FACULTY OF SCIENCES

SYLLABUS

FOR

B.Sc. (Medical & Non Medical)

(Semester I-II)
Session: 2018-19

KHALSA COLLEGE AMRITSAR

(An Autonomous College)

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B. Sc. (Medical & Non Medical) CHEMISTRY
Semester-I
INORGANIC CHEMISTRY–I

Time: 3 Hrs. **Marks: 25**
45 Hrs (3 Hrs/week)

The question paper shall consist of two parts as detailed below:–
Part A :- (Compulsory)
It shall consist of 7 very short answer type questions (Q. Nos. 1 to 7) from the entire syllabus and the maximum length of each question may not exceed 1/3rd of the page. Each question will be carrying one mark. Students are required to attempt 5 Questions (**5 x 1 = 5 Marks)**

Part B:-
It shall consist of three sections (Section I, II & III) having 6 questions in total (Q. Nos. 8 to 13) from the entire syllabus. Each section will consist of two questions from each unit of the syllabus. The maximum length of each question may not exceed 5 pages. The candidate will attempt four questions in total selecting atleast one question from each section. Each question will be carrying five (5) marks. (**4 x 5 = 20 Marks)**

SECTION–I

I. Atomic Structure 15 Hrs.
Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ψ and ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s,p,d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions.

II. Periodic Properties
Position of elements in the periodic table; effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

SECTION–II

III. Chemical Bonding 15 Hrs
Covalent Bond –Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF2 , BF3, CH4, PF5, SF6, IF7, SnCI2, XeF4, BF4, SnC16. Valence shell electron pair repulsion (VSEPR) theory to NH3, H3O+, SF4, CIF3, ICl2 and H2O. MO theory, homonuclear (elements and ions of 1st and 2nd row), and heteronuclear (BO, CN–, CO, NO+, CO+, CN), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes). Percentage ionic character from dipole moment and electronegativity difference.

SECTION–III

IV. **Ionic Solids 15 Hrs**

Concept of close packing, Ionic structures, (NaCI type, Zinc blende, Wurtzite, CaF2 and antifluorite, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born–Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic –b ofnrede electron, valence bond and band theories.

Weak Interactions –Hydrogen bonding, Vander Waals forces.

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SECTION–I

I. Structure and Bonding (5 Hrs.)
Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Vander Waals interactions, resonance, hyperconjugation, aromticity hydrogen bonding and Inductive and electrometric effects.

II. Mechanism of Organic Reactions (6 Hrs.)
Curved arrow notation, drawing electron movements with arrows, half–headed and double–headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations.Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes(with examples). Assigning formal charges on intermediates and other ionic species.

III. Alkanes (4 Hrs.)
Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction,Kolbe reaction, Corey–House reaction and decarboxylation of carboxylic acids), physicalproperties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes:
orientation, reactivity and selectivity.

SECTION-II

IV. Alkenes and Alkynes (8 Hrs.)
Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions,

Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4.
Substitution at the allylic and vinylic positions of alkenes.Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions ofalkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions,hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

V. Alkyl and Aryl Halides (7 Hrs.)

Nomenclature and classes of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

SECTION–III

VI. Cycloalkanes: (5 Hrs.)

Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring : banana bonds.

VII. Arenes and Aromaticity (10 Hrs.)

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain.Structure of benzene: Molecular formula and Kekule structure. Stability and carbon carbon bond lengths of benzene, resonance structure, MO picture.Aromaticity : the Huckel's rule, aromatic ions.Aromatic electrophilic substitution–general pattern of the mechanism, role of σ and π complexes.Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction.Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/pararatio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes.

B. Sc. (Medical & Non Medical) CHEMISTRY
Semester-I
PRACTICAL

Duration: 3½ Hrs. **Marks: 25**
6 Period/Week

Inorganic Chemistry: Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

Organic Chemistry Laboratory Techniques

Determination of Melting Point
Naphthalene 80–82^{o}C Cinnamic acid 132.5–133^{o}C
Benzoic acid 121.5–122^{0}C Salicylic acid 157.5–158^{o}C
Urea 132.5–133^{o}C Acetanilide 113.5–114^{o}C
Succinic Acid 184.5–185^{o}C m–dinitro benzene 90^{o}C
P–dichlorobenzene 52^{o}C Aspirin 135^{o}C

Determination of Boiling Point
Ethanol 78^{o}C Cyclohexane 81.4^{o}C,
Benzene–80^{o}C Toluene 110°C

Practical Examination

1) Inorganic Mixture	12
2) Melting Point/Boiling point of organic substance	05
3) Viva–Voce	05
4) Note Book	03

B. Sc. (Medical & Non Medical) CHEMISTRY
Semester-II
INORGANIC CHEMISTRY–II

Time: 3 Hrs. **Marks: 25**
45 Hrs (3 Hrs/week)

Part A :- (Compulsory)
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SECTION–I **15 Hrs.**

I. p–Block Elements–I
Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–16, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes.

SECTION–II **15 hrs.**

II. s-Block Elements
Comparative studies, diagonal relationship, salient features of hydrides, salvation and complexation tendencies.

III. p–Block Elements-II
Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide **,** Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

IV. Acids and Bases
Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

SECTION–III **15 Hrs.**

V. Chemistry of Transition Elements
Characteristic properties of *d*–block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their *3*d analogues in respect of ionic radii, oxidation states, magnetic behaviour.

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Semester-II
PHYSICAL CHEMISTRY–I

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Part B:-
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SECTION–I

I. Gaseous States 15 Hrs.
Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waal's equation of state.
Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waal's equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state.
Molecular Velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquefaction of gases

SECTION–II

II. Liquid State 10 Hrs.
Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquids crystal, solid and liquid.Classification, structure of nematic and cholestric phases.Thermography and seven segment cell.
III. Colloidal State 5 Hrs.
Definition of colloids, classification of colloids. Solids in liquids (Sol): kinetic, optical and electrical, properties, stability of colloids,protective action, Hardy Schulze law, gold number. Liquids in liquids (emulsions): Types of emulsions, preparation. Emulsifiers. general applications of colloids.

SECTION–III

IV. Solutions, Dilute Solutions and Colligative Properties 15 Hrs.

Ideal and non–ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass degree of dissociation and association of solutes.

B. Sc. (Medical & Non Medical) CHEMISTRY
Semester-II
PRACTICAL

Duration: 3½ Hrs. **Marks: 25**
6 Period/Week

Crystalisation:
Concept of indication of crystalisation. Phthalic acid from hot water (using fluted filter paper & stem less funnel)
Acetanilide from boiling water.
Naphthalene from Ethanol
Benzoic acid from water

Physical Chemistry
1. To determine the specific reaction rate of hydrolysis of ethyl acetate catalysed by hydrogenions at room temperature.
2. To study the effect of acid strength on hydrolysis of an ester.

Viscosity, Surface Tension (Pure Liquids)
3. To study the viscosity and surface tension of CCI glycerine solution in water.
4. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
5. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
6. To determine the enthalpy of dissolution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle.

Practical Examination: Marks

1) Crystalisation	05
2) Physical Experiment	12
3) Viva–Voce	05
4) Note Book	03