Course number and name: **MTSE 3100: Materials Science and Engineering Laboratory II**

Credits and contact hours: 1 Credit. Friday (9:00am-11:50pm), Primary Lab Rooms E-138 (UG Lab 1), E-154 (UG Lab 2), E-145 (UG Lab 3), Discovery Park

Instructor's or course coordinator's name: Dr. Thomas Scharf, Office: E-117 Discovery Park, 940.891.6837, scharf@unt.edu

Text book, title, author, and year

No required textbook. The instructor and TAs will provide the laboratory manual and handouts.

Specific Course Information

a. *Brief description of the content of the course (catalog description)*

Sequel laboratory designed to continue to introduce students to some of the most common materials processing, testing and characterization methods. Topics include ceramic powder processing and sintering, polishing and heat treatment of metallic alloys, electronic material characterization, tensile testing, hardness testing, electrical resistivity, scanning electron microscopy, and x-ray diffraction.

b. *Prerequisites or co-requisites*

MTSE 3090

c. *Indicate whether a required, elective, or selected elective course in the program*

Required

Specific goals for the course

a. *Specific outcomes of instruction*

1. Students will learn how to conduct module-specific processing techniques (e.g., heat-treatments, sintering, deposition, polishing)
2. Students will learn how to characterize materials using the different techniques specific to each of the modules (e.g., optical microscopy, scanning electron microscopy (SEM)-energy dispersive spectroscopy (EDS), X-Ray Diffraction, Raman spectroscopy, profilometry, density measurements)
3. Students will collect, analyze, and interpret data in teams and will share data with other teams assigned to other roles within each lab module.
4. Students will learn materials structure-property relationships for each module
5. Students will analyze and interpret data related to each of the modules and present the data in the form of original laboratory reports conforming to research and academic standards
6. Students will learn to relate concepts learned in the lab modules involving modern engineering tools to solve practical engineering problems

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

This course addresses ABET Criterion 3 Student Outcome(s): 4, 5, 6 and 7 and Program Outcomes 1, 2, 4, 5, 6, 7, 11.

	Student/ABET Outcome	1	2	3	4	5	6	7
Specific Course Learning Outcome								
1. Understand how heat treatments and cold working affect the microstructure of a structural alloy. (metals lab)					x	x	x	
2. Conduct property testing and optical/SEM characterization. (metals lab)						x		x
3. Understand how ceramic powders can be processed into bulk specimens. (ceramics lab)					x	x	x	
4. Determine how sintering affects microstructure and properties. (ceramics lab)						x		x
5. Use a 2- & 4-point probe and UV-Vis spectrophotometer to measure electrical sheet resistance/resistivity and optical transmittance of different electronic and optoelectronic materials, respectively. (electronic and optical materials lab)					x	x		x
6. Determine the thermal properties of a polymer, metallic alloy and ceramic. (electronic and optical materials lab)						x	x	

Brief list of topics to be covered

1. Introduction, safety training refresher/confirm chemical safety testing completion (1 week)
2. Metallic alloys – Heat treatment-structure-property characterization (4 weeks)
3. Ceramics – Powder compact sintering-structure-property characterization (4 weeks)
4. Electronic and Optical Materials – Structure-property characterization (4 weeks)

Course Requirements: Mandatory attendance. **Chemical Lab Safety** training and quiz testing must be completed at (https://riskmanagement.unt.edu/chemical-lab-safety-training). This is a yearly training so if you passed in Fall semester, no need to retake. You must pass the quiz, print out that you passed it, and turn into the instructor (or email it) in order to start the lab modules.

Grading: Lab attendance/participation is required for each of the labs. Lab reports are due at the end of each session (dates will be announced by Instructor on Canvas, typically two weeks after final lab for each module).
Grading is based on lab attendance/participation and the reports as follows:
Lab attendance/participation:10%, **electronic materials**:30%, **metallic alloys**:30%, **ceramics:**30%

Academic Integrity: As is understood by the vast majority of students, our basic relationship is based on trust. Do not plagiarize lab reports (see pages 53-59 in Lab manual for examples and how to cite references). I will use software to check for plagiarism.

LAB Reports: The lab includes three modules. After the lab experiments are completed, the students are required to write project reports summarizing his or her work on their class lab. This report must be typed, single spaced, 12-point Symbol and/or Times New Roman fonts, and with 1-inch margins around. The report will follow the style of a standard laboratory report and must include the following sections: *Title, Author and affiliation, Abstract, Introduction (of the method used and properties calculated), Results, Discussions (comparing the results with corresponding experimental values, or theory), Conclusions, References, and Acknowledgments.* You must include appropriate visual figures from the experiments (including charts, graphs, and images) and captions. All the legends and labels in the charts and graphs must be at least a 12-point font when scaled to fit to the report. Collaboration with your group members in preparing the reports is acceptable. However, in the main, the report should be primarily yours and blatant copying will result in failing grade. Your lab reports will be submitted on Canvas. Late lab reports will not be accepted.

LAB II Schedule

Week	Date	**Metallic Alloys** (Room: **E-154** Lab 2) **TA**: Alberto Cantu (Alberto.CanalesCantu@unt.edu)	**Ceramics** (Room: **E-138** Lab 1) **TA**: Allan Kolek (AllanKolek@my.unt.edu)	**Electronic Materials** (Room: **E-145** Lab 3) **TA**: Blake Emad (BlakeEmad@my.unt.edu)
1	1/20	Introduction, lab overview, and chemical lab safety information (Groups 1-3) → in Room B158		
2	1/27	Group 1	Group 2	Group 3
3	2/3	Group 1	Group 2	Group 3
4	2/10	Group 1	Group 2	Group 3
5	2/17	Group 1	Group 2	Group 3
6	2/24	Group 2	Group 3	Group 1
7	3/3	Group 2	Group 3	Group 1
8	3/10	Group 2	Group 3	Group 1
9	3/24	Group 2	Group 3	Group 1
10	3/31	Group 3	Group 1	Group 2
11	4/7	Group 3	Group 1	Group 2
12	4/14	Group 3	Group 1	Group 2
13	4/21	Group 3	Group 1	Group 2

Group 1: Estrada, Katie; Kusterer, Eric; Nguyen, Stacey; Urias, Cristian

Group 2: Hester, Carson; Lyon, Zachary; Powers, Carlos; Vela, Natalia

Group 3: Killam, Austin; McCoy, Caleb; Sanders, Kenneth; Wilkins, Robert