University of Puerto Rico
Mayagüez Campus
College of Engineering
Department of Industrial Engineering
Program of Bachelor of Science

# COURSE SYLLABUS

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| **COURSE TITLE:** | Design and Analysis of Production and Inventory Management |
| **ALPHA-NUMERIC CODIFICATION:** | ININ 4155 |
| **NUMBER OF CREDITS-CONTACT HOURS:** | Four credit hours. Four hours of lecture per week. |
| **PREREQUISITES, COREQUISITES AND OTHER REQUIREMENTS:** | Prerequisites: ININ 4020. Co-requisite: ININ 4015 and [ININ 4150 or ININ 4021] |

**COURSE DESCRIPTION:**

**Spanish**: Estudio de herramientas analíticas para el diseño y mejoramiento de sistemas de producción e inventario. Discusión de temas tales como técnicas de desarrollo de pronósticos, planificación de la producción agregada, modelos de inventarios, itinerarios maestros de producción, planificación de requerimientos de materiales, planificación de la capacidad y sistemas de control del piso de producción, entre otros.

**English**: Study of analytical tools for the design and improvement of production and inventory systems. Discussion of topics such as forecasting techniques, aggregate production planning, inventory models, master production scheduling, material requirements planning, capacity planning, and shop floor control systems, among others**.**

**COURSE OBJECTIVES:**

After completing the course, the student should be able to:

- Forecast the behavior of existing or new goods or services in a system based on available information using regression analysis and time series techniques.
- Design inventory systems of some complexity using deterministic and stochastic control models.
- Develop aggregate production plans and workforce models.
- Recognize the difference between dependent and independent demand and have a basic understanding of the Material Requirements Planning System and Scheduling Techniques.
- Recognize the difference between pull versus push systems
- Understand and integrate bill of materials, inventory, master production schedule, and work center information for capacity planning.
- Understand common manufacturing philosophies such as Lean Manufacturing.
- Develop technical communication skills.
- Use computer software to solve production planning problems.

**TEXT BOOK:**

Nahmias, S. and Lennon, T., 2021, Production and Operations Analysis, Eighth Edition, Waveland Press Inc.

| **Course time frame and thematic outline:** | |
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| | **TIME DISTRIBUTION** |
| **Theme** | **Face-to-Face** |
| **I. Introduction, Definitions, and Overview** | 7 |
| MPC framework | |
| Strategy and competition | |
| Production Systems: ATO, MTS, MTO | |
| Push and Pull: Major elements and definitions | |
| Bottleneck, utilization, WIP | |
| JIT, Takt time, Lean Manufacturing | |
| **II. Forecasting** | 9 |
| Purpose and use of forecasts | |
| Characteristics of forecasts | |
| Model building & adequacy | |
| Time series & causal models | |
| Stationary series (Moving Average, Exponential Smoothing Models) | |
| Trend-based models (Regression Analysis, Double Exp. Smoothing) | |
| Seasonal forecasting (Winter's Method) | |
| **III. Inventory Control:** Intro, certain demand | 6 |
| Types of inventories | |
| Characteristics & relevant costs | |
| Inventory subject to known demand | |
| EOQ Model, EMQ/EPQ | |
| Quantity discount models | |
| Resource constraint multiple product system | |
| **IV**. **Inventory Control:** Uncertain demand | 6 |
| Nature of randomness | |
| Optimization criterion | |
| Newsvendor model | |
| Reorder point inventory systems | |
| Service levels continuous review system and periodic review system | |
| **V. Aggregate Planning** | 5 |
| Related costs | |
| Planning tradeoffs | |
| Strategies: Computer applications, chase, constant & mixed workforce plans | |
| **VI. Manufacturing Production and Resource Planning** | 5 |
| Master Production Scheduling | |
| BOM | |
| Materials Requirements Planning | |
| **VII. Capacity Planning** | 8 |
| Overall factors | |
| Capacity bills | |
| Resource profiles | |
| Capacity Requirements Planning | |
| **VIII. Supply Chain** | 4 |
| Definition | |
| Role of information | |
| Risk pooling | |
| Incentives in the supply chain | |
| **IX. Scheduling** | 3 |
| Scheduling terminology | |
| One-machine case | |

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|---|---|
| Two-machine case | |
| **Oral and Written Reports** | 4 |
| **Exams** | 3 |
| **Total contact hours** | **60 hours** |

## INSTRUCTIONAL STRATEGIES:

**Face-to-Face**

- Conferences
- Lectures
- Team work
- Individual tasks
- Assessment activities
- Practice activities
- Oral presentations
- Instructional Videos

## MINIMUM OR REQUIRED RESOURCES AVAILABLE:

| RESOURCE | FACE-TO-FACE |
|---|---|
| Institutional learning management platform account (Ex. Moodle) (Cuenta en la plataforma institucional de gestión de aprendizaje) (Ej. Moodle) | Institution |
| Institutional email account | Institution |
| Computer with high-speed internet access or mobile device with data service | Student |
| Programs or applications: word processor, spreadsheets, presentation editor | Student |
| Built-in or external speakers | Not applicable |
| Webcam or mobile with camera and microphone | Not applicable |

## EVALUATION STRATEGIES:

**FACE to FACE**

| Strategy | Percentage Range |
|---|---|
| Exams | 40-60% |
| Final Exam | 10-30% |
| Participation, Assignments and Quizzes | 0-15% |
| Oral & Written Reports: | 5-25% |

## REASONABLE ACCOMMODATIONS:

The University of Puerto Rico at Mayagüez (RUM) recognizes that each student has an inherited right to request reasonable accommodation according to Law 51: Law for Integral Educational Services for People with Disabilities. Every student has the right to receive reasonable accommodation if he/she presents the necessary evidence to be evaluated by the Office of Services to Students with Disabilities (OSEI-RUM), and the related information can be found at the following link:

https://www.uprm.edu/cms/index.php/page/85. If your case is approved by OSEI-RUM, you will receive reasonable accommodation in your courses and evaluation, and you must contact each professor for course registered. For additional information contact OSEI-RUM at Sánchez Hidalgo 410 or via telephone 787-832-4040 extension 3107.

**ACADEMIC INTEGRITY:**

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Student General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person's answers to the questions of an oral or written exam by taking or having someone else take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure established by the UPR Student General Bylaws.─.

To ensure the integrity and security of user data, all hybrid, distance and online courses must be offered through the institutional learning management platform, which uses secure connection and authentication protocols. The system authenticates the identity of the user (student and professor) using the username and password assigned by the institution. The users are responsible for keeping their password safe, protected, and not to share it with other people.

**POLICY AGAINST DISCRIMINATION BASED ON SEX, SEXUAL ORIENTATION, AND GENDER IDENTITY:**

«The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification 130 (2014-2015) from the Board of Governors, any student subjected to acts constituting sexual harassment, may turn to the Office of the Student Ombudsperson, the Office of the Dean of Students, or the Coordinator of the Office of Compliance with Title IX for an orientation or formal complaint».

**GRADING SYSTEM**

☒ Quantifiable (letters, A, B, C, D, F) ☐ Not Quantifiable

**CONTINGENCY PLAN IN CASE OF AN EMERGENCY**

In case of an emergency or class interruption, the professor can apply Bylaw 19-85 of the UPRM. This bylaw states that up to 25% of a class can be offered online.

**BIBLIOGRAPHY**


- Nahmias, S. and Lennon, T., 2021, Production and Operations Analysis, Eighth Edition, Waveland Press Inc. (**Textbook**)
- Jacobs, F., Berry, W., Whybark D. and Vollmann, T., 2011, Manufacturing Planning and Control for Supply Chain Management. McGraw-Hill.*
- Hopp, w. and Spearman, M., 2011, Factory Physics, Third Edition, Waveland Press Inc.*
- Jacobs, F.R. and Chase, Richard, 2013, Operations and Supply Chain Management: The Core, 3rd Edition, McGraw-Hill.*
- Askin, R.G., and Goldberg, 2002, Design and Analysis of Lean Production Systems, John Wiley & Sons, Inc. *
- APICS Journal, http://www.apics.org/industry-content-research/publications/p-im-journal
- IIE Transactions Journal, http://link.springer.com/journal/10756
- The Lean Manufacturing Handbook, Continental Design and Engineering. http://www.continental-design.com/lean-manufacturing/handbook-1.html
- Lean Enterprise Institute, http://lean.org/

*This book is a classic with no up-to-date editions and remains as the top book in the subject.