56:134 Process Engineering
Course Syllabus
Fall 2011
http://css.engineering.uiowa.edu/~coneng/

Objectives: The course introduces a process approach to innovation, product development, manufacturing, and service applications. Models, modeling tools, solution approaches, and methodologies for analysis and improvement of processes, including the product development and manufacturing process are discussed. The science of process modeling and analysis is illustrated with case studies.

Textbook: There is no required textbook however, the text *Product Development: A Structural Approach to Consumer Product Development, Design, and Manufacturing* by A. Mital, A. Desai, A. Subramanian, and A. Mital (Elsevier, 2008) can be purchased at Amazon.com. All course material and Power Point slides will be available on the course website.

Software: Examples of the software used in the class
- Dependency Structure Matrix: [http://www.icaen.uiowa.edu/~ankusiak/process-model.html](http://www.icaen.uiowa.edu/~ankusiak/process-model.html)
- Data Mining: Weka and Statistica, both available at the CSS platform

References:

Instructor: Andrew Kusiak, Professor
2139 SC
Office hours: 10:00 – 11:00 AM, TTh
Tel: 319 - 335 5934
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andrew-kusiak@uiowa.edu
http://www.icaen.uiowa.edu/~ankusiak

Class Time: 8:00 – 9:15 AM, TTh
2229 Seamans Center

TA: Zijun Zhang
3221 SC
Office hours, *Room 1307 SC*: 3:00 – 5:00 PM, Tues or by appointment. Usually available in Room 3221 SC.
zijun-zhang@uiowa.edu
Course Contents:

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<td>2: Analysis of Process Models and Problems</td>
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<td>3: Process and System Decomposition</td>
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<td>Discovery and Innovation Clinic</td>
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<td>4: Product and Process Innovation</td>
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<td>5: Data Mining in Process Engineering</td>
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<td>6: Quality Function Deployment and Process Models</td>
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Midterm Exam: Oct 13 (Th)

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<td>8: Design of Process and Facility Layout</td>
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<td>10: Analytical Process Methodology</td>
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<td>12: Project Presentations Begin</td>
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Final Exam (see http://www.registrar.uiowa.edu/exams/)

Course grading scheme

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<td>Final Exam</td>
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<td>Participation (up to 3%)</td>
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Check your grade at the ICON website http://icon.uiowa.edu/index.shtml

Homeworks: Regular homework assignments are due by 9:30 AM on the day indicated on the assignment. Some homeworks that may be due in more than one week. All homeworks need to be submitted to ICON.

Each student is to submit her/his own work.

Exams: Two in-class exams (midterm and final) will be given. The exams and quizzes will be closed book and closed notes.

Quizzes: A number of quizzes will be given in preparation for exams. The quizzes will NOT be announced. The best n - 1 quizzes will be graded. If there is a valid reason for a student missing a quiz, the average grade of n - k quizzes (for k > 1) will be assigned for the missing quiz.

ABET Activities: In addition to the regular quizzes, two quizzes testing you on the knowledge developed in two mini-projects will be administered. The two quizzes will be scheduled within a week of the completion of the mini-project. The topics tested in the two ABET inspired quizzes include:

- Knowledge of contemporary issues, and
- Lifelong learning

Your knowledge of contemporary issues will be tested based on the following three criteria:

- Interest in (awareness of) contemporary issues
- Knowledge of contemporary issues
- Use of knowledge about contemporary issues

Your lifelong learning abilities and skills will be tested using the following four criteria:

- Curiosity
The semester project will be the basis of testing your written (based on the project report) and communication (project presentation) skills based on the three criteria:

- Organization and structure
- Subject knowledge and articulation
- Exposition and style

**Participation:** Classroom participation involves asking questions in the classroom, commenting on the material covered in class, or making a brief (not longer than 15 min an individual student or group of two students) presentation on a topic related to the class. The minimum requirement is asking two questions per student per Semester or making one classroom presentation. Semester project presentations do not count for the classroom participation.

To receive an extra credit, submit your comment to ICON the day of your participation. Email the topic of your presentation for approval to andrew-kusiak@uiowa.edu two weeks in advance of the planned classroom presentation.

**SEMESTER PROJECT**

There are three components to the semester project:

1. **Project Proposal (ICON)** DUE: Oct 13
   Post the proposal electronically at ICON.

2. **Project Report (ICON)** DUE: Dec 1
   Post the project report and power point presentation at ICON.
   (Look under “Project report” for submission details)

3. **Project Presentations** In class: Dec 1, 6 and 8
   ⇒ *The project content used in this class can not be used for credit in other courses.*
   ⇒ *Before engaging in a project check this website*
   http://www.icaen.uiowa.edu/%7Eie166/avoiding_plagiarism.doc

**Project grading scheme**

- 30% project presentation
- 60% project content
- 10% attendance of discussion meetings and project presentations

**YOU MAY CHOOSE ONE OF THE FOLLOWING SIX TYPES OF PROJECTS:**

A. **Application Project** (Teaming of 2 - 3 students is encouraged)

You need to describe the problem considered for your project and propose a model and/or solution approach for solving the problem. Ideally, the project should be based on an industrial application. For industrial projects the emphasis should be given on the problem statement and a model developed, as those might be relatively difficult to accomplish. The solution procedure for an industrial project is likely to be extension of one of the algorithms discussed in class or a combination of more than one algorithm. If you do not have an industrial project, you may want to select a problem from a journal (e.g., *IIE Transactions*, *Journal of Manufacturing Systems*, *International Journal of Production Research*, and *Journal of Intelligent Manufacturing*), a magazine (e.g., *IE Solutions*, *Interfaces*) or a book (e.g., one of the reference books) for your project. For the journal selected project you are expected to present a model (e.g., integer programming, neural network) of the problem and a solution procedure (e.g., heuristic algorithm, expert system). Writing computer codes (e.g., JAVA, C++) and using standard computer software (e.g., Expert System Shells, Neural Network software, Data Mining software — for DM software go under All Programs|Engineering Software|WEKA) to support the algorithm (methodology) developed in the project will be an asset. Make attempt to consider alternatives (e.g., three business process models) while
proposing design solutions, show the benefits and pitfalls of each alternative, and use visualization tools to
demonstrate the results (e.g., bar charts, virtual reality)
Examples of projects conducted by students in previous years include: *Modeling and Analysis of Dock-to-
Stock Operations at AAA Corporation, Analysis of Systems Engineering Activities at BBB Corporation,
Reengineering Image Data Storage and Retrieval Process at CCC Hospital, and Modeling Innovation
Process.*

B. **Technical Proposal** (Teams of 2 - 3 students are encouraged)
The technical proposal option involves preparing a proposal to a funding agency, e.g., Department of
Commerce, Company X. Each of you is likely to write numerous proposals in your professional career. In
fact, most of non-routine tasks performed at any corporation result from a proposal written by someone and
funded from an internal or an external source. Technical proposal usually involves a technical description
of an intended entity (e.g., product, software) and a business proposal. Calls for SBIRs and STTRs are
good models for such proposals. This link is useful [http://www.grants.gov](http://www.grants.gov) in searching current Call for
Proposals.

C. **Research Paper** (Teaming is not encouraged)
You may choose a specific topic in the area of engineering design, manufacturing, or business and explore
it in greater detail. This type of project should survey the existing literature, identify a problem (or a gap)
to be researched, present existing methods for solving the problem, and in some cases develop an improved
solution approach (e.g., an algorithm). Go to [http://www.icaen.uiowa.edu/~coneng/](http://www.icaen.uiowa.edu/~coneng/) and search the digital
libraries listed under “For literature search use” towards the bottom of the page.
for sample journal papers.

D. **Research Proposal** (Teaming is not encouraged)
The research proposal option involves preparing a proposal for a funding agency, e.g., National Science
Foundation, Department of Defense. Those of you planning research careers are likely to write many
proposals in your career.

E. **Software Development** Project (Teams of 1 - 2 students)
The student(s) will be responsible for the development of software of an algorithm discussed in the class,
e.g., the triangularization algorithm, decomposition algorithm, and reliability and risk assessment
algorithms. The code should be written in a widely accepted language, e.g., C, C++, JAVA and a user-
friendly interface should be developed (Visual Basic, etc.). Web implementation of the software is
encouraged.

F. **Software Tutorial** Project (Teams of 1 - 2 students)
The project team will develop a tutorial and a demonstration of widely accepted software or a
computational environment, for example, [http://css.engineering.uiowa.edu/~coneng/NETWeb](http://css.engineering.uiowa.edu/~coneng/NETWeb)

**SEMESTER PROJECT PROPOSAL REQUIREMENTS**
The purpose of your project proposal is to outline the topic proposed and to receive feedback from the
instructor. The proposal should be brief (less than 3 pages). You may attempt to prepare your project
proposal in the format a project report (e.g., application project, software development project).
Each semester project proposal should contain a Gantt chart of project activities prepared with MS Project
available on the CSS platform.

**SEMESTER PROJECT REQUIREMENTS**
Each semester project (irrespective of the type) must demonstrate some usage of software or
programming skills, e.g., Weka data mining, PS8 project planning, Sciforma process modeling, C
programming, etc. **ARENA can not account for more than 10% of the project content.**
SEMESTER PROJECT REPORT FORMAT

The project report should be prepared on a word processor and should contain figures and tables that well explain all design concepts. Be concise in your writing and consult technical writing references as needed (see below). The document should be double-spaced throughout and should use a standard font (Times 10 or 12). A title page should include the title of the project, project type (A, B, C, D, E, or F), student name(s), course title, and date. The title page should be followed by an abstract (executive summary). Include also a table of contents, a list of figures, and a list of tables. All references must be included at the end of the paper, followed by appendices, if any. All pages (with the exception of the title page) should be numbered.

Required Project Report Sections:
1. Project Plan: A Gant chart of project activities prepared with MS Project Software that is available on the CSS platform.
2. Innovation: A subsection on innovation of the proposed model, idea, or a solution. You may incorporate the Innovation subsection in any of the main sections of the project, e.g., the Conclusion section.
3. Broader Impacts: Broader impacts of the idea pursued in the project.

The body of the term project report should include:

A. Application Project
1. Introduction
2. Problem definition
3. Project goals
4. Model formulation
5. Solution approach
6. Computational results
7. Conclusion

B. Technical Proposal Project
Requirements determined by the funding agency selected.

C. Research Paper
1. Abstract (about 100 words)
2. Statement of the problem
3. Literature review
4. Existing models and solution approaches
5. Proposed model and/or solution approach
6. Examples
7. Conclusion

D. Research Proposal
Requirements determined by the funding agency selected.

E. Software Development Project
1. Introduction
2. Algorithm description
3. User’s manual
4. Example problems (2)
5. Disk with the code

F. Software Tutorial
The software tutorial should be implanted on the web in the form of a slide show. Use your creativity! All tutorials will be linked to the class home page.

REFERENCES ON TECHNICAL WRITING


Semester Project Guidelines

Time estimate
It is expected that each student should spend not less than 50 hours on a project. Industrial or service application projects may take longer.

Project presentation
Each project has to be presented in class. A project team will be given about 15 - 20 minutes to present the results. In your presentation summarize the problem studied, proposed solution, and address innovation and broader impacts.

Project report
Each project team should hand in the following items (one per project):

- Post the project report file, the Power Point presentation slides, and software developed (when applicable) at ICON. Label all files with your name and course number, e.g., Doe_134_Sem_Project.

Hint
Usage of standard software, e.g., Scitor (Sciforma) PS Suite, MS Project, QFD, Statistica (data mining) in the semester projects is strongly encouraged.

Sample projects
Sample projects available on the class website.

University Information
This course is given by the College of Engineering. This means that class policies on matters such as requirements, grading, and sanctions for academic dishonesty are governed by the College of Engineering. Students wishing to add or drop this course after the official deadline must receive the approval of the Dean of the College of Engineering. Details of the University policy of cross enrollments may be found at [http://www.uiowa.edu/~provost/deos/crossenroll.doc](http://www.uiowa.edu/~provost/deos/crossenroll.doc)