

IENG 446: Plant Layout & Material Handling – Spring 2020

Prerequisites:

IENG 220 Re-engineering Management Systems
IENG 350 Intro to Operations Research

Instructor: Leily Farrokhvar, Ph.D.
Assistant Professor, IMSE Department
Email: leily.farrokhvar@mail.wvu.edu
Phone: 304.293.9436
Office: 333 Engineering Sciences Building
Office Hours: MW 3:30 – 4:30 pm or by appointment (I am available to answer your questions via email and will usually respond in the same day. Please note that it is often difficult to explain mathematical problems via email. You are highly encouraged to stop by during office hours or make an appointment if that does not work for you.)

Graduate Teaching Assistant:

Email: TBA
Office: ESB 305
Office Hours: TBA

Class Meeting Schedule: MW 4:30 – 5:45 pm – Room MRB113

Text Books:

J.A. Tompkins, J.A. White, Y.A. Bozer, J. M. A. Tanchoco, *Facilities Planning*, 4th Edition, John Wiley & Sons, 2010.

Warehouse & Distribution Science, by Bartholdi and Hackman, Supply Chain and Logistics Institute at Georgia Tech, Release 0.94, January 2011, download at www.warehouse-science.com.

Course Description:

Facility design and economic selection of material handling equipment in a production/service facility. Emphasizes optimization of materials and information flow.

Course Objectives:

1. To provide students with the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
2. To provide students with methods for the generation, comparison and improvement of plant layouts.
3. To provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.
4. To provide students with tools to analyze alternative facility locations and methods to identify and select the optimal location(s).

Student Learning Objectives:

Upon completing the course, the student will be able to:

- a) Describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.
- b) Identify the characteristics of product and process layouts and their needs in terms of materials handling.
- c) Develop and analyze plant layouts using manual and computer aided software methodologies.
- d) Evaluate alternative facility layouts, select, and recommend a layout design and justify their selection based on several engineering design criteria.
- e) Identify and select various types of material handling equipment.
- f) Design material handling systems for a variety of scenarios pertaining to manufacturing and service industry.
- g) Evaluate alternative facility locations and apply optimization methods to select optimal locations.

Course Topics:

Introduction to facilities planning and materials handling

Facility location techniques

Alternative selection methodologies

Product, process, and schedule design

Flow systems, activity relationships, and space requirements

Principles of material handling

Plant layout generation

Warehousing operations

Manufacturing systems and material handling

Course Contribution to Professional Component:

Engineering topics 100%. This course has significant design content.

Course Relationship to Program Educational Outcomes:

The course relates strongly to the following program educational outcomes.

1. The course enables the students to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (Outcome 1). The key abilities the students will acquire are as below.
 - a) Facilities design methodologies including location and layout
 - b) Material handling system design
2. The course enables the students to communicate effectively with a range of audiences (Outcome 3). The key abilities the students will acquire are as below.
 - a) Evaluate various engineering solutions to make managerial decisions
 - b) Communicate findings and design recommendations in written and oral format

3. The course enables the students to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (Outcome 5). The key abilities the students will acquire are as below.
 - a) Identify, formulate, and solve problems in the design projects and group assignments
4. The course enables the students to acquire and apply new knowledge as needed, using appropriate learning strategies (Outcome 7). The key abilities the students will acquire are as below.
 - a) Design, implement, and improve facilities layouts and/or material handling systems
 - b) Analyze and interpret system data
 - c) Develop recommendations that are specific, practical, and cost effective.
 - d) Conduct an analysis of different alternatives and make appropriate recommendations.
 - e) Gather information from a variety of sources including publications, the internet, and reference materials

Performance Indicators:

The student performance indicators that are associated with the key abilities are:

1. Students will be able to use appropriate tools to generate, evaluate, and improve layout alternatives during the facilities planning process.
2. Students will be able to solve facility location problems using relevant techniques.
3. Students will be able to design and analyze the effectiveness of material handling systems.
4. Students will be able to identify, formulate, and solve facility layout problems using optimization tools and/or software.
5. Students will be able to identify appropriate tools for solving facility layout problems.
6. Students will be able to apply engineering design considering the impact of solutions in economic and environmental contexts.

Grading:

(Dates are subject to change!)

| ITEM | POINTS | DATE | Range | Grade |
|---------------------------------|--------|-------|----------|-------|
| Material handling presentations | 4 | 02/10 | 97 – 100 | A+ |
| Homework 1 | 4 | 02/17 | 93 – 96 | A |
| Mid-term exam 1 | 15 | 02/24 | 90 – 92 | A- |
| Project part 1 | 0 | 03/02 | 87 – 89 | B+ |
| Paper review presentation | 4 | 03/30 | 83 – 86 | B |
| Homework 2 | 4 | 04/06 | 80 – 82 | B- |
| Mid-term exam 2 | 15 | 04/13 | 77 – 79 | C+ |
| Project part 2 | 0 | 04/20 | 73 – 76 | C |
| Project presentations | 5 | 04/20 | 70 – 72 | C- |

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|--------------------------------------|------------|-------|
| Homework 3 | 4 | 04/27 |
| Final project report | 15 | 04/29 |
| Final exam | 25 | 05/04 |
| Participation and in-class exercises | 5 | |
| Total | 100 | |

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| 67 – 69 | D+ |
| 63 – 66 | D |
| 60 – 62 | D- |
| 0 – 59 | F |

Course Policies:

➤ Academic Integrity

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the West Virginia University Academic Catalog at <http://catalog.wvu.edu/undergraduate/coursecreditstermsclassification/#academicintegritytext>.

Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me before the assignment is due to discuss the matter.

➤ Exams

There will be three exams for this class (two midterms and a final exam). All exam problems demand both answers and work showing the complete solution procedure for full credits. Calculators are permitted in all exams. The exams will be cumulative. Make-up tests will be given if (i) a legitimate, documented excuse is provided (e.g. personal sickness, emergencies, or university-related trips), and (ii) the excuse and supporting documentation are provided either prior to the test date or no more than one week after you are able to take the test. Make-up tests will not be given if these conditions are not met.

➤ Homework

Homework is assigned as individual work unless specifically stated otherwise. Students are allowed to discuss homework among themselves; however, each student must submit his/her own work. Homework assignments must be submitted in class, at the start of class, and in hardcopy form, unless prior arrangements have been made with course instructor. Late submission of the homework will result in losing 20% of the full assignment grade per day.

➤ Re-grade

Requests for re-grades of exams and homework assignments must be submitted to the course instructor, in writing, within SEVEN days of the date the work was returned to the student. The instructor reserves the right to re-grade any other section of the work as deemed appropriate.

➤ Communication

Course announcements, information, assignments, and documents will be posted on eCampus. Students are expected to check email and the electronic blackboard regularly.

Statement on Social Justice:

West Virginia University is committed to social justice. I concur with that commitment. I expect to foster a nurturing learning environment that is based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, you must make appropriate arrangements through Disability Services (293-6700). They will identify the nature of the accommodation your disability requires.

Prepared By: Leily Farrokhvar, IMSE, CEMR