

Spring 2021

## **CHE 375-102: Structure, Properties, and Processing of Materials**

Murat Guvendiren

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## ChE 375-001 Structure, Properties and Processing of Materials Spring 2021 Syllabus

**Instructor:** Dr. Murat Guvendiren

PhD, Assistant Professor in CME Department

He/Him/His pronouns

Email: [muratg@njit.edu](mailto:muratg@njit.edu)

Office Hours via WebEx: Wednesdays 1-2pm & Fridays 1-2pm. Schedule an appointment through email. Please email me for other times (if needed).

**Teaching Assistant:** NA

**Required eTextbook (Online Subscription Required):** WileyPLUS: Fundamentals of Materials Science and Engineering: An Integrated Approach, 5<sup>th</sup> Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc.

**Class Time:** Friday 6:00 PM-9:00 PM via WebEx

**Course:** Tailoring materials properties by engineering their microscopic/macrosopic structures via processing is central to product design and development in the chemical industry. This course introduces the principles of materials engineering from the perspective of structure-property-processing relationships. Instead of covering different types of materials separately, this course will use the principles common to engineering of all important materials as an underlying theme. These are atomic/molecular structure, nanoscale, morphology, principles of phase transformation, structure development during processing, and property dependence on structure. All these topics will be introduced through the paradigm of comparing metals, ceramics and polymers. Besides single component systems, advanced materials such as multiphase and/or multi component systems, (e.g. composites and gels) and nanomaterials will be discussed based on these principles. An integral part of this course will be the criteria for selection of materials for the chemical process industry.

**Prerequisites:** Chem 236 or Chem 235

**Withdraw Deadline:** April 5, 2021

**Course Administration:** Administration of this course will be done through Canvas where links to the WileyPLUS platform and Webex can be found.

**Assignments:** Homework assignments will be given using WileyPLUS or otherwise posted on Canvas. In class practice problems may also be occasionally assigned and will contribute to the assignment grade (if assigned). Homework assignments (and practice problems) are graded and will be 10% of the overall grade. The WileyPlus assignments must be completed independently.

**Quizzes:** Quizzes will be given during class time online through the Canvas Quiz Tool and proctored through Respondus Lockdown & Monitor and Webex on a mobile device. Quizzes are closed book & notes, though an equation sheet will be provided. Quizzes are 15% of the total grade and the lowest quiz grade will be dropped.

**Presentation:** Students will be required to do a virtual presentation on a topic given by the instructor. A detailed rubric will be provided for grading criteria. Presentation will be 5% of the total grade.

**Exams:** There will be two exams and one final. The exams are each worth 20% of the total grade and the final is worth 30% of the total grade. All exams and finals will be closed book & notes, though an equation sheet will be provided. Exams will be given online through the Canvas Quiz Tool and proctored through Respondus Lockdown & Monitor, and Webex on a mobile device.

### **GRADING**

|              |        |            |     |
|--------------|--------|------------|-----|
| Assignments  |        | 10%        |     |
| Quizzes      |        | 15%        |     |
| Presentation |        | 5%         |     |
| Exams        |        |            | 40% |
|              | Exam 1 | 20%        |     |
|              | Exam 2 | 20%        |     |
| Final        |        | <u>30%</u> |     |
|              |        | 100%       |     |

Grades will be based on:

- A: 90 – 100%
- B+: 85 – 89%
- B: 80 – 84%
- C+: 70 – 79%
- C: 60 – 69%
- D: 50 – 59%
- F: 0 – 49%

**Honors Students:** Students registered for honors section will be given an additional project, which will be based on Chapter 20. Students will be expected to prepare a short presentation on the selected topic. A rubric will be provided by the instructor. Students will be expected to meet with the instructor 2-3 times to finalize the presentation. Grading will be based on overall presentation and content.

**Makeup Policy:** No makeup exams, finals, or quizzes will be granted unless the Dean of Students contacts me about your reason for missing and the reason is deemed suitable.

**Late Work Policy:** Assignments will not be accepted late unless there is an extenuating circumstance documented through the Dean of Student's office.

**Electronic Device Policy:** The quizzes, exams, and final for this class will be administered online through Respondus Lockdown & Monitor, so a computer with a webcam is required. In addition, a second electronic device with a camera (such as a cell phone or tablet) will be used to proctor using Webex and for uploading your work at the conclusion of the quiz/exam/final. If you are lacking any of these devices please reach out to either me or the Dean of Students office. During quizzes, exams, and the final calculators are permitted, but use of cell phones or other devices are not allowed except for using Webex for proctoring purposes or for uploading work at the end of the examination time.

**Webex Meeting Etiquette** – This class meets synchronously online through Webex and attendance is expected and will be collected. During class, please remain muted unless speaking. You may ask questions by unmuting and speaking, typing in the chat box, or using the ‘raise your hand’ feature. Please note that I may miss a question in the chat or a raised hand, so unmute and speak up if I have missed the question. Though use of your webcam is not required during lecture, it is strongly recommended to make class more interactive. Please have your webcam on during lecture if you are able to. Note that Webex has virtual backgrounds to afford you more privacy during class time. **Note that virtual backgrounds are not allowed during proctoring of quizzes/exams/final**).

**Academic Integrity Policy:** 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](mailto:dos@njit.edu).

Use of “homework help” sites such as Chegg.com to complete class work is prohibited. Any student found to have used one of these sites on an assignment will be reported to the Dean of Students Office for a potential academic integrity violation.

**Course Objectives:** Students will be able to:

1. name types of bonding in materials and identify which materials exhibit each of these bonding types
2. identify the structures of metals and ceramics

3. identify the chemical and structural characteristics of polymers
4. define types of imperfections and the roles they play in affecting the behavior of materials
5. design structures/components using predetermined mechanical properties and mechanical constraints and/or safety constraints
6. identify deformation and strengthening mechanism for materials
7. interpret phase diagrams for determination of phases present and computation of phase compositions and amounts
8. apply phase diagrams for development of microstructures in alloys
9. apply phase transformations concepts to determine microstructure
10. draw relationship between microstructure and mechanical properties
11. identify economic, environmental and societal issues in materials design and selection
12. identify key material design principles considering function, property and processing requirements for a commonly used or an advanced (recently developed) device or a tool (for daily life or industrial use) using online resources (including internet and NJIT library resources), and present findings effectively considering a lay audience.

**Topics & Dates (MAY BE SUBJECTED TO CHANGE):**

| <b>Month</b> | <b>Day</b> | <b>Chapters to be Covered</b> | <b>Topics</b>                            | <b>HW Assigned</b> |
|--------------|------------|-------------------------------|--|--------------------|
| January      | 22         | Chp 1                         | Introduction                             |                    |
|              |            | Chp 2                         | Atomic Struc and Interatomic Bonding     | HW-1               |
| January      | 29         | Chp 3                         | Structures of Metals and Ceramics        | HW-2               |
| February     | 5          | Chp 4                         | Polymer Structures                       |                    |
|              |            | Chp 5                         | Imperfections in Solids                  | HW-3               |
| February     | 12         | Chp 5                         | Imperfections in Solids                  |                    |
|              |            | <b>Quiz 1</b>                 |  | HW-4               |
| February     | 19         | <b>EXAM 1</b>                 |  |                    |
| February     | 26         | Chp 7                         | Mechanical Properties                    | HW-5               |
| March        | 5          | Chp 8                         | Deformation and Strengthening Mechanisms | HW-6               |
| March        | 12         | <b>Quiz 2</b>                 |  |                    |
|              |            | Chp 10                        | Phase Diagrams                           |                    |

|       |    |                                  |   |      |
|-------|----|----------------------------------|---|------|
| March | 19 |                                  | SPRING RECESS - No Class  |      |
| March | 26 | Chp 10<br>Review Quiz            | Phase Diagrams  | HW-7 |
| April | 2  |                                  | Good Friday - No Class  |      |
|       |    | <b>EXAM 2</b>                    |   |      |
| April | 9  |                                  |   |      |
| April | 16 | Chp 11                           | Phase Transformations   |      |
| April | 23 | Chp 11<br>Student Presentations  | Phase Transformations   | HW-8 |
| April | 30 | <b>Quiz 3</b><br>Review Problems |   |      |
| May   | 4  | Chp 20<br>Review Problems        | Economic, Environmental and<br>Societal Issue in Materials<br>Science and Engineering | HW-9 |

**Final Exam TBA** (will take place during the May 7 - 13 / Final Exam period)

### **Disability Support Services**

If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.