MATERIALS PROCESSING GRAD COURSES

Goals of the Courses
In the more technology-intensive manufacturing industries of the modern world, success often depends on our understanding—and precise control—of complex interactions between materials and processes. Widely different materials are often synthesized or transformed, at the same time and in close proximity, while a device or product is being fabricated. Material interactions and interfaces control the performance of the product, and they also present the manufacturing engineer with many constraints and sources of trouble. The manufacturing processes depend on physical, chemical, and mechanical phenomena that operate on a microscopic or atomic scale. These critical phenomena may not be evident except to materials professionals. Yet they must be under control, or the product will be defective.

In this course, students will learn about the production of advanced ceramics and other inorganic materials. They will learn about modern methods used to process, combine, and assemble metallic and nonmetallic materials into high-performance products. The course will include examples of materials engineering in the production of electronic and optical devices, aerospace systems, advanced energy conversion and conservation equipment, biomedical devices, automotive engines, chemical process equipment, etc. Students will explore the role of scientific fundamentals in material and process engineering. Much of the learning process in this course will consist of students learning on their own and communicating their knowledge to the class (with supervision and assistance from the instructor).

Instructor
Roy Arrowood. M-201 C Engineering Science Complex (Metallurgy Office Suite). Phone: 747-6934 or (secretaries) 747-5468. E-mail: arrowood@utep.edu Office Hours: MW 11:30 am -12:30 pm and Thursday 1:30-2:30 pm. (Office Hour policy: I am happy to talk with students about this course or other matters at any time. If you see me in the office or the labs or hallway, please feel free to approach me; if I'm too busy to talk at that moment, I'll make an appointment to speak with you later. The office hours are not the only times when I'm willing to see you. Office hours are merely times when I make every effort to be present in my office so that you can find me easily.)

Textbook and Reading Assignments
There is no textbook for this course. You will be expected to find and read relevant material on the Internet or in the library (on-line or physical), for homework or reading assignments or for research papers. On some topics, I will hand out notes, data sheets, or narrative that I have prepared.

Class Meetings
Most of the time, the grad course will meet with the undergraduate course. However, there will be a few sessions which are only for the graduate students. These grad sessions will deal with topics that grad students should master, but which are not expected of the students in the undergraduate course. They will relate to the **Analysis Requirement described on the next page. On the other hand, grad students will not be required to attend some of the undergrad class meetings, which will be identified by announcements in class or bye-mail messages to the grad
students.
**Deliverables and Assessment**

**Research Reports**

Each student will prepare two written reports, on two very different topics. The reports will be based on library and internet information sources. For these graduate-level courses, a significant portion of the information should come from papers published in peer-reviewed engineering and scientific professional journals and conference proceedings. Information from the Internet, or from trade journals or company catalogs or product data sheets, may also be very valuable. You should include a proper, professional, precise citation (reference) for every information source that you use. A citation for information from the Internet requires not only a descriptive title (if available on the web pages), but also the universal resource locator (URL) “address” for the web pages, the authors and/or organizations who provided the information, and the date on which you downloaded the information from the web. (Websites are not permanent, archived resources. They may change from day to day.)

You may select your paper topics from a list of suggested topics, or you may formulate your own topic. In any case, you should do a little preliminary research to see whether you can find adequate information for a paper on your topic. Then give me a “Paper Topic Proposal”, with a title and summary (not more than one page) for each paper. Based on your proposal, I will either approve your topics or suggest a different topic or scope or emphasis.

**Analysis Requirement:** At least one of the reports should include a detailed description of the application of fundamental materials science principles to a high-tech manufacturing process of the sort that is the subject matter of these courses. The type of materials science analysis should that you present should include one or more of:

* use of ternary phase diagrams to predict or evaluate microstructures;
* chemical or phase equilibrium calculations (free energy changes, equilibrium constants, electrochemical potentials, etc.) in the context of a manufacturing process;
* kinetic analysis (rate constants, atomic diffusion and transport, electrochemical currents, limiting heat-transfer rates, etc.) of a manufacturing process or a harmful reverse or byproduct reaction.

I am not requiring that you do original analysis yourself to fulfill this requirement. (However, that would be not only acceptable but also outstanding!) I do expect that you find and report on a paper that does this kind of analysis, and which is relevant to one or more of the material(s) and process(es) covered in your paper. You should describe the analysis and be prepared to explain it correctly.

**Presentations**

Each student will make one formal presentation to the class. The presentation will cover one of the two reports that the student has written. I strongly prefer that this presentation deal with the paper which meets the **Analysis Requirement** described above. This presentation will be made at the end of the semester, during a class, lab, or final examination time for the course. Each presentation will be allotted fifteen minutes, with an additional five minutes for questions and discussion. The formal presentation should be supported by projected images* that are well designed to convey information in a professional manner. You must give me paper copies of the images at the beginning of the presentation, so that I can conveniently write notes and suggestions about the images as well as about our spoken words. (For this purpose, a “slide show” printout made using PowerPoint™ or similar software would be fine. There may be several images per page, as long as the individual slides are shown at a large enough scale so that I can read them with reading glasses.)
* By projected images, I mean slides, transparencies, or digital-projector images.
Homework
There will be two homework assignments. Each assignment will require the use of fundamental concepts and calculations in the context of a material and process engineering problem.

You are welcome to work with other students who are also taking this course. If you do work with anyone, or receive help or information from anyone, you must acknowledge her/him/them in your homework paper. Working with someone else is completely acceptable, and will not affect your grade. However, failing to acknowledge another person (who made some contribution to the work) is not acceptable, and may result in a substantial grade penalty.

Quizzes
I will give a few quizzes (ten- or twenty-minute tests) during the semester. These quizzes provide feedback (for me and for you) about your understanding and recollection of basic terminology and concepts.

There will be no Formal (Hour-Long, Pre-Announced) Tests or Final Examination.

Laboratory
This course includes lab meetings on Fridays from 1:30 to 4:20 pm. formal lab exercises. Instead, the lab time will be used for:
- demonstrations in the laboratories, foundry and shops;
- field trips to local manufacturing plants or laboratories;
- research paper presentations;
- and special lectures or problem sessions.
Information on the lab activities will be provided in class each week.

Grading

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Research Reports</td>
<td>20%</td>
</tr>
<tr>
<td>Presentations</td>
<td>50%</td>
</tr>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>10%</td>
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</tbody>
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Grades will not be "curved". The grading scale is:
A 90-100
B 80-90
C 70-80
D 60-70
F <60

Expectations of Professionalism
Any instance of cheating or plagiarism will be reported to the Dean of Students for appropriate action, which may include dismissal from UTEP or failure in the course or other disciplinary actions.
MME 5302    Materials Extraction and Synthesis
MASE 6401   Materials Applications and Engineering
Roy Arrowood

Your attendance is expected. Most of the class activities cannot be made up if a class
or other meeting is missed. If you miss a class or activity for an approved reason, you will be
given a make-up assignment, which will require more of your time than the
missed activity would have. Approvable reasons for a limited number of absences include:
participation in University-sponsored activities such as athletics/band/orchestra events, illness or
family emergency, out-of-town professional job interviews or presentations at professional
conferences, religious holy days, etc. Except in emergencies or unexpected illness, you should
obtain approval for absences before missing the class meeting.

You are expected to extend professional courtesy to the other members of the class, and to
others who may host field trips or otherwise contribute to the course.

I expect that you will exhibit professional quality in all work for the course. This implies, among
other things, that the quality of your writing and graphics in your reports will affect your grades. So
will the professionalism of your presentations. You must include formal citations to the sources of
all information that you include in your work, and you must acknowledge any work or other
contributions made by other people.
Materials Criteria: Course Classification Form

Course Number MASE 6401/MME 5302 Course Name Material Processing/Engr. Application

Core (Required) Yes/No Semester/Instructor Spring/Dr. Arrowood

Laboratory Component: Yes/No Project/Paper Both

Course content as related to the Materials Criteria are indicated by level: High (H), Medium (M), or Low (L). Core courses are designed to address all criteria in the aggregate, but no course is expected to address all criteria at a high level.

<table>
<thead>
<tr>
<th>Outcome Criteria</th>
<th>Level</th>
<th>Comments/Relevant Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Materials Structure</td>
<td>L</td>
<td></td>
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<tr>
<td>B. Material Properties</td>
<td>M</td>
<td></td>
</tr>
<tr>
<td>C. Materials Processing/Syn.</td>
<td>H</td>
<td>Compliments MASE 6400/</td>
</tr>
<tr>
<td>D. Materials Performance</td>
<td>H</td>
<td>MME 5403</td>
</tr>
<tr>
<td>E. Materials Types</td>
<td>M</td>
<td>For MME component</td>
</tr>
<tr>
<td>F. Materials Characterization</td>
<td>L</td>
<td>students take additional</td>
</tr>
<tr>
<td>G. Oral/Written Communication</td>
<td>H</td>
<td>hour of MME 519X</td>
</tr>
<tr>
<td>H. Materials Research</td>
<td>L</td>
<td>for lab credit</td>
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