NJIT New Jersey Institute of Technology

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

Chemistry:
Spring 2025 Course Syllabus
CHEM 236-002

NJIT Academic Integrity Code: *"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: NJIT Academic Integrity Code.*

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

COURSE INFORMATION

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.

Number of Credits: 4

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

Course-Section and Instructors

Course-Section	Instructor
236-002	Dr. Mieke Peels

Office Hours: See Canvas

Required Textbook:

Title	Physical Chemistry Volume 1
Author	Atkins, de Paula, Keeler
Edition	12th
Publisher	Oxford University Press
ISBN #	9780198851301

University-wide Withdrawal Date: The last day to withdraw with a **W** is Monday, November 11, 2024. It will be strictly enforced.

Learning Outcomes:

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	15%
Participation (Recitations + Post-Exam Reflections)	10%
Quizzes	10%
Midterm Exam I	15%
Midterm Exam II	15%
Midterm Exam III	15%
Final Exam	20%

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 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 as a small group assignment. Corrections can be made individually to recitations for full credit before keys are posted.

Quizzes: Quizzes will be given at the start of class, and they will be announced only in-class, not on Canvas. The top five quiz grades will be kept and lower scores will be dropped. At least seven pop quizzes will be given over the course of the semester.

Exams: There will be three 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	2/18
Midterm Exam II	3/11
Midterm Exam III	4/22
Final Exam Period	5/10 – 5/16

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

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 stowed in bags during exams or quizzes.

Generative AI: This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.

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 documented disability, please contact the Office of Accessibility Resources and Services 973-596-5417 or via email oars@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 Spring 2025 Academic Calendar)

January	20	Monday	Martin Luther King, Jr. Day
January	21	Tuesday	First Day of Classes
January	25	Saturday	Saturday Classes Begin
January	27	Monday	Last Day to Add/Drop a Class
January	27	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	28	Tuesday	W Grades Posted for Course Withdrawals
February	3	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	17	Monday	Last Day for 50% Refund, Full Withdrawal
March	10	Monday	Last Day for 25% Refund, Full Withdrawal
March	16	Sunday	Spring Recess Begins - No Classes Scheduled - University Open
March	22	Saturday	Spring Recess Ends
April	3	Thursday	Wellness Day - No Classes Scheduled - University Open
April	7	Monday	Last Day to Withdraw
April	18	Friday	Good Friday - No Classes Scheduled - University Closed
April	20	Sunday	Easter Sunday - No Classes Scheduled - University Closed
May	6	Tuesday	Thursday Classes Meet
May	7	Wednesday	Friday Classes Meet
May	7	Wednesday	Last Day of Classes
May	8	Thursday	Reading Day 1
May	9	Friday	Reading Day 2
May	10	Saturday	Final Exams Begin
May	16	Friday	Final Exams End
May	18	Sunday	Final Grades Due
May	19	Monday	Master's and PhD Candidate Commencement - Bloom Wellness and Events Center
May	21	Wednesday	Undergraduate Candidate Commencement - Prudential Center

Course Outline

Lectur	Date	Topic	Assignment
1	T 1/21	Syllabus, Focus 1A: The perfect gas, Focus 1C: Real gases	See Canvas for HW
2	R 1/23	Focus 2A: Internal energy, Focus 2B: Enthalpy	
3	T 1/28	Focus 2C: Thermochemistry, Focus 2D: State functions and exact differentials	
4	R 1/30	Focus 2E: Adiabatic changes	
5	T 2/4	Focus 3A: Entropy, Focus 3B: Entropy changes accompanying specific processes, Focus 3C: The measurement of entropy	
6	R 2/6	Focus 3D: Concentrating on the system, Focus 3E: Combining the First and Second Laws	
7	T 2/11	Focus 4A: Phase diagrams of pure substances, Exam 1 Review	
8	R 2/13	Focus 4B: Thermodynamic aspects of phase transitions	
9	T 2/18	**Midterm Exam 1 (Topics 1-3)**	
10	R 2/20	Ideal Mixtures (Focus 5A/5B)	
11	T 2/25	Real Mixtures (Focus 5A/5B)	
12	R 2/27	Focus 5C: Phase diagrams of binary systems: liquids	
13	T 3/4	Focus 5D: Phase diagrams of binary systems: solids, Focus 5E: Phase diagrams of ternary systems	
14	R 3/6	Focus 5F: Activities, Midterm 2 Review	
15	T 3/11	**Midterm Exam 2 (Topics 4 and 5)**	
16	R 3/13	Focus 6A: The equilibrium constant	
Spring Break: March 17-21			
17	T 3/25	Focus 6B: The response of equilibria to the conditions	
18	R 3/27	Focus 17A: The rates of chemical reactions, Focus 17B: Integrated rate laws	
19	T 4/1	Focus 17C: Reactions approaching equilibrium, Focus 17D: Arrhenius equation	
Thursday, April 3: Wellness Day, no classes			
20	T 4/8	Focus 17E: Reaction mechanisms	
21	R 4/10	Focus 17F: Examples of reaction mechanisms, Focus 17G: Photochemistry	
22	T 4/15	Focus 1B: The kinetic model, Midterm 3 Review	
23	R 4/17	Focus 16A: Transport properties of a perfect gas	
24	T 4/22	**Midterm Exam 3 (Topics 6 and 17)**	
25	R 4/24	Focus 16B: Motion in Liquids, Focus 16C: Diffusion	
26	T 4/29	Focus 18A: Collision Theory, Focus 18B: Diffusion-Controlled Reactions	
27	R 5/1	Focus 18C: Transition-State Theory, Final Exam Review	
28	T 5/6 (**Thursday schedule**)	Final Exam Review	

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