MTE 481 – Analytical Methods for Materials

- INSTRUCTOR: Prof. Mark L. Weaver (secondary)
- LOCATION: *to be determined*
- LECTURE TIME: *to be determined*
- LAB TIME: *to be determined*
- OFFICE HOURS: ***By appointment***
- Textbooks (required):
  - Y. Leng, *Materials Characterization, 2nd Edition*, John Wiley & Sons, Hoboken, NJ, 2013. This book provides good general descriptions of all important characterization techniques.
  - Y. Waseda, E. Matsubara, and K. Shinoda, *X-ray Diffraction Crystallography*, Springer, New York, NY, 2011. This book provides good coverage of the fundamentals of crystallography and x-ray diffraction.
  - D.C. Van Aken and W.F. Hosford, *Reporting Results*, Cambridge University Press, Cambridge, UK, 2008. Good concise technical writing book, authored by a Materials Scientist
- Additional course material will be distributed in class or via Blackboard Learn.

Course Objectives

- At the conclusion of this course, students will be able to:
  - Characterize the structures and chemistries of materials using traditional analytical experimental techniques.
  - Select the proper characterization techniques to solve problems in research and/or industry.
  - “This course is centered around teaching you how to properly identify an unknown material.”

Provisional List of Topics

(in no particular order)

- Crystallography
- X-ray diffraction
- Optical microscopy
- Scanning electron microscopy
- Transmission electron microscopy
- X-ray spectroscopy for chemical analysis
- X-ray photoelectron spectroscopy and auger electron spectroscopy
- Technical Communication Skills

Assessment

- **Quizzes:** (30% of grade) Up to four 50 minute quizzes (graduate students will have additional 'take home' sections for each exam).

- **Laboratories:** (30% of grade) Several laboratories will be conducted in this course. Most will involve X-ray Diffraction. **Individual written lab reports will be required for each laboratory.** Lab reports will be graded individually. As this is a W designated course, **s**tudents must demonstrate the ability to write coherent, logical, properly edited sentences. Lab reports must be written in accord with *Reporting Results* by D.C. Van Aken and W.F. Hosford. Reports will be graded using the ABET evaluation criteria established for this course.

- **Final Project:** (40% of grade) There will be one final project. This will be a group activity. There is a required group project report and group project presentation.

Assessment

- **Homework:** There will be no regularly assigned homework problems. I will occasionally assign problems with due dates. I will grade them, however, they will not factor into your grades. Consider them as practice for the pending quizzes.

- **Grading Scale:**

	A+	≥ 98%
93% ≤	A	< 97%
90% ≤	A-	< 93%
87% ≤	B+	< 90%
83% ≤	B	< 87%
80% ≤	B-	< 83%
77% ≤	C+	< 80%

73% ≤	C	< 77%
70% ≤	C-	< 73%
67% ≤	D+	< 70%
63% ≤	D	< 67%
60% ≤	D-	< 63%
60% <	F	

Class Policies

- **Attendance:** Attendance at examinations and laboratories is mandatory. Attendance in lectures is not. If you must miss a scheduled laboratory or quiz due to serious illness, family death, accident, etc., notify Professor Weaver as soon as possible. Excuses of a non-urgent nature will not be accepted.

- **Disabilities:** Students with disabilities who may require more time than is allotted for the exams/quizzes must contact the UA Office of Disability Services (ODS) to obtain PRIOR APPROVAL and THE PROPER PAPERWORK in accordance with the rules and regulations of The University of Alabama. Alternate exams/quizzes must be scheduled through the ODS (348-4285).

- **Working Together:** You are allowed to work together. However, anything that you turn in must be written your own words and must be properly referenced.

In a typical week

M W: 8:00-8:50……Traditional lectures

F: 8:00-8:50……...Traditional Lecture or Lab Prep.

F: 1:00-3:00pm……..……..Lab section 1

(group 1 / group 2)

F: 3:00-5:00pm ……..Lab section 2

(group 3 / group 4)

We will not have labs every week nor will we meet every Friday.
Most labs will take more than one week to complete.
"It will take time to make samples and collect the data."
"You may even need to work in the evening or over the weekend. Plan on it."

Provisional List of Labs

(in no particular order)

1. Crystal Structure Determination via X-ray Diffraction
2. Lattice Parameter Determination and Phase Diagram Determination
3. Determination of Crystallize/Grain Size and Lattice Strain
4. Quantitative Analysis of Mixtures
5. Metallography and Optical Microscopy
6. Scanning Electron Microscopy and X-ray Analysis in an Electron Microscope
7. Identification of an Unknown Material (Final Project)

Regarding reports

- D.C. Van Aken and W.F. Hosford, *Reporting Results*, Cambridge University Press, Cambridge, UK, 2008.
  - This is your lab report writing manual. It is written by two metallurgical engineering professors. It has everything that you will need to know to do good technical writing. When in doubt about how to present something, look here.

- Reports will be graded for:
  - Technical content and merit
  - Grammar
  - Style and formatting
  - All references must be properly cited
  - MTE ABET evaluation rubrics will be used to assess you reports. I will hand them out.
  - NEVER plagiarize. If you plagiarize, "I will flunk you."

- Formats for lab reports
  - We will use a format consistent with a professional journal. It will be provided.

All pertinent course information can be found on the course syllabus!