SYLLABUS

A. Course Description

Course Code	*Course Num.*	*Course Name*	*Credit Hours*	*Lec.*	*Lab.*	*Tut.*	*Private study*	*Pre-requisites*	*Course Level*	*Language*
CHM	**242**	**Physical Chemistry (2)**	**4**	**2**	**3**	**1**	**6**	**CHM 241/ MAT 103**	**4**	**English**

This course improves student knowledge in the phase transformation with the description of basic principles chemical equilibria and relationships with thermodynamic function and properties of solutions. Topics covered in the course include Phase rules, the ideal solution, Dilute solutions of nonelectrolytes, states for nonelectrolytes, Determination of nonelectrolyte activities and excess Gibbs functions from experimental data, Activity, activity coefficients, and osmotic coefficients of strong electrolytes. Topics of the bases of Chemical Kinetics.

At the end of this course the student will be able to:

- recall phase transformations laws
- describe the basic principles of chemical equilibria related to thermodynamic functions
- state the laws of colligative properties
- evaluate the equilibrium constant from experimental data.
- interpret the equilibrium state or direction on variation operational conditions.
- determine reaction rate laws and constants along with the factor effecting them.
- operate laboratory instruments.
- diagram and illustrate experimentally obtained data.

B. References: Required Textbook & Internal Website

I shall use

Physical Chemistry, K. J. Laidler, J. H. Meiser, B. C. Sanctuary, (4th Ed), Houghton Mifflin Company, 2003, [ISBN: 0618123415.

Students are required to purchase the textbook/materials (it is an obligation). The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook. Other references:

- ***Chemical Thermodynamics Basic Concepts and Methods,*** Irving M. Klotz, Robert M. Rosenberg, (7thEd.), Wiley, 2008. ISBN-10: 471780154.
- ***Physical Chemistry***, Ira N. Levine, (5th Ed.), McGraw-Hill (ISBN: 0-07-231808-2).
- ***Physical Chemistry***, R.Silbey, R. Alberty, and M. Bawendi. (4th Ed), New York, NY: John Wiley & Sons, 2004, ISBN: 9780471215042.

Google Classroom Webpage: http://www.imamm.org/

C. Topics Outline

Disclaimer: **Disclaimer:** this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

a. ***Theory:***

1. **Physical Transformations of Pure Substances**, Phase Diagrams, Stabilities of Phases, Phase Boundaries, Three Typical Phase Diagrams, Phase Stability and Phase Transitions, Thermodynamic Criterion of Equilibrium, Dependence of Stability on the Conditions, Location of Phase Boundaries, Ehrenfest Classification of Phase Transitions, Phase Transitions, Ehrenfest Classification of Phase Transitions. Physical Liquid Surface, Surface Tension., Curved Surfaces, Bubbles, cavities and droplets, Nucleation, and, Capillary Action.
2. **Phase Transformations:** Phases, Components and Degrees of Freedom, Definitions. The Phase Rule, Two-Component Systems, Vapor Pressure Diagrams, Composition of the Vapor, Interpretation of the Diagrams. The Lever Rule. Temperature-Composition Diagrams. Distillation of Mixtures, Azeotropes, Immiscible Liquids. Liquid-Liquid Phase Diagrams, Phase Separations, Critical Solution Temperatures, Distillation of Partially. Miscible Liquids, Liquid-Solid Phase Diagrams, Eutectics.
3. **Chemical Equilibrium**: Spontaneous Chemical Reactions, The Gibbs Energy Minimum, The reaction Gibbs energy, Exergonic and endergonic reactions. The Description of Equilibrium, Perfect gas equilibria. The general case of a reaction, the relation between equilibrium constants, molality and mole fractions, The Boltzmann Distribution. Responses of Chemical Equilibria. The Response of Chemical Equilibria to Conditions, the Response to Pressure. The Response to Temperature, the Response to pH. Revision on the Response of Chemical Equilibria to Conditions. Acid-base equilibria in water and Buffer solutions.
4. **Quantitative chemical kinetics**. Integration of rate equations, zero, first, second order cases, rate constant. Graphical analysis of rate data for rate constant and half-life determination for each case. Dependence of rate on temperature. Arrhenius equation and activation energy, Kinetics of complex multistep reactions. Consecutive reactions. Concept of rate determining step and reaction intermediate. Surface reactions involving adsorbed reactants (Langmuir and Freundlich adsorption isotherm).

b. ***Practical:***

Safety and Laboratory equipment's and measurements and reports, Introduction and some basic mathematical concepts, Mutual Solubility Curve for Phenol – Water system, The Melting point of a binary system (Eutectic point), Phase diagram for a three-component system, Partial Molar Properties of Solutions, Determination of the distribution coefficient of the acetic acid between water and Diethyl ether, Determination the equilibrium constant of the reaction $KI + I_2 = KI_3$ by distribution method, Chemical Kinetics (The Iodine Clock Reaction), Kinetics of first order reactions (Hydrolysis of ethyl acetate in acidic solution), Catalysts for the decomposition of hydrogen peroxide.

D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word "semi-official" entails, can be found here:

- **Midterm 1:** 6th or 7th week &**Midterm 2:**11th or 12th week
- **Quizzes**: **2 Quizzes**
- **Homework: 4 Homework**
- **Final Exam:** 16th week.

	Teaching/learning activities	Contact Hours	Frequency	Total Contact hours	Self-study hours (hrs)	Total self-study hours	Student Learning Time
1	Lecture	2	15	30	2	30	60
2	Tutorial	1	15	15	1	15	30
3	Lab\Practical	3	14	42	0	0	42
4	Lab report	0	14	0	1	14	14
5	Lab Exam	3	1	3	3	3	6
6	Homework	0	4	0	2	8	8
7	Quiz	0.25	2	0.5	1	2	2.5
8	Test (Midterm)	1.5	2	3	8	8	11
9	Final Exam	2	1	2	9	9	11
Total				95.5		89	184.5

- **Independent self-study = 89/15** ≅ 6 **hrs per week (**as average**)**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

Midterm 1: 10 %	**Midterm 2:** 10 %	**Laboratory:** 30%	**Final Exam:** 40 %
Quizzes; Homework & Attendance & Participation:10 %			

Grading distribution:

A^+: [95, 100], A: [90, 95), B^+: [85, 90), B: [80, 85), C^+: [75, 80), C: [70, 75), D^+: [65, 70), D: [60, 65), F: [0, 60).

E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).

- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Examsgoo.gl/ykm7t3

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