Indian Institute of Technology, Kanpur

Proposal for a New Course

1. Course No: CHM221A
2. Course Title: Basic Physical Chemistry I
3. Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours[0-2]: 0 (A), Credits (3*L+2*T+P+A): 9-0-0-0

   Duration of Course: Full Semester
4. Proposing Department/IDP: CHM

   Other Departments/IDPs which may be interested in the proposed course: Open to all other departments

   Other faculty members interested in teaching the proposed course: All the members of Physical Chemistry Division of department of chemistry
5. Proposing Instructor(s): All the members of Physical Chemistry Division of department of chemistry
6. Course Description: Department Compulsory

A) Objectives: The objective of the course is to introduce BS/BTech students the basic concepts in thermodynamic, thermodynamic potentials, applications of thermodynamics, ideal and nonideal systems, and electrochemistry. In addition, the course will also introduce basic concepts of finite-time thermodynamics and nonequilibrium thermodynamics.

B) Contents (*preferably in the form of 5 to 10 broad titles)*:

S. No	Broad Title	Topics	No. of Lectures
1.	Thermodynamic Preliminaries	System, Surroundings, Extensive and Intensive Properties, Laws of Thermodynamics, Heat Engines	6
2.	Thermodynamic Potentials	Energy, Entropy, Legendre Transforms, Free energies, Stability criteria	4
3.	Applications of Thermodynamics	Partial Molar Quantities, Chemical Potential, Gibbs-Duhem Equation, Clapeyron Equation, Gibbs Phase Rule Applied to Reactive and Nonreactive Mixtures, Partial Molar Quantities, Chemical Potential, Phase Transitions, Liquid-Solid-Vapor, Solid-Solid Phases, Eutectic Mixtures	8
4.	Ideal and Nonideal Systems	Ideal and Nonideal Gases, Liquids, Binary Mixtures, Solutions	6
5.	Electrochemistry	Electrochemical Cell, Cell Potential, Nernst Equation, Electrochemical Series, Electrolytic	10

		Cells, Electrode Kinetics, Butler-Volmer Equation, Nernst Planck Equation, Li-Ion Batteries, Intercalation and Deintercalation	
6.	Finite-Time Thermodynamics and Nonequilibrium Thermodynamics	Flexible module with possible topics like Endo Reversible Engine Cycle, Introduction to Finite-Time Engine Cycle, Curzon-Ahlborn Efficiency, Concept of Local Equilibrium, Prigogine's Entropy Production Rate, Molecular Motors etc.	6
	Total Lectures		40

C) Pre-requisites, if any (*examples: a- PSO201A,or b- PSO201A or equivalent*): None

D) Short summary for including in the Courses of Study Booklet: The course introduces the basic concepts in thermodynamic, thermodynamic potentials, applications of thermodynamics, ideal and nonideal systems, and electrochemistry. In addition, the course has a module with flexible topics from finite-time thermodynamics and nonequilibrium thermodynamics.

7. Recommended books:

   Textbooks:

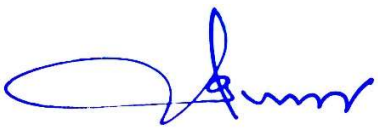
   Reference Books:

   - P. W. Atkins and Julio de Paula, Physical Chemistry
   - N. Levine, Physical Chemistry
   - R. J. Silbey, R. A. Alberty, and M. G. Bawendi, Physical Chemistry
   - D. A. McQuarrie, J. D. Simon, Physical Chemistry: A molecular approach

8. Any other remarks: None

Dated: 10.05.2022

Proposer: All the members of Physical Chemistry Division of department of chemistry

Dated: 14.05.2022 DUGC Convener: 

The course is approved / not approved

Chairman, SUGC/SPGC

Dated:_____