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|---------------------------------|-------------------------------------------|
| <b>SUBJECT CODE: 1SC2030103</b> | <b>TITLE OF PAPER: PHYSICAL CHEMISTRY</b> |
| <b>COURSE TYPE: CORE COURSE</b> |                                           |

**Course Objective:** To impart knowledge and training in chemistry at advanced level, make aware with recent analytical technique, use of reagents and reactions in laboratory, synthesis and study of materials, the exploration of their properties and development of ways to use them in real life.

| Teaching scheme (hours) per week |           | Credit |           |       | Theory Marks    |                  | Practical Marks |                  | Total |
|----------------------------------|-----------|--------|-----------|-------|-----------------|------------------|-----------------|------------------|-------|
| Theory                           | Practical | Theory | Practical | Total | Uni. Assessment | Cont. Assessment | Uni. Assessment | Cont. Assessment |       |
| 4                                | 2         | 4      | 2         | 6     | 60              | 40               | 30              | 20               | 150   |

| UNIT | DISCRIPTION IN DETAIL                                                                                                                                                                                                                                                                                                                                                                                                                | WEIGHTAGE | Hrs |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|
| I    | <b>Electronic Structure of Atoms and Molecular Orbital Theory</b><br>Electronic configuration, Russell-Saunders terms and coupling schemes, Slater-Condon parameters, term separation energies of the pn configuration, term separation energies for the dn configurations, magnetic effects, spin-orbit coupling. Huckel theory of conjugated systems, Applications to ethylene, butadiene. Introduction to extended Huckel theory. | 25%       | 12  |
| II   | <b>Solid state chemistry</b><br>Bonding in solids and electronic structure in solids, bond theory-metals, semiconductors and insulators, defects in crystals, calculation of schottly and Frenkel defects using statistical method, non stoichiometry, solid electrolytes, diffusion in solids, electrical conductivity in solids, super conductivity, perovskites.                                                                  | 25%       | 12  |

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|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|
| <b>III</b> | <b>Chemical thermodynamics</b><br>Nernst heat theorem and its applications to gaseous system, third law of thermodynamics and its applications to evaluate absolute entropies of solids, liquids and gases; partial molar quantities and their determination, Gibbs-Duhem equation, chemical potential, chemical potential of ideal gases and solutions, Raoult's law, real solutions, free energy and solutions, activity and activity coefficients, methods of determination of activity and activity coefficients, fugacity of gases and liquids and methods of its determination.<br>Non equilibrium thermodynamics-basic concepts. | <b>25%</b> | <b>12</b> |
| <b>IV</b>  | Dynamic chain (pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-chlorine reactions) and oscillatory reactions (Belousov-Zhabotinsky reaction), homogeneous catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of barrierless chemical reactions in solution, dynamics of unimolecular reactions. (Lindemann and Hinshelwood theories of unimolecular reactions.)                                                                                  | <b>25%</b> | <b>12</b> |

❖ **Learning Outcome**

- To provide the basic knowledge of very important concepts of the physical chemistry (chemical thermodynamics, surface chemistry, macromolecules, electro chemistry and chemical dynamics). To provide overview of the applications of these concepts in applied field to the students is also an objective.
- Students can learn the basic concepts and principles of physical chemistry effectively.
- To learn the applications of the subject in field.

**Practicals**  
**M.Sc. Semester I**

**Physical Chemistry**

**List of the Experiments (Physical Chemistry) any 6**

**Adsorption (any 2)**

1. Study the variation of surface tension of solution of n-propyl alcohol with concentration.
- a. Study the kinetic of the reaction between Potassium per sulphate and Potassium Iodide.
  - Determine rate constant and order of the reaction
  - Study the influence of ionic strength on the rate constant.

**pH metry:**

Determination of dissociation constant of weak like acetic and monochloroacetic acid.

**Conductometry:**

- To determine the solubility product and solubility of sparingly soluble salts-PbSO<sub>4</sub> and BaSO<sub>4</sub>.

**Potentiometry:**

- Redox Titration Ferrous ammonium sulphate –KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.
- To determine potentiometrically the formula of Silver ammonia complex.

**Distribution method**

- Determination of the formula of the complex formed between cupric ion and ammonia (1M) by distribution method.
- Distribution of CH<sub>3</sub>COOH between H<sub>2</sub>O and CHCl<sub>3</sub>/ CCl<sub>4</sub>

**LIST OF BOOKS:**

1. B.R. Puri, L.R. Sharma, Madan S. Pathania, Principles of physical chemistry,
2. Vishal Publishing-Jalandhar.
3. S. Glasstone, Thermodynamics for chemistry.
4. S. Glasstone, An introduction to electrochemistry”, Affiliated East-West press Pvt.Ltd.
5. B.S.Bahl, G.D.Tuli and ArunBahl, Essential of physical chemistry, S.Chand-New Delhi, Reprint, 2006.
6. V.R. Gowarikar, Polymer chemistry, New Age International(P) Ltd, Fifteen,Reprint, Sep.,1999.
7. Introduction to Quantum Chemistry, A. K. Chandra, Tata MacGraw Hill
8. Quantum Chemistry, Ira N. Levine, Prentice Hall
9. Quantum Chemistry by R. K. Prasad, New Age International Publishers (1985)
10. Elementary Quantum Chemistry by D. L. Pilar, McGraw Hill Book Co, New York (1968)
11. D. A. McQuarrie Quantum Chemistry, OUP 1983
12. M. W. Hanna, Quantum Mechanics in Chemistry, The Benjamin Pub.
13. Molecular Quantum Mechanics, Third Edition, P. W. Atkins and R.S. Friedman
14. Physical chemistry by P.W. Atkins ELBs
15. Chemical kinetics by K.L.Laidler, Magraw-Hill