FACULTY OF SCIENCES

SYLLABUS

FOR

B.Sc. (Biotechnology)

(Semester I-II)
Session: 2018-19

KHALSA COLLEGE AMRITSAR

(An Autonomous College)

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

Inorganic Chemistry–A

Periods: 3/week **Max.Marks:30+10 (Internal Assessment)**

Note for the paper setters/examiners:

Each question paper will consist of three sections as follows:

Section-A: 6 very short answer type questions are to be set, from whole syllabus, 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 6 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 3 marks, total weightage being 15 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 4.5 marks, total weightage being 9 marks.

Unit – I

Introduction, Werner'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. **(Books Consulted-Number 1,3,8).**

Unit – II

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, electro-neutrality and back bonding, limitations of V.B. theory.**(Books 5,9)**

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.**(Books consulted No. 3,4,5,6,7,8)**

Books Recommended:

1. G. L. Eichorn, Inorganic Biochemistry, Vol. I Elsevier,
2. R. Hilgenfeld & W. Saengar, Topics in Current Chemistry, Vol.101.page 38-65.
3. J. E. Huheey, Inorganic Chemistry, 3rd ed.
4. F. A. Cotton & G. Wilkinson, Advanced Inorganic Chemistry.
5. B. E. Douglas & D. H. McDaniel, Concepts & Models of Inorganic Chemistry,1970.
6. A. Earnshaw, Introduction of Magnetochemistry, Academic press,1968.
7. R. S. Drago, Physical Methods Inorganic Chemistry, 1971.
8. F. Basalo & R. C. Johson, Co-ordination, Chemistry, 1964.
9. Cowan, J.A. (1997) – Inorganic Biochemistry – An Introduction, Wiley-VCH.

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

Inorganic Chemistry (Practical)

Periods: 4/week **Max. Marks: 15+05 (Internal Assessment)**

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

Volumetric Analysis:

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

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

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

Organic Chemistry–A

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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 catalyseddehydrohalogenation 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.

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UNIT-III

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiralcentres 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,theunimolecular (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^2continum.

Books Recommended:

1. R.T. Morison and R.N. Boyd, Organic chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV ed. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
3. Schaum's Outlines Series, Theory and Problems of Organic chemistry.
4. I.L. Finar, Problems and their solution in Organic chemistry.
5. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
6. D. J. Cram and G. S. Hammond, Organic chemistry.
7. J. E. Banks, Naming Organic Compounds - Programmed Introduction to Organic Chemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry.

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

Organic Chemistry (Practical)

Periods: 4/week **Max. Marks: 15+05 (Internal Assessment)**

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:

- Aromatic hydrocarbons
- Aldehydes
- Ketones
- Carbohydrates

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

Inorganic Chemistry-B

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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.**(Book consulted, No. 4 Chapter 2)**

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. **(Book No. 2 pages 38-65).**

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 **(Book consulted No. 1 Chapter 2).**

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.

(Book consulted, No. 9 Page No. 37-76).

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

Inorganic Chemistry (Practical)

Periods: 4/week **Max. Marks: 15+05(Internal Assessment)**

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

- 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_4gp: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}
Conc, H_2SO_4gp: Cl^-, Br^-, I^-, NO_3^-, CH_3Coo^-
Individual gp: SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

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)

Organic Chemistry–B

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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.

Unit -III

Principles of nucleophillicadditon 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 catalysedcholization, haloform reaction ,aldolcondensaton, conjugate nucleophillicadditon to unsaturated carbonyl compounds.

Unit - IV

Mechanism of acid- catalysedesterification,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, claisencondensation ,theDeckmann condensation, acetic ester synthesis, malonic ester synthesis, Michael reaction Reformatsky reaction.

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Organic Chemistry (Practical)

Periods: 4/week **Max. Marks: 15+05(Internal Assessment)**

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:

- Amides
- Amines
- Carboxylic acids and phenols.