



University of Puerto Rico. Mayagüez Campus
College of Engineering.
Industrial Engineering Department



General Information

Course Number: InIn 6055

Course Title: **Mathematical Models in Distribution Logistics**

Credit-Hours: Three

Course Description

This course focuses on the logistics involved in transporting goods from manufacturers to customers. Particular emphasis is given to the design and operations of container terminals, cross-docks, and warehouses as well as the management of freight transportation modes. The course focuses on analytical models for the optimization of distribution systems and their implementation.

Prerequisites

ININ 4021 or approval from department director.

Prior knowledge

Students are expected to be familiar with mathematical modeling and optimization.

Textbook and References

- [1] Taylor, D. (2008) "Logistics Engineering Handbook." Boca Raton, FL: Taylor and Francis. (Available full-text in UPRM library through CRC collection.)
- [2] Bartholdi, J.J., and Hackman, S.T. (2007) "Warehouse and Distribution Science." Atlanta, GA: GaTech Press. (online resource; available free on the author's webpage: <http://www.warehouse-science.com/>)
- [3] Frazelle, E.H. (2002) "World-Class Warehousing and Material Handling." New York, NY: McGraw-Hill. (Available in UPRM library HF5485.F69 2002)
- [4] J.J. Bartholdi and K.R. Gue. The Best Shape for a Crossdock. *Transportation Science*, 38(2):235-244, 2004. (Available full-text in *Academic Search Complete* under Databases in the Library Web Site)
- [5] Y.A. Bozer and H.J. Carlo. Optimizing Inbound and Outbound Door Assignments in Less-than-Truckload Crossdocks *IIE Transactions*, 40(11): 1007-1018, 2008. (Available full-text in *Academic Search Complete* under Databases in the Library Web Site)
- [6] K.G. Murty, J. Liu, Y-w. Wan, and R.J. Linn. A Decision Support System for Operations in a Container Terminal. *Decision Support Systems*, 39(3):309-332, 2005. (Available full-text in *Academic Search Complete* under Databases in the Library Web Site)
- [7] D. Steenken, S. Voß, and R. Stahlbock. Container Terminal Operation and Operations Research – A Classification and Literature Review. *OR Spectrum*, 26(1):3-49, 2004. (Available full-text in *Academic Search Complete* under Databases in the Library Web Site)
- [8] G. Maroti. Operations Research Models for Railway Rolling Stock Planning. Retrieved October 2008, from <http://alexandria.tue.nl/extra2/200610302.pdf>. 2006

Purpose

This is a course primarily designed for the Masters program in Industrial Engineering although it could also be of interest to graduate students in business, economics, engineering, computer science, or applied mathematics interested in logistics. The purpose is to prepare each student with the mathematical tools required for the design and coordination of efficient distribution logistics.

Course Goals

Upon successfully completing the course, students are expected to be able to:

- identify challenges and the key factors that affect the complexity of distribution logistics
- apply and differentiate existing theoretical models in distribution logistics
- propose feasible solutions to real-world logistics problems
- assess and be able to make design and operational decisions involved in distribution centers, cross-docks, container terminals, and freight transportation.

Requirements

All students are expected to come to class all the time, on time, and prepared; do all assigned readings and related homework; actively participate in class discussions; and satisfy all assessment criteria to receive credit for the course.

Department/Campus Policies

Class attendance: Class attendance is compulsory. The University of Puerto Rico, Mayagüez Campus, reserves the right to deal at any time with individual cases of non-attendance. Professors are expected to record the absences of their students. Frequent absences affect the final grade, and may even result in total loss of credits. Arranging to make up work missed because of legitimate class absence is the responsibility of the student. (Bulletin of Information Undergraduate Studies)

Absence from examinations: Students are required to attend all examinations. If a student is absent from an examination for a justifiable reason acceptable to the professor, he or she will be given a special examination. Otherwise, he or she will receive a grade of zero of "F" in the examination missed. (Bulletin of Information Undergraduate Studies)

Final examinations: Final written examinations must be given in all courses unless, in the judgment of the Dean, the nature of the subject makes it impracticable. Final examinations scheduled by arrangements must be given during the examination period prescribed in the Academic Calendar, including Saturdays. (see Bulletin of Information Undergraduate Studies).

Partial withdrawals: A student may withdraw from individual courses at any time during the term, but before the deadline established in the University Academic Calendar. (see Bulletin of Information Undergraduate Studies).

Complete withdrawals: A student may completely withdraw from the University of Puerto Rico, Mayagüez Campus, at any time up to the last day of classes. (see Bulletin of Information Undergraduate Studies).

Disabilities: All the reasonable accommodations according to the Americans with Disability Act (ADA) Law will be coordinated with the Dean of Students and in accordance with the particular needs of the student.

Ethics: Any academic fraud is subject to the disciplinary sanctions described in article 14 and 16 of the revised General Student Bylaws of the University of Puerto Rico contained in Certification 018-1997-98 of the Board of Trustees. The professor will follow the norms established in articles 1-5 of the Bylaws.

General Topics

Topic	Ref.	Hrs.
Introduction to Logistics Systems: logistics systems as state of the art practice.	T:1-5	2
Strategic Design of the Logistics Network: facility location models, relevance to National Security	T:9,11,13	4
Designing and Operating a Distribution Center: layout, material flow, operations and performance, benchmarking.	T:12, R1:1-5, 13,14 R2: 3	5
Designing and Operating a Cross-dock: operations, design and management.	R1:12 R4, R5	5
Designing and Operating a Container Terminal: operations, design, management, and security.	R6, R7	8
Planning and Managing Long-haul and Short-haul Freight Transport: vehicle routing problems, traveling salesman problem (including capacitated, time-windows, etc.), arc routing problems, shipment consolidation and dispatching, vehicle allocation problem, dynamic driver assignment problem. Third-Party Logistics (3PLs)	T:14-19, 27	9
Planning and Managing Railroads	R8	3
Intermodal Transportation	T: 28	1
Tracking Technologies (RFIDs, GIS)	T:20-21	1
Sustainable logistics including Green Logistics and Reverse Logistics	T: 25	3
Exams		3
Total		45

T=

Taylor (2008)

R1 = Bartholdi and Hackman (2007)

R2 = Frazelle (2002)

R4 = Bartholdi and Gue (2004)

R5 = Bozer and Carlo (2008)

R6 = Murty, et al. (2005)

R7 = Steenken et al. (2004)

R8 = Maroti (2006)

Evaluation Policies

	Quantity	Percent
Exams	1-3	30 – 50%
Final Exam	1	20 – 30%
Short Quizzes	0 - 5	0 – 10%
Oral Reports	0 - 3	0 – 10%
Monographies		
Projects	1 - 3	20 – 30%
Journals		
Other, Specify:		
TOTAL:		100%

Coordinator: Dr. Hector J. Carlo (hcarlo@uprm.edu) (Revised in December 2008, October 2009)