Version: 09-06-2005

56:166 Production Systems

http://css.engineering.uiowa.edu/~ie166/

Fall 2005

Instructor: Andrew Kusiak

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Course Objectives:

The course is to introduce concepts of integrated design and manufacturing. The emphasis is placed on the study and analysis of models, algorithms, and systems applicable to the system-life-cycle from the design of components, through manufacturing, to distribution. The design and management of manufacturing and service systems is paramount to this course.

Course Webpage: http://css.engineering.uiowa.edu/~ie166/

For your convenience, the website includes the course material presented last year. All classroom presentation entries will be gradually replaced with the new content starting with the top of the *Course Materials* page. The new material will be posted in the order of classroom coverage. In a similar way the content of homeworks, quizzes, exams, and their solutions will be replaced.

Class Time and Place:

9:30 am - 10:45 am, TTh
2229 Seamans Center

Instructor Office Hours and Place:

11:00 am - 12:00 noon, TTh and 2:30 pm - 3:30 pm, T
2139 Seamans Center

Teaching Assistant:

Zhe Song
zhe-song@uiowa.edu

TA Office Hours and Place:

Noon - 1:00 pm, TTh or by appointment
3221 Seamans Center

Textbook:

A. Kusiak, *Computational Intelligence in Design and Manufacturing*, Wiley 2000.

References:

- J.R. Meredith and S.M. Shafer, *Operations Management*, John Wiley, New York, 2003.
- D. Braha (Ed.), *Data Mining for Design and Manufacturing*, Kluwer, Boston, MA, 2001
- W.J. Stevenson, *Production Operations Management*, McGraw Hill, 1999.

Course Grading Scheme:

Homeworks	20%
Midterm	20%
Quizzes (an average grade of the best n - 1 quizzes)	10%
Semester Project	27%
Final Exam	20%

- ❑ Classroom participation 3%

Check your grade at the ICON website http://icon.uiowa.edu/index.shtml

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 three questions per student per Semester or making one classroom presentation. Semester project presentations do not count for the classroom participation.

Project Grading Scheme:

- ❑ 15% project presentation
- ❑ 20% class content relevance
- ❑ 60% project content
- ❑ 5% attendance of the final project presentations

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

Dates to Remember:

- Oct 11: Project proposals are due. Email the project proposal to the TA zhe-song@ uiowa.edu.
- Oct 27: Midterm exam.
- Week of Sept 12: Class tutorials
- Week of Nov 7: Industrial Case Studies
- Nov 14: The sign-up sheet for project final presentations will be posted on TA's office door (3221 SC). You will be notified by email about the exact time of posting.
- Dec 1: Project presentations will begin.
- Dec 6: Project reports are due; Drop off a hard copy of the project report at the TA's Office (3221 SC) and email a zipped folder with all project files to the TA zhe-song@uiowa.edu. Name your compressed folder using the following format Your Last_Name_166_Sem_Project.
- Final exam: The date and time will be published on the *Course Materials* webpage. The final is open books and notes.

Course Contents:

- Modern manufacturing
- Knowledge-based systems
- Data mining
- Process planning
- Setup reduction scheduling
- Production planning and scheduling
- Kanban systems
- Selection of manufacturing equipment
- Group technology
- Neural networks
- Layout of machines and facilities
- Work-in-process space allocation
- Layout of a warehouse with class-based storage
- Design for agility
- Supplier evaluation
- Selected topics

Midterm
Project Presentations
Final Exam

The date and time of the final exam are provided at http://www.registrar.uiowa.edu/exams

Homeworks: Regular homeworks are due by 2:30 PM on the day indicated on the assignment. Some homeworks that may be due in more than one week. You may drop off the homework in the TA's office (3221 SC).
Each student is to submit her/his own work.

Quizzes: Numerous quizzes will be given in preparation for exams. The quizzes will not be announced in class.

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

YOU MAY CHOOSE ONE OF THE FOLLOWING FIVE 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 is normally given on the problem formulation and a model to be developed, as those might be relatively difficult to accomplish. The solution procedure for an industrial application project is likely to be an extension of one of the algorithms discussed in class or a combination of more than one algorithm. If you do not have industrial contacts, you may select for your project a problem from a journal (e.g., *Journal of Manufacturing Systems, IIE Transactions on Design and Manufacturing, International Journal of Production Research, Journal of Intelligent Manufacturing*), a magazine (e.g., *IE Solutions, Interfaces*) or a book (serf the web). In such case you will be expected to present a model (e.g., integer programming, neural network) of the problem and a solution procedure (e.g., heuristic, expert system). Writing computer codes (e.g., JAVA, C++, ASP) and using standard computer software (e.g., expert system shells, neural network software, and data mining software) to support the developments included in the project will be an asset. Make attempt to consider numerous alternatives (e.g., three layouts of a manufacturing facility) while proposing solutions, show the benefits and pitfalls of each alternative, and use visual tools to demonstrate the results (e.g., bar charts, virtual reality).
Examples of projects conducted by students in previous years include "Design of a Manufacturing Facility at AAA Corporation", "Production Scheduling System for BBB Corporation", "Process Planning of Rotational Parts", "Web-based System for Part Procurement", "Equipment Diagnosis System", "Disease Prognosis System", " Prevention of Manufacturing Faults with a Data Mining Approach".

B. **Technical Proposal** (Teams of 2 - 3 students is encouraged)
This project option involves preparing a proposal for a funding agency, e.g., Department of Commerce, Department of Defense, Company X. Each of you is likely to write numerous proposals in your professional career. In fact, most of non-routine tasked performed in any require proposal preparation. The project is then funded from an internal or external source.
Examples of websites of interest: nsf.gov, darpa.mil, nasa.gov, atp.nist.gov.

C. **Research Paper** (Individual activity)
You may choose a specific topic in the area of production and explore it in greater detail. This type of a project should survey the existing literature, identify and summarize a research problem, present existing methods for solving the problem, and formulate a new solution approach.

D. **Research Proposal** (Individual activity)
The research proposal option involves preparing a proposal to a funding agency, e.g., National Science Foundation, Defense Advance Project Agency. If you plan a research career, you are likely to write many proposal proposals.
Examples of websites of interest: nsf.gov, darpa.mil, nasa.gov.

E. **Software Development** Project (Teams of 1 - 2 students)
The student(s) are responsible for the development of software for one of the algorithms discussed in class, e.g., grouping algorithm, machine layout algorithm, scheduling algorithm. The code should be written in a widely used programming language (e.g., JAVA, C, C++, Visual Basic, ASP.NET) with a user-friendly