MTSE 3000
“Fundamentals of Materials Science and Engineering”
Spring Semester 2022 – 3 credit hours

Instructor: Dr. Xiao Li, Office: E119, Discovery Park
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Office Hours: In Zoom, Wednesday 3:00-4:00 pm. Please email the questions in advance.
Lecture: Tuesday and Thursday, 11:30 a.m. – 12:50 p.m.
Location: DP-B192

Teaching Assistant: Rifat Hasan Rupom, RifatHasanRupom@my.unt.edu

Course Description
This course combines case studies to teach materials science and materials selection in design. It will introduce engineering students to a rigorous process of selecting materials for engineering designs, and connect this to bonding, structure, processing, and properties of materials. Prof. Mike Ashby’s book and Ansys Granta EduPack software will be extensively used in lectures, assignments, and exams. The course will ensure that students have a broad-based knowledge of the science of all types of materials at an introductory level. The students will specifically learn the science of mechanical properties of materials, and develop an ability to select the “correct” materials, considering the limiting design variables in a qualitative and quantitative fashion. The influence of costing in materials choice and its incorporation into design considerations is also considered.

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 c₀ 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 σ-ε.
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 6)
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)

Notes:
1. Canvas will be used for communication tool and for posting course material. https://unt.instructure.com/login/ldap
2. Weekly announcements will be displayed on CANVAS, notifying the work to be done in the week, reminding the deadlines of assignments, quizzes and exams.
3. Upload Homework on CANVAS.
4. Each quiz will be limited to one or two questions with a time of up to 30 minutes. The content will be based on recent homework and example questions explained in your class.
5. There will be a total of three exams conducted during class period, each of which may contain multiple choice, short answer, and quantitative questions/problems.
6. Effort will be made to grade your assignments and exams within two weeks after they are due. Late assignments (homework or project) will NOT be accepted.
7. You are allowed to use only calculator, pencils, pens, and eraser in your quizzes and exams. Earphones, cell phones, laptops, smart watches, and other devices are banned.
8. Programmable calculators and sharing of calculators are not allowed.

Discussions Forum on CANVAS
You will be assigned a few materials science related videos to watch. Discuss, ask, and answer questions on materials selection in the Discussions Forum that I will create on CANVAS. This is a team-based activity. Please self-organize into teams with three members each and email the instructor on or before January 28, 2022. Points to consider in your discussions: (i) Identify and explain current materials need, (ii) Select a material and justify your selection; (iii) Discuss atomic bonding and structure of selected material; (iv) Present phase diagram of the selected material; (v) Predict microstructure, strengthening mechanisms, and mechanical properties; and (vi) Estimate impact on society.

ANSYS Granta EduPack software must be used for this activity. You will be instructed on how to use this software and also be provided access to it.

Calculators: Programmable calculators are 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 functions

**Cell Phones:** Please remember to turn off phones prior to class. Cell phones are not allowed during quizzes or examinations.

**Technical Assistance**
Part of working in the online environment involves dealing with the inconveniences and frustration that can arise when technology breaks down or does not perform as expected. Here at UNT we have a Student Help Desk that you can contact for help with Canvas or other technology issues.

UIT Help Desk: UIT Student Help Desk site (http://www.unt.edu/helpdesk/index.htm)
Email: helpdesk@unt.edu
Phone: 940-565-2324
In Person: Sage Hall, Room 130
Walk-In Availability: 8am-9pm
Telephone Availability:
- Sunday: noon-midnight
- Monday-Thursday: 8am-midnight
- Friday: 8am-8pm
- Saturday: 9am-5pm
Laptop Checkout: 8am-7pm

**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: 20%
- Exam Average: 60%
- Discussions Forum: 10%

**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 student missing her/his exam due such unavoidable situations must notify the instructor in writing and provide necessary documentation such as doctor’s note, supervisor’s note, conference talk abstract, etc. If allowed, a 10% penalty will be assessed.

**Class Attendance is Mandatory.** Please notify me if you have to miss a class or will be late.
While attendance is expected as outlined above, it is important for all of us to be mindful of the health and safety of everyone in our community, especially given concerns about COVID-19. Please contact me if you are unable to attend class because you are ill, or unable to attend class due to a related issue regarding COVID-19. It is important that you communicate with me prior to being absent so I may decide about accommodating your request to be excused from class.
If you are experiencing any symptoms of COVID-19 (https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html) please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu) or your health care provider PRIOR to coming to campus. UNT also requires you to contact the UNT COVID Hotline at 844-366-5892 or COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.
While attendance is an important part of succeeding in this class, your own health, and those of others in the community, is more important.

Statement on Face Covering
In accordance with Governor Abbott’s Executive Order 36 Prohibiting Government Entities From Mandating Masks, face coverings are not required at UNT. However, UNT is strongly encouraging everyone to wear a face covering when indoors, regardless of vaccination status. We ask our faculty and staff to lead by example and wear a face covering.

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
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. If you have any questions on this, please discuss with me or someone in the Office of Academic Integrity.