

List of courses

Course Type	Semester	Course Code	Title of the Course	Credits
Major Core	III	CHE-201-MJ-T	Physical Chemistry-I	2
		CHE-202-MJ-T	Inorganic Chemistry-I	2
		CHE-203-MJP	Chemistry Practical- III	2
Major Core	IV	CHE-251-MJ-T	Organic Chemistry-I	2
		CHE-252-MJ-T	Analytical Chemistry-I	2
		CHE-253-MJP	Chemistry Practical – IV	2
Vocational Skill Courses(VSC)	III	CHE-221-VSC-T	Industrial Chemistry-I	2
	IV	CHE-271-VSC-P	Industrial Chemistry Practical-I	2
Minor	III	CHE-241-MN-T	Physical and Inorganic Chemistry	2
		CHE-242-MNP	Physical and Inorganic Chemistry Practical	2
	IV	CHE-291-MN-T	Organic and Analytical Chemistry	2
		CHE-292-MNP	Organic and Analytical Chemistry Practical	2
Generic Elective (GE)/Open Elective (OE) Courses (any one)	III	OE-201-CHE-T	Chemistry of Cosmetics and Perfumes-I	2
		OE-202-CHE-T	Dairy Chemistry	2
Generic Elective (GE)/Open Elective (OE) Courses (any one)	IV	OE-251-CHE-T	Chemistry of Cosmetics and Perfumes-II	2
		OE-252-CHE-T	Agricultural Chemistry	2
Indian Knowledge System (IKS)	III	CHE-201-IKS-T	Ancient Indian Chemistry	2
Skill Enhancement Courses (SEC) (any one)	IV	SEC-251-CHE-P	Basic Software in Chemistry	2
		SEC-252-CHE-P	Clinical Chemistry Practical	2
Field Project (FP)	III	CHE-231 FP	Field Project	2
Community Engagement Project (CEP)	IV	CHE-281 CEP	Community Engagement Project	2

CHE-201-MJ-T: Physical Chemistry-I

Course Type: Major (Theory)

No. of Credits: 2

Course Outcomes

At the end of the course student will be able to

1. Remember definitions, laws, and formulas related to reaction kinetics, thermodynamics, electrolytic conductance, and phase equilibrium.
2. Understand the rate laws of third-order reactions, thermodynamic concepts like entropy and free energy, ionic conductance, and phase diagrams.
3. Solve numerical problems using the Arrhenius equation, entropy changes, conductance laws, phase rule etc .
4. Compare methods for determining reaction order, thermodynamic processes, and conductance and phase systems.
5. Assess reaction mechanisms, thermodynamic feasibility, and conductance behavior of electrolytes.
6. Summarize the effect of temperature on reaction rate, phase stability, or ion mobility in solution.

Course Contents

Chapter 1 : Chemical Kinetics

[8 Hours]

(Recapitulation: rate of chemical reaction, order of reaction, integrated rate law :zero-order, first order, second order) Third-order reactions, Derivation of integrated rate law for third-order reactions with equal initial concentrations, characteristics and examples of third-order reaction. Methods to determine the order of reaction using: Integrated rate equation method, Graphical method, Half-life method and Differential method. Effect of temperature on reaction rate, Arrhenius equation, temperature dependence of reaction rates, interpretation of Arrhenius parameters, **Numericals**. [Ref. 1:Pages 731-735, 745, 752-755, 757-759, Ref. 2: Pages 7-11, 18-21, 26, 39-44, Ref. 3: Pages: 1038-1046, 1050-1052, 1056-1060]

Chapter 2 : Chemical Thermodynamics

[7 Hours]

(Recapitulation: Introduction, terminology of thermodynamics, thermodynamic equilibrium, properties, thermodynamic processes) First law of thermodynamics, Enthalpy, Heat capacity, Relation between C_p and C_v , Expansion of ideal gas and changes in thermodynamic properties: Isothermal process, Adiabatic process, Limitations of the first law: Need for the second law,

Cyclic process, Carnot cycle, Second law of thermodynamics. Concept of entropy, Entropy change in isothermal expansion, Reversible and irreversible processes, Phase change and entropy of mixing of ideal gases, Work and free energy function. **Numericals** [Ref. 1: Pages-236-237, 303-327, Ref. 3: Pages-528-535, 571-582, Ref. 4: Pages-134-140, 175-189]

Chapter 3 : Electrolytic Conductance

[8 Hours]

(Recapitulation: *Electrolytes, Ohm's law and Electrical units, electrolytic conductance, resistance and specific resistance*) Electrolytic Conductance, Specific and equivalent conductance, Variation of equivalent conductance with concentration. **Kohlrausch's law and its applications to determine:** Equivalent conductance at infinite dilution of a weak electrolyte, The ionic product of water, Solubility of sparingly soluble salts. Migration of ions and ionic mobilities, Absolute velocity of ions, **Transport number determination by:** Hittorf's method, Moving boundary method, Relation between ionic mobility, ionic conductance and transport number, Ionic theory of conductance. **Numericals** [Ref. 1: Pages-860-861, 865-868, 883-896, Ref. 3: Pages- 801-815, Ref. 4: Pages- 303-306, 318-326]

Chapter 4 : Phase Equilibrium

[7 Hours]

Introduction, Phase, Components and Degree of Freedom of a system, Stability of Phases, Criteria of Phase equilibrium, Gibb's Phase rule and its thermodynamic derivation, Phase Diagrams of One Component system: Water, Carbon Dioxide and Sulphur system, **Numericals.** [Ref. 3: Pages – 661-672, Ref. 4: Pages – 393-397, Ref. 5: Pages- 925-930, 941-948]

References

1. Essentials of Physical Chemistry by Arun Bahl, B.S. Bahl and G.D.Tuli –Multicolor Edition
2. Chemical Kinetics, Keith J. Laidler (4th Ed)
3. Principles of Physical Chemistry by B. R. Puri, L. R. Sharma, M. S. Pathania (46th Ed.)
4. Physical Chemistry, G. M. Barrow (5th Ed.)
5. Physical Chemistry: A Molecular Approach by D. A. McQuarrie & J. D. Simon
6. Introduction to Chemical Thermodynamics by A. K. Chandra (4th Ed.)