

# Syllabus

## ISE 453: Production System Design

Spring 2009

**Lecture:** Tuesday and Thursday, 11:45–1:00 p.m., Daniels 407

**Instructor:** Ali Kefeli  
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Office Hours: Tue and Thu  
1:00 – 2:30 p.m.

**Prerequisite:** ISE 401: Stochastic Models in Industrial Engineering

### Required Text:

M.G. Kay, *Lecture Notes for Production System Design*, Spring 2009 (available as PDF file (see homepage for link))

### E-Reserve:

Wallace Hopp and Mark Spearman. (2001) *Factory Physics*, Second Edition, McGraw-Hill, New York, NY (selected chapters).

**Permanent Course Homepage:** <http://courses.ncsu.edu/ise453/common/>  
(this page will be accessible to you after the semester as a reference)

**Course Description:** Principles and practice in design of facilities and logistics networks. Integration of capacity planning, facility layout, material handling, storage and warehousing, and supply chain design issues into overall production system design. Emphasis on economic justification of alternative designs and use of computer software to aid design process. Group projects.

**Student Learning Outcomes:** By the end of this course, students will be able to:

- Formulate models and analyze the performance of a variety of different production system designs
- Perform an economic analysis of alternative designs and understand the limitations of the analysis
- Formulate and utilize heuristic solution procedures for different types of design problems, understand the difference between construction and improvement heuristics, and understand the limitations of any heuristic solution approach

- Evaluate the basic types of material handling equipment that are available and be able to select the most appropriate equipment for specific applications
- Discern the fundamental tradeoff in warehouse design between the competing objectives of minimizing building costs and minimizing handling costs
- Apply all of the knowledge and techniques learned in the course to the problem of developing an integrated design of a complete production system.

**Course Grading:** Unless otherwise noted, all grading will be on a scale of 0 to 100.

|                       |   |
|-----------------------|---|
| In-class Assignments  | 13% (breakdown within determined later) |
| Projects              | 12% (breakdown within determined later) |
| Quizzes               | 20%                                     |
| Midterm Exam          | 20%                                     |
| Final Project (group) | 10%                                     |
| Final Exam            | 25%                                     |

**Grade Boundaries:** Minimum grade in course based on the following boundaries:

|                     |                    |                    |
|---------------------|--------------------|--------------------|
| A+ : 100.00 – 96.67 | B– : 83.33 – 80.00 | D : 66.66 – 63.34  |
| A : 96.66 – 93.34   | C+ : 79.99 – 76.67 | D– : 63.33 – 60.00 |
| A– : 93.33 – 90.00  | C : 76.66 – 73.34  | F : 59.99 – 00.00  |
| B+ : 89.99 – 86.67  | C– : 73.33 – 70.00 |                    |
| B : 86.66 – 83.34   | D+ : 69.99 – 66.67 |                    |

**Tentative Topics** (see the current ISE 453 Course Schedule for more details):

1. *Supply Chain Design* (6 Lectures)  
Elements of the supply chain; logistics system modeling; great-circle distances and geocoding; minisum location; freight transport; total logistics cost concept
2. *Economic Analysis* (3 Lectures)  
Economics of production; discounting; economic analysis of alternative designs
3. *Capacity Planning* (6 Lectures)  
Production system design; design vs. operational problems; basic factory dynamics; line yield; machine sharing and setups; throughput and cycle time feasibility
  - Midterm Exam (75 min, in-class, open notes)
4. *Facility Layout* (3 Lectures)  
Material flow; machine layout; quadratic assignment problem; department layout; computer-aided layout improvement procedures

5. *Material Handling* (3 Lectures)  
 Unit load design; characteristics of material handling equipment; material handling equipment selection and evaluation; material handling system design and control
6. *Storage and Warehousing* (5 Lectures)  
 Basic storage/warehousing functions and elements; storage/retrieval policies; storage layout planning; warehouse operations; order picking; activity profiling
- Final Exam (20%-closed and 80%-open notes, covers mostly material since Midterm and uses the Final Project as the context for several comprehensive questions)

**Tentative Lab Assignments:**

- |                      |                    |
|----------------------|--------------------|
| 1. Facility Location | 4. Machine Layout  |
| 2. Capital Budgeting | 5. Facility Layout |
| 3. Capacity Planning |                    |

**Course Schedule:** A link to the web version of the course schedule is on the course homepage. The schedule will be updated before and after each lecture and will contain the topic, assignments, and text readings for the lecture. Since the schedule is subject to change, it should be checked on a regular basis.

**Wolfware Submission of Assignments:** Unless otherwise notified, you should use Wolfware to submit all of the electronic files that you have created for each assignment. Group submissions should be from one Unity ID, with all group members' names listed on all of the documents submitted.

**In-class Assignments:** In-class assignments (ICAs) will be either individual or group assignments and will be completed during the class period. ICAs will not be collected; however, they will be graded on a pass/fail basis at the end of each class. ICA grades will be based on effort. It is student's responsibility to make sure his/her ICA has been graded before leaving class. No ICA will be graded after the class hour it has been assigned. Because in-class assignments cannot be turned in late, *your lowest ICA grade will be dropped*. The assignments will be listed on the Course Schedule. The percentage breakdown for each individual assignment within the ICA grade total will be determined at the end of the semester.

**Projects:** There will be a maximum of four project assignments. Projects (see above for details) will be either individual or group assignments and will be completed outside of class, typically using some type of computer package. The percentage breakdown for each individual assignment within the Projects grade total will be determined at the end of the semester.

**Quizzes:** There will be a maximum of four quizzes during the semester. Each quiz will be closed book, about 20–30 minutes in length, and will be given at the beginning of the lecture

period. The date and material to study for each quiz will be announced in advance on the Course Schedule. The quizzes must be completed during the announced lecture period and will not be rescheduled.

**Final Project:** The final project will be a group assignment and will be assigned after the Midterm Exam. The grade for the final project will be based on a formal written report.

**Late Assignments:** Only regular Projects and the Final Project will be accepted late, with an immediate reduction of 20% in the assignment's grade and an additional 20% reduction for each weekday it is late. In-class assignments cannot be accepted late and are due the end of class.

**Re-grading:** Questions concerning any grade given for any assignment in class should be made within *one week* of the return of the graded assignment. This rule will be strictly enforced.

**Academic Integrity:** It is understood and expected that all work turned in under your name is your own work or, if a group assignment, the work of you and your group members, and that you have neither given nor received unauthorized aid. The University policy on academic integrity can be found in the Code of Student Conduct (see [Appendix L](#) of the Handbook for Advising and Teaching: [www.fis.ncsu.edu/ncsulegal/41.03-codeof.htm](http://www.fis.ncsu.edu/ncsulegal/41.03-codeof.htm)).

**Incomplete Grades:** If requested by a student, the grade of Incomplete will be given for work not completed because of a serious, documented interruption in the student's work not caused by their own negligence.

**Absences and Scheduling Make-up Work:** A make-up exam will be scheduled if a student has an excused absence (see [http://www.ncsu.edu/provost/academic\\_regulations/attend/reg.htm](http://www.ncsu.edu/provost/academic_regulations/attend/reg.htm) for NC State's policy on excused absences). There are no make-up in-class assignments or quizzes; the lowest one in-class assignment will be dropped in lieu of any absence.

**Students with Disabilities:** Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653 (<http://www.ncsu.edu/dss/>). For more information on NC State's policy on working with students with disabilities, please see [http://www.ncsu.edu/provost/hat/current/appendix/appen\\_k.html](http://www.ncsu.edu/provost/hat/current/appendix/appen_k.html).