SEMESTER – I

MDC-1 (T) : Inorganic Chemistry Atomic Structure and Chemical Bonding and Fundamentals of organic Chemistry

Course Objective

The Objective of CBCS based four year undergraduate Programme (FYUGP) in Chemistry Hons for Semester I & II, Specially for Major & Minor course is to provide the clear conception and understanding about theory and practical course mentioned in the syllabus.

MDC-1 (T) : Inorganic Chemistry Atomic Structure and Chemical Bonding (Theory: 2 credits)		
Unit	**Topics to be covered**	**No. of Lectures**
1	**Atomic Structure:** *Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.* Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configuration, Hund's, Pauli's and Aufbau's principle.	06
2	**Chemical Bonding and Molecular Structure** *Ionic Bonding:* General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. *Covalent bonding:* VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.	06
	Section B: Organic Chemistry-I	
3	**Fundamentals of Organic Chemistry** Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.	04
4	**Stereochemistry** Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis* - *trans* nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).	04
	TOTAL	20

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Suggested Readings :

19. Advanced Inorganic Chemistry, F.A. Cotton, G. Wilkinson.
20. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science, 2001.
21. Inorganic Chemistry, J.E. Huheey, E.A. Keiter and R.I. Keiter, Pearson Education Asia, 2000.
22. Inorganic Chemistry, ELBS 2nd Edition, D.F. Shriver, P.W. Atkins and C.H. Langford. Oxford University Press 2002.
23. Principles of Inorganic Chemistry. B.R. Puri, L.R. Sharma, Jauhar S.P., S.N. Chand & Co.
24. Inorganic Chemistry, 3rd Edition (ISE) A.G. Sharpe Addison Wesley.

Reference Books:

25. □ J. D. Lee: *A new Concise Inorganic Chemistry*, E L. B. S.
26. □ F. A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley.
27. □ Douglas, McDaniel and Alexader: *Concepts and Models in Inorganic Chemistry*,
28. John Wiley.
29. □ James E. Huheey, *Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles*
30. *of Structure and Reactivity*, Pearson Publication.
31. □ T. W. Graham Solomon: *Organic Chemistry, John Wiley and Sons*.
32. □ Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry,* Orient Longman.
33. □ E. L. Eliel: *Stereochemistry of Carbon Compounds*, Tata McGraw Hill.
34. □ I. L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S.
35. □ R. T. Morrison & R. N. Boyd: *Organic Chemistry*, Prentice Hall.
36. □ Arun Bahl and B. S. Bahl: *Advanced Organic Chemistry,* S. Chand

MDC-1(P): Inorganic and Organic Chemistry Lab

(Practical : 1 Credit)

Practical- 1. Inorganic Chemisry Practical

b. Preparation and standardization of solutions.
d. Permangnatometry / dichromatry.
e. Acidimetry / Alkalimetry.

Practical- 2. Organic Chemisry Practical

Organic Practical : Detection of elements, separation and purification of Organic Compounds.

Suggested Readings :

6. Practical inorganic chemistry : Shikha Gulati and J. L . Sharma
7. Practical Chemistry : Dr O .P. Pandey , D.N. Bajpayi& ,Giri.
8. Quantitative Chemical analaysis: A.I. Vogel, Prentice Hall Publication.
9. Text book of practical Organic Chemistry: A.I. Vogal, Prentice Hall Publication.
10. Practical Organic Chemistry, F.G. Mann & B.C. Saunders,Orient long man.

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SEMESTER – II

MDC-2 (T) : Inorganic Chemistry: Atomic Structure, Chemical Bonding and Fundamental of organic Chemistry

Course Objective

The Objective of CBCS based four year undergraduate Programme (FYUGP) in Chemistry Hons for Semester I & II, Specially for Major & Minor course is to provide the clear conception and understanding about theory and practical course mentioned in the syllabus.

MDC-2 : Inorganic Chemistry I Atomic Structure and Chemical Bonding

(Theory: 2 credits)

Unit	Topics to be covered	No. of Lectures
1	**Atomic Structure:** What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ_2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals.	04
2	**Chemical Bonding and Molecular Structure** MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1^{st} and 2^{nd} periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches.	04
	Organic Chemistry	
3	**Aliphatic Hydrocarbons** Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. **Alkanes:** (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation. **Alkenes:** (Upto 5 Carbons) *Preparation-* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation. **Alkynes**: (Upto 5 Carbons) *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.	06

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4	**Gaseous state:** Kinetic molecular model of a gas postulates and concept of an Ideal gas, Derivation of the kinetic gas equation and various gas laws; Maxwell's Distribution of Molecular velocities and its use in evaluating different types of molecular velocities – Most Probable Velocity, Average (Mean) Velocity, Root Mean Square (RMS) Velocity, and Average kinetic energy; Relationship between various molecular velocities; Law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Viscosity of gases, co-efficient of viscosity and its dependence on temperature and pressure; Collision frequency, Collision diameter and Mean free path; Relationship between mean free path (λ) and co-efficient of viscosity (η), Calculation of collision diameter (σ) from co-efficient of viscosity (η). Behaviour of real gases: Deviations form ideal gas behavior, compressibility factor Z, and its variation with pressure for different gases; Causes of deviation from ideal behaviour. Equation of states for real gases; Van der Waals equation of state, its derivation and application in explaining real gas behaviour, Virial coefficients, calculation of Boyle temperature; Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state & critical constants, relation between critical constants and van der Waals constants, law of corresponding states.	06
	TOTAL	20

Suggested Readings :

19. Advanced Inorganic Chemistry, F.A. Cotton, G. Wilkinson.
20. Concise Inorganic Chemistry, J.D. Lee, Blackwell Science, 2001.
21. Inorganic Chemistry, J.E. Huheey, E.A. Keiter and R.I. Keiter, Pearson Education Asia, 2000.
22. Inorganic Chemistry, ELBS 2nd Edition, D.F. Shriver, P.W. Atkins and C.H. Langford. Oxford University Press 2002.
23. Principles of Inorganic Chemistry. B.R. Puri, L.R. Sharma, Jauhar S.P., S.N. Chand & Co.
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28. John Wiley.
29. □ James E. Huheey, *Ellen Keiter and Richard Keiter: Inorganic Chemistry: Principles*
30. *of Structure and Reactivity*, Pearson Publication.
31. □ T. W. Graham Solomon: *Organic Chemistry, John Wiley and Sons.*
32. □ Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry,* Orient Longman.
33. □ E. L. Eliel: *Stereochemistry of Carbon Compounds*, Tata McGraw Hill.
34. □ I. L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S.
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MDC-2(P): Physical Chemistry Lab.

When the students will finish this practical course , they will be skilled in:-

- **: determination of coefficient of viscosity of various types of liquids and also in the determination of the surface tension of the various types of liquids.**
- **: molecular weight determination by victor Meyer Method.**
- **: pH dermination of various types of buffer solutions.**

MDC-2(P) :Physical Chemistry Lab.

(Practical: 1 credit)

Practical :

Surface tension measurements using Stalagmometer

Determine the surface tension of aqueous solutions by (a) drop number, (b) drop weight method.

Viscosity measurement using Ostwald's viscometer.

3. Determination of co-efficient of viscosity of an unknown aqueous solution.
4. Study of variation of viscosity with different concentration of sugar solutions.

Molecular weight of a volatile compound

Determination of molecular weight of a volatile compound using Victor Meyer's method.

Suggested Readings :

4. Khosla, B.D.; Garg, V.C. & Gulati, A.; Senior Practical Physical Chemistry; R. Chand & Co, NewDelhi.
5. Garland, C.W.; Nibler, J.W.; Shoemaker, D.P.; Experiments in physicalChemistry, 8th Edition, McGraw-Hill, New York.
6. Yadav, J. B.; Advanced Practical Physical Chemistry, 32nd Ed; Goel Publishing House.

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SEMESTER-III

MDC-3 (T): Chemistry in everyday life

Course outcomes:

After completion of this course, student will be able to understand:

CO1: Chemistry of hydrocarbons.

CO2: applications of Chemistry in everyday life.

MDC-3 (T): Chemistry in everyday life (Theory: 3 credits)		
Unit	**Name of Course**	**No. of Lectures**
1	**Polymers:** Monomers and polymers, classification of polymers, addition and condensation of polymers, homopolymers and copolymers, preparation, properties and applications of polymers, styrene, PVC, Teflon, acrolein, nylon-6, nylon-66, natural rubber, Buna-S, Buna-N, bakelite, neoprene, biodegradable polymers.	8
2	**Sources of energy:** Nuclear energy, solar energy, bioenergy, hydral energy, bio additives to fuels, blue and green hydrogen as fuel.	8
3	**Colloids:** True solution, suspension, colloidal solution, types of solution, preparation of colloids, Tindal effect, Brownian motion, electrophoresis, cataphoresis, dialysis.	8
4	**Chemistry in everyday life:** Air Pollution, Water Pollution, Toxic Chemicals (Inorganic and Organic), Chemicals in soil, Important Fertilizers, Green Chemistry and foods preservatives.	6
	TOTAL	30

Suggested Readings:

1. Organic Chemistry- Morrison & Boyd.
2. Environmental Chemistry, B. K. Sharma

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Semester-III

MDC-3 (P): Qualitative Analysis of Inorganic Salt Mixture Containing Four Radicals (P)

Course Outcomes

After the end of this practical course students will be skilled in: -

CO1: identification of basic radicals from known and unknown salts.

CO2: identification of acid radicals from known and unknown salts.

Qualitative Analysis of inorganic salt mixture containing Four Radicals. **(Practical 1 credits)**
1. Identification of known cations (basic radicals) and anions (acid radicals) from the supplied salt. 2. Identification of cation (basic radicals) and anions (acid radicals) from unknown salt. 3. Identification of cation (basic radicals) and anions (acid radicals) from binary mixture of inorganic salts.

SuggestedReadings:

1. Raj, G., Advanced Practical Inorganic Chemistry, Krishna Prakashan, Meerut (2013).
2. Mendham, J.; Denney, R. C., Barnes, J. D.; Thomas, M.; Sivasankar, B., Vogel's Quantitative Chemical Analysis, 6th Ed., Pearson Education India (2009).

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