

Syllabus
for
B.Sc. Course with
CHEMISTRY
Choice Based Credit System

Effective from the Session 2016-17

KAZI NAZRUL UNIVERSITY
Asansol
West Bengal

Kazi Nazrul University
Curriculum for B. Sc. Course

Semester - I

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Discipline – I (Theory)	Core Course – I	50				4/5
2	Discipline – I (Practical/Tutorial)	Core Course – I	50				2/1
3	Discipline – II (Theory)	Core Course – I	50				4/5
4	Discipline – II (Practical/Tutorial)	Core Course – I	50				2/1
5	Discipline – III (Theory)	Core Course – I	50				4/5
6	Discipline – III (Practical/Tutorial)	Core Course – I	50				2/1
7	EVS	AEC	50				2
Total Credit = 20							

Semester - II

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Discipline – I (Theory)	Core Course – II	50				4/5
2	Discipline – I (Practical/Tutorial)	Core Course – II	50				2/1
3	Discipline – II (Theory)	Core Course – II	50				4/5
4	Discipline – II (Practical/Tutorial)	Core Course – II	50				2/1
5	Discipline – III (Theory)	Core Course – II	50				4/5
6	Discipline – III (Practical/Tutorial)	Core Course – II	50				2/1
7	English	AEC	50				2
Total Credit = 20							

Semester - III

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Discipline – I (Theory)	Core Course – III	50				4/5
2	Discipline – I (Practical/Tutorial)	Core Course – III	50				2/1
3	Discipline – II (Theory)	Core Course – III	50				4/5
4	Discipline – II (Practical/Tutorial)	Core Course – III	50				2/1
5	Discipline – III (Theory)	Core Course – III	50				4/5
6	Discipline – III (Practical/Tutorial)	Core Course – III	50				2/1
7	Skill enhancement course	SEC – I	50				2
Total Credit = 20							

Semester - IV

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Discipline – I (Theory)	Core Course – IV	50				4/5
2	Discipline – I (Practical/Tutorial)	Core Course – IV	50				2/1
3	Discipline – II (Theory)	Core Course – IV	50				4/5
4	Discipline – II (Practical/Tutorial)	Core Course – IV	50				2/1
5	Discipline – III (Theory)	Core Course – IV	50				4/5
6	Discipline – III (Practical/Tutorial)	Core Course – IV	50				2/1
7	Skill enhancement course	SEC – II	50				2
Total Credit = 20							

Semester - V

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Skill enhancement course	SEC – III	50				2
2	Discipline – I (Specific Elective)	DSE – I	50				6
3	Discipline – II (Specific Elective)	DSE – I	50				6
4	Discipline – III (Specific Elective)	DSE – I	50				6
Total Credit = 20							

Semester - VI

Sr. No.	Name of the Subject	Nature	Marks	Teaching Scheme in hour per week			Credit
				L	T	P	
1	Skill enhancement course	SEC – IV	50				2
2	Discipline – I (Specific Elective)	DSE – II	50				6
3	Discipline – II (Specific Elective)	DSE – II	50				6
4	Discipline – III (Specific Elective)	DSE – II	50				6
Total Credit = 20							

Total Credit = 120

KAZI NAZRUL UNIVERSITY

Syllabus for B.Sc. Course with Chemistry

Course Structure

	Paper Code	Core Subject	Marks	Credit
SEMESTER – I	CHEMG 0101	Basics in Organic and Inorganic Chemistry	50	6
SEMESTER – II	CHEMG 0201	Elementary Physical Chemistry & Organic Chemistry	50	4
	CHEMG 0202	Organic Qualitative Practical	50	2
SEMESTER – III	CHEMG 0301	Physical Chemistry & Inorganic Chemistry	50	4
	CHEMG 0302	Inorganic Qualitative Practical	50	2
	CHEMG 0303	Industrial Chemistry [SEC] (Optional)	50	2
SEMESTER – IV	CHEMG 0401	Inorganic Chemistry & Organic Chemistry	50	4
	CHEMG 0402	Inorganic Quantitative Practical	50	2
	CHEMG 0403	Chemistry of Cosmetics & Perfumes [SEC] (Optional)	50	2
SEMESTER – V	CHEMG 0501	Applied Chemistry	50	6
	CHEMG 0502	Quantum Chemistry, Spectroscopy & Photochemistry	50	6
	CHEMG 0503	Pharmaceutical Chemistry [SEC] (Optional)	50	2
SEMESTER – VI	CHEMG 0601	Chemistry of Bio-molecules & Chemotherapy	50	6
	CHEMG 0602	Advanced Inorganic Chemistry	50	6
	CHEMG 0603	Fuel Chemistry [SEC] (Optional)	50	2

SEC : Skill Enhancement Course

SEMESTER – I (Total Marks 50, Credit 6)

CHEMG 0101: Basics in Organic and Inorganic Chemistry (Core)

Marks 50, Credit 6

[N.B.: Core – I for B.Sc. Course with Chemistry & GE – I for Honours Course (Except Chemistry Honours)]

Unit – I: Atomic Structure (12 L)

Bohr's theory: energy and radius calculations for H-like atoms, dual nature of matter and light, de Broglie's relationship, Heisenberg's uncertainty principle (qualitative), quantum numbers, Pauli exclusion principle, qualitative introduction of orbitals, shapes of orbitals, electron distribution of elements - Aufbau principle and Hund's rule.

Unit – II: Radioactivity (8 L)

Theory of disintegration, rate constant, half life period (their interrelationship – deduction) idea of disintegration series, artificial transmutation and artificial radioactivity, uses and abuses of radioactivity. Stability of atomic nucleus, n/p ratio, mass defect, binding energy.

Unit – III: Periodic Table and Periodic Properties (10 L)

Periodic law, Periodic classification of elements on the basis of electron distribution, s-, p- and d-block elements, connection among valencies, electron distribution and positions of the elements in the long form of the periodic table. Periodic properties: atomic radii, ionic radii, covalent radii, ionisation energy, electron affinity, electronegativity and its different scales.

Unit – IV: Functional Nature of Organic Compounds (3 L)

Classification of organic compounds in terms of functional groups, their IUPAC nomenclature and valence bond structures.

Unit – V: Electron Displacement in Molecules (7 L)

Concept of Inductive effect, Electromeric effect, Hyperconjugation, Resonance, Steric Inhibition of Resonance, Aromaticity and Tautomerism.

Unit – VI: Introduction to Organic Reaction Mechanism (20 L)

Homolytic and heterolytic bond cleavage; Reaction intermediates: carbocation, carbanion, free radical (generation, shape, stability and reaction)

Classification of organic reactions (substitution, elimination, addition and rearrangement) and reagent types (electrophiles, nucleophiles, acids and bases), Ideas of organic reaction mechanism (SN1, SN2, E1 and E2) Aromatic electrophilic substitution mechanism, orientation and reactivity, bromine and HBr addition to alkenes mechanism

SEMESTER – II (Total Marks 50, Credit 6)

CHEMG 0201: Elementary Physical Chemistry & Organic Chemistry (Core)

Marks 50, Credit 4

[N.B.: Core – II for B.Sc. Course with Chemistry & GE – II for Honours Course (Except Chemistry Honours)]

Unit – I: Kinetic Theory of Gases (8 L)

Ideal gas equation, derivation of gas laws, Maxwell's speed and energy distributions (derivation excluded); distribution curves; different types of speeds and their significance, concept of equipartition principle, van der Waals equation, Virial equation, continuity of state, Boyle temperature, critical constants, specific heats and specific ratios, laws of partial pressure, vapour density and density method of determination of molecular weights, limiting density, abnormal vapour density, frequency of binary collisions; mean free path

Unit – II: Thermodynamics (12 L)

Thermal equilibrium and zeroth law, First law, reversible and irreversible work, criteria of perfect gas, isothermal and adiabatic expansions, Joule-Thomson effect (derivation excluded); Thermochemistry: Hess's law and its application

Second law and its elementary interpretation, Carnot's cycle and theorems, Clausius inequality, criteria of spontaneity, free energy and entropy

Unit – III: Stereochemistry (20 L)

Concept of constitution, configuration and conformation, chirality and chiral centre, optical activity, optical rotation, specific rotation, optical purity enantiomerism and diastereomerism, optical isomerism of lactic acid and tartaric acid, D, L and R, S nomenclature;

Geometrical isomerism with reference to fumaric acid and maleic acid; cis-trans and E, Z nomenclature.

Conformational analysis of ethane.

CHEMG 0202: Organic Qualitative Practical (Lab)

Marks 50, Credit 2

Detection of elements (N, S, Cl) and any one of the following groups in organic compounds (solid only): $-\text{NH}_2$, $-\text{NO}_2$, $-\text{CONH}_2$, $-\text{OH}$, $>\text{C}=\text{O}$, $-\text{CHO}$, $-\text{COOH}$

SEMESTER – III (Total Marks 50, Credit 6)

CHEMG 0301: Physical Chemistry & Inorganic Chemistry (Core)

Marks 50, Credit 4

[N.B.: Core – III for B.Sc. Course with Chemistry & GE – III for Honours Course (Except Chemistry Honours)]

Unit – I: Phase Equilibria and Colligative Properties

(10 L)

Phase rule equation (derivation excluded); phase diagram of water system, Miscibility (phenol-water) and distillation of completely miscible binary liquid mixtures; azeotropes, Steam distillation

Graphical approach of Raoult's law of vapour pressure and colligative properties: osmosis, lowering of freezing point, elevation of boiling point, experimental methods of determination of molecular weights of substances in dilute solutions, van't Hoff 'i' factor and abnormal behaviour of electrolytic solutions

Unit – II: Electrochemistry

(10 L)

Electrolytic conduction, transport number (experimental determination excluded), velocity of ions: specific, equivalent and molar conductances, determination of equivalent conductivity of solutions, Kohlrausch's law, strong and weak electrolytes, Ion atmosphere; electrophoretic and relaxation effects, Debye-Huckel theory (qualitative) and the limiting law.

Electrochemical cells, half-cells (with types and examples), Nernst equation and standard electrode potentials, standard cells

Unit – III: Chemical Kinetics

(10 L)

Order and molecularity of reactions, integrated rate laws (first and second order), average life period, concept of Arrhenius activation energy

Catalysis, autocatalysis, enzyme catalyst, catalyst poisons, promoters, elementary treatment of mechanism of catalysis

Unit – III: Chemical and Ionic Equilibrium

(10 L)

Conditions of spontaneity and equilibrium, degree of advancement and Le Chatelier principle; Van't Hoff isotherm, isobar and isochore

Ostwald dilution law, Henderson equation, neutralization and acid-base indicators, buffers, common ion effect, solubility product (application in analytical chemistry)

CHEMG 0302: Inorganic Qualitative Practical (Lab)

Marks 50, Credit 2

Detection of three radicals by analysis of mixture containing not more than three radicals from the following list (insoluble salts excluded)

Silver, lead, mercury, bismuth, copper, cadmium, arsenic, antimony, tin, iron, aluminium, chromium, zinc, manganese, cobalt, nickel, calcium, strontium, barium, magnesium, sodium, potassium, ammonium and their oxides, hydroxides, chlorides, bromides, iodides, sulphates, sulphites, sulphides, thiosulphates, chromates, phosphates, nitrites, nitrates and borates.

CHEMG 0303: Industrial Chemistry (SEC) (Optional)

Marks 50, Credit 2

Water (3 L)

Types of water, analysis of water (different types of hardness), for municipal and industrial use

Electrochemical and Electro-thermal Industries (3 L)

Preparation and use of Potassium permanganate, hydrogen peroxide, synthetic graphite, calcium carbide, carborundum, alloy steels

Ceramics (4 L)

Refractories, pottery, porcelain, glass, fibre glass

Rusting of Iron and Steel (3 L)

Cause and prevention of corrosion

Industrial Safety and Fire Protection (4 L)

Flash point, fire extinguishers – foam, carbon dioxide, sprinkler system, inert gases.

Pollution (3 L)

Types of wastes – industrial, domestic, electronic; their causes and control

SEMESTER – IV (Total Marks 50, Credit 6)

CHEMG 0401: Inorganic Chemistry & Organic Chemistry (Core)

Marks 50, Credit 4

[N.B.: Core – IV for B.Sc. Course with Chemistry & GE – IV for Honours Course (Except Chemistry Honours)]

Unit – I: Chemical Forces and Molecular Structure

(12L)

Ionic bond, covalent bond (octet rule and expanded octet), dative bond, deformation of ions and Fajan's rules, Born-Haber cycle, hydrogen bond: intra- and intermolecular, bond polarity and dipole moment. Bond lengths, bond angles and qualitative description of shapes of some simple molecules like CO₂, SO₂, H₂O, BeCl₂, BF₃, NH₃, CH₄, C₂H₄, C₂H₂, C₆H₆.

Unit – II: Acids, Bases and Buffers

(6 L)

Different concept of acids and bases, ionic product of water, salt hydrolysis, pH and its colorimetric determination, Strengths of strong and weak acids and bases.

Unit – III: Oxidation and Reduction

(10 L)

Electronic concepts, oxidation number, ion-electron method of balancing equations, application of redox reactions, idea of standard potential and formal potential. Derivation of thermodynamic quantities of cell reactions (ΔG , ΔH and ΔS).

Unit – IV: Organic Synthesis

(12 L)

Preparation and synthetic uses of diethyl malonate, ethylacetoacetate and Grignard reagents

Preparation of TNT phenyl acetic acid, salicylic acid, cinnamic acid, sulphanic acid, phenyl hydrazine, nitrophenols, nitroanilines, picric acid glycerol, allyl alcohol, citric acid.

CHEMG 0402: Inorganic Quantitative (Lab)

Marks 50, Credit 2

- Titration of Na₂CO₃ + NaHCO₃ mixture vs HCl using phenolphthalein and methyl orange indicators
- To find the total hardness of water by EDTA titration
- Titration of ferrous iron by KMnO₄/K₂Cr₂O₇
- Titration of ferric iron by KMnO₄/K₂Cr₂O₇ using SnCl₂ reduction

CHEMG 0403 : Chemistry of Cosmetics & Perfumes (SEC) (Optional)

Marks 50, Credit 2

Preparation and Use of Cosmetics & Perfumes

(20 L)

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

SEMESTER – V (Total Marks 50, Credit 6)

CHEMG 0501: Applied Chemistry (Elective)

Marks 50, Credit 6

[N.B.: Discipline Specific Elective (DSE) for B.Sc. Course with Chemistry]

Unit – I: Analytical Chemistry (18 L)

(a) Accuracy and precision in analysis, types of errors, data analysis and curve fitting (linear $Y = mX + C$ type), numerical problems, mean, mode and variant

(b) Principles of acid-base titration, use of indicators and indicator constant, titration of $\text{Na}_2\text{CO}_3 + \text{NaHCO}_3$ mixture vs HCl using different indicators, estimation of mixture of strong and weak acids, qualitative discussion of salt hydrolysis (no derivation)

(c) Single electrode potential and emf of a chemical cell, principles of redox titration, use of redox potentials, iodometry, iodimetry, use of $\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4 as oxidant (acid, neutral and alkaline media)

Unit – II: Basic Principles of Green Chemistry (12 L)

Tools of green chemistry including the use of alternative feed stocks or starting materials, reagents, solvents, target molecules, and catalysts (homogeneous, heterogeneous and biocatalysis), green chemistry as the alternative chemistry for protection of environment.

Unit – III: Colloidal State (12 L)

General classification, general methods of preparation of lyophobic colloids and general properties of colloids, ideas of coagulation, peptization, protective colloids, dialysis, gold number, isoelectric point, Brownian motion

Unit – IV: Macromolecular Chemistry (18 L)

Introduction, definition of macromolecules, natural and synthetic polymers, monomers, polymers, degree of polymerization, simple idea of polymer structure: homopolymer (linear, branched, cross-linked) and copolymer (random, block, graft), polymerization reaction step (growth, addition, ring opening), importance of polymers both natural and synthetic

Number and weight average molecular weights of polymers – significance, structure and use of natural rubber, synthetic rubber (neoprene), synthetic fibres (Nylon 66, poly ester), plastics like polyethylene and PVC, macromolecules and environment.

CHEMG 0502: Quantum Chemistry, Spectroscopy & Photochemistry (Elective)

Marks 50, Credit 6

[N.B.: Discipline Specific Elective (DSE) for B.Sc. Course with Chemistry]

Unit – I: Quantum Chemistry (25 L)

Black body radiation, Planck's radiation law, photoelectric effect, Wilson-Sommerfeld quantization rule, application to Bohr atom, harmonic oscillator, rigid rotator and particle in 1-d box, de Broglie

relation and energy quantization in Bohr atom and box, Heisenberg uncertainty principle, Bohr's correspondence principle and its applications to Bohr atom and particle in 1-d box

Elementary concept of operators, eigenfunctions and eigenvalues, linear operators, commutation of operators, expectation value, hermitian operator, properties, Schrödinger's time independent equation, acceptability of wave function, probability interpretation of wave function

Particle in a box, setting up of Schrödinger's equation of 1-d box, its solution and application, degeneracy

Stationary Schrödinger equation for the H-atom in polar coordinates, separation of radial and angular parts

Unit – II: Photochemistry (15 L)

Absorption, Lambert-Beer's law, photochemical laws, primary photophysical processes, potential energy diagram, Franck-Condon principle, fluorescence and phosphorescence, Jablonsky diagram, Laws of photochemistry, quantum yield, kinetics of HI decomposition, H_2-Br_2 reactions

Unit – III: Spectroscopy (20 L)

Alkali metal spectra, multiplicity of spectral lines

Rotational spectroscopy of diatomic molecules, rigid rotator model, characteristic features (spacing and intensity), applications

Vibrational spectroscopy of diatomic molecules, Simple Harmonic Oscillator (SHO) model; vibration rotation spectra, applications

NMR spectra, nuclear spin, Larmour precession, chemical shift, spin-spin interaction

CHEMG 0503: Pharmaceutical Chemistry (SEC) (Optional) Marks 50, Credit 2

Drugs & Pharmaceuticals (15 L)

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, Ibuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Fermentation (5 L)

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

SEMESTER – VI (Total Marks 50, Credit 6)

CHEMG 0601: Chemistry of Biomolecules & Chemotherapy (Elective)

Marks 50, Credit 6

[N.B.: Discipline Specific Elective (DSE) for B.Sc. Course with Chemistry]

Unit – I: Carbohydrate Chemistry

(15 L)

Classification, Structure and configuration of D- arabinose, D – ribose, D- glucose, D – fructose and Sucrose (Fischer and Haworth projection) : Structure determination of D- glucose : Epimers and Anomers ;MutarotationOsazone formation, Oxidation and reduction of D – glucose ; Stepping up and stepping down of monosaccharides ; Conversion of aldose to ketose and vice – versa ; Elementary idea about starch and cellulose.

Unit - II: Amino acids and Protein

(15 L)

Essential and non-essential amino acid ; Synthesis of glycine and alanine ; Isoelectric point ; Detection of amino acid (Ninhydrin reaction) Classification of Protein , Geometry of peptide Linkage elementary idea about primary and secondary structure of protein ; Denaturation of proteins .

Unit – III: Heterocyclic Compound and Nucleic acids

(15 L)

Structures of furan, pyrrole, thiophene, Pyridine, Pyrimidine, Pyrimidine derivatives like uracil, thymine andcytosine, purine and purine derivatives like adenine, guanine & uric acid ; Reactivity and basicity comparison between pyrrole and pyridine, Synthesis of uric acid from barbituric acid .

Nucleosides, nucleotides, Nucleic acid, Structural component of RNA and DNA ; Secondary structure of DNA (Watson and Crick Model) .

Unit - IV: Enzymes and Biochemical Process

(8 L)

Definition of terms : enzymes, Cofactors, Coenzymes, Prosthetic groups Metalloenzymes, Metabolism (Catabolism and Anabolism) ; Nomenclature and Classification of enzymes ; Characteristics of enzymes ; Biochemical process : i) Conversion of pyruvate to acetyl CoA ; ii) glycolytic degradation of D – glucose into lactic acid.

Unit - V: Chemotherapy

(7 L)

Meaning of Chemotherapy, definition of drug, side effects, secondary effects and toxic effects of drugs ; preparation and uses of the drugs : Paracetamol, Aspirin, Sulphadiazine, Phenobarbitol and Metronidazole.

[N.B.: Discipline Specific Elective (DSE) for B.Sc. Course with Chemistry]**Unit – I: Coordination Chemistry (15 L)**

Double and complex salts, Werner's theory, ligands, coordination number, inner metallic complexes, chelate effect, different types of isomerism, IUPAC nomenclature.

Unit – II: Chemistry of Main Group Elements (30 L)

A comparative study of the elements belonging to a particular group to be made in brief on the basis of their electron distribution and position in the periodic table. Structures (excluding stereochemistry) and properties of important compounds mentioned to be explained.

Group 1: Hydrogen – isotopes and binary hydrides, lithium and its similarities and differences from other alkali metals, diagonal relationship with magnesium, lithium aluminium hydride,

Group 2: Calcium, strontium and barium, hydrolith, calcium cyanamide, gypsum and plaster of paris.

Group 12: Zinc, cadmium and mercury. Nessler's reagent, Millon's base.

Group 13: Diborane, boron trifluoride, sodium borohydride, inorganic benzene.

Group 14: Carbon, silicon, tin and lead, carbide, silicon carbide, silica, sodium silicate. Silica gel, hydrofluorosilicic acid, silicon tetra chloride, glass, fullerene.

Group 15: Nitrogen, phosphorus, arsenic, antimony and bismuth, hydrazine, hydrazoic acid, hydroxyl amine, hyponitrous acid, phosphorus oxyacids (H_3PO_2 , H_3PO_3 , H_3PO_4 , $\text{H}_4\text{P}_2\text{O}_7$ and HPO_3), sodium bismuthate.

Group 16: Oxygen and sulphur, composition and structure of ozone, oxyacids of sulphur (H_2SO_3 , H_2SO_4 , $\text{H}_2\text{S}_2\text{O}_3$, $\text{H}_2\text{S}_2\text{O}_8$), persulphate

Group 17: Fluorine, chlorine, bromine and iodine, oxides and oxyacids of chlorine, isolation of fluorine.

Group 18: Rare gases (isolation and uses) with special reference to general fluorides (structure)

Unit – III: Transition Metals (15 L)

Groups 6 and 7: Chromium, manganese, K_2CrO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$, CrO_2Cl_2 , KMnO_4 , chrome alum.

Groups 8, 9 and 10: Iron, cobalt and nickel, principles of isolation of Ni (excluding details), composition and uses of alloys, steels, rusting of iron, galvanization and tin plating.

Group 11: Cu, Ag, Au, principles of Ag and Au isolation

Energy Sources

(6 L)

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Petroleum and Petrochemical Industry

(10 L)

Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Lubricants

(4 L)

Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Recommended Books

A. Sangal, Advanced Organic Chemistry, Vol. 1, Krishna Prakashan Media (P) Ltd, Meerut, India, 2012.

S. R. Palit, Elementary Physical Chemistry; Book Syndicate Private Limited.

P. C. Rakshit, Physical Chemistry; Sarat Book Distributers.

Dr. A. K. Mondal, Degree Bhouto O Sadharan Rasayan; Sarat Book Distributers.

A. Ghoshal, Sadharan O Bhouto Rasayan;: Books and Allied (P) Ltd.

S. Ekambaram, General Chemistry; Pearson.

G. K. Mukherjee & J. Das, Ajaibo Rasayan, Books & Allied Pvt. Ltd.

R. L. Dutta and G. S. De, Inorganic Chemistry, Part – I, The New Book Stall, 7th Edn, 2013.

R. L. Dutta, Inorganic Chemistry, Part –II, The New Book Stall, 5th Edn, 2006.

P. K. Dutt, General and Inorganic Chemistry, (Vol- I & II).

S. N. Poddar & S. Ghosh, General & Inorganic Chemistry (Vol I & II) , Book Syndicate Pvt Ltd.

S. Sengupta, Organic Chemistry.

Bahl and Bahl, Organic Chemistry, S. Chand Publications.

R. K. Bansal, Organic Chemistry.

A. K. Das, Environmental Chemistry With Green Chemistry.

A. Kar, Medicinal Chemistry

Sriram & Yogeswari, Medicinal Chemistry.

G. A. Ozin and A. C. Arsenault, Nanochemistry: A Chemical Approach to Nanomaterials.

C. N. R. Rao, A. Muller and A. K. Cheetham, Nanomaterial Chemistry: Recent Development and New Directions.

G. L. Patrick, Introduction to Medicinal Chemistry, Oxford University Press, UK, 2013.

H. Singh & V.K. Kapoor, Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi, 2012.

E. Stocchi, Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK 1990.

Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.

B.K. Sharma & H.Gaur, Industrial Chemistry, Goel Publishing House, Meerut 1996.

B.K. Sharma & H. Gaur, Industrial Chemistry, Goel Publishing House, Meerut 1996.