NJIT New Jersey Institute of Technology

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

Chemistry:
Spring 2023 Course Syllabus
CHEM 236-002 (4 credits, 5 contact hours)

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.

COURSE INFORMATION

Chem 236 Course Description: 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.

Chem 236 Prerequisites: (CHEM 122 or CHEM 126) and (CHEM 124 or CHEM 125A) and ChE 230 with a grade C or better.

Office Hours: **TBA on Canvas**

Instructor: **Dr. Mieke Peels (they/them/theirs)**
Contact information: **mieke.peels@njit.edu or Canvas messaging**

Required Textbook:

Title	Physical Chemistry
Author	Peter Atkins, Julio de Paula, and James Keeler
Edition	11th
Publisher	Oxford University Press
ISBN #	ISBN: 9780198817895

University-wide Withdrawal Date: The last day to withdraw with a **W** is Monday, April 3, 2023. It will be strictly enforced.

Learning Outcomes: *By the end of this course, you should be able to do the following:*

1. Calculate thermodynamic functions of chemical reactions (enthalpy, entropy, Gibbs energy, heat capacity) based on the tabulated data at the reference and other temperatures.
2. Sketch, interpret, and use phase diagrams for one-component systems.
3. Derive the basic thermodynamic relations and state the approximations and the applicability.
4. Calculate the thermodynamic functions of pure compounds and of components in mixtures.
5. Sketch the phase diagrams for liquid-gas, liquid-liquid, and liquid-solid equilibria for mixtures and be able to interpret them.
6. Calculate activities and activity coefficients of ions in solutions.
7. Determine equilibrium constants and reaction quotients based on reaction and/or thermodynamic data.
8. Calculate the transfer parameters (diffusion coefficient, viscosity, thermal and electrical conductivity).
9. Determine the Arrhenius parameters of a chemical reaction from the rate constant vs. temperature data.
10. Analyze data for reactions of simple orders.
11. Build up mechanisms of complex chemical reactions, construct corresponding systems of ordinary different equations, and use the steady-state or pre-equilibrium approximations.
12. Estimate rate constants of elementary chemical 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:

Homework	25%
Recitation Participation	5%
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% and higher	**C**	70% to 74%
B+	85% to 89%	**D**	60% to 69%
B	80% to 84%	**F**	59% and lower
C+	75% to 79%		

Attendance Policy: Attendance at classes will be recorded and is **mandatory**. Each class is a learning experience that cannot be replicated through simply "getting the notes."

Homework Policy: Homework is an expectation of the course. The homework problems set by the instructor are to be handed in for grading and will be used in the determination of the final letter grade as described above. Homework must be submitted as a single pdf through Canvas. Homework will be accepted late at a penalty of 10% per day for up to five days after the due date. Late assignments will not be accepted after grades and comments are released.

Late Penalty Forgiveness Policy: For students who submit one and only one late homework assignment during the semester, I will remove the late penalty at the end of the course.

Recitations: Attendance at recitation is **mandatory**. During this time, problems will be worked through and uploaded to Canvas. Grades will be given for participation and completeness. One recitation grade will be dropped at the end of the course.

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

Midterm Exam I	Friday, February 17 Chapters 2 and 3
Midterm Exam II	Friday, March 24 Chapters 4, 5, and 6
Final Exam Period	Friday, May 5 – Thursday, May 11 Chapters 1B, 16, and 17

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 CES Department Office/Instructor that the exam will be missed so that appropriate steps can be taken to make up the grade.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times. Such devices must be stowed in bags during exams or quizzes.

ADDITIONAL RESOURCES

Chemistry Tutoring Center: Located in the Central King Building, Lower Level, Rm. G12. Hours of operation are Monday – Friday 10:00 am - 6:00 pm. For further information please click here.

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 Scott Janz at spj6@njit.edu, Associate Director of the Office of Accessibility Resources & Services (OARS), Kupfrian Hall 201, to discuss your specific needs. A Letter of Accommodation Eligibility from the OARS 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 2020 Academic Calendar, Registrar
https://www.njit.edu/registrar/spring-2023-academic-calendar

Date	Day	Event
January 16	M	Martin Luther King Jr Day
January 17	T	First Day of Classes
January 23	M	Last Day to Add/Drop a Class Last Day for 100% Refund, Full or Partial Withdrawal
January 24	T	W Grades Posted for Course Withdrawals

January 30	M	Last Day for 90% Refund, Full or Partial Withdrawal No Refund for Partial Withdrawal after this date
February 13	M	Last Day for 50% Refund, Full Withdrawal
March 6	M	Last Day for 25% Refund, Full Withdrawal
March 13	M	Spring Recess Begins
March 18	S	Spring Recess Ends
April 3	M	Last Day to Withdraw
April 7	F	Good Friday – No Classes Scheduled
April 9	Su	Easter Sunday – No Classes Scheduled
May 2	T	Last Day of Classes – Friday Classes Meet
May 3	W	Reading Day 1
May 4	Th	Reading Day 2
May 5	F	Final Exams Begin
May 11	Th	Final Exams End
May 13	Sa	Final Grades Due

Course Outline

Lecture	Date	Topic	Assignment
1	Th 1/19	Syllabus, Focus 1A: The perfect gas, Focus 1C: Real gases	See Canvas for homework
2	F 1/20	Focus 2A: Internal energy, Focus 2B: Enthalpy	
3	Th 1/26	Focus 2B: Enthalpy, Focus 2C: Thermochemistry	W 1/25 Focus 1A, 1C
4	F 1/27	Focus 2D: State functions and exact differentials, Focus 2E: Adiabatic changes	
5	Th 2/2	Focus 2E: Adiabatic changes, Focus 3A: Entropy	W 2/1 Focus 2A, 2B, 2C
6	F 2/3	Focus 3B: Entropy changes accompanying specific processes, Focus 3C: The measurement of entropy	
7	Th 2/9	Focus 3C: The measurement of entropy, Focus 3D: Concentrating on the system	W 2/8 Focus 2D, 2E, 3A
8	F 2/10	Focus 3D: Concentrating on the system	
9	Th 2/16	REVIEW	W 2/15 Focus 3B, 3C, 3D
10	F 2/17	**Midterm Exam 1 (Chapters 2-3)**	
11	Th 2/23	Focus 4A: Phase diagrams of pure substances, Focus 4B: Thermodynamic aspects of phase transitions	
12	F 2/24	Focus 4B: Thermodynamic aspects of phase transitions	**M 2/27 Exam 1 Corrections**
13	Th 3/2	Focus 5A: The thermodynamic description of mixing, Focus 5B: The properties of solutions	W 3/1 Focus 4A, 4B
14	F 3/3	Focus 5B: The properties of solutions, Focus 5C: Phase diagrams of binary systems: liquids	
15	Th 3/9	Focus 5C: Phase diagrams of binary systems: liquids, Focus 5F: Activities	W 3/8 Focus 5A, 5B, 5C
16	F 3/10	Focus 6A: The equilibrium constant, Focus 6B: The response of equilibria to the conditions	
SPRING RECESS: Monday, March 13 to Saturday, March 18			
17	Th 3/23	REVIEW	W 3/22 Focus 5C, 5F, 6A, 6B
18	F 3/24	**Midterm Exam 2 (Chapters 4, 5, and 6)**	
19	Th 3/30	Focus 1B, 16A: The kinetic model, Transport properties of a perfect gas	
20	F 3/31	Focus 16B: Motion in liquids	**M 4/3 Exam 2 Corrections**
LAST DAY TO WITHDRAW: Monday, April 3			
21	Th 4/6	Focus 17A: The rates of chemical reactions	W 4/5 Focus 1B-16A
Good Friday: No Classes Friday, April 7			
22	Th 4/13	Focus 17B: Integrated rate laws	W 4/12 Focus 16B, 17A
23	F 4/14	Focus 17C: Reactions approaching equilibrium, Focus 17D: Arrhenius equation	
24	Th 4/20	Focus 17E: Reaction mechanisms	W 4/19 Focus 17B
25	F 4/21	Focus 17F: Examples of reaction mechanisms	
26	Th 4/27	Focus 17G: Photochemistry	W 4/26 Focus 17C, 17D, 17E
27	F 4/28	REVIEW**	

28	T 5/2 (Friday Classes Meet)	REVIEW**	
FINAL	TBD	Chapters 1, 16, and 17	

*If we run out of class time, we may use one or both of the last two sessions to cover new material, and a review session will be held outside of class hours.

This syllabus may change based on material covered and other factors.