and method of Polymerizations.

UNIT: 2
Molecular weight and molecular weight distribution number, weight and viscosity average molecular weights of polymers. Methods of determining molecular weight, Practical significance of molecular weight distribution. Glassy state, Glass transition temperature (Tg), Factors affecting Tg, Crystallinity in polymers.

UNIT: 3

UNIT: 4
Detailed study of the following thermoplastic polymers with respect to Synthesis, Chemistry, Properties and Application Polyolefine Polyethelenes, LDPE, HDPE, Polypropylene, Polyvinyl chloride, Teflon, polystyrene. Homopolymers, Copolymers such as SBR, ABS, SAN. Polyvinyl acetate and its modifications. Polyamides: Nylon-6 and Nylon-66.

REFERENCE BOOKS:
4. Polymer Science and Technology, Joel R Fried, PHI
UNIT-1
Forms of legal ownership, Ideal form of an organization, Features, Advantages and Disadvantages of Sole Proprietorship, Partnership Organization, Co-Operative Organization, Join stock companies and Join Hindu family organization.
Entrepreneurial decision; Launching a new enterprise, ownership organization decision, Expansion of existing business.
Scale of operation and size of firm: Measure of size, Factors determining size of business, optimum size of business unit, force determining optimum size. Weakness of large firms.

UNIT-2
Concept of scientific management in industry, Function of Management, Decision making, Planning, organizing, Directing and Control.
Location of industry, Management of human resources selection, Incentives welfare and safety. Introduction to MIS, Functions of MIS, Problems with MIS, Knowledge requirements for MIS in seven area. (GST,DSS,EIS,ES,4GL,IT&MIS)

UNIT-3
Basic concept of Economics, Demand and Supply, Elasticity of Demand and Supply, Concept of Profit and Revenue, Concept of Equilibrium and Margin, Introduction to Micro and Macro Economics, Economies in production, Economics in management, Economies in finance.
Depreciation methods of determining depreciation, Taxes, selecting some aspects of marketing, Pricing policy, Profitability, Criteria, Economics of selecting alternatives, Variation of cost with capacity, optimum batch sizes, Production scheduling etc.

UNIT-4
Factors involved in project cost estimation, Methods employed for the estimation of capital investment, Capital information, Elements of cost accounting, interest and investment costs, Time value of money, Equivalence.
Material management, Inventory Management: Meaning, Importance, Techniques and Inventory Controls. Quality Control: Meaning, Importance, Total Quality Control and Total Quality Management Case Study on TQC and TQM

REFERENCE BOOKS
3. Finance Management by I.M.Pandey.
6. Essentials of Inventory Management, by Max Muller, AMACOM.
7. Total Quality Management – An Introductory Text by Paul James, Prentice Hall.
8. Quality Control and Applications by Housen&Ghose.
Unit 1:
Development of project, Evaluation of process, Plant design factors, Process design, Choice of process, engineering flow diagram.
Selection of process Equipment’s & Materials, Chemical reactors, Plant Layout.

Unit 2:
Surface chemistry & Interfacial phenomena, Absorption, Sols, Gel, Emulsion, Aerosols, Surfactants, catalysis & catalyst, Industrial important of catalyzed reaction.

Unit 3:
Advance separation Techniques: - Ion exchange resins & its Equipment’s, Membrane separation process, Ultra-filtration. Reverse Osmosis, Electro-dialysis.

Unit 4:
Automatic control system Terminology, Manual & automatic control, Feedforward& feedback control system, process times lags, control actions & its types of control actions, final control element.

REFERENCE BOOKS:

1. Chemical engineering plant design, vibrant & Dryden (McGraw hill publication)
2. Chemical engineering (volume II) Coulson & Richardson
3. Mechanical and industrial measurement, R.K. Jain (Khanna Publishers)
4. Plant design and economics for chemical engineering, Piter&Pimmerhours
5. Unit operations of chemical engineering, McCabe & smith
BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06CICV25 - Practical
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)
Analysis of intermediates: Nitrite titrations, Diazocoupling, titanous chloride titration, estimation of Cu, Ni, Cr, etc. Dyeing: Dyeing of various dyes on cotton. Evaluation of the fastness properties of dyes with respect to light, washing and sublimation. Preparation of various classes of dyes.

Part: II (02 Credits, 04 Hours, 35 External 15 Internal marks)

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)
Book review report writing and its submission cum presentation. A case study on selected management area of chemical industry visited.
BACHELOR OF SCIENCE
Industrial Chemistry Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICV26
TITLE: Specialty Chemicals – II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit-1
White pigments, White lead, Electric method, Characteristic of pigment, use of pigment, Titanium dioxide, morden chlorine method, Physical property of TiO₂ Ultramarine blue, Cobalt blue, Red lead, Synthetic iron oxide pigment, Green pigment, Chrome green, Yellow pigment, Black pigment, Tonner.

Unit-2
Introduction detergents, principal group of synthetic detergent, Classification of surface-active agent, Anionic detergents, Non-ionic detergents, Additives, sub regulators, Binders, Biodegradability of surfactants, Ecofriendly detergents containing enzymes, Ecofriendly detergents-Zeolites, Detrimental effect of detergent, Manufacturing of Shampoos.

Unit-3
Classification of paint, Distemper, Manufacturing of paint, Setting of paint, Good paint, Important of PVC, Paint failure, Emulsion paint, constituent of emulsion paint, Latex paint, Luminescent paints, paint remover, Application of paint and Varnishes, Raw material, Manufacturing of Varnishes, enamels, Gloss finisher.

Unit-4
Introduction of Explosive and Toxic chemical Industries, Classification of Deflagrating, Characteristics of explosive, Nitrocellulose, Di-nitrobenzene, Tri-Nitrobenzene, Tri-Nitrotoluene, Picric acid, Ammonium picrate or explosive, Nitroglycerin and dynamite, Gun powder, RDX.

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 Vocational – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICV27
TITLE: Occupational Health & Industrial Hygiene - II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

UNIT-1
Safety in chemical industries
Place of chemical industries in society, statutory provisions, Types of chemical hazard & its control, General safety precautions.

UNIT-2
Process Hazard & its control, Utility Hazard & its control, safety transportation of chemicals, Checklist of Routine inspections chemical factories, Types of tests, certificates & Records. Permits for vessel entry.

UNIT-3
Occupational health
Industrial hygiene & occupational health, occupational health hazard, adverse health effect & its control, Types and limits of radiation, Dangerous properties of chemicals and their health effects, Routes of entry & its toxic effects, Evaluation of health hazards, Sampling analysis in gas.

UNIT-4
Safety management
Concept of management , elements of management & principles, safety management & its responsibilities, safety organizations, department & Programme, safety education & training

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
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<td>Advance Organic Chemistry</td>
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<td>Petroleum and Petroleum Products</td>
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<td>US05CICH23</td>
<td>Chemical Process Industries</td>
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<td>Fluid Mechanics &amp; Mechanical Operations</td>
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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.
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 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

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, CS₂, 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)
4. Advanced Petrochemicals by Dr. G. N. Sarkar (Khanna Publishers)
5. Advanced Petroleum Refining by Dr. G. N. Sarkar (Khanna Publishers)
7. Shreve’s Chemical Process Industries by Austin (MacGrow- Hill Publication, New Delhi)
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-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, MgCl₂, MgO, hydrogen peroxide, potassium permanganate, hydroxyl amine.


REFERENCE BOOKS:

1. Industrial Chemistry by B. K. Sharma. (Krishna Prakashan Media (P) Ltd., Meerut)
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 WarreL Mc Cabe&Jullian C Smith (McGraw-Hill Book Co.)
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 conjingel point determination.

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)
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 Chlorodiphenyltrichloroethane), 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

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 EDITION)
3. Water Pollution by V.P. Kudesia (Pragatipraksham)
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.

REFERENCE 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
Sardar Patel University  
Syllabus for B. Sc. (Semester-VI) Industrial Chemistry  
Effective from Academic Year 2020-2021

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<th>Title Of Paper</th>
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<td>04</td>
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<td>US06CICH22</td>
<td>Polymer Technology</td>
<td>04</td>
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BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
PAPER NO.: US06CICH21
TITLE: Synthetic Dyes and Pharmaceuticals
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit 1: Dyes: Introduction, Theory of colors, Classification of dyes, Chemistry of Azo, Anthraquinone, Reactive and Disperse dyes.

Unit 2: Application of synthetic dyes of various fabrics and Fastness properties. Analysis of dyes and dye intermediates: Nitrite value, Coupling value, Titanous chloride reduction, Halogen content determination and estimation of Cu, Ni and Cr.

Unit 3: 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. Account of Sulfa drugs, Antipyretics and analgesics drugs.

Unit 4: Vitamins, Hormones, Antibiotics, Antituberculor, Antifungal and Antiinflammatory drugs: Introduction, classification and synthesis and study of selected drugs.

REFERENCE BOOKS:

BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
PAPER NO.: US06CICH22
TITLE: Polymer Technology
(04 Credits, 4 Hours; 70 External Marks & 30 Internal Marks)
(Effective from June 2020)

Unit-1
A Brief history of polymer, Classification and nomenclature of polymers, chemistry of polymerization and Polymerization methods.

Unit-2
Molecular weight and molecular weight distribution number, weight and viscosity average molecular weights of polymers. Methods of determining molecular weight, Practical significance of molecular weight distribution. Glassy state, Glass transition temperature (Tg), Factors affecting Tg, Crystallinity in polymers.

Unit-3
Raw material, manufacture, properties and application of PF, UF, MF, PU, Epoxy resins. Raw material, manufacture, properties and application of PE, PP, polycarbonates, PTFE, PVC, PS, PVA.

Unit-4

REFERENCE BOOKS

2. Riegel’s Hand Book of Industrial Chemistry by James A Kent (CBS Publishers & Distributors - New Delhi)
5. Polymer Science and Technology, by Joel R Fried, PHI.
Unit: 1

Unit: 2
Function of management I. Planning, Directing and Decision making. Function of management II. Staffing, control, organization.

Unit: 3
Financial management (source of finance, working and fixed capital). Interest and Depreciation, Taxes and Insurance. Marketing management (core concepts of marketing), Pricing policy, Break Even Analysis, Profitability criteria and selection of alternatives.

Unit: 4

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(SahityaBhawan – Agra).
6. Principle and Practice of Management by L M Prasad. (S. Chand & Co.).
7. Finance Management by I. M. Pandey (Vikas Publishing House Pvt. Ltd. – New Delhi)
8. Marketing Management by Philip Kotler. ( Prentice Hall of India Pvt. Ltd. – New Delhi)
10. Chemical Engineering Plant Designing By Vilbrandt& Dryden ( McGraw-Hill Co.).
Unit 1: Concept of measurement and accuracy, Principle, construction and working of temperature measuring instruments, Expansion thermometer, Thermo-electric temperature measurement, Resistances thermometers, Pyrometers. 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 2: Flow measurement – classification of instruments, Differential pressure and differential area meters, Open channel flow measurement. 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.


Unit 4: 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, Equipment’s of Distillation. 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. 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 (NiraliPrakashan – Pune)
5. Instrumentation Technology(volume iii)E.B. John
6. Unit Operations : Volume I & II, by K. A. Gavhane (NiraliPrakashan- Pune)
7. Introduction to Chemical Engineering by Walter L Badger and Juline T Banchero (McGraw-Hill Book Co.)
8. Unit Operation of Chemical Engineering by Warreh L Mc Cabe&Jullian C Smith (McGraw-Hill Book Co.)
BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
SUBJECT CODE: US06CICH25
TITLE: Practical (All Core Courses)
(06 Credits, 12 Hours; 50 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 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).

Part: II (02 Credits, 04 Hours, 35 External 15 Internal marks)
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 formalin, Benzoyl peroxide & Hydrogen peroxide. Determination of acid
value, Saponification value and Hydroxyl value.

Part: III (02 Credits, 04 Hours, 35 External 15 Internal marks)
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.
Book review report writing and its submission cum presentation. A case study on selected
management area of chemical industry visited.
BACHELOR OF SCIENCE
Industrial Chemistry – Sardar Patel University
Semester-VI
SUBJECT CODE: US06DICH26
TITLE: Specialty Chemical Industries - II
(02 Credits, 2 Hours; 50 External Marks)
(Effective from June 2020)

Unit -1
Introduction detergents, principal group of synthetic detergent, Classification of surface-active agent, Anionic detergents, Non-ionic detergents, Additives, sub regulators, Binders, Biodegradability of surfactants, Ecofriendly detergents containing enzymes, Ecofriendly detergents-Zeolites, Detrimental effect of detergent, Manufacturing of Shampoos.

Unit-2
Introduction of Explosive and Toxic chemical Industries, Classification of Deflagrating, Characteristics of explosive, Nitrocellulose, Di-nitrobenzene, Tri-Nitrobenzene, Tri-Nitro toluene, Picric acid, Ammonium picrate or explosive, Nitroglycerin and dynamite, Gun powder, RDX

Unit-3
White pigments, White led, Electric method, Characteristic of pigment, use of pigment, Titanium dioxide, morden chlorine method, Physical property of TiO₂ Ultramarine blue, Cobalt blue, Red lead, Synthetic iron oxide pigment, Green pigment, Chrome green, Yellow pigment, Black pigment, Tonner.

Unit-4
Classification of paint, Distemper, Manufacturing of paint, Setting of paint, Good paint, Important of PVC, Paint failure, Emulsion paint, constituent of emulsion paint, Latex paint, Luminescent paints, paint remover, Application of paint and Varnishes, Raw material, Manufacturing of Varnishes, enamels, Gloss finisher.

REFERENCE BOOKS
1. Environmental Chemist 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)
UNIT-1
Safety in chemical industries
Place of chemical industries in society, statutory provisions, Types of chemical hazard & its control, General safety precautions.

UNIT-2
Process Hazard & its control, Utility Hazard & its control, safety transportation of chemicals, Checklist of Routine inspections chemical factories, Types of tests, certificates & Records. Permits for vessel entry.

UNIT-3
Occupational health
Industrial hygiene & occupational health, occupational health hazard, adverse health effect & its control, Types and limits of radiation, Dangerous properties of chemicals and their health effects, Routes of entry & its toxic effects, Evaluation of health hazards, Sampling analysis in gas.

UNIT-4
Safety management
Concept of management, elements of management & principles, safety management & its responsibilities, safety organizations, department & Programme, safety education & training

REFERENCE 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