CHEMISTRY SYLLABUS

(For examinations to be held in the years Dec 2016, 2017 & 2018)

SEMESTER-I

Course No.: UCHTC101 **Title: Inorganic Chemistry-I**

Credits: 04 **Maximum Marks: 100**

Time: 03 hours **External Examination: 80 marks**

Internal Assessment: 20 marks

Atomic Structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbital. Schrodinger wave equation, significance of quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals. Aufbau and Pauli's exclusion principles, Hund's multiplicity rule, Electronic configurations of the elements, effective nuclear charge.

Periodic Properties

Atomic and Ionic radii, ionization energy, electron affinity and electronegativity – definition, methods of determination, trends in periodic table and applications in predicting and explaining the chemical behavior.

Chemical Bonding-I

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. Valence shell electron pair repulsion (VSEPR) theory and its applications to NH_3, H_3O^+,SF_4, CIF_3, ICI_2^-, and H_2O.

MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, calculation of percentage of ionic character from dipole moment and electronegativity difference.

Chemical Bonding-II

Ionic solids, Ionic structures, radius ratio effect and coordination number, limitations 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 rules.

Metallic bond – free electron, valence bond and band theories. Weak interactions-hydrogen bonding and van der Waals forces.

s-Block Elements

General study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems.

p-Block Elements-I

General study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, diborane and borazine. Chemistry of fullerenes, carbides, fluorocarbons, silicates (structural principle), tetra sulphur tetranitride, interhalogen compounds.

Chemistry of Noble Gases

Chemistry of xenon, structure and bonding in xenon compounds(oxides and fluorides).

Acids and Bases

Arrhenius, Bronsted Lowry, Lux Flood, solvent system and Lewis concepts of acids and bases.

Hard and Soft Acids and Bases (HSAB**):** Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness, symbiosis, theoretical basis of hardness and softness.

Non- aqueous Solvents

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

Oxidation and Reduction

Use of redox potential data- analysis of redox cycle, redox stability in water, Latimer diagrams for oxygen, copper (acidic medium, pH = 0) and for chlorine (acidic/ alkaline medium). Calculation of E-values for skip- step couples using EMF diagrams. Frost diagrams for oxygen and nitrogen.

Inorganic Polymers

Siloxanes and phosphazenes as example of Inorganic polymers, nature of bonding in phosphazenes.

Note for Paper Setting

Internal Assessment Test of 1 hour duration of 20 marks will be conducted when upto 50% (after 45 days) syllabus has been covered. Internal assessment test will contain one long answer type question of 10 marks and five short answer type questions of 02 marks each.

External End Semester University examination of 03 hours duration of 80 marks will be conducted after 100% syllabus (after 90 days) has been covered.

Pattern of examination: There will be two sections A & B. The candidate has to attempt five questions in all.

Section A will be compulsory containing ten very short answer type questions of 02 marks each covering the entire syllabus.

Section B will contain seven long answer type questions of 15 marks each covering the entire syllabus. The candidate will attempt any four questions from Section B.

Books Recommended:

1. Basic Inorganic Chemistry, F.A.Cotton, G.Wilkinson and PL. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D.Lee, ELBS.
3. Concepts of Models of Inorganic Chemistry, B.Douglas, S. McDaniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D.E.Shriver, P.W.Atkins and C.H.Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison-Wesey.
6. Inorganic Chemistry, A.G. Sharpe, ELBS.
7. Inorganic Chemistry, G.L Miessler and D.A. Tarr, Prentice Hall

CHEMISTRY SYLLABUS

(For examinations to be held in the years Dec 2016, 2017 & 2018)

SEMESTER-I

Course No.: UCHPC102 **Title: Inorganic Chemistry-I (Practical)**

Credits: 02 **Maximum Marks: 50**

Time: 04 hours **External Examination: 25 marks**

Internal Assessment: 25 marks

Quantitative and qualitative analysis

Preparation of standard solutions Dilution -0.1M to 0.001M solutions (NaOH, Oxalic acid, $KMnO_4$, $K_2Cr_2O_7$).

Quantitative Analysis (Volumetric Analysis)

(a) Determination of acetic acid in Commercial vinegar using NaOH.

(b) Estimation of calcium content in Chalk as calcium oxalate by permanganometry.

(c) Estimation of ferrous and ferric ions by dichromate method.

(d) Estimation of hardness of water by EDTA.

(e) Estimation of copper using thiosulphate.

Semi micro Analysis of salt mixtures containing three acidic and three basic radicals

20 marks

Viva -Voce

05 marks

Note for distribution of 25 marks in internal assessment in practical examination:

Internal Assessment: Total marks reserved for internal assessment shall be distributed as under:

(i)	Daily assessment in the laboratory and internal practical test	:	15 marks
(ii)	Regularity of attendance	:	05 marks
(iii)	Viva-voce	:	05 marks

External Examination: There shall be two exercises in the external examination of ten marks each and viva-voce of 05 marks.

Books Recommended:

1. Vogel's Qualitative Inorganic Analysis revised, Svehla, Orient Longman.
2. Vogel's Textbook of Quantative Inorganic Analysis, revised, Svehla, Orient Longman.
3. Vogel's Textbook of Quantative Inorganic Analysis (revised), J.Bassett, R.C.Denney, G.H.Jeffery and J.Mendham, ELBS.
4. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.

CHEMISTRY SYLLABUS

(For examinations to be held in the years May 2017, 2018 & 2019)

SEMESTER-II

Course No.: UCHTC201 **Title: Physical Chemistry - I**

Credits: 04 **Maximum Marks: 100**

Time: 03 hours **External Examination: 80 marks**

Internal Assessment: 20 marks

Mathematical concepts

Differentiation of functions like e^x, x^n, sin x, cos x, log x; Maxima and Minima, Partial differentiation and Euler's reciprocity relations, Integration of some useful/relevant functions; Factorials.

Solutions and Colligative properties

Ideal and non- ideal solutions, Methods of expressing concentration of solutions, Activity and activity coefficient. Dilute solution, Colligative properties, Raoult's law, Relative lowering of vapour pressure, Molecular weight determination. Osmosis and osmotic pressure and its measurement, Determination of molecular weight from osmotic pressure, Elevation of boiling point and Depression of freezing point.

Abnormal molar mass, Degree of dissociation and association of solutes.

Gaseous State

Postulates of kinetic theory of gases, Deviations from ideal behaviour, van der Waals 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, Linde's method and Claude's method.

Critical Phenomena: PV isotherms of real gases, Continuity of states, Isotherms of van der Waals equation, Relationship between critical constants and van der Waals constants, Law of corresponding states, Reduced equation of state, Numericals.

Solid State

Definition of space lattice, unit cell.

Laws of crystallography: Law of constancy of interfacial angles, Law of rationality of indices, Law of symmetry.

X-ray diffraction by crystals, Derivation of Bragg's equation, Determination of crystal structure of NaCl and KCl (Laue's method and Powder method), perfect and imperfect crystals, Frenkel and Schottky defects.

Thermodynamics-I

Definition of thermodynamic terms: System, Surroundings, etc., Types of systems, Intensive and extensive properties, State and path functions and their differentials, Thermodynamic process, Concept of heat and work.

First law of thermodynamics: Statement, Definition of internal energy and enthalpy, Heat capacity, Heat capacities at constant volume and pressure and their relationship, Joule's law, Joule-Thomson coefficient and inversion temperature, Calculation of w, q, dU and dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Application to cyclic process (The Carnot Theorem), Carnot cycle and its efficiency.

Thermochemistry: Standard state, Standard enthalpy of formation, Hess's law of constant heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo-chemical data, Kirchhoff's equation, Numericals.

Thermodynamics –II

Second law of thermodynamics, Need for the law, Different statements of the law, Concept of entropy, Mathematical treatment of entropy concept, Combined form of the first and second laws of thermodynamics, Entropy as a state function, Entropy as function of V and T, Entropy as function of P and T, Entropy change in ideal gases and mixing of gases, Numerical.

Thermodynamics –III

Third law of thermodynamics, Nernst heat theorem, Definition of third law, Evaluation of absolute entropy of solids, liquids and gases from heat capacity data, Residual entropy.

Free energy functions: Helmholtz (A) and Gibbs (G) free energy function, Significance of A and G, Variation of A and G with P, V and T; A and G as criteria for thermodynamic Equilibrium and spontaneity.

Relation between A and G, Gibbs – Helmholtz equation and its application, Clausius-Clapeyron equation and its applications, Integrated form of Clausius-Clapeyron equation, Numerical.

Chemical Kinetics

Chemical Kinetics and its scope, Rate of reaction, Factors influencing the rate of reaction: concentration, temperature, pressure, solvent, light, catalyst and surface area.

Concentration dependence of rates, Mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo order, half life and mean life period, Determination of the order of reaction: differentiation method, method of integration, method of half life period and isolation method, Radioactive decay as a first order phenomenon.

Effect of temperature on rate of reaction, Arrhenius equation, Concept of activation energy.

Note for Paper Setting

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Pattern of examination: There will be two sections A & B. The candidate has to attempt five questions in all.

Section A will be compulsory containing ten very short answer type questions of 02 marks each covering the entire syllabus.

Section B will contain seven long answer type questions of 15 marks each covering the entire syllabus. The candidate will attempt any four questions from Section B.

Books Recommended:

1. Mathematics for Chemists by Bhupendra singh, Pragati Prakashan.
2. An introduction to Chemical Thermodynamics by R. P. Rastogi and R. R. Misra, Vikas Publishing Co. Limited.
3. Text Book of Physical Chemistry by S. Glasstone, MacMillan India limited.
4. A Text Book of Physical Chemistry by K. L. Kapoor (Volumes 1 to 4), MacMillan India limited.
5. Chemical Kinetics by K. Laidler, Tata McGraw Hill Publishing Co. Limited.
6. Principles of Physical Chemistry by Maron and Prutton, Oxford and IBH Publishing Co. Pvt. Limited.

CHEMISTRY SYLLABUS

(For examinations to be held in the years May 2017, 2018 & 2019)

SEMESTER-II

Course No.: UCHPC202 | **Title: Physical Chemistry-I (Practical)**

Credits: 02 | **Maximum Marks: 50**

Time: 04 hours | **External Examination: 25 marks**

Internal Assessment: 25 marks

Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strength of HCl and H_2SO_4 by studying the Kinetics of hydrolysis of ethyl acetate.

Distribution law

1. To study the distribution of benzoic acid between benzene and water.
2. To study the distribution of iodine between carbon tetrachloride and water.

Colloids

To prepare arsenious sulphide sol and compare the precipitating power of mono-, bi- and trivalent anions.

Viscosity and Surface Tension

1. To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.
2. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.
3. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl Ketone).
4. To determine the density of the liquid.

To determine the transition temperature by thermometric/dialatometric method.

To study the effect of a solute on the critical solution temperature of two partially miscible liquids (e.g., Phenol-Water system) and to determine the concentration of that solute in the given Phenol-Water system.

To determine the solubility of given inorganic salt (KCl, NaCl, KNO_3, $NaNO_3$ & $NaSO_4$) at different temperatures and obtain the solubility curves.

20 marks

Viva-Voce

05 marks

Note for distribution of 25 marks in internal assessment in practical examination:

Internal Assessment: Total marks reserved for internal assessment shall be distributed as under:

(i)	Daily assessment in the laboratory and internal practical test	:	15 marks
(ii)	Regularity of attendance	:	05 marks
(iii)	Viva-voce	:	05 marks

External Examination: There shall be two exercises in the external examination of ten marks each and viva-voce of 05 marks.

Books Recommended:

1. Advanced Practical Physical Chemistry by J. B. Yadav, Goel Publications, Meerut.
2. Advanced Practical Chemistry by J.Singh, L.D.S.Yadav and J. Srivastava, Pragati Parkashan
3. Practical Physical Chemistry by B. Viswanathan and P.S. Raghavan, Viva Books Pvt. Ltd.