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):

<table>
<thead>
<tr>
<th>S. No</th>
<th>Broad Title</th>
<th>Topics</th>
<th>No. of Lectures</th>
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<tbody>
<tr>
<td>2.</td>
<td>Thermodynamic Potentials</td>
<td>Energy, Entropy, Legendre Transforms, Free energies, Stability criteria</td>
<td>4</td>
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<td>4.</td>
<td>Ideal and Nonideal Systems</td>
<td>Ideal and Nonideal Gases, Liquids, Binary Mixtures, Solutions</td>
<td>6</td>
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<tr>
<td>5.</td>
<td>Electrochemistry</td>
<td>Electrochemical Cell, Cell Potential, Nernst Equation, Electrochemical Series, Electrolytic</td>
<td>10</td>
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### 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 thermodynamics, 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: ____________________________