Fall 2021

MTSE 301-003: Principles of Material Science and Engineering

N. M. Ravindra

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Principles of Material Science and Engineering - MTSE 301 003

Instructor:
Prof. N.M. Ravindra (Ravi)
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E-mail: nmravindra@gmail.com

Course Facilitator:
Mr. Haizheng Zhuang
PhD Candidate, Materials Science & Engineering
Email Address: hz444@njit.edu

Class meeting schedule:

<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Face-to-Face</strong></td>
<td></td>
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<tr>
<td>Book 003 94780</td>
<td><strong>M</strong> 02:30 PM - 03:50 PM</td>
<td><strong>KUPF 117</strong></td>
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<tr>
<td></td>
<td><strong>R</strong> 02:30 PM - 03:50 PM</td>
<td><strong>CKB 204</strong></td>
</tr>
</tbody>
</table>

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.


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”

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 - Introduction to Nature, Matter & Materials**

**Week 2 - Atomic Structure and Bonds**
- Chapt. 2 Sect. 2.1 – 2.4 (5th)
- Chapt. 2 Sect. 2.5 – 2.6 (6th)

**Week 3 - Crystal and Amorphous Structure in Materials**
- Chapt. 3 Sect. 3.1 – 3.6 (5th)
- Chapt. 3 Sect. 3.9 – 3.12 (6th)

**Week 4 - Solidification, Crystalline Imperfections, Diffusion in Solids**
- Chapt. 4 Sect. 4.1 – 4.5 (5th)
- Chapt. 5 Sect. 5.1 – 5.4 (6th)

**Week 5 - Mechanical Properties of Metals I**
- Chapt. 6 Sect. 6.1 – 6.5 (5th)
- Chapt. 6 Sect. 6.6 – 6.10 (6th)

EXAM 1

**Week 6 - Mechanical Properties of Metals II**
- Chapt. 7 Sect. 7.1 – 7.7 (5th) (6th)

**Week 7 - Phase Diagrams, Engineering Alloys**
- Chapt. 8 Sect. 8.1 – 8.10 (5th) (6th)

**Week 8 - Engineering Alloys**
- Chapt. 9 Sect. 9.2 – 9.4, 8 (5th)
- Chapt. 9 Sect. 9.5 – 9.7, 9 (6th)

**Week 9 - Polymeric Materials**
- Chapt. 10 Sect. 10.1 – 10.4 (5th)
- Chapt. 10 Sect. 10.6, 10.10-10.12 (6th)

**Week 10 - Ceramics**
- Chapt. 11 Sect. 11.1 – 11.5 (5th)
- Chapt. 11 Sect. 11.6 – 11.11 (6th)
## EXAM 2

### Week 11 - Composite Materials
- Chapt. 12 Sect. 12.1 – 12.3  
  *(5th)*
- Chapt. 12 Sect. 12.10 – 12.11  
  *(6th)*

### Week 12 - Corrosion
- Chapt. 13 Sect. 13.1 – 13.4  
  *(5th)*
- Chapt. 13 Sect. 13.4 – 13.7  
  *(6th)*

### Week 13 - Electrical Properties of Materials
  *(5th)*
- Chapt. 14 Sect. 14.4 - 14.6
  *(6th)*

### Week 14 - Optical Properties of Materials
- Chapt. 15 Sect 15.1 – 15.4  
  *(5th)*
- Chapt. 15 Sect 15.5 – 15.7  
  *(6th)*

### 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
<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>September</td>
<td>1 Wednesday</td>
<td>First Day of Classes</td>
</tr>
<tr>
<td>September</td>
<td>4 Saturday</td>
<td>Saturday Classes Begin</td>
</tr>
<tr>
<td>September</td>
<td>6 Monday</td>
<td>Labor Day</td>
</tr>
<tr>
<td>September</td>
<td>8 Wednesday</td>
<td>Monday Classes Meet</td>
</tr>
<tr>
<td>September</td>
<td>8 Wednesday</td>
<td>Last Day to Add/Drop a Class</td>
</tr>
<tr>
<td>September</td>
<td>8 Wednesday</td>
<td>Last Day for 100% Refund, Full or Partial Withdrawal</td>
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<tr>
<td>September</td>
<td>9 Thursday</td>
<td>W Grades Posted for Course Withdrawals</td>
</tr>
<tr>
<td>September</td>
<td>15 Wednesday</td>
<td>Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date</td>
</tr>
<tr>
<td>September</td>
<td>29 Wednesday</td>
<td>Last Day for 50% Refund, Full Withdrawal</td>
</tr>
<tr>
<td>October</td>
<td>20 Wednesday</td>
<td>Last Day for 25% Refund, Full Withdrawal</td>
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<tr>
<td>November</td>
<td>10 Wednesday</td>
<td>Last Day to Withdraw from Classes</td>
</tr>
<tr>
<td>November</td>
<td>25 Thursday</td>
<td>Thanksgiving Recess Begins</td>
</tr>
<tr>
<td>November</td>
<td>28 Sunday</td>
<td>Thanksgiving Recess Ends</td>
</tr>
<tr>
<td>December</td>
<td>10 Friday</td>
<td>Last Day of Classes</td>
</tr>
<tr>
<td>December</td>
<td>11 Saturday</td>
<td>Saturday Classes Meet</td>
</tr>
<tr>
<td>December</td>
<td>12 Sunday</td>
<td>Sunday Classes Meet</td>
</tr>
<tr>
<td>December</td>
<td>13 Monday</td>
<td>Reading Day 1</td>
</tr>
<tr>
<td>December</td>
<td>14 Tuesday</td>
<td>Reading Day 2</td>
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<tr>
<td>December</td>
<td>15 Wednesday</td>
<td>Final Exams Begin</td>
</tr>
<tr>
<td>December</td>
<td>21 Tuesday</td>
<td>Final Exams End</td>
</tr>
<tr>
<td>December</td>
<td>23 Thursday</td>
<td>Final Grades Due</td>
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</table>