MTSE 3000.006
“Fundamentals of Materials Science and Engineering”
Fall 2019 – 3 Credit Hours

Instructor: Prof. Anupama Kaul Office: C136G, Discovery Park
E-mail: anupama.kaul@unt.edu Phone: 940-369-7715
Office Hours: Monday, Wednesday, 10:30 am - 11:30 am and by appointment

Lecture Time: Monday and Wednesday, 11:30 am – 12:50 pm
Location: UNT Discovery Park, Room B158


Other Suggested Textbooks:

Teaching Assistant: Kishan Jayanand; E-mail: KishanJayanand@my.unt.edu
Office Hours: Tuesday, Thursday 10:30 am – 11:30 am and by appointment, Discovery Park, Room D144

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.

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

Chapters from Callister that will be covered

Chapter 1 – Introduction
Chapter 2 – Atomic Structure and Interatomic Bonding
Chapter 3 – Structures of Metals and Ceramics
Chapter 4 – Polymer Structures
Chapter 5 – Imperfections in Solids
Chapter 6 – Diffusion
Chapter 7 – Mechanical Properties
Chapter 8 – Deformation and Strengthening Mechanisms
Chapter 10 – Phase Diagrams
Chapter 11 – Phase Transformations

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.

**ABET / Student (Learning) Outcomes (SOs):**

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (Course Objectives 1,2,3,4,5,7)

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively with a range of audiences

4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

**Specific goals for the course**

a. *Specific outcomes of instruction*

b. *Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.*

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<tr>
<th>Specific Course Learning Objectives</th>
<th>Student/ABET Outcome</th>
<th>1</th>
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<tr>
<td>1. Demonstrate ability to relate bond energy to properties of engineering materials</td>
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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 a material, including globally, economically, and environmentally, as well as occupational safety.

7. Conduct and present a material selection survey as part of a team for current materials applications.

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<th>Tentative Grading Scheme (subject to change):</th>
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<td>(10) Homework, Average: 10 %</td>
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<td>(5) Quizzes, Average: 20 %</td>
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<td>(3) Exams, Average: 50 %</td>
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<td>(1) Team Project: 20 %</td>
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**Team Project**

The team project will be composed of a final paper (10%) and a presentation (10%). At the end of Exam 3, you will have the opportunity to evaluate the rest of your team members through a peer-review process for their contribution toward the team project. This will include both the participation and the technical content. These scores will be taken into consideration.

**Notes related to Lectures and Grading**

1. Canvas will be used as the primary communication tool. The syllabus, lecture notes, homework assignments and solutions will be posted on Canvas which can be accessed at [https://unt.instructure.com/](https://unt.instructure.com/).

2. Homework assignments are intended to serve as a way to exercise your understanding of the concepts. Solutions to homework assignments will be posted on canvas prior to the homework due date.

3. There will be 5 in-class quizzes and each will be for a duration of approximately 15 minutes. The content of the quizzes will be based on recent homework assignments and material covered during lectures.

4. There will be 3 in-class exams. Each exam will include a combination of (A) multiple choice questions, (B) short answer questions, and (C) quantitative problems. The 3 exams will be weighted equally and an average for the exams will be computed which will count toward 50% of the overall grade. Each
exam builds upon concepts from previous chapters and, hence, the second and third exams are progressively more comprehensive.

5. For all exams and quizzes, the only thing you may use during the exam is a calculator (plus a pencil, pen, and/or an eraser). Earphones, cell phones, laptops, etc. will not be allowed.

**Attendance**
Though a formal attendance roll will not be conducted, at the beginning of every class, pop-quizzes or mini-quizzes will be given. These mini-quizzes will be collected and count toward your classroom attendance and will serve as bonus points toward your overall grade. The mini-quizzes will be given sharply at 11:30 am and will be for about 3-4 minutes. Therefore, if you are late to class, it will affect your score for attendance.

**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. A 10% penalty may be effective, if this is deemed necessary.

**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 ($\sqrt{x}$)
- Natural Logs (LN)
- Logs (LOG)
- Inverse

**Cell Phones**
Please remember to turn off phones prior to class. Cell phones are not to be on the desks during quizzes or examinations.

**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 events 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 the instructor and/or the Dean of Students to
initiate 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**
You will be expected to conduct yourself in a professional manner. Academic dishonesty such as plagiarism and cheating will NOT be tolerated. Therefore, students are expected to be honest and ethical in their academic work. Academic dishonesty is defined as an intentional act of deception in one of the following areas:
* cheating – use or attempted use of unauthorized materials, information or study aids
* fabrication – falsification or invention of any information
* assisting – helping another commit an act of academic dishonesty
* tampering – altering or interfering with evaluation instruments and documents
* plagiarism – representing the words or ideas of another person as one's own.

For more information about academic integrity and the University's policies and procedures in this area, please see the UNT academic manual. Any student in violation of these policies will be given an overall **F grade (Fail)**. In addition, your case will be forwarded to university administrators, and you may be subject to additional punishments/sanctions according to university policies. When in doubt, please ask me.