

# INEG 4543: Materials Handling<sup>1</sup>

## Fall 2008

<b>Instructor:</b> Russell D. Meller, Ph.D.	<b>Office Hours:</b> M/W, 2:30p – 4:00p
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<b>Internet:</b> WebCT will be used	<b>Lab:</b> W, 9:30a – 10:20a
	Foust Lab

**TA:** Jen Pazour, Bell 4115, 575-8654, jpazour@uark.edu, office hours T/R 8:30–9:30a.

**Print Text:** Tompkins, White, Bozer and Tanchoco, *Facilities Planning*, 3e, Wiley, 2003.

**Online Text:** *Warehouse & Distribution Science*, Bartholdi and Hackman, Release 0.89, Aug. 2008. Available for free at: [www.isye.gatech.edu/~jjb/wh/](http://www.isye.gatech.edu/~jjb/wh/).

**Course Pack (CP):** The course pack includes important supplemental course material including handouts and past exams. This material is available at the University Bookstore (Packet 555).

**Prerequisites:** Engineering Economy (INEG 3413), Methods & Standards (INEG 3713), and Manufacturing Systems (INEG 3523)

### Learning Objectives:

Having successfully completed this course, the student will be able to:

1. construct models for the design and analysis of material handling systems and the facility layout;
2. illustrate the techniques and approaches used to design material handling systems and develop facility layouts;
3. apply theory and concepts to the design of distribution facilities;
4. show proficiency in techniques for the design and operation of a distribution center; and
5. identify major material flows, determine activity relationships, and specify space requirements.

**Course Format:** The course will be organized around subject areas in material handling and facility layout. We will review the fundamentals of each subject area and illustrate problem-solving in each area with the use of a case study. The case studies are all based on actual manufacturing/service companies, although the cases are usually simplified for educational purposes. (See note on Educational Philosophy for more details.)

**Course Lab:** The course laboratory sessions will be used weekly to provide practice sessions to go over material presented in lecture through the Foust Lab. The course TA will be responsible for the laboratory sessions. Lab sessions may also be used for local tours or special presentations.

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<sup>1</sup>Syllabus last revised on September 3, 2008.

**Grading:** Final course grades will be based on total weighted points using the percentages below:

- 30% (2) Group Case Study Report (15% each)
- 15% Individual Homework Assignments  
(due most Thursdays, the lowest will be dropped)
- 5% Reading Quizzes (average out of 10 rounded up to the nearest integer, while dropping the lowest)
- 30% (2) Midterm Examinations (15% each)
- 20% Final (cumulative) Examination
- +2% Extra Credit Class Participation

**Group Assignments (30% of total):** The instructor will organize groups and these groups will be responsible for compiling a condensed written report that addresses the problems presented in the cases.

**Individual Assignments (70% of total):** Each individual will be responsible for homework assignments. To facilitate assignment preparation, there will be reading quizzes throughout the semester. The lowest quiz grade and the lowest homework assignment will be dropped. Additionally, there will be two midterm examinations and a cumulative final examination for the course.

**Exams:** There will be two midterm examinations and a cumulative final exam. Students will be permitted to use one 8.5" × 11" sheet of notes (two sided) for each of the midterms and three such sheets for the final exam. Each exam will be of the same format: the first 70 points will be considered fundamental questions and will not be curved and the last 30 points will be more conceptual and therefore the curve on these questions will be 40% of the points that you missed. There will typically be two extra credit points on the exam that a student will have to answer exactly correct to receive the extra credit points.

**CICMHE Case Competition:** Groups that score above 88 on the first case will be given the opportunity to compete in the CICMHE material handling case competition. This case will be in lieu of Case 2 for the other groups in the class. Last year's University of Arkansas team won 2nd place (and \$1,000), while my VT student teams won 1st place and \$1,500 for the last four years I was there — Arkansas needs to win this!

**Solution Sets:** Homework and exam solutions will not be posted. It is your responsibility to make sure you find out how to solve problems by asking about them in class, during office hours, or in the lab problem sessions.

**Grading Statement:** Although I may assign letter grades to various assignments throughout the semester, the final course grade will be based on total weighted points (with the %-ages above). Class participation will be used to reward a student for excellent class preparation and participation. The final weighted points are not curved and final grades (except as noted below) will be determined as follows:

	>= 90.0	82.0 – 89.9	72.0 – 81.9	60.0 – 71.9	< 60
Grade	A	B	C	D	F

**GRADING NOTE!** *The final examination will be cumulative and therefore carries additional significance. For those students who fail either of the midterms (<60%), a*

*grade of at least 60% must be earned on the final exam to earn a passing grade (D or above) in the course. In addition, for those students who earn a C or below on either of the midterms (<82%), a grade of at least 75% must be earned on the final exam to earn a B in the course.*

**WebCT:** Students will be required to participate in the course via the WebCT course webpage setup for this purpose. This means checking your WebCT e-mail daily (or having it forwarded to your standard UArk account and check that e-mail account daily).

**Accommodations:** Students who need accommodations are asked to arrange a meeting during the first week of classes. Bring your Accommodation Letter and associated paperwork to the meeting. If you do not have the associated paperwork, please make an appointment with The Center for Students with Disabilities, Arkansas Union 104, 575-3104, ada@uark.edu.

**Inclement Weather Policy:** If the University cancels classes, then our class will be canceled. Any other cancelation will be made via e-mail and/or a posting on the course WebCT webpage.

### **Educational Philosophy**

In this course we employ an approach to education known as experiential learning. In this approach, the problem receives central attention and the student assumes ownership of the responsibility to solve the problem. The role of the instructor becomes that of a guide. The instructor offers feedback by pointing out ideas that should be considered and methodologies that might be useful, but it is primarily up to the student to forge a solution. I have found the approach to be uniquely rewarding to both students and instructor.

### **Instructor's Commitment**

You can expect your instructor to be courteous, respectful, and punctual; be well organized and prepared for lecture and other class activities; answer questions to the best of his ability and in a non-negative fashion; be available during office hours or notify you beforehand if he is unable to keep them; and grade uniformly and consistently to the syllabus rules and regulations.

### **Academic Honesty**

I take academic honesty very seriously since I consider honor to be one of the highest traits of human character. You are expected to read, understand, and abide by the "Code of Ethics." One of the places that you can find this policy is in the *Department of Industrial Engineering Undergraduate Student Handbook* (pp 13–15). Since this is such an important

topic to me, I will make clear what is permissible with regards to student cooperation and working together (see below). Academic dishonesty will result, at a minimum, in the assignment of a double-weighted zero. I am more than happy to clarify questions on this since this is one of those things that being safe rather than sorry is strongly advised (and last year's case was distasteful for me and I assume for the students involved as well).

**Homework Assignments** shall be individual assignments, but some amount of student collaboration is permissible. Specifically, as long as there is independent work on each part to each question that is turned in, working together is allowed. Examples of acceptable situations follow. Two students discuss how to complete a problem, but then go and finish the problem independently. This is permissible since there was independent work at the end of the process. Another example is that two students begin to work on a problem independently, compare answers and find a discrepancy, and then one or both students modify their answers after determining which answer is correct (neither student may “copy” the other’s work without working through the problem to determine which answer is correct). Note that the verb “modify” is much different than the verb “copy” since modify implies there is active thought to find the mistake in the answer you are modifying. Copying is passive since there is no active thought to find the mistake for the answer you are replacing with the copied work. **It is not acceptable, for even part of a problem, to directly copy answers to a question (or part of it) since there is no independent thought in copying.**

**Case Studies** shall be group efforts. Collaboration between the group members is required. Collaboration between group members of different groups is not allowed.

**Reading Quizzes** are strictly individual efforts and no collaboration of any type is allowed.

**Exams** are strictly individual efforts and no collaboration of any type is allowed.

### A Few Notes on Homework (Individual) Assignments

In general, homework assignments are due **at the beginning of class** on most Thursdays. After I collect the homework assignments, any turned in assignment will be considered 1-day late (see penalty below). If a due date does not correspond to a class day, then the assignment is due by 12:00 noon on the due-date. Late homework will be marked down 20% for each calendar day late (integer values only; e.g., 1-day late, 2-days late, etc.). I am the only person that can extend any deadlines for assignments — the TA cannot extend deadlines.

Assignments must be neat, legible, organized, and stapled in the upper left-hand corner (or bound). **Do not hand in assignments that are not stapled.** In general, you are expected to hand in assignments that are easy for the TA and I to grade. If they are not, then you will be marked down.

## Additional Note about Reading Quizzes

The purpose of the reading quizzes is to prepare you for discussion about the material in class. By completing the reading assignment you will be in a better position to contribute to class discussion or to benefit from it. As such, there are **no makeup reading quizzes permitted**. (Ask any former students, I've never granted one for any reason — not even job interviews, labs running late, weddings, etc.) Also, since coming to class just to take the reading quiz and then leaving defeats the purpose of the reading quizzes, doing so would result in a zero on the quiz and be considered a violation of the Code of Ethics.

## A Few Notes on Case Reports

Case reports in this course will consist of two elements:

1. Each case report will include a one-page executive summary that contains all the necessary information for the decision-maker to make a decision. The executive summary may also include a figure that summarizes the main deliverable for the case study (in which case, the executive summary may be more than one page). The executive summary will report the results of the case analysis in such a way as to provide a persuasive argument for the decision-maker to follow your recommendation. The executive summary will contain detailed results from your analysis. The executive summary will be worth 20 points of the 100 total points for a case — many groups lose points unnecessarily here.
2. Each case report will include an organized appendix that documents your detailed analysis. Your analysis will be worth the remaining 80 points.

The case reports will be written to the decision-maker in your role as an entry-level engineer or consultant. The executive summary will be your communication mechanism with the decision-maker, and the appendix is important to the engineers below the decision-maker that will use it to evaluate the correctness and completeness of your analysis.

Since there is not a real decision-maker, I will serve in that role for the purpose of the case reports. That means that I will read your report at two levels: overview and results in the executive summary, and I will examine your detailed analysis. I will be interested in evaluating the correctness and completeness of your analysis by looking at your appendix material. If you cannot determine how I would accomplish these tasks while grading, you have not provided enough details in your appendix.

Cases that address every aspect of the case study assignment correctly and write a perfect executive summary will receive 95 of the 100 points. The last 5 points are reserved for creatively extending what you were asked to do in the case assignment (“sensitivity and extras”).

**Course Topics and Extra Activities**  
(tentative and subject to change)

The following topics are expected to be covered during the semester:

WH'ing 101	New Aisle Designs
Warehouse Rationale	End-of-Aisle Unit Load AS/RS
Material Flow & Storage Strategy	Carton Storage System Design
Crossdocking Design	Split-Case Sorting Systems
Material Handling Equipment	Piece-Picking Systems — Automated
Determining the Number of Vehicles	Manual Piece-Picking
Basic Introduction to Conveyors	Facility Layout Problem
Warehouse Operations (or, WH'ing 201)	Facility Layout Algorithms
Unit-Load Storage System Design	Warehousing Around the World

The following *extra* activities are expected to be incorporated into the semester (schedules permitting):

Wal-Mart DC Tour	WMS Guest Lecturer
RFID Lab Tour	Data Analytics Guest Lecturer
Library Sorter Tour	Company Guest Lecturer

I will provide an upcoming schedule in each class meeting and will have it posted on the course website so that it is always available and up-to-date.

**Exam Dates (that will not change)**

Midterm Exam 1	Wed., Oct. 8	7:00-8:45p
Midterm Exam 2	Wed., Nov. 19	7:00-8:45p
Final Exam	Sat., Dec. 13	10:00-12:00p

**Mandatory attendance is required for all examinations — Official University Excuses only.**

**Critical Dates (that will announced during the semester)**

Due Date for Case 1	_____
Due Date for Case 2	Tues., Nov. 25
Canceled Lecture 1	_____
Canceled Lecture 2	_____