Enclosure-I-1.3

Yogi Divine Society inspired,

Sarvodaya Kelavani Samaj managed,

Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot

(Autonomous)

Affiliated to Saurashtra University, Rajkot

Re-Accredited at 'A' Level by NAAC

STAR college Scheme & Status by MST-DBT

UGC- College with Potential for Excellence (CPE)

UGC-DDU KAUSHAL Kendra

GAAA – Highest Grade A-1 by KCG, Government of Gujarat

GPCB-Government of Gujarat approved Environment Audit Center

UGC-Autonomous College

DEPARTMENT OF CHEMISTRY

B.Voc. CHEMICAL TECHNOLOGY

B. Voc. Chemical Technology
SEMESTER – III

BVCT-301	Fundamental Chemistry-II

Unit-I: Fundamental Concepts of Organic Chemistry
Types of chemical bonds, patterns of bond cleavages, Types of reagents – electrophiles & nucleophiles, Reactive intermediates – carbocation, carbanion and free radicals, Types of reactions – Addition reaction and Substitution reaction involving S_N^1, S_N^2, E^1, E^2

Unit-II: Carboxylic Acid and Carbonyl Compounds
Carboxylic Acids, Aldehydes & Ketones: Nomenclature, structure & bonding, physical properties, preparation and chemical reactivity, HVZ reaction, Method of Decarboxylation, Method of Acid Derivatization, Tautomerism, Condensation reactions of carbonyl compounds

Unit-III: Organic Compounds of Oxygen: Alcohol, Phenol & Ether
Nomenclature and classification, structure and bonding, Physical Properties, preparation, chemical reactions, test for identification.

Unit-IV: Organic Compounds of Nitrogen: Amines, Nitroalkanes and Nitroarenes
Amines: Nomenclature, classification, stereochemistry of amines, basicity of amines, preparation, chemical reactivity, test for identification separation of primary, secondary and tertiary amine mixture. Nitroalkanes: Preparation, reduction in different media, picric acid.

Unit-V: Open-chain and Cyclic Hydrocarbons
IUPAC Nomenclature of Branched and unbranched hydrocarbons, classification of carbon atom, method of formation, physical properties and chemical reactivity. Cyclopropane ring-banana bond, Markownikoff's rule, polymerization of alkynes.

Reference Books:

1. Chemistry for Degree Students – First Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
2. Chemistry for Degree Students – Second Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
3. Chemistry for Degree Students – Third Year, Dr. R. L. Madan, S. Chand & Co. Ltd.
4. The language of Chemistry or Chemical Equations, G. D. Tuli & P. L. Soni, S. Chand & Co. Ltd.
5. Principles of Organic Chemistry, Peter R. S. Murray, CBS Publications

B. Voc. Chemical Technology
SEMESTER – III

BVCT-302	Fundamental Industrial Chemistry-II

Unit-I: Utilities in Industry
Fuel: Types of fuels – advantages and disadvantages. Combustions of fuels, Calorific value, Specifications of fuel oil.
Water: Specifications for Industrial use, various water treatments.

Unit-II: Boilers
Types of boilers and their functioning, Steam generation and uses, Specifications of air and its industrial use, Processing of air.

Unit-III: Transport Equipments
Fans, Blowers, Compressors, Reciprocating pump, Centrifugal pumps, Gear pumps.

Unit-IV: Heat exchangers
Construction and Working of Shell & tube type heat exchangers, finned tube exchanger, Plate type heat exchangers.

Unit-V: Size Reduction
Principles of comminution, Rittinger's and kick's laws, Bond's crushing law and work index, Size reduction equipments, crushers, grinders, Ultra fine grinders, Cutting machines.

Reference Book:

1. Industrial Chemistry, Regregel, Reinhold Publication.
2. Chemical Engineer Hand Book, J. H. Perry, McGraw Hill Book Comp.
2. Introduction to Chemical Engineering, Badger Banchero McGraw Hill Comp.
4. Engineering Chemistry by S.S. Dara.

B. Voc. Chemical Technology
SEMESTER – III

BVCT-303	Industrial Unit Process & Operations

Unit-I: Oxidation & Hydrogenation
Oxidation: Introduction, Types of oxidation reactions, oxidizing agents, Chemical factors, Physical factors, Outline of chemical kinetic, mechanism and thermodynamics, Manufacturing process of acetic acid, Manufacturing process of acetaldehyde, Manufacturing process of benzoic acid, Manufacturing process of phthalic anhydride, Manufacturing process of maleic anhydride, Manufacturing process of acrolein.
Hydrogenation: Introduction, Various methods of reduction, Chemical factors, Physical factors, Outline of chemical kinetic, mechanism and thermodynamics, Various hydrogenating catalyst, Hydrogenation process of vegetable oils, Synthesis process of methanol, Reforming process.

Unit-II: Sulphonation & Nitration
Sulphonation: Definition, Sulfonating agents, Chemical factors, Physical factors, Outline of chemical kinetic, mechanism and thermodynamics, Sulphonation process of benzene, Sulphonation process of naphthalene, Sulphonation process of dodecyl benzene.
Nitration: Introduction, nitrating agents, mechanism & nitration of paraffin hydrocarbons – benzene to nitrobenzene, m-dinitrobenzene, acetanilide to p-nitro acetanilide, continuous vs. batch wise nitration.

Unit-III: Halogenation
Definition, Types of halogenation reactions, Various halogenating agents, Chemical factors, Physical factors, Outline of chemical kinetic, mechanism and thermodynamics, Manufacturing process of mono chloro acetic acid, Manufacturing process of sodium mono chloro acetate, Manufacturing process of chloral, Manufacturing process of chloro benzene, Manufacturing process of freon-12, Chlorination of methane.

Unit-IV: Distillation
Introduction, boiling point, driving force, equilibrium stage, vapour- liquid equilibrium, boiling point diagram, raoult's law, dalton's law, relative volatility, differential distillation, flash distillation, fractionating column, mccabe-thiele method, reflux ratio, azeotropic distillation, extractive distillation, types of plate, packed column, types of packing.

Unit-V: Gas Absorption
Introduction, Phase Equilibrium, Absorption with Chemical Reaction, Non-isothermal Absorption, Absorption Equipment: Packed Towers, Plate Towers, Agitated Vessels, Centrifugal Absorbers, Spray Towers, Gas absorption Calculations.

Reference Books:

1. Industrial Chemistry, Regregel, Reinhold Publication.
2. Unit Operations in chemical Engineering, McCabe & Smith, McGraw Hill Book Comp.
3. Unit Operations I & II, D.D. Kale Pune Vidyarthigriha Prakashan-Pune.

B. Voc. Chemical Technology
SEMESTER – III

BVCT-304	Water Analysis

Unit-I: Introduction
Introduction, distribution of water in the body, function of water in human body, water required meant in human body ,guideline of WHO for the drinking water, sampling of water, preservation of sample of water, pre-concentration of sample of water , basic terminology and relationship.

Unit-II: Physical examination of water
pH, temperature, total dissolved solid, solid, suspended solid, acidity, alkalinity, conductivity, colour, test, order, turbidity, density, hardness of water .

Unit-III: Analysis of inorganic non-metallic constitute
chloride, sulphate, sulphide, fluoride, phosphate, sulphur, nitrate, nitrite, carbon dioxide, ammonia, cyanide.

Unit-IV: Analysis of metal ion
Mineral ion: calcium, magnesium, iron, sodium, silver, zinc, manganese. Toxic ion: lead, mercury, arsenic, beryllium, cadmium, chromium, copper, selenium

Unit-V: Analysis of organic content and water treatment process
Dissolved oxygen (OD), biochemical oxygen demand (BOD), chemical oxygen demand (COD), UV absorbing constituent. Water treatment process: membrane separation process, Reverse osmosis, Ultra filtration, Dialysis, Ion exchange process.

Reference Books:

1. Instrumental Analysis, H H Willard, CBS Publishing Co.
2. Wastewater Engineering – Treatment and Reuse, 4th Edition, Metcalf & Eddy, Tata McGraw-Hill
3. Food Science & Technology – Potable Water, S. N. Mahindru, APH Publishing Corp.

B. Voc. Chemical Technology
SEMESTER – IV

BVCT-401	Petroleum & Petrochemicals

Unit-I: Origin, formation and composition of petroleum
Origin and formation of petroleum, reserve and deposition of world, Indian petroleum industry, composition of petroleum

Unit-II: Petroleum processing data
Evolution of petroleum, distillation characteristics, thermal properties of petroleum fraction , important product properties and test method-gas, natural gas, associated gas, dissolved gas, casing head gas, refinery off gas, LPG, test for gasoline, additive for gasoline, jet fuels, naphtha, kerosene's tests & properties, diesel fuels, lube oil and its composition

Unit-III: Fractionation of petroleum
Dehydration & desalting of crudes-electric desalting, pumping of waxy crude, heating of crude-pipe still heaters, distillation of petroleum, arrangement of towers-top tray reflux, pump back reflux, pump around reflux, design aspect, atmospheric distillation unit, vacuum distillation unit.

Unit-IV: Thermal and catalytical processes
Cracking, thermal cracking reaction, properties of cracked material, effect of pressure on cracking, visbreaking, catalytic cracking, fixed bed cracker, moving bed cracked, catalytic reforming-reaction conditions, effect of pressure & temperature, naphtha cracking-feed stock selection, effect of steam, coking

Unit-V: Asphalt technology
Source of asphalt, chemical structure of asphalt, action of heat on asphalt, types of asphalt, air blowing of bitumen, up gradation of heavy crudes

Reference Books:

1. Fuels & Combustion by Samir Sarkar
2. Introduction to Petroleum Chemicals, H.Stdiner, Pergmon Press.

B. Voc. Chemical Technology
SEMESTER – IV

BVCT-402	Chemistry of Polymer & Composite materials

Unit-I: Fundamental concepts of Polymer
Introduction, Classification, method of linking, organic & inorganic polymers, heterochains, electronegativity, Homo-polymer, co-polymer, configuration, addictive polymers, bulk co-polymers, applications of polymers.

Unit-II: Chemistry of Monomers
Coal products, etro electro chemical, hydrocarbons and their derivatives, functional monomers

Unit-III: Polymerization
Step polymerization, Chain transfer polymerization, Anionic & Cationic polymerization, Coordination polymerization, Solution & Template polymerization, Bulk & Block polymerization, Radical polymerization, Electrochemical polymerization, Ring Opening polymerization.

Unit-IV: Chemistry of Polymers
Monomers, Cellulose esters & ethers, Hydrocarbon derived polymers, P-F Resin, Aminopolymers, Epoxy & Silicons.

Unit-V: Characterization and molecular weight determination
Characterization: Molecular structure, chemical tests, thermal method, Tg, molecular weight, distribution, stability. M.Wt. Determination: Atomic weight, mole concept, M.Wt. in colloids, M.Wt. of polymers, method of determining M.Wt., Chemical & Physical methods.

Reference Books:

1. A Textbook of Polymers – Vol I & II, M. S. Bhatnagar, S. Chand Publication
2. Plastic Materials – John Brydson, Elsevier Publication
3. Polymer Science & Technology – Joel Fried, PHI
4. Introductory Polymer Chemistry, G. S. Misra, New Age International
5. Polymer Science, G. Govariker, New Age International

B. Voc. Chemical Technology
SEMESTER – IV

BVCT-403	Polymer Technology

Unit-I: Solvents
Introduction, Classification, types of solvents, types of solutions, method of finding chain length, demixing, flexible chains, particle size & shape, compatibility, phase transition, ternary systems.

Unit-II: Fillers and Additives
Fillers: Introduction, types of fillers, particle geometry, organic fillers, cellulosic, fibers, and inorganic fillers, applications. Additives: Introduction, plasticizers, classification, effect on chemical properties & stability, flexibilizers, release agents, antioxidants, applications.

Unit-III: Moulding & Casting Techniques
Moulding: Introduction, moulding powder, processing, mixing, curving, types of moulding, compression moulding, infection moulding, extrusion moulding, blow moulding, spinning, properties of moulding polymers. Casting: Introduction, thermosetting resins, types of casting, ultrusion, cellular plastics, chemical methods.

Unit-IV: Rubber & Adhesives
Rubber: Introduction, concentration & coagulation of Latex, classification, types of rubber, modification of natural rubbers, terminology, mixing, processing, types of extruders, reclaiming of rubber. Adhesive: Introduction, theory of adhesives, surface treatment, physical nature of adhesives, types, natural glues, elastomer adhesives, synthetic adhesives, olefinic polymer adhesives, Epoxy adhesives, Inorganic Adhesives, Bioadhesives, Analysis of adhesives.

Unit-V: Laminates & Composites
Lamination Introduction, preparation, types of fibers, techniques, high & low pressure laminates, applications. Composites: Introduction, matrix material, types of resin, composite wood material, moulded products, plywood, composite fabrication process, classification, analysis of polymer matrix composites.

Reference Books:

1. Outline of Polymer Tech, R. Sinha, PHI
2. A Textbook of Polymers – Vol I & II, M. S. Bhatnagar, S. Chand Publication
3. Plastic Materials – John Brydson, Elsevier Publication
4. Polymer Science & Technology – Joel Fried, PHI
5. Polymer Science, G. Govariker, New Age International

B. Voc. Chemical Technology
SEMESTER – IV

BVCT-404	Petroleum Analysis

Unit-I: Overview of Petroleum Analysis
Petroleum – definition and composition, historical & modern perspectives, analysis, specifications, sampling, measurement, accuracy, precision, method validation (only concept).

Unit-II: Petroleum Assay
Carbon residues, Asphaltene content, density (specific gravity), distillation, light hydrocarbons, metallic constituents, salt content, Sulphur content, viscosity, pour point, water & sediment, wax content, miscellaneous tests.

Unit-III: Test Methods for Naphtha, Gasoline, Kerosene & Diesel
Naphtha: Aniline point & mixed aniline point, composition, density, evaporation rate, flash point, volatility, appearance, Kauri-Butanol Value. **Gasoline**: Additives, composition, corrosiveness, density, flash & fire point, volatility, water & sediments. **Kerosene**: Acidity, composition, flash & fire point, pour point, density, viscosity, water & sediments. **Diesel**: Acidity, composition, flash & fire point, pour point, density, viscosity, water & sediments.

Unit-IV: Test Methods for Distillate Fuel Oil, Residual Fuel Oil, Mineral Oil & Lubricating Oil
Composition, ash content, acidity or alkalinity, aniline point, asphaltene content, molecular weight, flash point, pour point, density, viscosity, water & sediments.

Unit-V: Test Methods for Grease, Wax, Asphalt & Coke
Composition, specific properties, mechanical or chemical stability, acidity or alkalinity, density, viscosity, specific tests for quality & property determination.

Reference Books:

1. Handbook of Petroleum Analysis, James Speight, Wiley International
2. Instrumental Analysis, H H Willard, CBS Publishing Co.