INTERNATIONAL UNIVERSITY LIAISON INDONESIA IULI

SYLLABUS

Date/ Revision	August 15th 2016
Faculty	Life Sciences
Approval	Dean of Faculty of Life Sciences

SUBJECT : PHYSICAL CHEMISTRY

1. Identification of Subject:

Name of Subject : Physical Chemistry
Code of Subject : PHCH-2300
SKS / ECTS : 3/
Semester : III
Study Program : Chemical Engineering and Food Technology
Lecturer : Tutun Nugraha, BASc, MASc, Ph.D.

2. Competency

After having the course, students are expected to:

a) Understand the the underlying physical principles that govern the properties and behaviour of chemical systems.
b) Use critical thinking and logic in the solution of problems
c) knwo the applications of calculus into various problems that are faced in this course. The uses of Calculus ie. integral and differenctial are inseparable. This will provide the opportunities for the students to begin to link various concepts in basic mathematics into the realm of physics and chemistry. Integration of basic knowledge beins in this course.
d) students will be introduced to new concepts and to some were given the chances to study in depth various phenomena in thermodynamics, chemical equilibrium as well as kinetics in the gas phase and in theliquid phase.

3. Description of Subject:

This course provides more insight into chemistry following the basic chemistry courses that the students have learned in the previous year. The course focuses on the topics of thermodynamics and kinetics, the concept of ideal gas, and the 0th, 1st, 2nd, and 3rd law of thermodynamics. Students will also learn to utilize tables of enthalpy, entropy, as well as Cp and Gibbs energy. On the kinetics side, the students will learn the basic concept of kinetics in both gas phase and liquid phase starting with the more theoretical material and continued with the derivation of rate equation from elementary reactions that forms the mechanisms of reaction. The students would also get the opportunity to use their mathematical skills particularly in the use of Calculus which is used substantially throughout the course.

DAAD Federal Ministry of Education and Research
Coordinator TECHNISCHE UNIVERSITÄT ILMENAU

PO Box 150, BSD CPA 15330
Tel. +62 21 50588000
+62 85212318000
info@iuli.ac.id; www.iuli.ac.id
IULI – Eco Campus, The Breeze
Jl. BSD Grand Boulevard
BSD City 15345
Island of Java

4. Learning Approach

Approach : Lecture, Problem based learning
Method : Discussion, question answer, sample problem/tutorials, group work
Student Task : discussion in class, tutorial questions for students exercise
Media : Power Point Presentation, Video, Instrument (lab work will be given in separate course ie physical chemistry laboratory)

5. Evaluation

a) Absence maximum : 25%
b) Daily quizes/assignment : 40 points
c) Final Examination : 60 points
Total : 100 points

6. Contents/ Topics of Lecturing:

Week	Topics	Content	Remark
1	Introduction	To provide an overview to the students concerning the course as well as the general requirement and the marking scheme The course will cover two main parts, i.e. thermodynamics and kinetics	Lecture Chapter 1 1 x 50 minutes
1,2	Zeroth law of thermodynamics and the properties of gases	To introduce the properties of matter at equilibrium (T, P, V, n, system boundary, and degree of freedom) To discuss the 0th law of thermodynamics, and how it leads to the ideal gas temperature scale to introduce the critical phenomena To introduce the concept of ideal gas and ideal gas mixture including the Dalton's law as applied to partial pressur Followed by the discussion of Equation of States for real gases, including van der Waals and Virial EoS which will allow students to evaluate relationships between P, V, T, and n for real gases Exercises/review of problem set	Lecture, Group discusion, tutorial for exercise Chapter 1 & 2 (law of thermodynamics) Chapter 8 on ideal and real gas) 2 x 50 minutes and 3 x 50 minutes
3,4	First law of thermodynamics	To introduce processes that take a chemical system from one state to another is described 1st law of thermodynamics, also referred to as law of conservation of energy, is discussed; which is followed by the	Lecture, Group discusion, tutorial for exercise Chapter 1 & 2 2 x 3 x 50 minutes

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		introduction ofWork (W), Internal Energy (U) as well as Enthalpy (H). Heat capacities (Cv and Cp) are then discussed The concept of thermochemistry which deals with the production of heat during a chemical process is discussed Students are also learning how to use or read various table of thermodynamics data to extract needed physical constant Exercises/review of problem set	
5	2nd and 3rd law of thermodynamics	Students learned the concept of Entropy (S) and how it is related to the natural/spontaneous direction of a process or a chemical reaction The 2nd law is discussed as related to the determination whether a process will occur in the forward or the backward direction through evaluation of DS Calculation of entropy at any desired temperature relative to its entropy at zero Kelvin through integration of dq_{rev}/T is discussed To introduce to student, the 3rd law of thermodynamics Heat engine and its efficiency is introduced	Lecture, Group discusion, tutorial for exercise Chapter 3 3 x 50 minutes
6	Fundamental equations of thermodynamics	To introduce the Gibbs and Helmholtz Energy to determine spontaneity of a process To discuss the effects of T and P on Gibbs energy To introduce the concept of fugacity & activity as well as how they are related to the calculation Gibbs energy for real gases Exercises/review of problem set	Lecture, Group discusion, tutorial for exercise Chapter 4 & 5 3 x 50 minutes
7,8	Chemical Equilibrium	To introduce the concept of chemical equilibrium and derive mathematical equations that describe it To discuss the evaluation of equilibrium constant through the values of Gibbs energy The effects of the values of T, P, and the concentrations of the initial compositions as well as the presence of inert compounds are described Students will also learn the concept of	Lecture, Group discusion, tutorial for exercise Chapter 6 3 x 50 minutes

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		heterogeneous reactions where solid phase are involved in the chemical reactions	
9,10	Phase equilibrium	To introduce the Gibbs and Helmholtz Energy to determine spontaneity of a process To discuss the effects of T and P on Gibbs energy To introduce the concept of fugacity & activity as well as how they are related to the calculation Gibbs energy for real gases Exercises/review of problem set	Lecture, Group discusion, tutorial for exercise Chapter 12 3 x 50 minutes
11	Electrochemical Equilibrium	To introduce the concept of chemical equilibrium and derive mathematical equations that describe it To discuss the evaluation of equilibrium constant through the values of Gibbs energy The effects of the values of T, P, and the concentrations of the initial compositions as well as the presence of inert compounds are described Students will also learn the concept of heterogeneous reactions where solid phase are involved in the chemical reactions	Lecture, Group discusion, tutorial for exercise Chapter 13 3 x 50 minutes
12,13	Reaction Kinetics in the gas phase	Introduction to kinetic theory of gases Probability density for molecular speeds of gas molecules Velocity distribution in one direction Maxwell distribution of speeds Types of average speeds Transport phenomena Rate and order of reaction Reversible first order reactions Consecutive first order reactions Effects of temperature Mechanisms of chemical reactions rrelations between rate constants for forward and backward reactions Unimolecular, bimolecular and trimolecular reactions Unbranched and branched chain reactions	Lecture, Group discusion, tutorial for exercise Chapter 14 & 15 2 x 3 x 50 minutes
14	Reaction Kinetics in the liquid phase	Viscosity of a liquid, diffusion Mobility of an ion Encounter pairs and solvent cage Diffusion controlled reactions in liquids Acid and Base catalysis	Lecture, Group discusion, tutorial for exercise Chapter 16

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		Enzyme catalyses Exercises/review of problem set	3 x 50 minutes
15,16	**FINAL EXAMINATION**		

7. Book Reference:

a) Physical Chemistry, Ira N Levine, McGraw Hill, 6th Edition, ISBN 978-007-127636-8, 2009
Estimated Price of book: Rp 305,000,-

Other readings:

b) R. J. Silbey, R. A. Alberty, M.G. Bawendi, Physical Chemistry, Edisi ke-4, John Wiley & Sons, Inc. 2005.

8. Non TextBook Reading:

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