NJIT New Jersey Institute of Technology

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE

Chemistry 340 – Chemistry of Materials
*Course Syllabus*

## COURSE INFORMATION

**Instructor:** Prof. Michael Eberhart
**Email:** michael.s.eberhart@njit.edu, Office: 351 Tiernan Hall, Phone: 973-596-6994
**Office hours:** Wednesdays 3:00-4:00 PM in Tiernan 351. Other times and virtual meetings are available by appointment.
**Class meetings:** Mondays and Wednesdays 10:00 AM – 11:20 AM, FMH 307
**Course Description:** Chem 340 – Chemistry of Materials (3 credits)

Covers chemistry of materials and introduces relevant concepts of bonding and structure. Topics covered include the crystalline solid state, bonding and thermodynamics, semiconductors/electronic materials, nanoscale materials, biomaterials, chemistry at interfaces, characterization techniques, and application of materials in devices. Materials chemistry is a multidisciplinary field and topics relate to inorganic chemistry, organic chemistry, physical chemistry, physics, and biochemistry among others.

**Prerequisite:** A grade of C or better in Chem 243 Organic Chemistry I or Chem 245 Organic Chemistry for Chemical Engineers.

**Required Textbooks:**

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| **Title** | Introduction to Materials Chemistry |
| **Authors** | Harry R. Allcock |
| **Edition** | 2nd |
| **Publisher** | Wiley |
| **ISBN** | 978-1-119-34119-2 (print)/ 978-1-119-34725-5 (ebook) |

**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.

**Learning Outcomes:**
Use theory to describe bonding in materials
Relate chemical properties to the properties of materials
Describe synthesis, isolation, and processing of materials
Describe the structure of solids
Describe the electronic structure of insulators, semiconductors, and metals
Explain the thermodynamics of solid formation

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: 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

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

Homework, Problem Sets, Projects/Presentations, Quizzes, Assignments: 30%
Participation: 10%
Exam 1: 15%
Exam 2: 15%
Final Exam: 30%

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

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| A | 90% and above |
| B+ | 85% and above |
| B | 80% and above |
| C+ | 75% and above |
| C | 65% and above |
| D | 60% and above |
| F | below 60% |

Percentage scores required to earn a particular letter grade may be adjusted. The percent score required to earn a particular letter grade will not be increased.

**Attendance Policy:** You are expected to be in class, actively participating, and engaged in class discussions. Each class is a learning experience that cannot be replicated without being present.

**Homework, Problem Sets, and Projects:** Homework is an expectation of the course. Problem sets are significant homework assignments and are usually assigned shortly before exams. Additional smaller homework assignments may be assigned from time to time. There will be a significant project during the semester to give you an opportunity to explore a topic in materials chemistry in depth and present on that topic.

**Late Submission Policy:** Assignments should be turned in on time. Late work may not be accepted. If late work is accepted, it will usually be assessed a late penalty of 1% per hour.

**Exams:** There will be two exams held during the semester and one comprehensive final exam.

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| Exam 1 | Monday, September 30th |
| Exam 2 | Monday, November 4th |
| Final Exam Period | December 15th – December 21st |

**Exam Proctoring:** Exams may be administered using Lockdown Browser/Respondus Monitor or in person using pencil/paper. Exams may require an environment scan. The exam proctoring method will be announced in class one week before each exam. The proctoring method used for each exam does not set a precedent for exams later in the semester, including the final. Exams must be started on time.

**Makeup Exam Policy:** There will normally be NO MAKE-UP QUIZZES OR EXAMS during the semester. If a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office.

**Quizzes:** There may be announced quizzes and unannounced quizzes. Generally, the quizzes will consist of a few exam style questions.

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

**Excuse Policy:** Excuses should be sent to the Dean of Students.

**Concerns:** If you have concerns or are struggling, please let me know. I want you to succeed.

**Email Policy:** Please use your NJIT email address for course related correspondence.

**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. All references and sources used for preparation of any assignment in the course must be cited.

Additionally, intellectual property law is important in the context of this course. Advances in modern materials chemistry are typically patented and can be highly profitable. It is in your interest to understand intellectual property law to protect your future economic interests.

**Generative AI Policy:** If you want to use generative AI as part of your process to craft anything for the course, you must include an appendix with supporting information detailing how you used generative AI. At a minimum, the appendix must include the raw input (for example a prompt), the raw output, and should identify the generative AI service/source. Use of generative AI without including supporting information is prohibited. It is not appropriate to use generative AI as a substitute for learning something yourself. You are responsible for the quality of everything submitted. Generative AI may be prohibited on some or all assignments.

**Effort, Quality, and Professionalism:** Students are expected to make an effort to submit good quality work. A grade of zero may be assigned for any graded item where the effort to prepare the assignment

and follow directions is inadequate. Illegible, unclear, or tortuous responses may not be awarded credit even if correct answers are contained within the response. You must be able to explain how you produced the answers/content of all work you submit for the course. Professional conduct is expected at all times during the course.

**Electronic Devices:** Electronic devices including laptops and phones should be stowed during class. Tablet/hybrid devices in tablet mode only are allowed for note taking.

## ADDITIONAL RESOURCES

**Accommodation of Disabilities:** If you are in need of accommodations due to a disability, please contact the Office of Accessibility Resources & Services (OARS) to discuss your specific needs. A Letter of Accommodation Eligibility from the OARS authorizing your accommodations will be required.

**Important Dates:** See the Fall 2024 Academic Calendar
https://www5.njit.edu/registrar/calendars

**University-wide Withdrawal Date:** The last day to withdraw with a W is Monday, November 11th.

**Tentative Schedule of Topics/Chapters Covered:**
This selection of topics is *tentative* and the order is subject to change, chapters listed may not be covered and additional topics may be covered depending on time and interest. On average, two class meetings will be devoted to most chapters or groups of chapters below.
Chapter 1: What is Materials Chemistry
Chapter 2: Fundamental Principles that Underlie Materials Chemistry
Chapter 3: Background to Basic Synthesis and Reaction Chemistry
Chapter 4: Chemistry of Representative Elements Utilized in Materials Science
Chapter 8: Ceramics and Inorganic Glasses
Chapter 5: Structure Determination and Special Techniques for Materials Characterization
    X-ray diffraction and crystallography
Chapter 6: Small Molecules in Solids
Chapter 7: Porous Solids
Chapter 20: Surface Science of Materials
Chapter 12: Metals and Alloys
    Metallurgy
Chapters 13-16: Semiconductors
Chapter 17: Optical and Photonic Devices
Chapter 18: Materials and Devices for Energy Generation and Storage
Chapters 9-10: Polymers