Course: Generic Elective (Set 2)

<table>
<tr><td>Semester ____</td><td>4</td></tr>
<tr><td>Paper Number</td><td>HCHGE4042T (60 MARKS) & HCHGE4042P (40 MARKS)</td></tr>
<tr><td>Paper Title</td><td>Physical Chemistry 1</td></tr>
<tr><td>No. of Credits</td><td></td></tr>
<tr><td>Theory/Composite</td><td>Composite</td></tr>
<tr><td>No. of periods assigned</td><td>Th: 4; Pr: 2</td></tr>
<tr><td>Name of Faculty member(s)</td><td>Dr. Indranil Chakraborty/ Dr. A. K. Nag
Dr. Rahul Sharma/ Dr. Rina Ghosh</td></tr>
<tr><td>Course description/objective</td><td>The primary aim is to give a flavour of the basic concepts of Physical Chemistry to the students of other discipline</td></tr>
<tr><td>Syllabus</td><td>Annexure GE Set 2</td></tr>
<tr><td>Texts</td><td></td></tr>
<tr><td>Reading/Reference Lists</td><td>1. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, Oxford University Press
2. Castellan, G. W. Physical Chemistry, Narosa
3. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva Press
4. Engel, T. & Reid, P. Physical Chemistry, Pearson</td></tr>
<tr><td>Evaluation</td><td><table><tr><td>Theory: 60 marks</td><td>Practical: 40 marks
(Continuous Assessment)</td></tr><tr><td>CIA: 10
End-Sem: 50</td><td>Internal Assessment Exams: 30
Viva (End Sem): 8
Attendance: 2</td></tr></table></td></tr>
<tr><td>Paper Structure for the End Sem Theory Exam (50 marks)</td><td>6 (SIX) Questions (each of 10 marks) will be set and the students will have to answer any 5 (FIVE).
Each of the Questions (10 marks) will consist of 2 or 3 parts (of 2/ 3/ 4/ 5)</td></tr>
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Annexure GE Set 1

GE: 1 (Theory) 52 Lectures

Module 1: Chemical Kinetics (14 Lectures)

a) Definition of rate of a chemical reaction in terms of degree of advancement.
b) Introduction of some methods to study a chemical reaction to find its rate.
c) Definition of order of a reaction.
d) Methods for determination of order of a reaction.
e) Dimension of rate and rate constants for reactions with different orders.
f) Integrated rate law for (i) zeroth, (ii) first, (iii) second and (iv) n'th order cases.
g) Nature of variation in concentration with time for reactions with different orders.
h) Use of the integrated rate laws in determining order of a chemical reaction.
i) Half life period, its expression for reactions with different orders.
j) Usage of half-life period in determining order of a chemical reaction.
k) Expression of rate constant for binary reaction involving gases.
l) Variation of rate constant with temperature: Arrhenius equation.
m) Complex reactions: opposing, parallel and consecutive reactions assuming each elementary reactions to be first order.

Module 2: **Electrical conductance** (13 Lectures)

a) Metallic and electrolytic conduction.
b) Ions as charge carrier.
c) Strong and weak electrolytes.
d) Solvation of ions in solution: effect of charge to radius ratio.
e) Interaction among ions in solution and its variation with concentration (qualitative idea of assymmetric and electrophoretic effect).
f) Definition of specific and equivalent conductance.
g) Variation in conductance, specific conductance and equivalent conductance with concentration.
h) Equivalent conductance at infinite dilution: Kohlrausch law of independent migration.
i) Interrelation among strength of current, specific conductance, ionic mobility and ion conductance.
j) Definition of transport number and expression.

Module 3: Principles of thermodynamics (25 Lectures)

a) Definition of systems, surroundings and types of systems (isolated, closed and open).
b) Extensive properties and intensive properties.
c) Concept of Thermodynamic equilibrium, concept of temperature.
d) Concept of heat and work, reversible work, irreversible work and maximum work.
e) First law of Thermodynamics, internal energy as a state function, properties of state function and path function.
f) Definition of isothermal and adiabatic processes.
g) Joule's experiment and its consequences.
h) Joule-Thomson experiment and enthalpy as a state function.
i) Calculation of work done, heat changes for isothermal and adiabatic changes involving ideal gas.
j) Statement of Second law of Thermodynamics and their equivalence.

k) Carnot's cycle and Carnot's theorem.
l) Absolute scale of temperature, concept of Entropy as a state function, Entropy changes in various Physical processes.
m) Clausius inequality, condition of reversibility and irreversibility of a process.
n) Auxiliary state function-Helmholtz free energy and Gibbs free energy and their simple applications.
o) Laws of Thermo chemistry and their applications, Born Haber Cycle, Standard Enthalpy changes in various transformations, Kirchoff's relation.
p) Maxwell's relation, Cp-Cv relation, Joule- Thompson coefficient for van der Waals gases, Thermodynamic Equation of state.
q) Gibbs- Helmholtz relation, Coupling reactions, concept of orders of phase transition, Clausius-Clapeyron relation and phase transition.
r) Chemical Equilibrium: State of equilibrium and thermodynamic condition of equilibrium (condition of Minimum Gibbs' potential), van't Hoff's reaction isotherm (deduction using chemical potential).
s) Temperature dependence of Equilibrium constant.
t) Homogeneous equilibrium: Use of different standard states to define K_PKp, K_C and K_x and their interrelations, examples of homogenous equilibrium in gas phase.

GE: 2 (Practical) 28 Lectures

1. Standardization of potassium permanganate by oxalic acid
2. Estimation of Fe(II) and Fe(III) in a mixture
3. Standardization of sodium thiosulphate by potassium dichromate
4. Estimation of copper by iodometry
5. Estimation of hardness of water
6. Estimation of NH_4^+ by formol titration
7. Estimation of Ca and Mg in a mixture
8. Estimation of Ni by gravimetry