

MME 4413/MME 5401/MASE 6402

Structural Characterization

Microstructural & Microchemical Characterization

Fall 2019 Syllabus

Instructor: David A. Roberson, Ph.D., droberson@utep.edu

Office Hours: TR 10:00 to 11:50 or by appointment

Days: T-R 12:00 – 1:20 LART 107

Lab: There are many

Course description: The application of modern instrumentation and techniques to structural characterization of various material systems. Both theory and operation will be stressed. Optical microscopy, X-Ray analysis, electron microscopy (TEM-SEM), electron probe analysis, optical emission spectroscopy will be included. Real-world examples of the use of characterization equipment will be given based on my experience in the semiconductor industry. The equipment we will cover in this class are the tools you will most likely use to perform your job whether you decide to pursue an academic career or a career in industry.

Textbook: Microstructural Characterization of Materials by David Brandon and Wayne D. Kaplan, John Wiley & Sons, **ISBN-10: 0470027851**

Additional sources for reference (you do not have to buy): ASM Handbook Volume 10 Materials Characterization, Articles available through UTEP licensing, Handouts

Course Topics

- 1) Optical Microscopy
- 2) Electron Microscopy
- 3) X-Ray Analysis
- 4) Other Analytical Methods such as AFM and OES
- 5) Technical Aspects of Analytical Equipment

| Grading | Percent |
|-------------------|---------|
| Quizzes | 20% |
| Lab Reports | 20% |
| 4 Exams | 30% |
| Final (Project ?) | 30% |

| | |
|-------|--|
| Final | Tuesday December 10 th 1:00 to 3:45 |
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Course Goals: After completing this course the student should be able to identify what type of information a given analytical tool is capable of providing. The student should be able to interpret the data produced by analytical techniques. The student should

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know the basic principles associated with the function of the analytical tools covered in class.

Laboratory: The class will be divided into lab groups. Due to the large class size and limited space capacity for the instrumentation, Every two weeks or so we will meet officially as a class so each group will present what they did for a given lab topic.

The lab schedule is as follows (tentative):

| Week | Subject | Week | Subject |
|------|--------------------------------|------|-----------------|
| 1 | No Lab | 8 | Present SEM Lab |
| 2 | No Lab | 9 | XRD Training |
| 3 | Metallography workshop | 10 | |
| 4 | | 11 | Present XRD Lab |
| 5 | Present Optical Microscopy Lab | 12 | TBD |
| 6 | SEM Training | 13 | TBD |
| 7 | | 14 | Holiday |

Tentative Lecture/Exam Schedule

| Week | Topic | Chapter | Week | Topic | Chapter |
|------|---------------------|-----------|------|--------------------------|---------|
| 1 | First Day! Intro | | 9 | X-Ray Diffraction | 2 |
| | Microstructure | 1.1 | | X-Ray Diffraction | 2 |
| 2 | Crystallography | 1.2/Notes | 10 | X-Ray Diffraction | 2 |
| | Digital Imaging | Notes | | Exam 3 | |
| 3 | Optical Microscopy | 3/Notes | 11 | IR Spectrography | |
| | Optical Microscopy | 3/Notes | | Electron μ -analysis | 7,8 |
| 4 | Optical Microscopy | 3/Notes | 12 | Probe Microscopy | 7,8 |
| | Exam 1 | | | Surface Analysis | 7,8 |
| 5 | Electron Microscopy | 4 | 13 | Surface Analysis | 7,8 |
| | Electron Microscopy | 4 | | Exam 4 | |
| 6 | Electron Microscopy | 4 | 14 | TBD | |
| | Electron Microscopy | 5 | | TBD | |
| 7 | Electron Microscopy | 5 | 15 | TBD | |
| | Exam 2 | | | TBD | |
| 8 | X-Ray Diffraction | 2/Notes | | | |
| | X-Ray Diffraction | 2 | | | |

Attendance: University policy dictates that all students attend all scheduled classes meaning that attendance to both the class and laboratory sessions is mandatory, however, I understand if you have conferences or other school-related activities to

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attend. Please notify me of any commitments you may have prior to you being absent from class. "Emergency" absences will be handled on a case by case basis. If you have more than 6 unexcused absences, you will need to drop the class or receive an F. I do not allow for the taking of make-up quizzes or exams.

Drop deadline for the Fall, 2017 Semester is November 3, 2017.

Use of Electronic Devices: As a courtesy to me and the other students in class, the use of cell phones, pagers, and laptops is not allowed while class is in session. I am wise to Electronic devices should be stored IN a backpack or purse. I have seen many instances of folks trying to hide electronic device usage behind a backpack or purse while texting, etc. so do not even try it! Use of said electronic devices will result in your being asked to leave the class and receiving a zero grade for attendance for that day. The electronics policy also applies to the laboratory session.

Cheating, Plagiarism, Scholastic Dishonesty, and Student Discipline

Students who engage in scholastic dishonesty will be subject to disciplinary action as stated in the UTEP-HoOP:

"Scholastic dishonesty (which includes the attempt of any student to present the work of another as his or her own, or any work which s(he) has not honestly performed, or attempting to pass any examination by improper means) is a serious offense and will subject the student to disciplinary action. The aiding and abetting of a student in any dishonesty is held to be an equally serious offense. All alleged acts of scholastic dishonesty should be reported to the Dean of Students for disposition. It is the Dean of Students' responsibility to investigate each allegation, dismiss the allegation, or proceed with disciplinary action in a manner which provides the accused student his or her rights of due process."

See the Dean of Students office for further information at website

<http://sa.utep.edu/studentlife/>; judicial affairs process at

<http://sa.utep.edu/studentlife/files/2010/10/Appendix-A-Discipline-process-NEW-OSL-2009.pdf>

Cite, reference, or quote information obtained from other sources and give credit where credit is due. In addition, when it is specified that a task needs to be performed individually, soliciting your classmates' help is considered scholastic dishonesty. Do NOT copy any material regardless of where you obtained it into your own work. Do NOT submit work under your name if you did not complete it entirely yourself; you may **not** **submit work you completed for another class**, unless specifically stated otherwise. In accordance with university policy, any instances of plagiarism and dishonesty will be

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reported to the Dean of Students Office. If you are caught cheating you will be subject to the disciplinary action defined by UTEP's Standards of Conduct and Dishonesty including the receiving of an incomplete "I" for the class and adjudication by the Dean of Students.

Disabilities: UTEP seeks to provide reasonable accommodations for all qualified individuals with disabilities, including learning disabilities. This university will adhere to all applicable federal, state, and local laws, regulations and guidelines with respect to providing reasonable accommodations as required affording equal educational opportunity. It is the student's responsibility to register with The Center for Accommodations and Support Services in The Union Building East Room 106 and arrange the appropriate accommodations. The contact information for CASS is:

<http://sa.utep.edu/cass/>

(915) 747-5148

cass@utep.edu

Or

If you have a disability and need classroom accommodations, please contact The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.