

21PCM103T					Introduction to Physical Chemistry					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

## COURSE OBJECTIVES

- To provide a broad foundation of fundamentals of thermodynamic
- To provide students with the skills required to succeed in graduate school, the petroleum industry
- To develop the knowledge about the chemical and phase equilibrium of multicomponent system
- To understand the basic concepts of chemical kinetics
- To learn the basic concepts of homogeneous and heterogeneous catalysis
- To understand the basic concepts of different methods of catalyst characterization

### UNIT I FUNDAMENTALS OF THERMODYNAMICS

**7 Hrs.**

Laws of thermodynamics, definitions of Fundamental thermodynamic quantities, Thermodynamic property relations, Maxwell relations, expansion of ideal gas and changes in thermodynamic properties, cyclic rule, Partial derivatives and Jacobian method; Residual properties; Partial molar properties, Ideal and non-ideal solutions, Standard states definition and choice, Gibbs-Duhem equation, Excess properties of mixtures.

### UNIT II PHASE EQUILIBRIA

**7 Hrs.**

Phase rule and its applications, vapour-liquid equilibrium, phase diagrams for homogeneous and heterogenous systems and for systems with a miscibility gap; Concept of Azeotropes and its applications to single and multiphase system. liquid-liquid equilibrium, ternary liquid, liquid equilibrium; Activity coefficient composition models, thermodynamic consistency of phase equilibria, application of the correlation and prediction of phase equilibria in systems of engineering interest particularly to distillation and liquid extraction processes.

### UNIT III CHEMICAL KINETICS

**7 Hrs.**

Rate of reactions, rate law, order, molecularity, Integrated rate laws: zero order reactions, First, Second and Third order reactions, Rate law for nth order reaction, Pseudo-unimolecular reactions, Half life time: for zero order, 1st order, 2nd order, third order, nth order reactions, Methods of determination of order of a reaction, Factors affecting the rate of a reaction. Homogeneous and Heterogeneous Catalysis, Biocatalysis, Positive catalyst, Negative catalyst, Catalyst promoters, Catalyst poisons, Auto Catalyst, Industrial applications of catalyst, Catalysts in Petroleum Refining, Catalytic converter.

### UNIT IV STATISTICAL MECHANICS

**7 Hrs.**

Types of statistics, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics, Translational, Rotational, Vibrational Electronics and Nuclear partition function, Thermodynamics properties in terms of partition function, application of BE statistics to black body radiation, Quantum statistics: Ideal Bose Einstein and Fermi-Dirac gas.

**Max. 28 Hrs.**

## COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Understand the fundamental concepts of thermodynamics

CO2 Assess and get acquainted with the concepts of work, power, and heat in thermodynamics; determine work involved with moving boundary systems (graphical and analytical methods)

CO3: Analyse the first and second law of thermodynamics, Carnot cycle and thermodynamic properties of pure substances

CO4: Create the phase diagram of single and multicomponent system

CO5: Analyze the chemical kinetics and its applications to find rate, order and molecularity

CO6: Elucidate the mechanism of catalysis with the help of knowledge of characterization techniques for solving research problem in petrochemical industry

**TEXT/REFERENCE BOOKS**

1. Atkins, Peter, 'Physical Chemistry', 8th ed New Delhi: Oxford & IBH Publishing House, 2006.
2. Chemical Kinetics, 3rd edition, K. J. Laidler, Pearson India.
3. Physical Chemistry, 9th edition, Peter Atkins, Julio De Paula, Oxford University Press.
4. Essentials of Physical Chemistry, A. Bahl, B.S. Bahl, G.D. Tuli, S Chand Publication.
5. Principle of Physical Chemistry, Puri, Sharma & Pathania, Thomson Press (India) Limited

**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks: 100**

Part A: 10 Questions each carrying 5 marks

Part B: 5 Questions each carrying 10 marks

**Exam Duration: 3 Hrs.**

50 Marks

50 Marks