

Fall 2024

METN 201-003: Intro Principles of Materials Engineering

Gennady Gor

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1. **MTEN 201 - Introductory Principles of Materials Engineering**
2. **Credits and contact hours:** 3 lecture hr/wk - 3 course credits
3. **Course Coordinator or Instructor:** Gennady Gor
4. **Textbook:** WileyPLUS: Fundamentals of Materials Science and Engineering: An Integrated Approach, 6th Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc.
ISBN13: 9781119764816 WileyPLUS one-term access
ISBN13: 9781119750499 WileyPLUS one-term access + loose leaf text

5. **Specific course information**

- a. **Description:** This course introduces the basic concepts of Materials Engineering, and covers introductory topics including structure, property, performance, and processing of materials. This course focuses on conventional materials including metallic materials and their alloys, ceramics, polymers, and composites. Relationship between structure and material properties, such as mechanical, electronic, thermal, optical, magnetic, and electrochemical, are investigated with a particular interest on ways to engineer material structures to produce desired set of properties. Broader themes associated with the property, processing and performance of materials that influence the economy, environment, and society are discussed.
- b. **Prerequisites:** CHEM 126, PHYS 121 or PHYS 122, MATH 112.
- c. **Required, Elective, or Selective Elective** - Required

6. **Specific goals for the course**

- a. A student should 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. Select appropriate materials for various applications
 12. Identify economic, environmental and societal issues in materials design and selection

MTEN 201 Introductory Principles of Materials Engineering (Fall 2024)

Instructor: Dr. Gennady Gor, Associate Professor, <https://people.njit.edu/faculty/gor>
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Teaching Assistant: Supun Rangana, Ph.D. student, E-mail: srh37@njit.edu;

Class: Monday, Friday, 10:00 AM – 11:20 AM; Room: Faculty Memorial Hall 108

Office Hours: Friday, 11:30 AM – 12:30 PM; Room: see the last page

Course Web Page: <https://njit.instructure.com/courses/42442>

Course Description and Requirements

This course introduces the basic concepts of Materials Engineering, and covers introductory topics including structure, property, performance, and processing of materials. This course focuses on conventional materials including metallic materials and their alloys, ceramics, polymers, and composites. Relationship between structure and material properties, such as mechanical, electronic, thermal, optical, magnetic, and electrochemical, are investigated with a particular interest on ways to engineer material structures to produce desired set of properties. Broader themes associated with the property, processing and performance of materials that influence the economy, environment, and society are discussed.

Pre-Requisites: CHEM 126, PHYS 121 or PHYS 122, MATH 112.

Course Objectives

Taking this course, a student should 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
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7. Interpret phase diagrams for determination of phases present and computation of phase compositions and amounts
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11. Select appropriate materials for various applications
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Learning Materials

Textbook Required: WileyPLUS: Fundamentals of Materials Science and Engineering: An Integrated Approach, 6th Edition, W.D. Callister, Jr., and D.G. Rethwisch, John Wiley and Sons, Inc.

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Other Learning Material: The textbook is the main source for preparing for classes and reading the textbook before each class is necessary. Additional materials will be posted on Canvas

<https://njit.instructure.com/courses/42442>

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

Course Outline

Class	Day	Date	Topic (preliminary, subject to changes)
1	F	6-Sep	Ch1. Introduction
2	M	9-Sep	Ch2. Atomic Structure and Interatomic Bonding
3	F	13-Sep	Ch2, Ch3. Structure of Metals and Ceramics
4	M	16-Sep	Ch3
5	F	20-Sep	Ch3
6	M	23-Sep	Quiz 1, Ch3
7	F	27-Sep	Practice Problems
8	M	30-Sep	Ch4. Polymer Structures
9	F	4-Oct	Ch4
10	M	7-Oct	Exam1
11	F	11-Oct	Ch4, Ch11. Polymer Crystallization and Glass Transition
12	M	14-Oct	Ch5. Imperfections in Solids
13	F	18-Oct	Ch7. Mechanical Properties
14	M	21-Oct	Quiz2, Ch7
15	F	25-Oct	Ch7
16	M	28-Oct	Ch7, Ch8. Deformation and Strengthening Mechanisms
17	F	1-Nov	Ch8, Ch10. Phase Diagrams
18	M	4-Nov	Exam2
19	F	8-Nov	Ch10
20	M	11-Nov	Ch10, Ch11. Phase Transformations
21	F	15-Nov	Ch11
22	M	18-Nov	Quiz3, Ch11
23	F	22-Nov	Ch11
24	M	25-Nov	Ch11
25	W	27-Nov	Ch11, Ch13, Types and Applications of Materials
26	M	2-Dec	Quiz4, Ch13, Ch14. Synthesis, Fabrication and Processing
27	F	6-Dec	Ch15. Composites
28	M	9-Dec	Ch20. Economic, Environmental and Social Issues
		15-Dec	Final exams begin
		21-Dec	Final exams end

Important Dates

- Midterm exams: October 7, November 4, 2024
The dates can be adjusted depending on the pace of the class and other circumstances
- Final exam: between December 15 and 21, 2024
- Last day to withdraw from classes: November 11, 2024

Assessment and Grading

Assignments: Homework assignments will be given using WileyPLUS or otherwise posted on Canvas. In class practice problems will also occasionally be assigned and will contribute to the assignment grade. Homework assignments (and practice problems) are graded and will be 10% of

the overall grade. While the in-class practice problems can be worked on with other students, the WileyPlus assignments must be completed independently.

Quizzes: Quizzes will be given in class. Quizzes are closed book and notes, though an equation sheet will be provided. Quizzes are 20% of the total grade and the lowest quiz grade will be dropped.

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 and notes, though an equation sheet will be provided.

Late submissions: Late submissions will not be accepted.

Missed assignments: If a student missing an in-class assignment (activity, quiz or an exam) they receive zero for the missed assignment, unless there is a documentation from the Dean of Students, confirming an excused absence. In this case the student will be allowed to take a make-up quiz, make-up exam, or make-up activity. Note that the assignment on the make-up quiz (activity, exam) will differ from the original assignment. The opportunity to take a make-up quiz (activity, exam) will be offered only during the official office hours within two weeks after the missed quiz or after the student's return from absence (whichever is later).

Assignments	10%
Quizzes	20%
Midterm Exam 1	20%
Midterm Exam 2	20%
Final Exam	30%
	100%

Percent	Grades
$\geq 90\%$	A
$\geq 85\%$	B+
$\geq 80\%$	B
$\geq 70\%$	C+
$\geq 60\%$	C
$\geq 50\%$	D
$< 50\%$	F

Policies

Statement on Academic Integrity: (as formulated by Provost Pelesko) “*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”

More on Academic Integrity Among other things, the following actions are considered violations of academic integrity:

- Cooperation on any of the graded assignments
- Using online resources (e.g. Chegg) to solve graded assignments
- Sharing or posting online any course resources or assignments without an explicit permission of the instructor

Special Needs: If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit us in Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.

In-class Policies

- Attendance is strongly recommended and will be recorded. The examples discussed in the class are not necessarily from the main textbook and therefore missing a class will have consequences for preparation to quizzes and exams.
- The classes start at 10:00, and the students must be in class by that time.
- Electronic devices other than laptops (tablets, cell-phones etc.) are not permitted during the classes.
- Laptops will be permitted only when necessary for in-class activities.
- No photo, audio or video recording is allowed without an explicit permission.
- Cellphones should be turned off during lectures, in-class activities, quizzes and exams and their use is not allowed unless specifically permitted by the instructor.
- Eating is not allowed any time during the classes.

Course materials, office hours and correspondence

- The course Canvas page is the main platform for delivering information about the course. All relevant course materials and assignments will be posted on Canvas, so a student should check it regularly: <https://njit.instructure.com/courses/42442>
- The students have to upload a professional-looking head shot for their Canvas profile.
- The students are strongly encouraged to attend Office Hours.
- Questions regarding grades can be discussed only during the Office Hours.
- All the communications should be done via Canvas (not email), so that a TA has an opportunity to help.
- All communication should be conducted in a professional style, using formal English.

Exams, Quizzes, Homeworks and Grades

- A letter grade is based on the final score, calculated using an Excel spreadsheet in accordance with the Tables given in this syllabus. The assigned letter grade is final and cannot be negotiated.
- There is no curve.
- A student can dispute the exam scores within a week after the announcement of the score. Exam scores can be disputed during the official Office Hours, not during class time or via email.
- The graded exams must be returned within a week to be saved for the department course assessment initiative. If a student does not return the exam, the grade for this exam is zeroed.
- Students will get zero for not coming to quizzes, exams, or any other course activity. If students miss an exam due to extreme circumstances (such as a medical problem), they need to notify the instructor via email before the beginning of the exam, and bring proof of the circumstance to the Dean of Student's office. Only in the case of official approval from the Dean of Student's office, may a make-up be given at the discretion of the instructor.

- A student must show as many details when solving a problem during an exam or a quiz. Not showing the work will cause losing points even if the final answer is correct.
- Partial credits can be given for solving the exams problems.
- No partial credit will be given if there is not enough details to follow.
- The final answer should be always evaluated with respect to its reasonability. No partial credit will be given if the final answer is wrong and unreasonable, and it is not stated.
- Student handwriting must be legible in order to receive points.

Office Hours: Friday, 11:30 AM – 12:30 PM; locations are given below, rooms are in Tiernan Hall

Date	Room
09/06	321A
09/13	321A
09/20	150
09/27	373
10/04	373
10/11	150
10/18	373
10/25	373
11/01	373
11/08	150
11/15	373
11/22	373
12/06	150