Materials Science and Engineering Design 635:411
Department of Materials Science and Engineering

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Course Description:

Materials Science and Engineering Design is a 2 part course covering aspects of design related to part manufacturing and process development. This course covers the fundamentals of equipment and plant design. Included in the course are concepts relating to material selection, fabrication methodology (including tool design), machining and post fire evaluation. Concepts related to total quality and quality manufacturing are reviewed. The Scope of this class is to design and plan the manufacturing of assigned parts. Student will work in groups, with each group being assigned a type of part to produce. Groups will work on 1) designing a QC lab, 2) designing forming tooling, and 3) designing green and fired machining processes.

Prerequisites:

The prerequisites for this course are Processing I, II, III. 635:411 must be taken before 635:412.

Textbooks:

Required Text: Materials: Engineering, Science, Processing and Design" by Michael Ashby, Hugh Shercliff and David Cebon 3rd Edition. This is published by Elsevier.

The following resources are suggested: 1) **Materials Selection in Mechanical Design (2nd Edition)** By: Ashby, M.F. (order through Amazon.com. 2) Glasses and Ceramics: Volume 4 ASM. 3) Supplemental (not required) Handbook of Properties of Technical & Engineering Ceramics: Part I An Introduction for the Engineer and Designer By: R. Morrell. 4) Handout materials.

Software:

Granta's Design Software will be distributed to each student. You will have one year to use this. The username when you register is rhaber1@rci.rutgers.edu and password: coucou. This is for your use only. You are not to distribute this to anyone else. I have a limited number of licenses and any unauthorized distribution violates the Rutgers agreement.

Objective:

The objective of this course is to provide the student with a capstone experience in Materials Science and Engineering. MSE Design stresses the concept of design related to the manufacturing of parts having detailed specifications. Students will develop an

understanding of real world manufacturing. Students will work in teams. Topics such as how to make effective presentations, total quality management, risk and reliability analysis, “green” manufacturing, and the use of materials processing and testing will be integrated within the teams project.

Each week students will have a lecture and homework set. In addition, there will be 4 group projects that will use the second half of the class period to work on.

Student groups will select a project from a list provided by the instructor. Groups will have the opportunity to discuss the various topics prior to the final selection.

Grading:

The Grading for the class will be as follows:

50% Participation and 2 Exams

50% Projects 1-4 are equally weighted

The projects for the class will be as follows: 1) Improved Quality of Life, 2) Quality Laboratory, 3) Design of a forming method and a machining process and 4)Technical Outline for the start of 412. The grading for each project will be divided as follows: 50% oral, 50% written. No written report will be accepted after class the dates indicated. No makeup oral will be given.

Course Content

WEEK	1	Introduction: Materials-history and character; Granta software
	2	Family trees-organizing materials and processes; Strategic thinking-matching materials to design
	3	Stiffness and Weight; Plasticity, yielding and ductility
	4	Bend and crush: Fracture and fracture toughness
	5	Exam 1
	6	Materials and heat; Using materials at high temperatures
	7	Conductors, insulators and dielectrics
	8	Magnetic material
	9	Manufacturing processes
	10	Manufacturing processes
	12	Exam 2
	13	Start of 412 Project: Technical Outline
	14	Technical Outline

Contributions of Course to Meeting the Professional Component:

MSE Design I is the capstone course for students wishing to emphasize production and management in ceramic engineering. The course integrates the fundamental science, e.g. physics and chemistry, and mathematics with the engineering courses the students completed in earlier semesters. By going through the process of material selection and process development, the student teams are able to understand how their prior education is critical in the engineering profession.

Relationship of Course to Program Objectives:

MSE Design I provides the student with an opportunity to integrate engineering principles developed in prior courses into a single goal, that being the conceptualization and manufacturing of parts needed for a specific application. The students must demonstrate an understanding of structure, processing, performance and properties of a specific ceramic system in order to complete the course. Students will prepare reports and make presentations weekly in a manner similar to that expected from an engineer. Students develop an understanding of teamwork and by making presentations develop organizational skills. Communication is stressed in this course, with emphasis on the student becoming more confident in both written and oral presentations over the duration of both Design I and II.

Scheduling Conflicts with Class:

MSE Design I is scheduled to meet on Thursday's. In general we will meet for the double period, however a great deal of the course is based upon project work. As the semester moves on anticipate that we will meet for 90 minutes.

Office Hours:

I will have office after class on Thursdays and will be available on most days between 7:30-8:00am. In addition, as I am here most of the time, you can make an appointment. I will try to meet with you within 48 hours of your request.

Attendance and Class Communications:

Class Attendance is mandatory. I will allow one missed class. Any class missed beyond that will drop your final grade by 1 grade! Since what we cover is not in a text, the only way for you to learn is to be in class.

I will email members of class if there are any changes. I will post assignments and readings that I have in pdf format on ccmc.rutgers.edu/design. This will not have a password, so you can just pop on as you need. I highly recommend that you check this out once a week.