

# THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

Chemistry 412/610: Spring 2024 Course Syllabus

### COURSE INFORMATION

Instructor: Prof. Michael Eberhart Email: michael.s.eberhart@njit.edu, Office: 351 Tiernan Hall, Phone: 973-596-6994 Office hours: Tuesdays 4:00 PM-5:00 PM, other times are also available by appointment.

Meeting Time and Location: Tuesdays 6:00-8:50 PM Cullimore Hall Room 110

**Course Description:** Chem 412 – Inorganic Chemistry (3 credits)

Chem 610 – Advanced Inorganic Chemistry (3 credits)

The course covers structure, bonding, properties, and reactivity in inorganic chemistry. Topics covered will include inorganic structure/bonding, molecular orbitals, coordination chemistry, organometallic chemistry, catalysis, symmetry, and group theory.

**Prerequisite for Chem 412:** Organic Chemistry. Many concepts in this course build upon topics from courses that are expected to have been taken earlier in the chemistry curriculum.

**Canvas:** Important course information including announcements, assignments, exams, quizzes, and details about office hours will be posted.

#### **Required Textbook:**

Title	Inorganic Chemistry	
Authors	Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr	
Edition	5 <sup>th</sup>	
Publisher	Pearson	
ISBN	ISBN-13: 978-0-321-81105-9/ ISBN-10: 0-321-81105-4	

#### **Recommended:**

A molecular model kit. There are many options available at various price points, but one with "metal" atoms is recommended (atoms with five and six bonding sites). Some sets for organic chemistry include metal type atoms, but not all. Molecular models are permitted on quizzes and exams.

**Teamwork and Collaboration:** Teamwork is an important skill for any scientist and formation of study groups is strongly encouraged. You may work with others on homework/problem sets, however you are responsible for knowing how to solve the problems on your own. Quizzes and exams are to be completed alone without assistance from others.

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

Class Participation, Group Discussion, In Class Questions: 10% Homework, Problem Sets: 10% Quizzes: 10% Midterm 1: 20% Midterm 2: 20% Final Exam: 30%

Your letter grade is assigned based on the following tentative curve:

Chemistry 412		Chemistry 610	
А	100-85%	А	100-85%
B+	84-80%	B+	84-80%
В	79-70%	В	79-70%
C+	69-65%	C+	69-65%
С	64-55%	С	64-55%
D	54-50%	F	<55%
F	<50%		

**Homework and Problem Sets:** Before each exam, a comprehensive problem set will be distributed and is intended as exam preparation. Additional smaller homework assignments may be assigned from time to time.

Late Policy: Assignments should be turned in on time. The late penalty is 1% per hour and late assignments will not be accepted once answer keys or graded assignments have been returned to the class.

**Quizzes:** Quizzes will be graded similarly to exams but are shorter, given more frequently, and make up a smaller percentage of your grade. Up to two quiz grades may be excluded from your grade calculation if you can demonstrate proficiency with the quiz topics; the deadline to do so is before the next exam.

**Exams:** There will be two midterm exams held during the semester and one comprehensive final exam. Each midterm will be 90 minutes; students will be allowed the full final exam period (150 minutes). The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam I	Tuesday, February 27 <sup>th</sup>
Midterm Exam II	Tuesday, April 9 <sup>th</sup>
Final Exam Period	May 3 <sup>rd</sup> – May 9 <sup>th</sup>

**Exam/Quiz Proctoring:** Exams and Quizzes will be administered in person using pencil and paper. Exams and quizzes must be started on time.

### **Topics Covered:**

Introduction to Inorganic Chemistry (Chapter 1) Atomic Structure as it pertains to bonding in Inorganic Chemistry (Chapter 2.2, 2.3) Basic Structure and Bonding (Chapter 3) Symmetry and Group Theory (Chapter 4) Molecular Orbitals (Chapter 5) Acid-Base and Donor-Acceptor Chemistry (Chapter 6) Coordination Chemistry (Chapters 9-11) Organometallic Chemistry (Chapters 13,14) Bioinorganic Chemistry (Chapter 15) If time permits, additional topics may also be covered.

#### **Learning Outcomes:**

-Predict structure, physical properties, and chemistry of coordination compounds

-Predict structure, physical properties, and chemistry of organometallic compounds

-Apply group theory to predict IR and Raman active vibrational modes

-Learn how to apply symmetry and group theory to describe orbital interactions in bonding -Explain the bonding in inorganic compounds

-Describe common reaction mechanisms of coordination and organometallic complexes

-Explain experimental techniques and strategies to elucidate reaction mechanisms and understand experimental strategies that might be used to control chemical reactions on the basis of mechanistic understanding

# 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.

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: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

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

**Electronic Devices:** Use of electronic devices is only permitted for appropriate course related activities.

**Make-up Exam Policy:** There will normally be **NO MAKE-UP EXAMS** during the semester. In the event that a student has a legitimate reason for missing an exam, the student should contact the Dean of Students office.

**Attendance Policy:** Each class is a learning experience that cannot be replicated through simply "getting the notes." Active participation and discussion are expected.

**Class Recording Policy:** Class meetings will not be recorded. Recording of class is prohibited and subject to sanctions as outlined by the NJIT Code of Student Conduct. Students are expected to respect their fellow students' privacy and freedom to learn without disruption.

**Copyright and Intellectual Property:** Do not violate intellectual property laws. Posting of course materials online is prohibited. Intellectual property violations may also be violations of the academic integrity code. Content (text, images, etc) from outside sources used in any course assignments must be cited properly and used in a manner permissible under copyright law.

# ADDITIONAL RESOURCES

Accommodation of Disabilities: If you are in need of accommodations due to a disability please contact Scott Janz, 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.

**Important Dates:** See the Spring 2024 Academic Calendar <u>https://www5.njit.edu/registrar/calendars</u>

University-wide Withdrawal Date: The last day to withdraw with a W is Monday, April 1<sup>st</sup>.

### **Meeting-by-meeting Outline:**

The topics listed below for each meeting date are *tentative* and subject to change. Tuesday, January 16, 2024 – Introduction to Inorganic Chemistry, Atomic Structure Tuesday, January 23, 2024 – Simple Bonding Theory Tuesday, January 30, 2024 – Symmetry Tuesday, February 6, 2024 – Symmetry Tuesday, February 13, 2024 – Symmetry, Molecular Orbitals Tuesday, February 20, 2024 – Molecular Orbitals Tuesday, February 27, 2024 – Acid Base, Electron Pair Donor/Acceptor, Midterm I Tuesday, March 5, 2024 – Acid Base, Electron Pair Donor/Acceptor, Coordination Chemistry – Structure and isomers Tuesday, March 12, 2024 – No Class, Spring Break Tuesday, March 19, 2024 – Coordination Chemistry – Bonding Tuesday, March 26, 2024 – Coordination Chemistry – Electronic Spectra Tuesday, April 2, 2024 – Coordination Chemistry – Kinetics and Mechanisms Tuesday, April 9, 2024 – Organometallic Chemistry, Midterm II Tuesday, April 16, 2024 – Organometallic Chemistry Tuesday, April 23, 2024 – Bioinorganic Chemistry Tuesday, April 30, 2024 – No class, Friday Classes Meet