B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT - 3 **Inorganic Chemistry–A**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(July to August 2014)

Unit – I

Introduction, Wemer's coordination theory, naming of co-ordinate complexes.
Co-ordination numbers 1-12 and their stereo-chemistries. Co-ordination numbers and stereo chemistries of the common transition metal : Ti,V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, & W. Factors affecting co-ordination numbers and stereo-chemistry Isomerism in coordination compounds.

Unit – II

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, electroneutrality
and back bonding, limitations of V.B. theory.

(October to November 2014)

Unit – III

Crystal field theory-Spliting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands, calculation of C.F.S.E. in high spin and low spin octahedral and high spin tetrahedral complexes, factors affecting the 10 Dq value, structure effects of crystal field splitting (Jahn-Teller distortion). Paramagnetism, diamagnetism, ferro and anti ferromagnetism, Microstates and spectroscopic terms, a calculation of spectroscopic terms for d_1 –d_2 electronic configurations using LS coupling, Hunds rule for finding the ground state term, limitations of C.F.T.

Unit – IV

Molecular Orbital Theory- Evidence for covalent character in bonding, MOEL diagram for octahedral and tetrahedral complexes involving σ as well as π bonding, charge transfer transitions.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT-3 **Inorganic Chemistry (Practical)**

Time: 3 Hrs **Max. Marks: 20**

Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

(July to August 2014)

- Volumetric Analysis:

Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

(October to November 2014)

Complexometric titration using EDTA Ca^{++},Mg^{++}: in context with study of hardness of water.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT - 4 **Organic Chemistry–A**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(July to August 2014)

UNIT-I

Conformations of alkanes and cycloalkanes; conformational analysis of ethane, Butane, cyclohexane, monosubstituted and disubstituted cyclohexane, conformation of small, medium and large ring cycloalkanes and of polycyclic ring systems. Factors that affect reaction rates of these reactions, structure and relative stabilities of free radicals, halogenation, mechanism of chlorination of methane, selectivity in chlorination and bromination of higher alkanes .

Alcohols as Bornsted bases and acids, reactions of alcohols with hydrogen halides with detailed mechanism structure and bonding in carbocations and their relative stabilities, potential energy diagrams for chemical reactions.

UNIT-II

Stereochemistry of alkenes, naming stero isomeric alkenes by E-Z system, mechanism of hydrogenation of alkenes, stereochemistry of hydrogenation of cycloalkenes, Dehydration of alcohols and regioselectivity of these reactions, Acid catalysed dehydrohalogenation of alcohols with complete mechanistic discussion, Mechanism of dehydrohalogenation of alkylhalides (E_1 mechanism), stereoselective and antielimination in E_2 reactions, the E_1 Mechanism, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism , free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.

(October to November 2014)

UNIT-III

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantionmers, chiral centres other than carbon, prochirality.

UNIT-IV

Functional group transformation by nucleophilic substitution, the biomolecular (SN_2), mechanism of nucleophilic substitution , stereochemistry of SN_2 reactions, how SN_2

reactions occur, steric effect in SN_2 reactions, nucleophiles and nucleophilicity,the unimolecular (SN_1) mechanism of nucleophilies substitution, carbocation stability and the rate of substitution, by the SN_1 mechanism sterochemistry of SN_1 reactions, carbocation real arrangements in SN_1 reactions, solvent effects, subtitution and elimination as competing reactions. The SN_1 -SN_2 continum.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

Organic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**

Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

(july to august 2014)

- Aromatic hydrocarbons
- Aldehydes

(October to November 2014)

- Ketones
- Carbohydrates

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 3 **Inorganic Chemistry-B**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(July to August 2014)

Unit – I

л - **Acid ligands**

Carbon monooxide complexes, Two methods of preparation, structural and bonding in (linear MCO groups, polynuclear metal carbonyls carbonyl hydrides and halides). Complexes of N_2, with Ru and No with Fe.

Unit – II

Alkali metal and alkaline earth metal chelators

Definition and few examples of macrocyclic ligands, macrocyclic effect, crown ethers & podands, coronauds, cryptands, structure of 18 crown -6 complex with KNCS, ion cavity complex, effect of anion on phase transfer catalysis, sandwich formation, cryptands and their cation complexes.

(October to November 2014)

Unit –III

Stability of co-ordination compounds

Introduction Factors affecting the stability of metal ion complexes with general ligands and some biochemical ligands like amino acids, peptides, nucleotides and Nucleic acids and porphyrin

Unit – IV

Metal ions in biological system

Fe: Haemoglobin, structure and functions, oxygen transport, Bohr effect.

Mg: Chlorophyll structure and function in photosysthesis.

Zn: Carboxypeptidase enzyme functions.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

Inorganic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**

Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

(January to February 2015)

- Inorganic qualitative analysis:

Four ions (Two cations two anions).

A. Preliminary tests: Physical examination, Dryheating test, charcoal cavity test, $Co(NO_3)_2$ test, flame test, borax bead test.

B. Acid radical analysis:
Dil H_2SO_4 gp: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}
Conc, H_2SO_4 gp: Cl^-, Br^-, I^-, NO_3^-, CH_3COO^-
Individual gp: SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

(March to April 2015)

C. Basic radical analysis:
NH_4^+ Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+} or Fe^{3+}, Al^{3+} , Co^{2+} , Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+} Mg^{2+}, Na^+, K^+ and their confirmation.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT - 4 **Organic Chemistry–B**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

SectionB: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(January to February 2015)

Unit -I

Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkyne, with detailed discussion of mechanism of these reaction, the Diels Alder reaction, orbital symmetry and the Diels alder reaction.

Unit -II

Conversion of alcohol to ether and ester with full dicussion of the reaction, crown ethers, conversion of vicinal halohydrin to epoxides, nucleophillic ring opening reaction of epoxides, acid catalysed ring opening of epoxides.

(March to April 2015)

Unit -III

Principles of nucleophillic additon to carbonyl groups: Hydration ,acetal formation , cyanohydrin formation ; reaction with primary and secondary amines, Wittig reaction, steroselective addition to carbonyl groups mechanism of halogenation ,acid and base catalysed cholization, haloform reaction ,aldol condensaton, conjugate nucleophillic additon to unsaturated carbonyl compounds.

Unit - IV

Mechanism of acid- catalysed esterification,intramolecular ester formation lactone), Hell-Volerid-Zelinsky reaction, decarboxylation of malonic acid and related compounds. Mechanism of hydrolysis of acid chlorides, acid anhydrides, acid and base catalysed hydrolysis of esters, acid assisted hydrolysis of amides. Hoffman rearrangement of N-bromoamides. Hydrolysis of nitriles, claisen condensation ,the Deckmann condensation, acetic ester synthesis, malonic ester synthesis, Michael reaction Reformatsky reaction.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

Organic Chemistry (Practical)

Time: 3 Hrs. **Max. Marks: 20**

Periods: 4

Note: The question paper will be set by the examiner based on the syllabus.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

(january to february 2015)

- Amides
- Amines

(March to April 2015)

- Carboxylic acids

- phenols.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT - 1 **Physical Chemistry – A**

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the Paper Setters/Examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(July to August 2014)

Unit-I

Chemical Thermodynamics:

State of a system, state variables, thermodynamic equilibrium, thermodynamic properties, Intensive and Extensive properties, various types of processes. First Law of Thermodynamics, internal energy and enthaply, change in internal energy and change in enthalpy for expansion of real and ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes. Relation between Cp and Cv. Internal energy change and enthaply change in a chemical process. Hess's law of heat summation. Enthaply of formation, enthaply of ionisation and calculation of bond dissociation energies from thermochemical data.

Unit-II

Second law of thermodynamics, entropy and Gibb's free energy, Carnot's cycle, Calculation of entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions. Gibbs Hemholtz equation. Third law of thermodynamics, Nernst heat theorem, calculation of absolute entropies of substances. Meaning of chemical equilibrium, homogeneous and heterogeneous equilibria. Thermodynamic derivation of law of chemical equilibrium, Van't Hoff relation, Relation between free energy change and equilibrium constants Kp Kc and Kf. Temperature and pressure dependence of equilibrium constant.

(October to November 2014)

Unit-III

Solutions:

Definition, types of solutions, vapour pressure of solution and Raoult's law. Factors influencing the solubility of gas in liquids, Henry's law. Ideal solutions, Duhem Margules equation. Distillation of ideal solutions, Lever rule, vapour pressure of ideal solutions and non ideal solutions. Distillation of non ideal solutions. Azeotropes, colligative properties, lowering of vapour pressure, depression in freezing point, elevation in boiling point, osmotic pressure. Their common features and applications. Thermodynamic derivation of elevation in boiling point, depression in freezing point and osmotic pressure. Van't Hoff factor and its application to calculate degree of association and degree of dissociation.

Unit-IV

Phase Equilibria:

Definition of phase, component and degree of freedom, Phase rule and its thermodynamic derivation. Derivation of Clausius-Clapeyron equation and its importance in phase equilibria,

phase diagrams of water system, KI water system and lead-silver system.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-1

Physical Chemistry – A Practical

Time: 3 Hrs. **Max. Marks: 20**

Periods: 4

Note. The question paper will be set by the examiner based on the syllabus.

(July to August 2014)

1. Surface tension: Determination of surface tension of a given liquid by Stalgometer. Using number of drops and weight of drops methods
2. Determination of coefficient of viscosity of a pure liquid (Acetone, Ethanol, Propanol, Butanol, Glycol) (Effect of hydrogen bonding on viscosity)
3. Photometry.

Verification of Lambert beer's law for solution of $CoCl_2H_2o$ (in water) and $K_2Cr_2O_7$(in water)

(October to November 2014)

4. a) pH of buffer solution

b) Acid base titration HCl vs. NaOH.

c) Determination of ionization constant of a weak acid (CH_3COOH)

5. Study of distribution law of Benzoic acid between benzene and water.
6. Study of distribution law by iodine distribution between water and CCl_4. Given standar solution $Na_2S_2O_3$.
7. Determine composition of HCl and CH_3COOH in the given solution pH metrically.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER–IV)

BT - 1

Physical Chemistry – B

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(January to February 2015)

Unit-I

Electrochemical Cells:

Electrode poential, Electromotive force (EMF). Reversible and irreversible cells, measurement of EMF of a cell. Nernst equation. Reference electrodes and other electrodes, standard electrode potential. Activity and activity coefficient determination from EMF results. Concentration cells with transference and without transference, liquid function potential, pH, glass electrode, quinone-hydroquinone electrode, Potentiometric titrations.

Unit-II

Chemical Kinetics:

Rate of reaction, rate constant, factors influencing rate of reaction, order, molecularity. Rate equations for Ist order, IInd order & IIIrd order reactions. Methods for determining order of reaction. Half Life, Complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions. Activation energy and calculation from Arrhenius equation. Theories of reaction rates collision theory and transition state theory of biomolecular processes. Catalysis, acid base catalysis, enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis. Heterogeneous catalysis and its mechanism. Surface reactions with special reference to Unimolecular surface reactions.

(March to April 2015)

Unit-III

Ionic Equilibria and Conductance: Conductivity, equivalent and molar conductance. Variation of equivalent conductance with dilution of weak and strong electrolytes. Arrhenius and Debye Huckel theory. Kohlraush law of independent migration of ions. Transference number and their experimental determination using Hittorf and moving boundary methods. Ionic elocity, ionic mobility. Applications of conductance measurements. Determination of degree of ionisation of weak electrolyte, solubility, solubility product of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt, conductometric titrations. Ionic strength. Debye Huckel theory of activity coefficients. Mathematical treatment of multistage equilibria of acids and bases. Salt hydrolysis, calculation of hydrolysis constant, Buffer solutions, Buffer index, Buffer capcity universal buffer preparation. Acid base indicators. Theory of acid base indicators. pH change and selection of indicators in different acid base titrations.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER–IV)

BT-1

Physical Chemistry – B Practical

Time: 3 Hrs. **Max. Marks: 20**

Periods: 4

Note. The question paper will be set by the examiner based on the syllabus.

(January to February 2015)

1. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).
2. Polarimetry: Determine the %age composition of an optically active solution.
3. Calorimetry:

a) Determination of Heat of neutralization

(i) Strong acid-strong base

(ii) Weak acid-strong base.

b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

(March to April 2015)

4. Conductometry:

a) Determination of cell constant.

b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).

c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.

d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

5. Determination of adsorption isotherm of oxalic acid on charcoal.

B.Sc. (BIO-TECHNOLOGY) SEMESTER-V

BT-7

Physical, Organic & Inorganic Aspects of Spectroscopy-A

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length
of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(July to August 2014)

UNIT – I

1. Energy and Electromagnetic Spectrum

Introduction, electromagnetic spectrum and Units, regions of the spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degree of freedom, Frank Condon Principle, Fluorescence and Phosphorescence.

UNIT – II

II. Ultraviolet and Visible Spectroscopy

The energy of electronic excitation, measurement techniques, Beer-Lambert Law, Molar extinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, auxochromes, Absorption and intensity shifts, Transition probability. Factors affecting λ_{max} Effect of steric hindrance to coplanarity, Solvent Effects.

(October to November 2014)

UNIT – III

III. Infrared Spectroscopy

Vibrational Energy Levels, Selection Rules, Force Constant, Fundamental Vibration Frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Sampling Techniques.

UNIT – IV

IV. Applications of UV and IR Spectroscopy

Applications of UV spectroscopy, Woodward Fieser rules for calculating λ_{max} of conjugated polyenes and α ,ß -unsaturated carbonyl compounds. Applications of IR spectroscopy, Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print Regions. Simple numerical problems based on UV and IR spectroscopy.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER–VI)

BT-7

Physical, Organic & Inorganic Aspects of Spectroscopy-B

Time: 3 Hrs. **Max. Marks: 40**

Periods: 3

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 8 very short answer type questions are to be set, two from each unit, the maximum length of answer can be about 1/3 of a page. All questions are compulsory. Each question will carry one mark, total weightage being 8 marks.

Section-B: This section will comprise of 8 questions, two from each unit. 5 questions to be attempted and maximum length of answer can be upto two pages. Each question will carry 4 marks, total weightage being 20 marks.

Section-C: This section will comprise of four essay type questions, one from each unit. Two questions to be attempted. Maximum length of answer can be upto 5 pages. Each question will carry 6 marks, total weightage being 12 marks.

(January to February 2015)

UNIT-I

I. Proton Magnetic Resonance spectroscopy (1H NMR)

The Nuclear spin, Larmor frequency, the NMR isotopes, population of nuclear spin level, spin and spin lattice relaxation. Measurement techniques (CW & FT method), solvent used. Chemical shift, reference compounds, shielding constant, range of typical chemical Shifts simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

UNIT-II

II. Applications of NMR spectroscopy

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone. Simple numerical of structure elucidation of NMR spectroscopic data.

(March to April 2015)

UNIT- III

III. Mass Spectrometery

Basic Principles Elementary theory. Molecular ions, isotope ions, fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, simple cleavage, cleavages at a hetero atom, multicentre fragmentations, rearrangements, diels – alder fragmentation, Mc Lafferty rearrangement.

UNIT- IV

IV. Applications of Mass Spectroscopy

Cleavage associated with common functional groups , Aldehydes, ketones cyclic and acyclic esters, alcohols, olefins, aromatic compounds amines, Interpretation of the spectrum of unknown simple molecules.