SYLLABUS
B.Sc. (Medical & Non-Medical and Biotechnology)
(SEMESTER I and II)
(2012-2013)

Paper Code	Title of Paper	No. of Lectures	Max. Marks	Time Allowed
SEMESTER-I				
BCH 101	Inorganic Chemistry	30	50	3 hrs.
BCH 102	Organic Chemistry	30	50	3 hrs.
BCH 103	Physical Chemistry	30	50	3 hrs.
PRACTICALS				
BCH 104	Chemistry Practical	60	50	6hrs
SEMESTER-II				
BCH 101	Inorganic Chemistry	30	50	3 hrs.
BCH 102	Organic Chemistry	30	50	3 hrs.
BCH 103	Physical Chemistry	30	50	3 hrs.
PRACTICALS				
BCH 104	Chemistry Practical	60	50	6 hrs.

PAPER BCH 101: INORGANIC CHEMISTRY

Maximum Marks: 50   (2 Hrs. /week)

(i) University Examination: 40   Time: 3 Hours

(ii) Internal Assessment: 10   Pass Marks: 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

Note: Internal assessment will be given on the basis of attendance, class tests, assignments and seminar.

SECTION - A

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Idea of de Broglie matter wave, Heisenberg's uncertainty principle and its significance, Schrodinger's wave equation, significance of ψ and ψ^2, Normal and Orthogonal wave functions, Quantum numbers and their significance, sign of wave functions, radial and angular wave function. Radial probability distribution curves. Shapes of s, p, d and f orbitals, Aufbau's principle and its limitations, Pauli's exclusion principle, Hund's rule of maximum multiplicity, variation of orbital energy with atomic number, electronic configurations of the elements and ions.

SECTION - B

Periodic Properties: The long form of periodic table, position of s, p, d and f block elements in the periodic table. Effective nuclear charge, shielding or screening effect, Slater's rules, variation of effective nuclear charge in periodic table. Atomic radii (Vander Waal's), ionic and crystal radii and variation in periodic table, covalent radii (octahedral and tetrahedral). Ionization

enthalpy, successive ionization enthalpies and factors affecting it, applications of ionization enthalpy and trends in periodic table. Electron gain enthalpy and trends in periodic table. Electronegativity; Pauling's, Mulliken's, Alfred Rochow's electronegativity scales. Trends in periodic table and applications in predicting and explaining the chemical behaviour.

SECTION - C

Oxidation and Reduction : Use of Redox potential, data-analysis of redox cycle, redox stability to water, Frost, Latimer and Pourbaix diagrams. Principles involved in extraction of elements.

Non-Aqueous solvents : Physical properties of a solvent, types of solvents, their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Reference books:

1. Atkins, P.W & Paula, Physical Chemistry, Oxford, 2006.

2. Douglas, B.E and Mc Daniel, D.H. Oxford.

3. Lee, J.D. Concise Inorganic chemistry, ELBS, 1991.

4. Day, M.C. and Selbin, J. Theoretical Inorganic chemistry, ACS Publications 1962.

PAPER BCH 102: ORGANIC CHEMISTRY

Maximum Marks: 50   (2 Hrs. /week)

(i) University Examination: 40   Time: 3 Hours

(ii) Internal Assessment: 10   Pass Marks: 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

Note: Internal assessment will be given on the basis of attendance, class tests, assignments and seminar.

SECTION – A

Basics of Organic Chemistry: Hybridization: shapes of molecules, bond length, bond angles, bond energy, Localized and delocalized chemical bond, Vander Waal's interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding (applications of all these effects). Organic acid and bases, and their relative strengths. Dipole moment, homolytic and heterolytic fission, curved arrow notation, drawing electron movements with half headed and double headed arrows types of reagents :- Electrophiles and nucleophiles. Nucleophilicity and basicity. Types of organic reactions and their mechanisms, Energy considerations. Reactive intermediates: Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes, their types, shapes and their relative stability. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereochemical studies).

SECTION – B

Stereochemistry-I: Concept of isomerism, Types of isomers: optical isomerism – elements of symmetry, molecular asymmetry, chirality, enantiomers, stereogenic center, optical activity, specific rotation, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rule, D & L and R & S systems of nomenclature.

Stereochemistry – II: Geometrical isomerism, determination of configuration of geometrical isomers, syn-anti and E, Z notations with C.I.P. rules, geometric isomerism in oximes and alicyclic compounds. Optical isomerism, conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformations of mono-substituted cyclohexane derivatives. Difference between configuration and conformation, Fischer and flying wedge formulae, Newmann and sawhorse projection formulae and their interconversion.

SECTION – C

Alkanes and cycloalkanes : Isomerism in alkanes, sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radial halogenation of alkanes, orientation, reactivity and selectivity. Cycloalkanes: Nomenclature, Chemical reactions, 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.

Books Prescribed:

- Robert Thornton Morrison and Robert Neilson Boyd, organic chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
- I.L. Finar, Organic Chemistry (Volume I), Darling Kindersley (India) Pvt. Ltd. (Pearson Education)
- I.L. Finar Organic Chemistry (Volume 2): Stereochemistry and the chemistry of natural products, Darling Kindersley (India) Pvt. Ltd. (Pearson Education).

PAPER BCH 103: PHYSICAL CHEMISTRY

Maximum Marks: 50   (2 Hrs./week)
(i) University Examination : 40   Time : 3 Hours
(ii) Internal Assessment : 10   Pass Marks : 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from Sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

Note: Internal assessment will be given on the basis of attendance, class tests, assignments and seminar.

SECTION – A

Mathematical Concepts:- Logarithmic relation, curve sketching, linear groups & Calculation of slopes, differentiation of functions, like K^x, e^x, x^n , sin x, log x, maxima & minima, partial differentiation & reciprocity relation, integration of some useful relevant functions.

Liquid State:-

Inter molecular forces, difference between the gaseous, liquid & solid states, physical properties of liquid- vapour pressure, surface tension, surface active agents, viscosity, effects of temperature on viscosity, liquid, crystal-difference between liquid crystal, solid and liquid .thermography, LCDs and the seven segment cell, classification of thermotropic, liquid crystal, semetic liquid crystal, nematic liquid crystals, cholesteric liquid crystal, disc shaped liquid crystals polymer liquid crystals.

SECTION -B

The Gaseous State:-

The kinetic molecular theory of gases, deviation from ideal behavior, Vander walls equation of state, kinetic energy and temperature, Maxwell distribution of molecular velocities and energies, types of molecular velocities, collision parameters (diameter, cross section, number frequency) mean free path, The critical phenomena P-V isotherm of CO_2, the Vander Waal's equation of critical state, principal of corresponding states, reduced equation of state, molar masses and density of real gases, liquefaction of gases, viscosity, diffusion.

SECTION -C

Chemical Kinetics:-

Rate of reaction, Rate law and Rate constant, Factors affecting rate of a reaction order of reaction, units of rate constant, integration of rate expressions, zero order, I^{st}, IInd and IIIrd order, pseudo order reactions, Half life time of a reaction, Methods of determining order of a reaction, Radioactive decay as a first order phenomenon. Order and Molecularity of reactions, Kinetics of complex reactions: Opposing, Consecutive, Chain, Eyring equation, Lindmann theory of unimolecular gaseous reactions.

Books Prescribed:-

Physical Chemistry by Gurdeep Raj; Krishna Prakashan Media (P) Ltd.

Physical Chemistry by Puri Sharma Pathania; Vishal Publishing Co.

Physical Chemistry by Atkins; W.H. Freeman and Company,New York.

Advanced Physical Chemistry by Gurthu; Praghati Prakashan.

Physical Chemistry by K L Kapoor; Rajiv Beri for Macmillan India Ltd.

PAPER BCH 104: CHEMISTRY PRACTICALS

Maximum Marks: 50   (6 Hrs./week)

(i) University Examination : 40   Time: 6 Hours

(ii) Internal Assessment : 10

Note: Internal assessment will be given on the basis of attendance, class tests, assignments and seminar.

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Inorganic: 20 marks

Organic: 10(3+7)

Viva: 5

Notebook: 5

INORGANIC

Semi micro analysis: cationic analysis, separation and identification of groups: I, II,II,IV,V and VI, anionic analysis, four ions with no interference

ORGANIC

1. a) Determination of melting point of following solids: naphthalene, benzoic acid, acetanilide and urea.
   b) Determination of boiling point of following liquids: ethanol, cyclohexane, propanol, toluene
2. Purification of organic compounds by crystallisation:
   a) Phthalic acid from hot water.
   b) Acetanilide from boiling water.
   c) Benzoic acid from water.

PAPER BCH 201 : INORGANIC CHEMISTRY

Maximum Marks : 50   (2 Hrs./week)
(i) University Examination : 40   Time : 3 Hours
(ii) Internal Assessment : 10   Pass Marks : 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

SECTION - A

Ionic Solids :Concept of close packing, Ionic structures (Sodium chloride type, Zinc-Blende, Wurtzite,,Calcium fluoride and antifluorite); Radius Ratio rule, co-ordination number, Limitations of Radius Ratio rule Lattice Defects, semiconductors, Lattice Energy, Born-Haber cycle, solvation energy, solubility of ionic solids; polarizing power, polarizability of ions, Fajan's rule, Metallic bond-free electron, Valence Bond and Band theories, consequences of polarization.

SECTION - B

Covalent Bond : Valence Bond Theory and its limitations; directional features of covalent bond; various types of hybridization; shapes of ring in organic molecules and ions. Resonance and resonance energy. Equivalent and non- equivalent hybrid orbitals BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, $SnCl_2$, XeF_4, PF_6, $SnCl_2$ VSEPR theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2, H_2O. Molecular Orbital theory. Molecular theory to homonuclear elements and ions of 1st and 2nd row), heteronuclear (CO,CO^+,CN,CN^-,NO^+,NO) diatomic molecules (N_2, C_2, O_2 B_2, F_2) and their ions (O_2^+,O_2^-,H_2^+); HF, HCl, NO, BeF_2, CO_2. Formal charge. Multicenter bonding in electron

deficient compounds (Boranes). Multicenter Bonding (,   approach); Bent bond approach, Bond lengths, Percent Ionic character from dipole moment, electro negativity differences; Bond moment and dipole moment.

SECTION - C

Weak chemical forces : Vander Waal's forces, ion-dipole forces, dipole-dipole interactions; induced – dipole interactions, instantaneous dipole-induced dipole interactions, Repulsive forces, Hydrogen bonding (theories of H-Bonding; Valence Bond Treatment), Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

Acids and Bases : Bronsted- Lowry concept of acid base reaction; solvated proton, relative strengths ,types of acid base reactions, Lewis acid-base concept; Classification of Lewis acids, Leveling solvents, Arrhenius concept of acids- bases. Hard, soft acids and bases (H.S.A.B) and applications of H.S.A.B. principle; Symbiosis, Acid-base strength and hardness and softness.

Books Prescribed:-

1   Huheey, J.E. Inorganic Chemistry, Prentice Hall 1993.
2   Inorganic chemistry, oxford 1970.
3   Lee, J.D. Cencise Inorganic chemistry ELBS.
4   Shriver & Atkins, inorganic chemistry, oxford press.

PAPER BCH 202: ORGANIC CHEMISTRY

Maximum Marks: 50   (2 Hrs./week)
(i) University Examination : 40   Time : 3 Hours
(ii) Internal Assessment : 10   Pass Marks : 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

SECTION – A

Alkenes and Cycloalkenes: Nomenclature of alkenes. Methods of formation of alkenes, Mechanism of dehydration of alcohols, Dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration, Saytzeff's rule. Hoffmann elimination. Physical properties and relative stabilities of alkenes. Chemical reactions of alkenes: Mechanisms involved in hydrogenation, electrophilic, free radical additions, Markownikoff's rule, Antimarkownikoff's rule, Hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$. Polymerisation of alkenes, Substitution at allylic and vinylic positions of alkenes.
Methods of formation, Conformation and chemical reactions of cycloalkenes.

SECTION – B

Dienes and Alkynes: Nomenclature of dienes and alkynes. Isolated, Conjugated, Cumulated Dienes, structure of Allenes, butadiene; Polymerisation of dienes, chemical reactions 1, 2 and 1, 4 additions; Diels alder reaction.

Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, Hydroboration-oxidation, Metal-NH_3 reductions, oxidation and polymerization.

Alkyl Halides: Nomenclature and classes of alkyl halides, Methods of preparation including Finkelstein and Hunsdiecker reaction. Chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN^1 and SN^2 mechanism with stereo- chemical aspects and effect of solvent, Nucleophilic substitution versus elimination, Haloform reaction with Mechanistic details.

SECTION – C

Aromatic Hydrocarbons : Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples, antiaromaticity and nonaromaticity. Structure and stability of benzene: Electrophilic Aromatic substitution : Halogenation, nitration, sulphonation, and Friedel-craft's alkylation/acylation with their mechanism. Stability of wheland intermediates (Sigma complex). Activation/deactivation of the aromatic ring and directing effects of the groups.

Aryl Halides

Nomenclature of aryl halides; methods of formation; nucleophilic aromatic substitution. Addition-elimination and elimination–addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides, allyl, Benzyl, vinyl and aryl halides towards the nucleophilic substitutions.

Books Prescribed:-

1. Robert Thornton Morrison and Robert Neilson Boyd; Organic Chemistry; Darling Kindersley (India) Pvt. Ltd. (Pearson education).
2. Fred W. Billmeyer, textbook of polymer science, John Wiley & sons Inc.
3. I.L. Finar, organic chemistry (volume I) Dorling Kindersley (India) pvt.Ltd. (Pearson education).

PAPER BCH 203: PHYSICAL CHEMISTRY

Maximum Marks: 50   (2 Hrs./week)

(i) University Examination : 40   Time : 3 Hours

(ii) Internal Assessment : 10   Pass Marks : 35%

INSTRUCTIONS FOR PAPER-SETTER AND CANDIDATES

In the case of Chemistry, each theory paper will have three sections A, B, C and an additional section D. The paper-setter will set eight questions from Section A, B and C in such a way that not less than two and not more than three questions are set from any section, Section D will have one question only which will consist of 10 objective/very short answer type parts uniformly covering the whole syllabus. All the questions from sections A, B, C and D will carry the same marks.

Candidates will attempt five questions, selecting at least one but not more than two from each section.

SECTION – A

Thermodynamics:- Introduction , Intensive and extensive properties, system, surrounding. State and path functions, zeroth law of thermodynamics.

First Law:- Definition of internal energy U, Heat capacity, Relation between heat capacities, free expansion of gases under isothermal and adiabatic conditions.

SECTION -B

Thermodynamics-II :-

Concept of entropy, entropy as a state function, entropy as a function of V and T, entropy as a function of P and T, entropy change in Physical process, Clausius inequality, entropy as a criterion of spontaneity and equillibrium entropy change in ideal gases and mixing of gases.

Thermodynamics-III :-

Third law of thermodynamics, concept of residual entropy, Gibbs and Helmholtz function, Variation of Entropy, Gibbs free energy, Helmholtz free energy with T,V,P. Maxwell relations, thermodynamic equation of state.

SECTION -C

Thermochemistry:-

Heats of reaction: standard states, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, Flame and Explosion temperatures, Bond energies and its application.

Chemical Equillibrium:-

Law of mass action, Thermodynamic treatment of the law of mass action Van't Hoff reaction isotherm, Relation between Kp, Kc and Kx, Homogeneous & heterogeneous equillibria, Le chatelier's principle, Clausius- Clapeyron equation .

Books Prescribed:-

Physical Chemistry by Gurdeep Raj; Krishna Prakashan Media (P) Ltd.

Physical Chemistry by Puri Sharma Pathania; Vishal Publishing Co.

Physical Chemistry by Atkins; W.H. Freeman and Company,New York.

Advanced Physical Chemistry by Gurthu; Praghati Prakashan.

Physical Chemistry by K L Kapoor; Rajiv Beri for Macmillan India Ltd.

PAPER BCH 204: CHEMISTRY PRACTICALS

Maximum Marks: 50   (4 Hrs. /week)

(i) University Examination: 40   Time: 5 Hours

(ii) Internal Assessment: 10

Instructions: Practical examination will be conducted in one single day and marks distribution will be as follows:

Organic: 20

Physical: 10

Viva: 5

Notebook: 5

PHYSICAL

1. Determine the surface tension of glycerin and ethanol at room temperature using stalagmometer by drop number method.

2. Determine the coefficient of viscosity of glycerin and ethanol using Ostwald viscometer.

ORGANIC

Qualitative analysis: Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide in simple organic compounds.