MTSE 3000.004  
“Fundamentals of Materials Science and Engineering”  
Spring Semester 2018 – 3 credit hours

*Primary communication method with the instructor is “Message” on Blackboard.*  
If you send me a message on Blackboard/Learn, I will try to respond within 48 hours.

Instructor: Dr. Diana Berman, Office: E102, Discovery Park  
E-mail: Diana.Berman@unt.edu  Phone: 940-891-6778  
Office Hours: Tuesday 10:00 am - 11:00 am; Wednesday 2:00 pm – 3:00 pm and by appointment  
Lecture: Tuesday and Thursday, 8:30 a.m. – 9:50 a.m.  
Location: UNT Discovery Park, Room B190  
Other Suggested Textbooks: Introduction to Materials Science for Engineers, by Shackleford, Prentice Hall  

Teaching Assistant: Asghar Shirani  E-mail: AsgharShirani@my.unt.edu  
Study/Tutor Room: Wednesday, 2:00 pm – 5:00 pm and by appointment, UNT Discovery Park, Room E136

Course Description  
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.  

Brief list of topics to be covered

I. Electronic and Atomic Structure and Bonding  
   Atomic Structure  
   Bonding Types and correlations with properties

II. Material Building Blocks  
   Crystalline Structures (Metals and Ceramics)  
   Miller Indices  
   Single Crystals  
   Polycrystalline materials  
   Non-crystalline materials  
   Polymeric Structures  
   Defects

III. On Microstructure-Property Relationships  
    Mechanical Properties  
    Deformation and Strengthening Mechanisms

IV. On Microstructural Evolution  
    Phase Diagrams  
    Diffusion  
    Phase Transformations

V. Materials in Application  
   Failure and Corrosion
Material Applications and Processing
Team Presentations on Material Applications

VI. Other Considerations (environment, health, availability, design)
Electrical, Thermal, Magnetic and Optical Properties
Characterization

**Course (Learning) Objectives:**
1. Demonstrate ability to relate bond energy to properties of engineering materials.
2. Interpret various crystal structures using Miller Indices for planes and directions.
3. Determine contributions of various strengthening mechanisms, including solid solution strengthening, precipitation strengthening, strain hardening, and grain size strengthening (the Hall-Petch relationship).
4. Demonstrate ability to read a phase diagram, including determining phase diagram type, predict phase compositions (given $c_0$ and $T$), and predict microstructures for given compositions.
5. Interpret mechanical properties, including yield strength, ultimate tensile strength, and elastic modulus from engineering plots of $\sigma$-$\varepsilon$.
6. Exhibit awareness of societal implications associated with various materials, including specifically occupational safety and health and global availabilities of commodity material.
7. Conduct and present a material selection survey as part of a team for current materials applications.

**Course Outcome:**
1. An ability to apply knowledge of mathematics, science, and engineering, and the ability to apply and integrate knowledge of structure, properties, processing, and performance to solve materials selection and design problems within realistic constraints. (Course Objectives 1,2,3,4,5,7)
2. An ability to design and conduct experiments, as well as to analyze and interpret data (Course Objectives 1,2,4,5)
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. (Course Objective 7)
4. An ability to function on multi-disciplinary teams. (Course Objective 7)
5. An ability to identify, formulate, and solve engineering problems. (Course Objective 7)
6. An understanding of professional and ethical responsibility. (Course Objective 7)
7. An ability to communicate effectively. (Course Objective 7)
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. (Course Objectives 6,7)
9. A knowledge of contemporary issues. (Course Objectives 2,6,7)

**Lecture Notes will be posted on blackboard:** Lectures, homework assignments, and solutions will be posted on Blackboard [http://learn.unt.edu](http://learn.unt.edu).

**Notes:**
1. BlackBoard will be used as the primary communication tool. It will be used exclusively for posting homework assignments, homework solutions, topical coverage of each exam, formula sheets for exams, and grades.
2. Your assignments and exams will be graded within two weeks after the due date or the day of the exam. If you see that your grade is not posted on Blackboard, the assignment or exam has not been graded. Late assignments (homework or project) will NOT be accepted.
3. Each quiz will be limited to one or two problems with a time limit of 15 minutes. The content will be based on recent homework problems and sample problems gone over in class.
4. Each exam will include a combination of (A) multiple choice questions, (B) short answer questions, and (C) quantitative problems.
5. The final exam will be comprehensive, but it will be weighted equally with the other exams to determine the exam average component of the grade.
6. For all exams and quizzes, the only thing you may use during the exam is a calculator (plus a pencil, pen, and/or eraser). Earphones, cell phones, laptops, etc. will not be allowed.

**Team Project:**
For the project, there will be a final paper (10%) and a presentation (10%). On the last examination, you will score your team members according to both their participation and their accuracy.

**Calculators:** Programmable calculators are not allowed. Sharing of calculators is not allowed. Bring them to quizzes and exams. You must have an inexpensive scientific calculator that can solve:
- Trig functions (SIN, COS, TAN)
- Exponentials (e^x)
- Square Root
- x^y
- Natural Logs (LN)
- Logs (LOG)
- Inverse

**Cell Phones:** All cell phones and other electronic communication devices are not to be used during class time and should remain “out-of-sight” during class time. Please demonstrate your respect by not texting, checking messages, etc. during class time.

**Prerequisites:** PHYS 1710. CHEM 1410/CHEM 1430 or CHEM 1415/CHEM 1435.

**Tentative Grading Scheme with weight percent contributions to the final grade (subject to change):**
- Homework Average: 10%
- Quiz Average: 10%
- Exam Average: 60%
- Team Project: 20%

**Makeup Exam Policy:** If a student cannot take an exam on the scheduled date due to some unavoidable circumstances, such as out of town business trip, sickness, etc., then he/she must notify the instructor in writing before the scheduled exam time to schedule a makeup exam. If allowed, a 10% penalty will be assessed.

**Class Attendance is Mandatory.** Regular attendance in class and active listening/participating in classroom discussion is necessary for optimal learning. Please notify me if you have to miss a class or will be late. Additional pop-quizzes may be given due to overall classroom attendance and participation.

**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.

**Additional Policies**

**Authorized Absences and Extenuating Circumstances**

Absences due to extenuating circumstances or participation in sponsored must be verified by the Dean of Students. Consideration of such absences will be made for quizzes and examinations, but not homework. For participation in sponsored activities, you must seek approval prior to the absence. For extenuating circumstances, you have 1 week to contact me and/or the Dean of Students to begin the process.

**Absence for Religious Holidays**

In accordance with state law, a student absent due to the observance of a religious holiday may take examinations or complete assignments scheduled for the day(s) missed, including those missed for travel, within a reasonable time after the absence. The student is responsible to notify the instructor of each class of the date of the anticipated absence as early in the semester as possible. Only holidays or holy days observed by a religion whose place of worship is exempt from property taxation under Section 11.20 of the Tax Code may be included. A student who is excused under this provision may not be penalized for the absence.

**Academic Integrity** — Plagiarism and cheating will NOT be tolerated.

**Statement of Expectations for Student Conduct**

When you submit work for this class, that is the same as making a statement that you have produced the work yourself, it its entirety. Plagiarism, copyright infringement, and similar uses of other people’s work are unacceptable. This is also true of fabrication. Anything taken from the internet (or any other source) should not just be paraphrased, but should be rewritten in your own words incorporating your own ideas. Plagiarism — using other people’s words as your own — can take many forms:

- If you cut and paste information into a paper without attribution, that’s plagiarism.
- If you copy a direct quote without putting it in quotation marks, that’s plagiarism.
- If you paraphrase another person’s idea without giving credit, that’s plagiarism.
- If you submit someone else’s work as your own, that’s plagiarism.

(See The Dallas Morning News, Jan. 22, 2006, p. 26A.)

You’ll receive a “zero” for any work that is the result of plagiarism or cheating and will not be allowed to revise the work. The situation may also be reported to the Office of Academic Integrity, and you may be required to reapply to be a major in the Mayborn School of Journalism. Depending on the weight of the assignment, you could fail the course. Just don’t do it.

Your enrollment in this class presupposes your commitment to this Honor Code. If you have any questions about your responsibility or my responsibility as a faculty member under this Honor Code, please bring them to me or discuss them with someone in the Office of Academic Integrity.