INSTRUCTOR
Dr. Reza Mirshams
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Email Subject Line: ENGR 3450 – Fall 2015
Office hours: Wednesdays 10:30 – 11:30 AM. You may make an appointment at possible convenient times.

CATALOG COURSE DESCRIPTION
3 Credit hours (3 contact hours per week)
Principles of bonding, structure, and structure/property relationships for metals and their alloys, ceramics, polymers and composites. Emphasis on properties and how processes change structure and, consequently, properties.
Prerequisites: PHYS 1710; CHEM 1410/1430 or CHEM 1415/1435.

ENGR 3451-Engineering Materials Laboratory is required for MET and MEE Majors

COURSE LEARNING OBJECTIVES (CLOs)
Engineers and engineering technologists design products and the processing systems for their production. As materials are required to produce the designed components, engineers and engineering technologists should be knowledgeable about the properties and performance of materials in service. With the completion of this course, you will learn the fundamental scientific knowledge about materials for engineering applications and effects of processing on their internal microstructure and properties, so you can select the most suitable ones for various application and evaluate basic causes of materials failure in service.

The students who complete the course will know:
1. Interrelationships of Processing-Structure-Properties-Performance in Solid Materials
2. Fundamentals of Materials Selection for Engineering Applications
3. Fundamental Knowledge for Evaluation and Analysis of Materials Failure

Information about Student Learning Outcomes (SLOs) and teaching strategies are in the APPENDIX I.

COURSE MATERIALS AND RESOURCES

REQUIRED TEXTBOOK (print or online version)

LECTURES SLIDES
- I will post my lecture slides on UNT Blackboard website http://learn.unt.edu prior to the lecture for you to print and take notes on them.
- Some of the classes will be as “flipped classes”. For these classes, your “homework” will be to watch pre-recorded lectures or/and the in-class period will be a chance to ask questions and work problems.
HANDOUTS AND REFERENCES

- Occasionally, I will supply additional handouts and references.

ASSESSMENT METHODOLOGY

- Homework (Every Week)
- Quizzes (Every 2 Weeks)
- Midterm Exam
- Comprehensive Final Exam

HOMEWORK:

- Homework assignments will be online through UNT Blackboard.
- Number of questions in each homework will be varied. However, each question will have 10 points value.
- The lowest 2 homework assignments will be dropped.
- Suggested solutions will be provided on the course website.
- No late homework will be accepted.
- No make-up on homework assignments.
- Discussion and exchange of ideas are important parts of the learning process and I encourage collaboration. However, you must be sure the work you submit for grading is your own. Submitted works that are copies from solution manuals or website solutions or your classmates will be treated as plagiarism.

QUIZZES:

- Quizzes will be in the class (first 15 minutes) or on UNT Blackboard.
- Number of questions in each quiz will be varied. However, each question will have 10 points to 20 points value.
- There will be quizzes every 2 weeks, except in the exam weeks.
- The lowest 3 quiz grades will be dropped.
- Group collaboration and submission would be allowed in some quizzes.
- No make-up on quizzes.

EXAMS:

- Exam grades will be on percentage of total points of correct answers.
- Exams questions will be on topics have been discussed in the class lectures.
- Exam review sessions will be offered on (TBD).
- Class exams are written and closed textbook and notebooks.
- It will be helpful to bring a ruler for solving graphical problems. It will not been allowed to use a laptop or an iPhone or any other handheld computers and cell phones during the exams and quizzes. Use of such devices during the exam and quizzes will be considered plagiarism. Of course, you are allowed to bring an inexpensive scientific/engineering calculator. However, sharing calculators during the exams will not be permitted.
- Grades are based in part on the student's ability to communicate. You must present your entire solution in an orderly way for a problem if it is required. Grade points will not be assigned only on the final answers. You must show complete process of your solution. Partial credits will be assigned for correct steps have been taken in a solution.
- No make-up will be given for the scheduled exams, unless the student has a legitimate excuse documented properly (e.g., letter from court clerk that he/she must appear in a court, letter from physician that he/she is sick).
- Requests for the review of graded exam or quiz problems must be made the day the exam/quiz is handed back. Once class is dismissed, regrade requests will not be accepted.
EVALUATION AND GRADING POLICY

EVALUATION SCALE
Class Attendance and Participation (instructor’s discretion) 5%
Homework 15%
Quizzes 20%
Midterm Exam (October 1, 2015) 30%
Final Exam (December 8, 11:00 AM – 1:00 PM) 30%

GRADING POLICY
A: 90 % - 100%
B: 75% - 89 %
C: 60% - 74%
D: 50% - 59%
F: Below 55%

ADDITIONAL COURSE POLICIES AND INFORMATION
1. Class Attendance: Attendance is required for the class hours.
2. Syllabus updates: This syllabus is subject to change at any time during the semester with changes to be announced during the class hours.
3. Classroom Use of Communication Devices: Cell phones, iPhones, iPods, iPads, laptops, and tablets must be turned off or in silent mode before the start of the class and left in your pocket, purse, or book bag. Cell phones are not to be on the desks during quizzes or examinations.
4. Dishonesty: The UNT Catalog procedures on cheating and plagiarism will be vigorously enforced. It is the duty of each student to protect their work so it is not available to others for submission as their efforts. This is especially true of files that are generated on the computer. Students that knowingly allow others to use their work are partners in this unethical behavior. All rules relating to academic dishonesty will be enforced in accordance with University policies. Use of cell phones, iPhones, iPods, iPads, laptops, and tablets are prohibited during the class exams and quizzes.

The Instructor also has the discretion to assign a failing grade to portions of an assessment, a whole assessment, or the whole course depending on the severity of the event.

5. Distribution of Course materials: State common law and federal copyright laws protect this course lectures and materials. They have my own original expression and revisions to the textbook author(s) and I record them at the same time that I deliver them in order. Whereas you are authorized to take notes in class, thereby creating a derivative work from my lecture, and/or make a print of my lecture notes/slides. The authorization extends only to making one set of notes for your own personal use and no other use. You are not authorized to record my lectures, to provide your notes to anyone else or to make any commercial use of them without express prior permission from me.

6. End of Semester Course Evaluations: Students course evaluations are a requirement for all organized courses at UNT. This survey will be made available at the end of the semester, providing you a chance to comment on how this class is taught. I am very interested in the feedback from students, as I work to continually improve this course and my teaching. I consider this evaluation to be an important part of your input to this class.

7. Disabilities Accommodation: The University of North Texas complies with Section 504 of the 1973 Rehabilitation Act and with the Americans with Disabilities Act of 1990. The University of North Texas provides academic adjustments and auxiliary aids to individuals with disabilities, as defined
under the law. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please see the instructor and/or contact the Office of Disability Accommodation at 940-565-4323 during the first week of class.

8. **On Work and Academics** “Work, sleep, friends – choose two (author unknown)”: A typical 3-credit class, meeting 3 hours per week, may require on average 5-7 additional hours of work per week that includes reading/catching up from the previous class and revising notes; preparation for the next class meeting, that is, reading ahead and formulating questions; solving additional practice problems; preparing for lab work (for example, pre-lab designs) and writing lab reports (applicable to courses with a lab component); and taking care of homework assignments. The total is 8-10 hours per week per course. Hence, a student taking a full-time load of say 12 credits (four 3-credit classes) requires on average 32-40 hours of academic work per week leaving time for socializing and even some part-time work; this is why it is called a full-time academic load. Trying to fit a full-time or even a substantial part-time job always takes a toll especially during exams and project due-dates. My advice is that your academic load needs to be carefully balanced with all other non-academic activities, and accept the fact that if you work, then you must be a part-time student.

9. **Campus Resources for Student Success** To learn more about campus resources and information on how you can achieve success, go to https://success.unt.edu.
## APPENDIX I
### Student Learning Outcomes and Teaching Strategy
#### ENGR 3450 – Engineering Materials

<table>
<thead>
<tr>
<th>OUTCOMES</th>
<th>ASSESSMENT</th>
<th>INSTRUCTION</th>
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| 1. Students will understand interrelationships of processing-structure-properties-performance in solid materials  
1.1. Demonstrate the ability to relate materials properties and microstructure by  
1.1.1. Relate bond energy to properties of engineering materials  
1.1.2. Analyze crystalline structures  
1.1.3. Calculate Miller Indices, Packing Factor, and Density of Selected Unit Cells.  
1.1.4. Understand crystals imperfections  
1.1.5. Explain the process of work hardening and Schmidt’s Law  
1.1.6. Illustrate understanding of atomic scale diffusion of atoms  
1.1.7. Interpret mechanical properties, including yield strength, ultimate tensile strength, and elastic modulus from engineering plots of $\sigma$–$\varepsilon$  
1.2. Demonstrate understanding the relationships of processing and microstructure by  
1.2.1. Illustrate contributions of various strengthening mechanisms, including solid solution strengthening, precipitation strengthening, strain hardening, and grain size strengthening relationship.  
1.2.2. Explain a phase diagram, including determining phase diagram type, predict phase compositions (given various temperatures and compositions), and predict microstructures for given compositions.  
1.2.3. Demonstrate understanding of heat-treatment of steels and cast irons  
2. Fundamentals of materials selection for engineering applications  
2.1. Demonstrate knowledge of engineering materials by  
2.1.1. Classify various engineering materials: Ceramics; Polymers; Composites  
2.1.2. Conduct and present a materials selection survey as part of a team for current materials applications  
3. Evaluate and analyze of materials failure  
3.1. Demonstrate understanding of various materials failure mechanisms by  
3.1.1. Describe the type of failure as Mechanical or Degradation  
3.1.2. Characterize the type of failure  
3.1.3. Analyze the possible process for materials failure | Formative Tests:  
- Multiple choice,  
- Extended questions (problem solving, mini projects, presentation)  
Summative Tests:  
- Midterm Exam  
- Final Comprehensive Exam | - Lectures  
- Homework (in and out of class, some group work)  
- Quizzes (in class)  
- Some video clips  
- Reading textbook  
- Reading other course Materials  
- Some “flipped class” sessions |
## APPENDIX II
### Course Calendar
*(May be adjusted during the semester)*

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<tr>
<th>Fall 2014 Schedule</th>
<th>Lecture Topic</th>
<th>Readings</th>
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<tr>
<td>Week 1</td>
<td>25-Aug Orientation and Introduction</td>
<td>Chapter 1</td>
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<td>27-Aug Atomic Structure and Bonding</td>
<td>Chapter 2</td>
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<td>Week 2</td>
<td>1-Sep Atomic and Ionic Arrangements</td>
<td>Chapter 3</td>
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<td>3-Sep Crystalline Structures</td>
<td>Chapter 3</td>
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<td>Week 3</td>
<td>8-Sep Practice</td>
<td>Chapter 3</td>
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<td>10-Sep Imperfections in Crystalline Structures</td>
<td>Chapter 4</td>
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<td>Week 4</td>
<td>15-Sep Atom and Ion Movements</td>
<td>Chapter 5</td>
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<td>17-Sep Mechanical Properties</td>
<td>Chapter 6</td>
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<tr>
<td>Week 5</td>
<td>22-Sep Mechanical Properties</td>
<td>Chapter 6</td>
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<td>24-Sep Mechanical Properties</td>
<td>Chapter 7</td>
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<td>Week 6</td>
<td>29-Sep Review for Midterm Exam</td>
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<td>1-Oct <strong>Midterm Exam</strong></td>
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<tr>
<td>Week 7</td>
<td>6-Oct Strain hardening and Annealing</td>
<td>Chapter 8</td>
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<td>8-Oct Strain hardening and Annealing</td>
<td>chapter 8</td>
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<td>Week 8</td>
<td>13-Oct Basics of Solidifications and Casting Process</td>
<td>Chapter 9</td>
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<td>15-Oct Phase Diagrams</td>
<td>Chapter 10</td>
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<tr>
<td>Week 9</td>
<td>20-Oct Phase Diagrams</td>
<td>Chapter 10</td>
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<td>22-Oct Hardening Processes and Heat Treatments</td>
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<tr>
<td>Week 10</td>
<td>27-Oct Dispersion and Age Hardening process</td>
<td>Chapter 12</td>
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<tr>
<td></td>
<td>29-Oct Dispersion and Age Hardening process</td>
<td>Chapter 12</td>
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<tr>
<td>Week 11</td>
<td>3-Nov Heat Treatment of Steels</td>
<td>Chapter 13</td>
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<td>5-Nov Heat Treatment of Steels</td>
<td>Chapter 13</td>
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<tr>
<td>Week 12</td>
<td>10-Nov Nonferrous Alloys</td>
<td>Chapter 14</td>
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<td>12-Nov Ceramic Materials</td>
<td>Chapter 15</td>
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<td>Week 13</td>
<td>17-Nov Polymers and Composites</td>
<td>Chapters 16 &amp; 17</td>
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<td>19-Nov Basics of Materials Selections for Design</td>
<td>Handout</td>
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<tr>
<td>Week 14</td>
<td>24-Nov Materials Performance and Failure</td>
<td>Chapter 18</td>
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<td>26-Nov Thanks Giving Holiday</td>
<td>Handout</td>
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<td>Week 15</td>
<td>1-Dec Case Studies</td>
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<td>3-Dec Pre-Final Week, Review</td>
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<td>Week 16</td>
<td>8-Dec Final Exam, 11:00 AM -1:00 PM</td>
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