M. Sc. Chemistry
Semester-1(2018-19)
Foundation Course

Paper-1 CHEF-01
Full marks: 70(end Semester) Time: 3 hrs.
30(Internal Assessment)

In all nine question of equal value will be set, out of which examinee shall have to answer five questions. Question No. 1 will be compulsory, consisting of seven very short answer type questions each of two marks covering the entire syllabus.

UNIT-1 Mathematics for Chemists

A. Matrix

Matrix and determinant, the operation of Matrix algebra-Addition, subtraction and Scalar multiplication, Multiplication of determinants (of third order). Diagonal Matrix, Scalar matrix, unit matrix, singular and Non-singular Matrix, transpose matrix, Adjoint matrix Orthogonal matrix and its properties. Inverse of a Matrix, Solution of Homogeneous and Non-homogeneous linear equations.

B. Operators:

Linear and non-linear operators, Hamiltonian operator, Hermitian operator and its significance, operators and commutation relations, Angular momentum operator and their commutation relations, operator using ladder operators.

UNIT-2

Electronic structure of free atoms/ions - L- S coupling & J - J coupling Schemes, Determination of term symbols of p^n and d^n (n =1, 2, 3) systems, Hund's rule for deciding relative energies of terms, Selection rules for electronic transitions.

UNIT-3

VSPER theory - shapes of inorganic molecules/ions, Bent's rule and energetic of hybridization, Role of p and d orbital's in bonding and their implications, Simple reactions of covalently bounded molecules.

UNIT-4

Symmetry elements, Symmetry operators, Point groups, Systematic approach to determine the point group of molecules/ions, multiplication of symmetry operators, Multiplication table for C_{2v} , C_{2h} and C_{3v} Point groups (C_{2h} and C_{3v}), use of character table in vibrational spectroscopy, point group symmetry in the determination of dipole moment and optical activity of molecules.

UNIT-5 REACTION MECHANISM: STRUCTURE AND REACTIVITY

Types of mechanism, types of reactions Thermodynamic and kinetic requirements, kinetics thermodynamic control, Hammond's postulate. Curtin-Hummett principle, Polential energy diagram, transition states and intermediates, methods determining mechanism, isotopic effects, hard Soft acid and bases. Effect of structure reactivity-resonance and field effects, ste---effect, Hammett equation and linear free energy relationship, substitution and reaction constants.

M. Sc. Chemistry
Semester-1(2018-19)
INORGANIC CHEMISTRY

Paper-II CHEC-02

Full marks: 70(end Semester) Time: 3 hrs.

30(Internal Assessment)

In all nine question of equal value will be set, out of which examinee shall have to answer five questions. Question No. 1 will be compulsory, consisting of seven very short answer type questions each of two marks covering the entire syllabus.

UNIT-1 METAL-LIGAND EQUILIBRIA IN SOLUTION

Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

UNIT-2 METAL-LIGAND BONDING

Step wise and overall formation constants and their interaction, trends in Stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH and spectrophotometer.

UNIT-3(a) METAL-IONS IN BIOLOGICAL SYSTEMS

- Essential and trace metals.
- Na^+ /K^+ Pump
- Role of metals ions in biological processes.

UNIT-3(b) METAL-IONS IN BIOLOGICAL SYSTEMS

DNA polymerization, glucose storage, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water model System.

UNIT-4(a) TRANSPORT AND STROGE OF DIOXYGEN

Heme proteins and oxygen uptake, structure and function of hemoglobin, hemocyanins and hemerythrin, model systhetic complexes of iron, cobalt and copper.

UNIT-4(b) ELECTRON TRANSFER IN BIOLOGY

Structure and function of metalloproteinase in electron transport processes-cytochromes and ion-sulphur proteins, synthetic models.

Nitrogenase

Biological nitrogen fixation, molybdenum nitrogenase, spectroscopic and other nitrogenases model systems.

M. Sc. Chemistry
Semester-1(2018-19)
ORGANIC CHEMISTRY

Paper-III CHEC-03
Full marks: 70(end Semester) Time: 3 hrs.
30(Internal Assessment)

In all nine questions of equal value will be set, out of which examinee shall have to answer five questions. Question No. 1 will be compulsory, consisting of seven very short answer type questions each of two marks covering the entire syllabus.

UNIT-1 STEREOCHEMISTRY OF ORGANIC COMPOUNDS

Optical isomerism:

Fischer, Newman, Sawhorse and Flying – Wedge projections and their introconversions, molecular symmetry and point groups, asymmetry and dissymmetry, stereochemical, descritors, centre of chirality, assigning of absolute stereochemistry, CIP rules, isotopic asymmetry, variation of specific rotation in sign and magnitude under different conditions, optical isomerism of compounds containing more than one asymmetric carbon atoms, number of stereoisomers, prochirality – topacity - homotopic and heterotopic, prostereoisomerism.

Geometrical isomerism:

Nomenclature of geometrical isomers (E-Z notation) of compounds with one and more double bonds in acyclic system, methods of determination of the configuration of geometrical isomers in acyclic and cyclic system, interconversion of geometrical isomers.

Stereochemistry of aldoximes and ketoximes:

Naming, types of isomerism, methods of determining configurations.

Annulenes:

Binary number methods of designing the stereochemistry of annulenes.

UNIT-2 NUCLEOPHILIC SUBSTITUTION REACTIONS

(a). Aliphatic nucleophilic substitution: The SN^2, SN^1, mixed SN^1 and SN^2 mechanisms. The neighbouring group mechanism, neighbouring group participation by σ and π bonds.

(b). The SN^1 mechanism Nucleophilic substitution at an allylic aliphatic trigonal and at vinylic carbon. Reactivity effect of substrate structure, attacking nucleophilc, leaving group and reaction medium, ambident nucleophile, regioselectivity.

(c). Aromatic Nucleophilic Substitution: The SN^{Ar}, SN^{1}, benzyne and $S_{RN}{}^{1}$ mechanis Reactivity effect of substrate structure. Leaving group and attacking nucleophaile. Tovar Richter and Smiles rearrangement.

UNIT-3 ADDITION TO CARBON MULTIPLE BONDS

Mechanism and stereochemical aspects of addition reactions involving electrophile Nucleophiles and Free radicals, region and chemoselectivity, Orientation and reactivity Addition to cyclopropane ring. Hydrogenation of double and triple bonds.Hydrogenation Aromatic rings. Hydroboration, Michael reaction, Sharpless asymmetric epoxidation.

UNIT-4 ADDITION TO CARBON-HETRO-MULTIPLE BONDS

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compound acids, esters nitriles. Addition of Grignard's reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds, Mechanism of condensation reaction involving enolates Aldol. Knowledge, Mannich, Perkin and Stobb reactions. Hydrolysis of ester and amides.

UNIT-5 ELIMENTATION REACTIONS

The E_2,E_1 and E_{1CB} mechanism and their spectrum, orientation of double bond. Reactivity effects of substrate, Structures, attacking base, the leaving group and the medium.