

Spring 2019

CHEM 236-004: Physical Chemistry for Chemical Engineers

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Chem 236: *Spring 2019 Course Syllabus*

NJIT Academic Integrity Code: All Students should be aware that the Department of Chemistry & Environmental Science (CES) takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

Obtaining course materials such as past exams or solutions to assignments from external sources constitutes as **cheating**. The official Student's Solutions Guide by Atkins is exempt.

Posting of course materials on external websites without the approval of the instructor violates intellectual property laws and hence **strictly forbidden**.

COURSE INFORMATION

Course Description: Chem 236, Physical Chemistry for Chemical Engineers

Number of Credits: 4 credits, 5 contact hours

Prerequisites: - Chem 122 or 126 with a grade C or better
- Chem 124 with a grade C or better
- Che 230 or Che 232 with a grade C or better

This course will introduce the chemical engineering students to the concepts of order, disorder, chemical equilibrium and phase equilibrium. Credit for this course will not be given if credit for Chem 235 has been given.

Course-Section and Instructors

Course-Section	Instructor
Chem 236: 004	Dr. Krishtal

Office Hours: Monday 10:00am - 11:20am
Tuesday 02:30pm - 03:50pm
Thursday 01:00pm - 02:20pm
Friday 01:00pm - 02:20pm
In case of schedule conflicts, you can make an appointment outside of these hours by emailing krishtal@njit.edu.

Required Textbook:

Title	Physical Chemistry
Author	Peter Atkins and Julio de Paula
Edition	10 th or 11 th . For approval of older editions please contact the instructor
Publisher	Freeman for 10 th edition; Oxford for 11 th edition
ISBN #	10 th edition: 978-1-4292-9019-7; 11 th edition: 978-0-19-876986-6

University-wide Withdrawal Date: The last day to withdraw with a W is Monday, April 8, 2019. It will be strictly enforced.

Learning Outcomes:

At the end of 236, you will be able to

1. Distinguish the different thermodynamic functions of chemical reactions (U, H, S, G, A and C) and evaluate their variation with conditions such as pressure, temperature and volume.
2. Derive basic thermodynamic relations for different conditions
3. Calculate thermodynamic functions of components in pure compounds and mixtures.
4. Interpret and use phase diagrams for one component systems and binary mixtures.
5. Calculate thermodynamic relations for non-ideal systems using activities.
6. Determine equilibrium constants and reaction quotients based on reaction data.
7. Evaluate how equilibrium responds to change in conditions.
8. Understand the relation between equilibrium, thermodynamics and kinetics.
9. Calculate transfer parameters for gases.
10. Determine the order of reactions and Arrhenius parameters.
11. Derivate rate laws for chemical reactions based on the mechanism.
12. Estimate rate constants of elementary reactions using the Simple Collision Theory and the Transition State Theory.

POLICIES

All CES students must familiarize themselves with, and adhere to, all official university-wide student policies. CES takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Online homework	10%
Quizzes	20%
Midterm Exam I	20%
Midterm Exam II	20%
Final Exam	30%

Your final letter grade in this course will be based on the following tentative curve:

A	90.0%-100%	C	70.0%-74.9%
B+	85.0%-89.9%	D	60.0%-69.9%
B	80.0%-84.9%	F	<60.0%
C+	75.0%-79.9%		

Attendance Policy: Attendance is mandatory. Each class is a learning experience that cannot be replicated through simply “getting the notes.”

Lectures: Students are expected to read the specified textbook material and review the slides posted on Moodle before coming to class. The lectures will consist out of in depth discussion of the material, active solving of exercises and group assignments.

Homework: Homework will be assigned both online on Moodle and as exercises and problems from the book. The online homework will count directly towards the final grade as described above. The assigned homework from the textbook will not be collected, but will serve as a base for the questions on the quizzes and exams.

Quizzes: Short (15-20 minute) quizzes will be given every Friday on weeks without exams, as indicated in the Tentative Course Schedule below. Quizzes will be based on exercises solved during the lecture and the assigned

homework. Some quizzes may be substituted with take home assignments.

Exams: There will be two midterm exams held in class during the semester and one comprehensive final exam. The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam I	Tuesday February 26th
Midterm Exam II	Tuesday April 2nd
Final Exam Period	May 10 - 16, 2019

The final exam will test your knowledge of all the course material taught in the entire course.

All quizzes and exams are **closed book**. A formula sheet will be given. In addition, students are allowed to bring one letter-size piece of paper, on which they are allowed to write any information of their choosing, front and back. No electronic devices are allowed during exams except for calculators.

Makeup Exam Policy: There will normally be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event that a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

ADDITIONAL RESOURCES

Accommodation of Disabilities: Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required.

For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

- <http://www5.njit.edu/studentsuccess/disability-support-services/>

Important Dates (See: [Fall 2018 Academic Calendar, Registrar](#))

Date	Day	Event
January 22, 2019	T	First Day of Classes
February 1, 2019	F	Last Day to Add/Drop Classes
March 17 - 24, 2019	Su - Su	Spring Recess
April 8, 2018	M	Last Day to Withdraw
April 19, 2018	F	Good Friday - University Closed
May 7	T	Last Day of Classes, Friday Classes Meet
May 8-9	W - R	Reading Days
May 10 - 18	F - R	Final Exam Period

Course Outline

Lecture	Chapter	Topic	Quizzes/Exams
1 T 1/22	2A	Internal energy, calculating q and w	
2 F 1/25	2B, 2C	Enthalpy, Thermochemistry	
3 T 1/29	2D	State functions and exact differential	
4 F 2/1	2E	Adiabatic changes	Quiz 1 on 2A - 2D
5 T 2/5	3A	Entropy: 2 nd law, Carnot cycle, change in entropy	
6 F 2/8	3B, 3C	Measuring entropy: 3 rd law. G and A	Quiz 2 on 2E and 3A
7 T 2/12	3C, 3D	Maximum work, G_m , Maxwell relations	
8 F 2/15	3D	Variation of G with p and T	Quiz 3 on 3B - 3C
9 T 2/19	4A, 4B	Pure substance phase diagrams, phase rule	
10 F 2/22	4B	Dependence of phase stability on conditions, slopes	
11 T 2/26	EXAM 1	There will be no lecture after the exam	EXAM CHAPTERS 2-4
12 F 3/1	5A	Mixtures: G and S of mixing, chemical potential, Raoult's law, Henry's law	
13 T 3/5	5B	Colligative properties	
14 F 3/8	5C	Phase diagrams of binary systems, lever rule, azeotropes, partially miscible liquids, solids	Quiz 4 on 5A-5B
15 T 3/12	5E, F	Activities	
16 F 3/15	6A	Equilibrium constant, reaction quotient	Quiz 5 on 5C
17 T 3/26	6B	Response of equilibrium to conditions	
18 F 3/29	EXAM	There will be no lecture after the exam	EXAM ON CHAPTERS 5-6
19 T 4/2	1B	Maxwell-Boltzmann, mean velocities in gas	
20 F 4/5	19A	Collision frequency, mean free path, Collision flux	Quiz 6 on 1B
21 T 4/9	19A	Thermal conductivity, viscosity	
22 F 4/12	20A, 20B	Rate of reaction, integrated rate laws	Quiz 7 on 19A
23 T 4/16	20C, 20D	Arrhenius equation, reactions approaching equilibrium	
24 T 4/23	20E	Elementary reactions, steady-state approximation	
25 F 4/26	20E	Steady-state approximation, pre-equilibria	Quiz 8 on 20A, 20B and 20D
26 T 4/30	20F	Examples of reaction mechanisms	
27 F 5/3		INTEGRATED ACTIVITY/REVIEW	
28 T 5/7		INTEGRATED ACTIVITY/REVIEW	
TBD		FINAL EXAM	

