

Spring 2022

## **MTSE 301-002: Materials Science**

N. Ravindra

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Principles of Material Science and Engineering - MTSE 301-002Instructor:

Prof. N.M. Ravindra (Ravi)

Lab: TIER 414

Tel: 973 596-3278/6453

E-mail: [nmravindra@gmail.com](mailto:nmravindra@gmail.com)Course Facilitator:

Mr. Haizheng Zhuang

PhD Candidate, Materials Science &amp; Engineering

Email Address: [hz444@njit.edu](mailto:hz444@njit.edu)

## Class meeting schedule:

	<u>Face-to-Face</u>	
<u>Book</u> 002 14468	M	02:30 PM - 03:50 PM
	R	02:30 PM - 03:50 PM

KUPF 202

Office Hours:

Ravi: Fridays 2 to 3 PM; Tiernan Building - 414

Haizheng: Thursdays – 1 to 3 PM; Tiernan Building – 323 D

Online Meetings

Webex platform will be used for online meetings. Conference invitation messages for the class meetings will be sent to your NJIT email addresses. WebEx meetings will take place at:

<https://njit.webex.com/meet/ravindra>

**PREREQUISITE:** Phys 111 and Phys 121, Chem 125 and Chem 126, Math 111 and Math 112 or equivalent.

**TEXTBOOK:** “FOUNDATIONS OF MATERIAL SCIENCE AND ENGINEERING” *William F. Smith, Javad Hashemi, Sixth Edition (or Fifth Edition), McGraw-Hill, Inc.*

**YOUR FINAL LETTER GRADE** in MTSE 301 will be based on a composite score for term’s work that includes one midterm exams, final exam, lecture quizzes and homework. Here are the approximate weights to be used for calculating the composite score:

**Exam 1 = 25% Exam 2 = 25% Final Exam = 30% Homework = 10% Lecture Quizzes = 10%**

**The conversion of numerical to letter grades is as follows:**

> 80% A; >75% to 80% B+; >66 %to 75% B; >58%-66% C+; >50%-58% C; <50% D and <40% F.

## COURSE POLICIES

In order to insure consistency and fairness in application of the NJIT policy on withdrawals, student requests for withdrawals after the deadline (*end of the 10th week of classes*) will not be permitted unless extenuating circumstances are documented **through the Office of the Dean of Students**. The course instructor and the Dean of Students are the principal points of contact for students considering withdrawing from a course. When a student invokes extenuating circumstances for any reason (late withdrawal from a course, request for a make-up exam, request for an Incomplete grade) the student should contact the Dean of Students Office.

**Missed lecture quizzes:** There are no make-ups for in-class activities. If you miss a lecture quiz, you will receive a grade of zero.

## HONOR 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: <http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.*

*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) ”*

## **LEARNING OUTCOMES**

For this course, you can expect to be assessed on the following learning outcomes:

1. Comprehend the interrelations among structure, properties and performance of engineering materials.
2. Apply the principles of crystallography to understand the structure of materials.
3. Understand the effect of solid-state imperfections on diffusion and mechanical properties of materials.
4. Analyze phase diagrams of binary alloy systems.
5. Understand the mechanical, electrical and optical properties of metals, semiconductors, ceramics and polymers
6. Apply the equations governing different processes in solid materials. Calculate unknown quantities based on physical relationships, boundary conditions, and known quantities.

**COUNSELING AND ACADEMIC SUPPORT:** The Center for Counseling and Psychological Services is committed to assisting students experiencing high levels of personal challenge and stress. If you need accommodations due to a disability, please contact Ms. Chantonette Lyles, Associate Director of Disability Support Services, Fenster Hall Room 260 to discuss your specific needs.

## Course Outline

Week 1,2- Introduction to Nature, Matter & Materials

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Week 2- Atomic Structure and Bonds

Chapt. 2 Sect. 2.1 – 2.4 (5<sup>th</sup>)

Chapt. 2 Sect. 2.5 – 2.6 (6<sup>th</sup>)

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Week 3 - Crystal and Amorphous Structure in Materials

Chapt. 3 Sect. 3.1 – 3.6 (5<sup>th</sup>)

Chapt. 3 Sect. 3.9 – 3.12 (6<sup>th</sup>)

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Week 4 - Solidification, Crystalline Imperfections, Diffusion in Solids

Chapt. 4 Sect. 4.1 – 4.5 (5<sup>th</sup>)

Chapt. 5 Sect. 5.1 – 5.4 (6<sup>th</sup>)

(5<sup>th</sup>)

(6<sup>th</sup>)

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Week 5 - Mechanical Properties of Metals I

Chapt. 6 Sect.6.1 – 6.5 (5<sup>th</sup>)

Chapt. 6 Sect. 6.6 – 6.10 (6<sup>th</sup>)

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### **EXAM 1**

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Week 6 - Mechanical Properties of Metals II

Chapt. 7 Sect. 7.1 – 7.7 (5<sup>th</sup>)

(6<sup>th</sup>)

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Week 7 - Phase Diagrams, Engineering Alloys

Chapt. 8 Sect. 8.1 – 8.10 (5<sup>th</sup>)

(6<sup>th</sup>)

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Week 8 - Engineering Alloys

Chapt. 9 Sect. 9.2 – 9.4, 8 (5<sup>th</sup>)

Chapt. 9 Sect. 9.5 – 9.7, 9 (6<sup>th</sup>)

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Week 9 - Polymeric Materials

Chapt. 10 Sect. 10.1 – 10.4 (5<sup>th</sup>)

Chapt. 10 Sect. 10.6, 10.10-10.12 (6<sup>th</sup>)

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Week 10 - Ceramics

Chapt. 11 Sect. 11.1 – 11.5 (5<sup>th</sup>)

Chapt. 11 Sect. 11.6 – 11.11 (6<sup>th</sup>)

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## EXAM 2

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### *Week 11* - Composite Materials

Chapt. 12 Sect. 12.1 – 12.3 (5<sup>th</sup>)

Chapt. 12 Sect. 12.10 – 12.11 (6<sup>th</sup>)

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### *Week 12* - Corrosion

Chapt. 13 Sect. 13.1 – 13.4 (5<sup>th</sup>)

Chapt. 13 Sect. 13.4 – 13.7 (6<sup>th</sup>)

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### *Week 13* - Electrical Properties of Materials

Chapt. 14 Sect. 14.1 – 14.3 (5<sup>th</sup>)

Chapt. 14 Sect. 14.4 - 14.6

Chapt. 14. Sect. 14.7 – 14.8 (6<sup>th</sup>)

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### *Week 14* - Optical Properties of Materials

Chapt. 15 Sect 15.1 – 15.4 (5<sup>th</sup>)

Chapt. 15 Sect 15.5 – 15.7 (6<sup>th</sup>)

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### *Week 14* - Biological Materials and Biomaterials

Chapt. 17 Sect.17.1- 17.8

Reading only

Review – Q&A Session

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## Final Exams

## Spring 2022 Academic Calendar

January	17	Monday	Martin Luther King, Jr. Day
January	18	Tuesday	First Day of Classes
January	22	Saturday	Saturday Classes Begin
January	24	Monday	Last Day to Add/Drop a Class
January	24	Monday	Last Day for 100% Refund, Full or Partial Withdrawal
January	25	Tuesday	W Grades Posted for Course Withdrawals
January	31	Monday	Last Day for 90% Refund, Full or Partial Withdrawal, No Refund for Partial Withdrawal after this date
February	14	Monday	Last Day for 50% Refund, Full Withdrawal
March	7	Monday	Last Day for 25% Refund, Full Withdrawal
March	14	Monday	Spring Recess Begins - No Classes Scheduled - University Open
March	19	Saturday	Spring Recess Ends
April	4	Monday	Last Day to Withdraw
April	15	Friday	Good Friday - No Classes Scheduled - University Closed
April	17	Sunday	Easter Sunday - No Classes Scheduled - University Closed
May	3	Tuesday	Friday Classes Meet
May	3	Tuesday	Last Day of Classes
May	4	Wednesday	Reading Day 1
May	5	Thursday	Reading Day 2
May	6	Friday	Final Exams Begin
May	12	Thursday	Final Exams End
May	14	Saturday	Final Grades Due
May		TBA	Commencement