

REVISED AUGUST 23, 2016
MSE Engineering Design 635:412
Fall 2016
Department of Material Science and Engineering

Professor R. Haber
Office FO201
Phone: 848/445-4931 Email: rhaber1@rci.rutgers.edu

Course Description:

This course covers the fundamentals of equipment and plant design. Included in the course are concepts relating to construction, installation, and maintenance and cost analysis. The Scope of this class is to design and plan a ceramic/material based manufacturing facility. Each student will be assigned a type of product to produce. From this the student will conduct a technical overview and market survey, propose a type of facility, and design and equip the facility.

There will be 3 groups of 3 students and 1 group of 2 students. Each group will meet independent of the rest of the class for 60 minutes on a date to be agreed upon. Note that class will be on Thursday, BUT Groups MUST SECURE A TIME SLOT: TBD. Class will not be from 5-8 as indicated in the Schedule of classes.

Prerequisites:

The prerequisites for this course are Processing I, II, III and MSE Design I.

Textbooks:

The course is not taught from a textbook. The following resources are suggested: 1) **Materials Selection in Mechanical Design (2nd Edition)** By: Ashby, M.F. (order through Amazon.com. 3) Glasses and Ceramics: Volume 4 ASM. 4) Supplemental (not required) Handbook of Properties of Technical & Engineering Ceramics: Part I An Introduction for the Engineer and Designer By: R. Morrell. 5) Handout materials.

Objective:

The objective of this course is to provide the student with a capstone experience in MSE. MSE Design stresses the concept of design of a project related to construction and operation of a ceramic manufacturing facility. 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.

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. Group assignments will be given out Week 1 April. Groups will be allowed to review topics and down select an area of interest from the broad based topics below. Groups will work on developing an outline during March and complete the Technical Overview by week 14 in May. Topic

Grading:

The Grading for the class will be as follows: The Final Presentation will make up most of the grade.

- 10% Market analysis (oral and written)
- 10% Proposal (oral and written)
- 10% Facility design (oral and written)
- 70% Final presentation and report (oral and written)

Each phase of the project will be handed in as a separate report. For each section the student will make a 10-15 minute presentation. The dates for each section are as follows:

Topic Selection and Extended Outline May 1st Week

Technical overview September 1st Week First Draft/ Presentation and Report Sept 22

Market analysis: October 1st Week First Draft/Presentation and Report Oct 20

Proposal November 3

Facility design November 22 First Draft

Final Report Presentation and Report December 8

The grading for each section 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. Each week groups will be required to show progress in developing an understanding of their specific topic. Each person within the group should have an understanding of the subject matter at each meeting. The sections of the project are as follows:

Extended Outline: The purpose of this is for groups to have time to independently investigate their broad topic and narrow it down to a manageable subsection of the topic. Groups will have to provide an extended outline and assign the sections within the outline to a group member. Essentially this is a contract the groups will make with each other to show what will be done over the summer.

Technical Overview: The purpose of this section is for the student to research the topic in general. The basic theory of product use, properties, materials, processing, types of products, the specifications of the products should be considered. Remember, this is a general topic discussion. When discussing the processing of the product type you can use generic formulations and process technologies. This section is typically 25-40 pages. A minimum of 10 references is required for groups in this portion of the project. Students will be required to conduct a patent search of US and European patent pertinent to their topic. Your group presentation will be 20 minutes.

Market Analysis: The purpose of this section is for the student to research the companies producing similar or competitive products. The idea is for the student to examine an existing market. Questions to be considered include: 1) How do you define the product or product area, 2) who are the major producers, 3) how large is the market and how is it divided, 4) is the market growing, 5) what are the price/performance characteristics of possible competitive products, 6) who are the primary customers, 7) what are the channels of distribution, 8) who are the producers suppliers, 9) what are competing products, and 10) what are the barriers to entering this market, e.g. patent concerns? This section is typically 25-40 pages. Your group presentation will be 20 minutes. Students should read pages 1-135 from Aaker, Developing Business Strategies

Proposal: The student will take the information gained in the first two sections and decide on a product within the topical area that could be profitable. Based upon this information, the

student will propose a product to manufacture. Included in this will be the materials, the type of processing, the quantity to be produced, the location for the facility and the justification for selecting this product. Safety and environmental concerning your process and plant should be considered. Students will be expected to select a site for their facility based upon location, building cost, taxes, environmental considerations, workforce availability and transportation. This is available by contacting local Chambers of Commerce. This section is 5 to 7 pages. Your group presentation will be 5 minutes.

Design of Facility: The student will design a factory based upon the proposal. Included in this section will be a plant layout, construction considerations and plant location. Students will be required to use some CAD software to map out the floor plan for the facility. The facility and equipment must be sized to meet the goals set forth in the Proposal. Major equipment related to the production of the product must be listed. This will require the groups to contact suppliers. When possible exact costs should be listed. If costs are not available, then estimated costs should be used. Groups will provide an estimate of the cost of manufacturing for the first two years. This will be estimated based upon the cost of the facility, equipment and startup. This section is typically 15-30 pages. Your group presentation will be 15 minutes.

Final Report: The final report should be a simple assembly of the four earlier sections. Here the student will put all the information into a coherent package for presentation. All corrections made in earlier sections will be included. This report will be submitted for the final grade in the course. You will make a final presentation on the entire project with a maximum of 35 minutes.

Considerations: I will expect that you have 15 interviews (minimum) as well as 20 archival references (minimum) for your work. As far as internet based references, you can have an unlimited amount.

Contributions of Course to Meeting the Professional Component:

MSE Design II 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 developing a technical overview, market analysis, plant layout and cost analysis, 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 II provides the student with an opportunity to integrate engineering principles developed in prior courses into a single goal, that being the conceptualization and construction of a ceramic manufacturing facility. The students must demonstrate an understanding of structure, processing, performance and properties of a specific ceramic system in order to complete the course.

Group Times

Thursday Fall Semester

	Names	Group #
8 to 9	Justin, Brian, Taihao	Group 4
9 to 10	Jennifer and Joshua	Group 1
1 to 2	Chris, Chris, Nicole	Group 2
2 to 3	Anthony, Ryan, Avie	Group 3

Groups Topics Selected

Topic	Names	Group #
safety	Jennifer and Joshua	Group 1
renewable energy	Nicole, Chris, Chris	Group 2
Heat	Anthony, Ryan, Avie	Group 3
Hydroponics	Justin, Brian, Taihao	Group 4