

have to perform 1 (one) experiment)

1. Study of laws of Parallel and perpendiculars axes for moment of inertia.
2. Determination of coefficient of restitution for inelastic collision.
3. Moment of inertia of fly wheel.
4. Study of compound pendulum.
5. To determine moment of inertia of a body using bifilar suspension.
6. Modulus of rigidity by Torsional Pendulum.
7. Acceleration due to gravity by Kater's pendulum.
8. Study of Oscillations of mass under different combinations of springs.
9. Young's modulus by cantilever.
10. Young's Modulus by bending of beam.
11. Modulus of rigidity by statical method.
12. Young's modulus by Vibration Method.
13. Modulus of rigidity by Maxwell's needle.
14. Coefficient of Viscosity by Poiseuille's method.
15. Surface tension by Quincke's method.
16. Determination of Surface tension by Jager's method.

#### Reference BOOKS : Semester 1S-PHY

1. Mechanics ó Chadha T.K.
2. Waves and Oscillations ó Chaudhary R.N.
3. University Physics I Mechanics of Particles waves and Oscillations ó Kamal, Anwar
4. Mechanics ó Shukla R.K.
5. Mechanics ó Shrivastava P.K.
6. Properties of Matter ó Murugesan R
7. Properties of Matter ó Brijlal
8. Text book of vibrations and waves ó Puri, MacMillan Publisher India Ltd.
9. Barkeley Physics course Vol. I Eno Purcell Ed. (McGraw Hill)
10. The Feymann Lectures in Physics ó Vol. I, R.P.Feymann, R.B.Lighton & M. Sands
11. Mechnics & properties of matter ó D.S.Mathur
12. Fundamental of Physics ó Halliday & Resncik (6th edition)
13. Concepts of Physics Vol I & Vol II by H.C.Varma

## 9.CHEMISTRY

### 1S Chemistry

(Effective from session 2013-14)

The examination in Chemistry of First semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-I (8 marks).

#### B.Sc. Part- I (Semester- I)

### 1S Chemistry

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

#### Unit I

**14L**

#### A] Periodic Properties:

Atomic and ionic radii. Types of atomic radii (only definitions - covalent radius, metallic radius, Van der Wall's radius and ionic radius). Periodic trends in atomic and ionic radii. Ionization energy, electron affinity and electronegativity (definition and periodic trends). Effect of ionization energy and electronegativity on different properties of elements namely metallic and non-metallic character, relative reactivity, oxidizing and reducing properties., Scales of electronegativity Pauling scale and Mulliken Scales. Electronegativity and partial ionic character of a covalent bond. [6]  
Screening effect, screening constant and effective nuclear charge. Slater's rules for calculating screening constant. Problems. [2]

#### B] Ionic bonding:

Definition of ionic bond, types of cations. Factors affecting ionic bond formation (energetic of ionic bond formation ionization energy, electron affinity and lattice energy). Born Lande equation (no derivation) to calculate lattice energy. Born-Haber's cycle to determine lattice energy. Solvation and salvation energy, factors affecting salvation energy, Determination of salvation energy. Solubility of ionic solids, lattice energy and salvation energy. [6]

**Unit II****14L****A] S-Block element:**

Comparative study of 1<sup>st</sup> and 2<sup>nd</sup> group elements with reference to electronic configuration, ionisation energy, oxidation states, reactivity and flame colouration. Diagonal relationship between Li and Mg.

**[5]****B] P-Block element:**

Comparative study of 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> group elements with reference to electronic configuration, ionisation energy, oxidation states. Concept of inert pair effect. Diagonal relationship between Be and Al. Structure of diamond and graphite. Abnormal behaviour of nitrogen. Hydrides of boron- preparation (from BCl<sub>3</sub> and NaBH<sub>4</sub> two), properties (action of heat, water, alkali and oxygen), structure and bonding in diborane. Carbides, types of carbides and fullerenes.

**[9]****Unit III****14L****A] Electronic Displacements:**

Inductive effect, Electromeric effect, Resonance and Hyperconjugation (definition, and applications of these effects). **[3]**

**B] Reactive Intermediates:**

Carbocations, Carbanions and free radicals: their generation stability and reactions. **[2]**

**C] Aliphatic Hydrocarbons:**

Alkanes: Methods of formation: i) Wurtz reaction and ii) Corey-House reaction, Reactions: i) Halogenation (With mechanism), ii) Aromatisation. **[2]**

Alkenes: Methods of formation (With mechanism): i) Dehydrohalogenation of alkyl halides (E<sub>1</sub> & E<sub>2</sub>) ii) Dehydration of alcohols, Reactions: Electrophilic and free radical addition of HX and X<sub>2</sub> (with mechanism). **[3]**

Alkynes: Preparation from vicinal and geminal dihalides, Reaction-Hydrogenation. **[2]**

Alkadienes: Classification, 1,3-Butadiene- Preparation from cyclohexene, Reactions- Addition of H<sub>2</sub>, Br<sub>2</sub> and HBr. **[2]**

**Unit IV- Aromatic Hydrocarbons****14L**

**A]** Nomenclature and Isomerism of Aromatic Compounds. Structure of Benzene: Kekule structure and Molecular orbital structure. **[4]**

**B]** Aromaticity and Huckel's rule Aromatic, antiaromatic and non-aromatic systems. **[4]**

**C]** Mechanism of Electrophilic Aromatic Substitution: Nitration, Friedel Craft Alkylation and Acylation. Nuclear and Side Chain Halogenation, Birch Reduction. **[4]**

**D]** Orientation: Effect of substituent groups. Activating and deactivating groups. Theory of reactivity and orientation on the basis of inductive and resonance effects (-CH<sub>3</sub>, -OH, -NO<sub>2</sub> and -Cl groups). **[2]**

**Unit V : Thermodynamics****14L**

Adiabatic and Isothermal processes. Work done in adiabatic and isothermal processes, Evaluation of different expressions showing relationship between pressure, volume and temperature. First law of Thermodynamics and its limitations, Need of Second law. Carnot's heat engine, derivation of expression for the work done and efficiency of Carnot's engine. Statements of Second law of thermodynamics.

Concept of Entropy, Physical significance of Entropy, Derivation of expression for the Entropy change for an ideal gas in terms of pressure, temperature and volume. Entropy change for an ideal gas for isothermal, isobaric and isochoric processes, Entropy of fusion, sublimation, vapourization, transition and its calculations. Entropy change for reversible and irreversible processes. Entropy change as a criteria for spontaneity. Numericals. **[14]**

**Unit VI****14L**

**A] Gaseous State:** Postulates of Kinetic theory of gases, Derivation of Kinetic gas equation. RMS, Average and Most probable velocities and their relationship. Maxwell-Boltzmann distribution law of molecular velocities (only qualitative treatment), Mean free path, collision number and collision diameter. Deviation of real gases from ideal gas behaviour. Vanderwaal's equation of state and its derivation for real gases. Critical phenomenon, Andrew's experiment - isotherm of CO<sub>2</sub>. Critical state, critical constant, P<sub>c</sub>, V<sub>c</sub> and T<sub>c</sub> in terms of Vanderwaal's constants  $a$  and  $b$ . Reduced equation of state and its derivation. Law of corresponding state. Numericals. **[10]**

**B] Phase Rule:**

Statement of phase rule, explanation of phase, number of components and degree of freedom. Application of phase rule to water and sulfur system. **[4]**

**Semester I**  
**1S Chemistry Practicals**

**Total Laboratory Sessions: 26**

**Marks: 50**

**Exercise 1: Inorganic Qualitative analysis**  
**12 Laboratory sessions**

Semimicro qualitative analysis of inorganic salt mixture containing two acidic radicals and two basic radicals of same or different groups. At least six mixtures to be given.

Analysis of basic radicals to be done by using spot test reagents. Following radicals to be given carbonate, nitrite, sulphite, sulphide, chloride, bromide, iodide, nitrate and sulphate, silver(I), lead(II), copper(II), bismuth(III), cadmium(II), tin(II), arsenic(III), antimony(III), iron(III), chromium(III), aluminium(III), nickel(II), cobalt(II), manganese(II), zinc(II), calcium(II), strontium(II), barium(II), magnesium(II).

**Exercise II: Organic Preparations** **14 Laboratory sessions**

1. Preparation of acetanilide (Acetylation).
2. Preparation of Benzanilide (Benzoylation).
3. Preparation of m-di-Nitrobenzene (Nitration).
4. Preparation of tri-Bromoaniline from Aniline (Bromination).
5. Preparation of Benzoic acid from Benzamide (Hydrolysis).
6. Preparation of Benzoic acid from benzaldehyde (Oxidation).
7. Preparation of phenylazo  $\beta$  naphthol dye (Diazotisation).
8. Preparation of sulphanilic acid from aniline (Sulphonation).

**Organic Preparations Using Green Chemistry Concept**

9. Acetylation of primary amine (Preparation of acetanilide).
10. Base catalysed Aldol Condensation (Synthesis of dibenzal propanone).

**Note:**

- a) Student should perform the single stage preparation with the help of given procedure.
- b) Melting point and percentage yield should be reported.
- c) The sample should be submitted.
- d) Students should recrystallize the sample with suitable solvent.
- e) Students should know the reaction and its mechanism of given single stage preparation.

**Distribution of Marks for Practical Examination**

**Time: 6 hours (One Day Examination)**

**Marks: 50**

<b>Exercise-I</b>	í í í ..	<b>18</b>
<b>Exercise-II</b>	í í í ..	<b>18</b>
<b>Viva-Voce</b>	.í í í .	<b>07</b>
<b>Record</b>	.í í í .	<b>07</b>
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<b>Total:</b>		<b>50</b>

**Books Recommended:**

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia- S. Naginchand & Co., Delhi.
2. Text book of Inorganic Chemistry by A.K. De, Wiley East Ltd.
3. Selected Topics in Inorganic Chemistry by Malik, Tuli and Madan- S. Chand & Co.
4. Modern Inorganic Chemistry by R.C. Agrawal, Kitab Mahal.
5. Instrumental Methods of analysis by Chatwal and Anand, Himalaya Publishing House.
6. Concise Inorganic Chemistry by J.D. Lee, ELBS.
7. Inorganic Chemistry by J.E. Huheey- Harper & Row.
8. Fundamental concepts of Inorganic Chemistry by E.S. Gilreath, McGraw Hill book Co.
9. Modern Inorganic Chemistry by W.L. Jolly, McGraw Hill Int.
10. Chemistry Facts, Patterns & Principles by Kneen, Rogers and Simpson, ELBS.
11. Theoretical Principles of Inorganic Chemistry by G.S. Manku, Tata McGraw Hill.
12. Inorganic complex compounds by Murmann, Chapman & Hall.
13. Text book of Inorganic Chemistry by K.N. Upadhyaya, Vikas Publishing House, Delhi.
14. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Pulishing House, Meerut.
15. Co-ordination Chemistry by D. Banerjee, TMH Publication.
16. Text book of Inorganic Chemistry by Marathe, Bhadange, Mopari and Kubade.
17. Organic Chemistry by R.T. Morrison & R.T. Boyd, 6<sup>th</sup> edition, PHI.
18. Organic Chemistry by Pine, 5<sup>th</sup> edition.
19. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor- Wiley Eastern.
20. Organic Chemistry by S.K. Ghosh.

21. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
22. Spectroscopy of Organic Compounds by P.S. Kalsi.
23. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
24. Organic Chemistry by TWG Solomons, 4<sup>th</sup> edition, John Wiley.
25. Hand Book of Organic Analysis by H.J. Clarke, Arnold Heinmen.
26. Text book of Practical Organic Chemistry by A. I. Vogel.
27. Text book of Organic Chemistry by Jamode, Ganar, Makode, Waghmare, Mahajan, Toshniwal.
28. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.
29. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
30. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
31. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
32. Physical Chemistry: Walter, J. Moore, 5<sup>th</sup> edn., New Delhi.
33. Physical Chemistry: G.M. Barrow, McGraw Hill, Indian Edn.
34. Principles of Physical Chemistry: Maron and Prutton.
35. Principles of Physical Chemistry: Puri and Sharma.
36. Physical Chemistry: P.W. Atkins, 4<sup>th</sup> Edn.
37. Text book of Physical Chemistry: P.L. Sony O.R. Dhrma.
38. Physical Chemistry: Levine.
39. Practical Physical Chemistry: Palit and De.
40. Practical Physical Chemistry: Yadao.
41. Practical Physical Chemistry: Khosla.
42. Laboratory Mannual of Physical Chemistry: W.J. Popiel.
43. Practical Chemistry: Dr. S.B. Lohiya, Bajaj publ., Amravati.
44. Text book of Physical Chemistry: Satpute, Kabra, Raghuwanshi, Wankhade, Jumle and Murarka.
45. Text book of Chemistry, B.Sc.-I, First Semester, BokeyPrakashan, Amravati

#### 10. INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

The examination in Industrial Chemistry (Regular/Vocational) of First semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabi is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has

been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-I (8 marks).

#### 1S INDUSTRIAL CHEMISTRY (REGULAR/VOCATIONAL)

**Total Lectures: 84**

**Marks: 80**

**Note:** Figures to the right hand side indicate number of lectures.

##### UNIT-I : [14]

- A] Dimensions and Units: Fundamental and derived quantities, Interconversions of units.
- B] Mole Concept: Mole, Atomic weight, Molecular weight, Equivalent weight, Methods of expressing compositions of i) solid mixtures, ii) liquid solutions, iii) gaseous mixtures Problems based on these.

##### UNIT-II : [14]

- A] Material Balance without Chemical Reactions: Distillation, Crystallization, Evaporation, Extraction, Filtration with flow sheet diagram and Problems
- B] Material Balance with Chemical Reactions: Stoichiometric equation, Stoichiometric coefficient, Conversion, Yield, Selectivity, Limiting and excess reactants, Problems.

##### UNIT-III : [14]

- A] Energy : General idea about conventional energy sources, and non-conventional Energy Sources óSolar energy, Space heating and water heating by solar energy, Production of electricity by solar energy, Tidal power, Wind energy , Biomass energy
- B] Energy Balance: Heat capacity, Cp, Cv, Molar heat capacity, Heat of reaction, formation, combustion, neutralisation, Heat of solution, Hess's law of constant heat summation. Problems based on heat of reaction, heat of vaporization, fusion and sublimation.

##### UNIT-IV [14]

##### **Fuels : Classification, Units of heat and calorific value**

- A] Solid fuels: Coal-Types of coal, Coal formation, Coal analysis (proximate and ultimate), Destructive distillation of coal, Coal tar distillation, uses of coal tar products, Manufacturing of coal gas and water gas.
- B] Liquid fuels: Petroleum-Origin and classification, Fractional distillation of crude oil, Cracking, Mining of petroleum, natu-