TRIPURA UNIVERSITY

(A CENTRAL UNIVERSITY)

SURYAMANINAGAR-799022

SYLLABUS FOR
B.SC. GENERAL COURSE
2014

Structure of syllabus:

1. In each course/paper of 80 marks shall be 4 distinct units.
2. In each of paper/course of 40 marks there shall be 2 distinct units.

Duration of examination:

1.	For paper of 80 marks	3 hours	(General and Major)
2.	For paper of 40 marks	2 hours	(General and Major)

Question pattern:

A. Papers/Course having forty (40) marks:-

1. Three (3) questions will be set from each unit out of which two (2) questions of 10 marks each are to be answered.
2. Each question of ten (10) marks may be subdivided into 2 to 3 marks having maximum of 5 marks for a part.

B. Papers/Course having eighty (80) marks:-

1. Three (3) questions will be set from each unit out of which two (2) questions of 10 marks each are to be answered.
2. Each question of ten (10) marks may be subdivided into 2 to 3 marks having maximum of 5 marks for a part.

C. Papers/Course having sixty (60) marks:-

1. Out of sixty (60) marks twelve (12) marks will be for Internal Assessment.
2. Remaining forty-eight (48) marks are to be divided into 2 units each of which will comprise twenty four (24) marks
3. In each of the aforesaid unit there will be three (3) questions out of which two (2) questions of twelve (12) marks each are to be answered.
4. Each question of twelve (12) marks may be subdivided into 2 to 3 marks having maximum of 5 marks for a part.

D. There will be no MCQ type of questions in Honours papers and in case of General Courses the papers having practical component also there will be no MCQ type question.

B.Sc. Subject wise marks distribution

Semester	Paper	Marks	Semester	Paper	Marks
S1	C1P1	100	S2	C1P2	50+50(Pr)
	C2P1	100		C2P2	50+50(Pr)
	C3P1	100		C3P2	50+50(Pr)
	FNDC (English)	100		FN (MIL) +HAC	100
S3	C1P3	50+50(Pr)	S4	C1P4	50+50(Pr)
	C2P3	50+50(Pr)		C2P4	50+50(Pr)
	C3P3	50+50(Pr)		C3P4	50+50(Pr)
	EVS	100		Computer Skill	
S5	C1P5	50+50(Pr)	S6	Project	100
	C2P5	50+50(Pr)		NER Studies	100
	C3P5	50+50(Pr)		Entrepreneurship Development	100
	Constitution of India & Planning	100		Human Rights & Gender Studies	100

B.Sc. Honours

SEM-I	SEM-II	SEM-III	SEM-IV	SEM-V	SEM-VI
Eng	MIL	EVS	Computer	H5	H7
C1P1	C1P2	C1P3[50+50(Pr)]	C1P4[50+50(Pr)]	H6[00(Pr)]	H8[100(Pr)]
C2P1	C2P2	C2P3[50+50(Pr)]	C2P4[50+50(Pr)]	Constitution & Planning	Project
H1(100)	H2[60+40(Pr)]	H3[60+40(Pr)]	H4[60+40(Pr)]	C1P5 [50+50(Pr)]	Human Rights & Gender Studies
				C2P5 [50+50(Pr)]	

Semester wise marks distribution

Semester	General Programme	Major Programme
I	400	400
II	400	400
III	400	400
IV	400	400
V	400	500
VI	400	500
Total (I to VI)	**2400**	**2600**

B.Sc. Pass, Semester – I

Subject –Chemistry

Paper – C1P1

Full Marks: 100 (80+20)

Time: 3 hours

Unit-I General Chemistry (Marks:20) 30 Lectures

A. Structure of atom: (15 lectures)

Atomic spectra of hydrogen atom, Bohr's atomic model and its limitations (simple mathematical treatment of hydrogen atom), Sommerfield model, Black body radiation, Plank's Equation, Qualitative idea of Photoelectric effect and Compton effect, Wave-particle duality, de-Broglie matter wave, Heisenberg's uncertainty principle, Schrodinger's wave equation for one electron system (no mathematical derivation), wave functions and physical concept of ψ and ψ^2, shapes of s, p and d orbitals; quantum numbers and their significances, s, p, d, f orbitals, Pauli's exclusion principle, Hund's rule, , energy order of orbitals, Aufbau principle and its limitations, electronic configurations of atoms (up to Z = 30).

B. Periodic properties of elements: (10 lectures)

Modern periodic table, classification of elements on the basis of electronic configuration. Periodic properties: atomic radii, ionic radii, ionization potential, electron affinity, electronegativity, oxidation states, diagonal relationship; Pauling and Mulliken scale of electronegativity.

C. IUPAC Nomenclature of simple inorganic and coordination compounds. (05 lectures)

Unit-II Inorganic Chemistry (Marks:20) 30 Lectures

A. Redox Reactions: **(15 lectures)**

Ion electron method of balancing equations, calculation of equivalent weights of oxidants and reductants, standard electrode potential, electrochemical series; redox potentials and its applications, choice of indicators in redox titrations.

B. Nuclear Chemistry: (15 lectures)

Stability of nucleus: neutron-proton ratio and its implications, binding energy, mass defects, Einstein's mass-energy relation, Natural and artificial radioactivity, measurement of

radioactivity, radioactive disintegration and group displacement law, disintegration series, half-life period, radioactive equilibrium, types of nuclear reactions, artificial transmutation reactions, nuclear fission and nuclear fusion, Carbon-14 dating, nuclear forces: n-n, n-p, p-p.

Unit-III Organic Chemistry (Marks: 20) 30 Lectures

A. Structure, Reactivity in Organic Molecules: (10 Lectures)

Hybridization (spn, n= 1, 2, 3) of organic compounds, bond lengths, bond angles, bond energy, bond polarity, bond polarizability, formation of σ and π bonds, localized and delocalized chemical bonds, van der Waals interaction, resonance, tautomerism, steric inhibition of resonance, hyperconjugation, inductive and field effects, H-bonding, dipole moment- bond moment and group moment, physical properties (m. p., b. p., solubility) related to molecular structures.

B. Organic reaction mechanism in aliphatic compounds: (10 Lectures)

Synthesis of alkanes, alkenes, alkynes and alkadienes; Synthesis (preparation)of alcohols and ethers, aldehydes and ketones, carboxylic acids and their derivatives, alkyl nitrates, nitro alkanes, nitriles, amines. Study of a) Electrophilic and free radical addition at C=C , b) Nucleophilic addition at the C=O group of aldehydes and ketones; c) Nucleophilic substitution reactions - S_N^1, S_N^2, S_N^i; d) Elimination reactions - α and β –eliminations, syn – and anti-elimination; E_1 and E_2- mechanism.

C. Important reactions with mechanism of aliphatic compounds: (10 Lectures)

Alkane: free radical halogenations, Alkenes: halogenation, hydroxylation, hydrogen halides, ozonolysis, hydroboration-oxidation, catalytic hydrogenation of alkenes. Alkynes: acidity, use of Lindlar's catalyst, Birch reduction; hydration. Alcohols: dehydration, oxidation, pinacol-pinacolone rearrangement, Carbonyls: Oppenauer oxidation, MPV reduction, Rosenmund reduction, Stephen's reaction, Baeyer-Villiger oxidation, Wolff-Kishner reduction; Aldol condensation, Claisen condensation; Cannizzaro and Tischenko reactions.

Unit-IV Physical Chemistry (Marks: 20) 30 Lectures

A. i) The Gaseous states (10 Lectures)

Gas laws, postulates of kinetic theory of gases, gas pressure, kinetic theory of gas equation $PV = 1/3\ mnc^2$ deduction of gas laws, average kinetic energy of molecules, mean free path, collision diameter, collision number, collision frequency, their dependence on temperature

and pressure, heat capacity of gases, atomicity of molecule, viscosity of gases.

ii) Real gases:

Deviation from ideal behavour, Regault, Andrews and Amagat experiments, causes of such deviations, compressibility factor, van der Waals equation, critical phenomenon, critical constants, law of corresponding states.

iii) Maxwell distribution law of molecular, velocities (no derivation), most probable, average and root mean square velocities- their inter relationship, Boltzman equipartition energy (no derivation).

B. The Liquid state: (5 Lectures)

Physical properties of liquids including their experimental methods of determination, internal pressure, vapour pressure, surface tension and viscosity, effect of temperature on these properties.

C. Thermodynamics: (15 Lectures)

i) Thermodynamic apparatus, definitions of various system, processes, functions, concept of heat and work. Zeroth law of thermodynamics.

ii) First law- mathematical relation, internal energy, Joule's experiment, heat capacity of gases at constant volume and constant pressure, relationship between Cp and Cv, Kirchhoff's equation, calculation of change in thermodynamic parameters for expansion/compression of an ideal gas under various conditions for reversible/irreversible processes, Joule-Thomson experiment, inversion temperature (elementary ideas only).

D. Second law of thermodynamics:

i) Need for second law, spontaneous process, reversible process, statements of second law, heat engine, Carnot cycle, Carnot engine and its efficiency, concept of entropy, entropy change in simple transformations, physical significance of entropy.

ii) Gibb's free energy, Helmholtz free energy, Gibbs Helmholtz equation, criteria for thermodynamic equilibrium and spontaneity of a process.

B.Sc. Pass, Semester – II

Subject –Chemistry

Paper – C1P2 (A)

Full Marks: 50 (40+10)

Time: 2 hours

Unit-I General Chemistry (Marks:20) 30 Lectures

A. Chemical bonding: (15 Lectures)

Ionic bond: lattice energy, Born-Haber cycle, ionic solids: radius ratio rule and its limitations, ionic potential, polarizing power and polarizability, Fajan's rule.

Covalent bond: Basic concepts of valence bond theory and its limitations, resonance and resonance energy, hybridization involving s, p, d orbitals; sigma and pi-bonds, bond length, bond order, bond energy, formal charge, dipole moment, percentage of ionic character of covalent bond, VSEPR theory and its applications, LCAO-MO theory (qualitative) and its application to homo-nuclear diatomic molecules (H_2, B_2, C_2, N_2, O_2, F_2); hydrogen bond, metallic bond (electron sea model and band theory).

B. i) Chemical equilibrium: **(8 Lectures)**

Reversible and irreversible reactions, law of mass action, derivation of expression for equilibrium constant for homogeneous and simple heterogeneous systems, temperature, pressure and concentration dependence on equilibrium state- La-Chatelier principle, simple application, inter relations hip between Kp, Kc and Kx, characteristic of the equilibrium state.

ii) Thermochemistry: (7 Lectures)

Exothermic and endothermic reactions; enthalpy (heat of formation, reaction, combustion, solution, neutralization, atomization, etc., laws of thermochemistry, bond dissociation energy, Born – Haber cycle.

Unit-II Inorganic Chemistry (Marks: 20) 30 Lectures

A. Coordination Chemistry: (15 lectures)

Werner's theory, IUPAC nomenclature, different types of ligands, multidentate ligands, coordination number and stereochemistry (up to coordination number 6); chelates, inner

metallic complexes, types of isomerism in coordination compounds, bonding in coordination compounds: Valence Bond Theory (VBT). Double Salts and their applications. Molecular Orbital Theory: H_2, N_2 and O_2

B. Magnetochemistry: (15 lectures)

Concept of diamagnetism, paramagnetism, ferromagnetism and antiferromagnetism, origin of paramagnetic moment: electron spin moment and orbital angular moment, magnetic susceptibility and magnetic moment; magnetic susceptibility measurement by Gouy methods.

B.Sc. Pass, Semester – II

Subject –Chemistry

Subject –Chemistry (Practical)

Paper – C1P2 (B)

Full Marks: 50 (40+10)

Time: 6 hours

A. Inorganic Practical: **Marks : 24** **Time:4 hours**

Experiment for 4 radicals	16 marks
Practical Note Book	03 marks
Viva-Voce	05 marks

Inorganic qualitative analysis:

Qualitative analysis of inorganic salt mixtures containing not more than **four** radicals from the following list:

Silver, lead, bismuth, copper, cadmium, arsenic, antimony, tin, iron, aluminium, chromium, manganese, cobalt, zinc, nickel, calcium, barium, strontium, magnesium, potassium, ammonium; chloride, bromide, iodide, sulphate, sulphide, sulphite, phosphate, borate, nitrate, nitrite, arsenate, oxides and hydroxides.

B. Organic Practical: **Marks:16** **Time:2 hours**

Experiment	10 marks
Practical Note book	03 marks
Viva-voce	03 marks

Organic Preparation*:

Any one preparation is to be set in the practical examination.

Exp. No.	Experiment Titles
1.	Preparation of 7-hydroxy-4-methyl coumarin by Pechmann method
2.	Acetylation of aniline via green method
3.	Preparation of dibenzylidene acetone by condensation reaction.

*Identity of the product should be done by MP comparison with literature.

C. Internal assessment: Marks: 10

B.Sc. Pass, Semester – III

Subject –Chemistry

Paper – C1P3 (A)

Full Marks: 50 (40+10)

Time: 2 hours

Unit-I Organic Chemistry (Marks: 20) 30 Lectures

A. Stereochemistry of organic compounds: (15 Lectures)

Types of stereoisomers – configurational and conformational, enantiomers and diastereomers, geometrical and pi-diastereomers and their nomenclatures, difference in chemical and physical properties of pi-diastereomers, optical isomers, R/S and D/L notations of optical isomers, racemic mixture and resolution.

Conformation: Conformational nomenclature; eclipsed, staggered, gauche and anti; dihedral angle, energy barrier of rotation, relative stability of conformers on the basis of steric effects, conformational analysis of ethane, n-butane.

B. Aromatic compounds: (05 Lectures)

Aromaticity, non-aromaticity, anti-aromaticity, homoaromaticity (benzenoid and nonbenzenoid). Preparation and properties of benzene and naphthalene.

C. Organic reaction mechanism in aromatic compounds: (10 Lectures)

Electrophilic substitution in benzene (general mechanism): alkylation, acylation, halogenations, nitration, sulphonation. Synthesis and reactivities of aromatic alcohols, aromatic halides, phenols, carbonyls, amines and carboxylic acids

Unit-II Physical Chemistry (Marks:20) 30 Lectures

A. Chemical kinetics: **(8 Lectures)**

Order and molecularity of a reaction, rate and differential rate of reaction, rate laws and equations, differential and integral forms of rate equation (up to second order only), experimental methods for the determination of order of reactions.

B. Catalysis: **(4 Lectures)**

Criteria of catalyst, classification, catalyst promoters, catalyst poison, theories of catalysis, applications of catalysts in the manufacture ammonia, nitric acid and sulphuric acid, acid -

base catalysis and enzyme catalysis.

C. Phase equilibrium: **(6 Lectures)**

Phase, component, degree of freedom, phase rule equation F = C-P+2 (derivation is not required), phase diagram one component systems water, sulphur and carbon dioxide, principle of sublimation, Henry's law for solubility of a gas in liquid, Nernst Distribution law, partition coefficient.

D. General features of solution: **(4 Lectures)**

Type of solution, mode of expressing composition of solution- molarity, normality, molality, mole fraction and percentage, Type of properties- extensive, intensive, additive, constitutive and colligative.

E. Properties of dilute solution: **(8 Lectures)**

Raoult's law of relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmosis (thermodynamic derivation excluded), laws of osmosis, experimental method of determination, van't-Hoff factor, determination of molecular weight based on these properties, analogy between ideal gas and dilute solution, abnormal solution properties.

B.Sc. Pass, Semester – III

Subject –Chemistry (Practical)

Paper – C1P3 (B)

Full Marks: 50 (40+10)

A. Inorganic Practical: **Marks : 16** **Time :2 hours**

Inorganic Preparation

Experiment	10 marks
Practical Note book	03 marks
Viva-voce	03 marks

Inorganic Preparation:

Chrome alum, Potash alum, Potasium –tri(oxalate) Chromate (III), Hexammine Cobalt (III)Chloride, Tris(thiourea) CU(I) Sulphate, Bis (dimethylglyoximinato)Ni(II), Tetra ammine CU(II) Sulphate, Tris(oxalate)ferrate(III).

B. Organic Practical: **Marks : 24** **Time :4 hours**

Experiment	16 marks
Practical Note book	03 marks
Viva-voce	05 marks

Organic qualitative analysis:

Identification of functional group(s) in a pure solid organic compound through detection of special elements (nitrogen, sulphur, halogens) and functional groups (phenolic-OH, -COOH, -CHO, >CO, $-NH_2$, $-NO_2$, $-CONH_2$, >C=C<). (Determination of m. p.; solubility test, detection of special elements, detection of functional groups). No need to write detail analytical methods, observations instead total analytical data should be submitted in the given format to be supplied in the examination.

C. Internal assessment: Marks:10

B.Sc. Pass, Semester – IV

Subject –Chemistry

Paper – C1P4 (A)

Full Marks: 50 (40+10)

Time: 2 hours

Unit-I Organic Chemistry (Marks: 20) 30 Lectures

A. Synthetic applications of active methylene compounds and Grignards reagent:

(10 Lectures)

Synthesis and synthetic applications of diethyl malonate and ethylacetoacetate; Preparation and synthetic applications of Grignard reagents;

B. Heterocyclic compounds: (10 Lectures)

Introduction, five- and six- membered heterocycles, nomenclature, aromatic character, structure, synthesis and chemical reactivity of furan, pyrrole, thiophene, pyridine and basicity of pyrrole and pyridine; Chemistry of indole and quinolone.

C. Carbohydrates: (10 Lectures)

Introduction, occurrence, classification, nomenclature, inter-relationship amongst monosaccharides, constitution of glucose and fructose, reactions of glucose and fructose, osazone formation, mutarotation and its mechanism, cyclic structures, pyranose and furanose forms.

D. Amino acids and Peptides:

Introduction, alpha-amino acids – synthesis, physical and chemical properties, iso-electric points, peptide synthesis and determination of C and N terminal amino acid residues of peptides.

Unit-II Physical Chemistry (Marks:20) 30 Lectures

A. Electrical conduction through solution: (6 Lectures)

Arrhenius theory of electrolytic dissociation, mode of transport of electricity through solution, transport number of ions, experimental method of determination of transport number –Hittorf's method, abnormal transport number, specific, equivalent and ionic conductances, ionic mobility, absolute velocity of ions, strong and weak electrolytes,

Kohlrausch's law and its applications, measurement of conductance of solutions and applications. Solubility of sparingly soluble salts.

B. Ionic equilibrium: (5 Lectures)

Ostwald dilution law, ionization of water, pH, buffer solution, buffer capacity, mechanism of buffer action, Henderson equation, hydrolysis of salts, common ion effect, solubility product, application of solubility product principle in analytical chemistry, ionic strength.

C. Electrochemical cells: (4 Lectures)

Galvanic cells vis-à-vis electrolytic cells, reversible and irreversible cells, standard cells.

D. Physical properties and molecular constitution: (5 Lectures)

Additive and constitutive properties – molar volume at boiling point, parachor, refractive index, molar refraction, optical activity, specific and molar rotation, dielectric constant, induced and orientation polarization, polar and non-polar molecules, dipole moment and its experimental methods of determination, Clausius-Mossotti equation (no derivation), ionic character of bonds.

E. **Adsorption: (5 Lectures)**

Adsorption; types adsorption-Physical & Chemical adsorption; Freundlich and Langmuir isotherms, Surface Catalysis. Application of adsorption phenomenon in nature and industry.

F. Colloids: (5 Lectures)

Preparation and purification of colloids, Lyophilic & Lyophobic Colloids properties of colloids – physical, mechanical (Brownian motion),optical (Tyndal effect), electrical (Zeta potential) , stability of colloids; Hurdy – Schulze rule, Electro-kinetic Phenomena, micelles .

B.Sc. Pass, Semester – IV

Subject –Chemistry (Practical)

Paper – C1P4 (B)

Full Marks: 50 (40+10)

Time: 6 hours

A. Organic Practical; **Marks : 20** **Time :2 hours**

Experiment: 12 marks

Viva-voce: 03 marks

Lab. Note book: 05 marks

Organic Quantitative analysis:

Experiments to be performed

1. Estimation of aniline using brominating mixture
2. Estimation of glucose by Benedict reagent

B. Physical Practical; **Marks : 20** **Time :4 hours**

Experiment: 12 marks

Laboratory note book: 03 marks

Viva-voce: 05 marks

List of the experiments which are to be performed by the students (at least three experiments are to be set in the examination and students are to be performed only one experiment):

1. Determination of the surface tension of a supplied liquid solvent/ solution by drop volume method.
2. Determination of the coefficient of viscosity of a given liquid/solvent using Oswald viscometer.
3. Determination of the partition coefficient of iodine between water and an organic solvent.

C. Internal Assessment : Marks : 10

B.Sc. Pass, Semester – V

Subject –Chemistry

Paper – C1P5 (A)

Full Marks: 50 (40+10)

Time: 2 hours

Unit-I General Chemistry (Marks: 20) 30 Lectures

A. Acid-Base Concept: (18 Lectures)

Arrhenius concept, Bronsted-Lowry concept, Lewis concept, Solvent dependence of acidity and basicity, Ionic product of water, The pH scale, Buffer solutions, Hard and Soft acids and based and their classifications, Acid-base strength and hardness and softness, symbiosis.

B. i) Solid state: (8 Lectures)

Nature of solid state, laws of crystallography, Weiss and Miller indices, unit cell, crystal systems, Bravis lattice, symmetry elements, types of crystals, crystal forces. X-ray diffraction of crystals, Bragg's law.

ii) Theory of indicators : (4 Lectures)

Detailed concept of acid base indicators; types criteria and selection of indicators.

Unit-II Inorganic Chemistry (Marks: 20) 30 Lectures

A. s-and p-Block Elements: The oxides and hydroxides of alkali and alkaline earth elements, Boron hydrides, Silicates, Silicones, oxyacids of sulphur.

B. d-Block Elements: First row Transition Series: (3d) electronic configuration ,Oxidation states, Reactivities, colour and Magnetic properties.

C. Preparation, properties and structure in the following compounds:
Potassium ferro and ferricyanide, Lithium aluminium hydride, Sodium cobaltinitrite, Nesseler's reagent, Sodium borohydride, Ferrocene, Sodium nitropuruside.

B.Sc. Pass, Semester – V

Subject –Chemistry (Practical)

Paper – C1P5 (B)

Full Marks: 50 (40+10)

Time: 6 hours

A. Inorganic Chemistry; **Marks : 20** **Time :2 hours**

Experiment: 12 marks

Laboratory note book: 03 marks

Viva-voce: 05 marks

Inorganic estimation

1. Estimation of Na_2CO_3 & $NaHCO_3$ present in a mixture
2. Estimation of Fe (II) by $KMnO_4$
3. Estimation of Cu (II) by iodometric titration
4. Estimation of Fe (III) by standard $K_2Cr_2O_7$ solution

B. Physical Chemistry; **Marks : 20** **Time :4 hours**

Experiment: 12 marks

Laboratory note book: 03 marks

Viva-voce: 05 marks

List of the experiments which are to be performed by the students (at least three experiments are to be set in the examination and students are to be performed only one experiment):

1. Determination of pH of a buffer solution by colour matching method.
2. Determination of concentration of HCl/NaOH by conductometric titration.
3. Determination of concentration of supplied $BaCl_2$ by standard Na_2SO_4/K_2SO_4 conductometrically.
4. Determination of order of a reaction – hydrolysis of ester.

C. Internal assessment: Marks : 10

B.Sc. Pass, Semester – VI

Subject –Chemistry

Paper – Project

Full Marks: 100

In the final semester (vi), students have to carry out their project work under the guidance of a faculty member. The area of the work is to be decided by the faculty member. Upon completion of the project work students have to submit the work in the form of a dissertation followed by oral presentation.

RECOMMENDED BOOKS

Organic Chemistry (Pass):

1. Organic Chemistry - I.L. Finar, Vol. I, 6th Edn. ELBS
2. Advanced Organic Chemistry - B.S. Bahl & A. Bahl
3. Advanced Organic Chemistry, Reactions & Mechanism – Mukherjee & Singh
4. Organic Chemistry - R.T. Morison & R.N. Boyd
5. Stereochemistry of Carbon Compounds - D. Nashipuri
6. Basic Stereochemistry of Organic Molecules - Subrata Sengupta
7. Advanced Organic Chemistry - N.K. Visnoi
8. Jaiba Rasayan - Subrata Sengupta

Inorganic Chemistry (Pass):

1. Inorganic Chemistry Vol. I & II - R.L. Datta
2. Advanced Inorganic Chemistry Vol. I & II - Prakash, Tuli, Basu and Madan
3. Fundamental concepts of Inorganic Chemistry - A.K. Das
4. General and Inorganic Chemistry - R. P. Sarkar
5. General and inorganic chemistry - S.N. Podder & S.P. Ghosh

Physical Chemistry (Pass):

1. Bhouta Rasayan - N.N.Kundu, Vol. I & II
2. Essentials of Physical Chemistry - Bahl & Tuli
3. Bhouta Rasayan - P.C. Rakshit & P.R. Gupta
4. Elementary Physical Chemistry - S.R. Palit

Practical Chemistry (Pass):

1. A Manual of Practical Chemistry (Vol. I & II) - R.C. Bhattacharjee
2. University hand book of undergraduate chemistry experiments – G.N. Mukherjee, University of Calcutta.
3. College practical chemistry - Ahluwalia, Dingra & Gulati.
4. Bebaharic Rasayan, Podder & Ghosh

Some Important Text Books

Inorganic Chemistry

1. Advanced Inorganic Chemistry – Satyaprakash, Basu, Tuli
2. Inorganic Chemistry – Puri, Sharma and Kalia

3. Inorganic Chemistry – J.D. Lee

Ref. Books:

1. General and Inorganic Chemistry (Part-I & II) R. Sarkar
2. Basic Inorganic Chemistry – Cotton and Wilkinson
3. Inorganic Chemistry – J.E. Huheey