**Semester III**

**CORE COURSE**

**THEORY**

**Course Title: Comprehensive Chemistry - I**

**Course Code: CHE- III. C-5**

**Name of Faculty: Dr. S. B. Kakodkar and Dr. L. R. Gonsalves**

**Maximum Marks: 75**

**Credits: 3**

Section - I (Physical Chemistry)

**COURSE SCHEDULE**

Tuesday, Alternate Wednesday (Time: 1.00 to 2.00 pm)

Class room: **D-302**

**COURSE MARKS**

ISA I – 7.5 marks + ISA II – 7.5 marks + ISA III – 7.5 marks + ISA IV – 7.5 marks +

SEE – 40 marks

**SYLLABUS**

**SEMESTER – III**

**SECTION –I (PHYSICAL CHEMISTRY)**

1. **Thermodynamics 10 L**

Second law of thermodynamics: Different statements of the law; Carnot cycle and its efficiency, Carnot theorem; Thermodynamic scale of temperature; 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 processes, entropy as a criteria of spontaneity and equilibrium; Entropy change for ideal gases. Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data; Gibbs and Helmholtz functions; A and G as criteria for thermodynamic equilibrium and spontaneity, their advantages over entropy change; Variation of G and A with P, V and T.

1. **Chemical Equilibrium 05 L**

Reversible reactions, equilibrium constant, Equilibrium constant and free energy; Thermodynamic derivation of law of mass action; Reaction isotherm and reaction isochore - Clapeyron equation and Clausius - Clapeyron equation; Le Chatelier’s principle and its applications to some industrial processes.

1. **Electrochemistry 08 L**

Electrical transport-conduction in metals and in electrolyte solutions, weak and strong electrolytes; conductance, specific conductance and equivalent conductance and measurements;variation of specific and equivalent conductance with dilution; Arrhenius theory of electrolyte dissociation and its limitations; Ostwald's dilution law, its uses and limitations; Migration of ions and Kohlrausch law; Debye-Huckel-Onsager’s equation for electrolytes; Transport number, determination of transport number by Hittorf’s method, Applications of conductance measurements: degree of dissociation, dissociation constant of acids; Solubility and solubility product of a sparingly soluble salts; Conductometric titrations (e.g. Strong acid and strong base).

**TEXT BOOK** (PHYSICAL CHEMISTRY)**:**

1. Raj Gurdeep, Advanced Physical Chemistry; Goel Publishing House, Meerut, 27th Edition

**REFERENCE BOOK:**

1. Puri B.R., Sharma L.R., Pathania M. S., Principles of Physical Chemistry
2. Bahl A., Bahl B. S., Tuli G. D., Essentials of Physical Chemistry

**TENTATIVE SCHEDULE FOR SEMESTER III**

**ACADEMIC YEAR 2015-2016**

**SECTION I**

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| **LECTURE NUMBER** | **TOPIC** | **REFERENCE** | PAGE NUMBER |
| 1 | Chemical Equilibrium | 3 | 685-707 |
| 2 | Equilibrium constant and free energy, Thermodynamic derivation of law of chemical equilibrium | 3 | 707-709 |
| 3 | Reaction isotherm and reaction isochore – Clapeyron equation and Clausius – Clapeyron equation, applications | 3 | 710-712 |
| 4 | Le Chatelier’s principle | 3 | 717-725 |
| 5 | **Thermodynamics**  Second law of thermodynamics: need for the law, different statements of the law | 1 | 303-305 |
| 6 | Carnot cycle and its efficiency | 1 | 311-315 |
| 7 | Carnot theorem. Thermodynamic scale of temperature. | 1 | 316-318 |
| 8 | Concept of entropy :entropy as a state function ,entropy as a function of V & T, | 1 | 318-319 |
| 9 | entropy as a function of P & T, entropy change in physical change, Clausius inequality , Entropy as a criteria of spontaneity and equilibrium .Entropy change in ideal gases and mixing of gases. | 1 | 319-321 |
| 10 | Third law of thermodynamics: Nernst heat theorem | 1 | 321-323 |
| 11 | Statement and concept of residual entropy Evaluation of absolute entropy from heat capacity data. | 2 | 146-147 |
| 12 | Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantages over entropy change. Variation of G and A with P, V & T | 2 | 146-149 |
| 13 | Electrical transport –conduction in metals and in electrolyte solutions Specific  conductance and equivalent conductance measurement of equivalent conductance,  variation of equivalent and specific conductance with dilution | 1  2 | 860-864  1107-1109 |
| 14 | Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and  its limitations | 1  2 | 865-869  1110-1115 |
| 15 | Weak and strong electrolytes | 1  2 | 884-898  1116-1120 |
| 16 | Ostwald’s dilution law its uses and  limitations | 1  2 | 909-911  1129-1132 |
| 17 | Debye –Huckel-Onsager’s equation for strong electrolytes, Transport number, definition and determination by Hittorf method | 1  2 | 888-894  1179-1190 |
| 18 | Applications of conductivity measurements :determination of degree of dissociation ,  determination of ka of acids , determination of solubility product of a sparingly soluble  salt, conductometric titrations | 1  2 | 898-901  1118-1120 |

**Course Objectives:**

1. To understand some important core topics in Physical Chemistry.

**Learning Outcome:**

1. Will learn principles of Physical Chemistry and its applications in various processes.