Instructor: Andrew Kusiak 2139 Seamans Center
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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:

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 (surf 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
interface. Sample software projects can be viewed at http://www.icaen.uiowa.edu/~ankusiak/ under “Software”.

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
The project prepared for this class can NOT be used to meet requirements of any other class. Each semester project (irrespective of the type) must demonstrate some usage of software or computer programming skills, e.g., Scitor PS, layout software, neural network software, C programming, etc.

Using ARENA in a project may account for NOT more than 10% of any project content.

SEMESTER PROJECT REPORT FORMAT
The project report should be prepared on a word processor and should contain figures and tables that are necessary to make the report easy to read. Be concise in your writing and consult technical writing references as needed (see below). The document should be double-space throughout and should use a standard font (Times 12). The first page should include the title of the project, project type (A, B, C, D, or E), student name(s), course title, and the 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.

The body of each semester project report should include the sections outlined next.

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

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

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

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

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

The developed software should run on the CSS platform.

SEMESTER PROJECT PROPOSAL

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 page long). 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 Gant chart of the proposed project activities prepared with Scitor PS and MS Project (both available on the CSS network).

PROJECT STATUS REPORT

Each project team (student) is to make a five-minute presentation in class to report on the project status. The data and a sign-up sheet will be posted outside of TA’s office.

REFERENCES ON TECHNICAL WRITING


Semester Project Guidelines

**Project effort (time) estimate**

It is expected that each student will spend about 45 hours on a project. Industrial or service application projects may take longer.

**Project presentation time estimate**

Each project has to be presented in class. A project team will be given about 15 minutes to present the results.

**Project report submission requirements**

Each team (student) should submit the following items (one per project):

- Hard copy of the project report should be dropped off at the TA’s office (3221 SC).
- Create a project report folder containing the project report file, the Power Point presentation slides, and software developed (when applicable). Compress the folder with all files with Winzip and label it with your name and course number, e.g., Doe_134_Sem_Project. Reference your email accordingly, e.g., RE: Doe_134_Sem_Project. Email the zipped folder to zhesong@uiowa.edu.

**Sample projects**

Sample projects performed by the students in the previous years will be available on the course webpage under "Projects".