

# IE 365 Manufacturing and Service Systems Planning I

**Year and Semester:** 2020-2021 Fall

**Credit Hour:** (3 2 4)

**ECTS:** 6

**Prerequisite(s):** IE 232 (Operations Research I – Modeling)

## Catalog Description

This is the first of two sequel courses, which are designed to introduce the planning issues for manufacturing and service systems. The topics covered in the first course are manufacturing and service systems, long-range planning, forecasting, aggregate planning, deterministic and independent demand inventory management, dynamic lot sizing.

## Textbook

- S. Nahmias, *Production and Operations Analysis* (6<sup>th</sup> ed.), McGraw-Hill, 2010.

## Reference Books

- D. Sipper, and R.D. Bulfin, *Production Planning, Control, and Integration*, McGraw-Hill, 1997.
- E.A. Silver, D. Pyke, and R. Peterson, *Inventory Management and Production Planning and Control* (3<sup>rd</sup> ed.), Wiley, 1998.
- T.E. Vollmann, W.L. Berry, and D.C. Whybark, *Manufacturing Planning and Control Systems* (3<sup>rd</sup> ed.), Irwin, 1992.
- S. Chopra, and P. Meindl, *Supply Chain Management: Strategy, Planning, and Operation* (4<sup>th</sup> ed.), Prentice-Hall, 2009.

## Course Objective

This course aims to introduce basic and advanced models and solution techniques for forecasting, aggregate planning and inventory planning problems for manufacturing and service systems.

## Learning Outcomes

On successful completion of the course, all students will have developed:

- Ability to identify basic managerial concepts and issues in manufacturing and service systems
- Capability to use quantitative methods to model, analyze, and optimize manufacturing and service systems planning problems
- Capability to formulate mathematical programming models for solving a variety of manufacturing and service systems planning problems, and have improved their skills in mathematical modeling
- Ability to understand the shortcomings and limitations of analytical models and quantitative solution techniques devised for solving the manufacturing and service systems planning problems and how qualitative decision making can be incorporated

- Skills in using basic mathematical programming and optimization software (such as LINGO, GAMS, CPLEX etc.) and coding an algorithm in a general purpose language

On successful completion of the course, all students will have:

- Improved their teamwork skills
- Awareness of ethical issues

## Course Outline

**Week 1:** Introduction and background of production planning. Business strategies for being competitive. Components of operations strategy. Decision making and time horizons in production and operations management. Market-driven systems and global competition. The product life cycle. The process life cycle. Trade-off between production spectrum and production volume. Learning and experience curves.

**Week 2:** Classification of forecasting: Qualitative and quantitative approaches. Error analysis and evaluation of quantitative methods. Time series approach in forecasting. Methods for stationary series. Moving averages and exponential smoothing

**Week 3:** Methods for series with increasing or decreasing trend. Double exponential smoothing. Seasonal series. The seasonal trend model and Winter's method.

**Week 4:** Linear regression for causal forecasting and time series forecasting. Monitoring of forecasts. Tracking signal and corrective action.

**Week 5:** Hierarchy of decision making in production and operations management. Aggregation and aggregate units. Spreadsheet methods for aggregate planning. Alternative strategies for spreadsheet methods.

**Week 6:** Formulation of aggregate planning problems by linear programming. Fixed work-force models and the transportation problem approach for aggregate planning. Nonlinear programming models for aggregate planning. Solution approaches by mixed integer programming.

**Week 7:** Significance of inventories for production planning, conventional inventory policies, continuous review versus periodic review. Deterministic lot sizing and the economic order quantity (EOQ) model.

**Week 8:** Sensitivity of inventory problems. Infinite replenishment versus finite rate production systems and the economic production quantity (EPQ) model.

**Week 9:** Deterministic continuous review problems with backordering and finite production rate. EOQ models with all units discount and incremental discount.

**Week 10:** Resource constrained inventory problems. Multiple item EOQ models in the presence of budget and storage space limitations.

**Week 11:** Multi item ordering. Joint replenishment of multiple products lot sizing with multiple products or customers

**Week 12:** Mathematical programming models for deterministic demand discrete lot sizing inventory problems. Wagner-Whitin algorithm. Silver-Meal, Least unit cost, and Part period balancing methods. Trial-error solution techniques using spreadsheets.

**Week 13:** Supply chain management as a part of business strategy. Goals of the supply chain. Supply chain process cycles. Supply chain macro processes in a firm. Successful examples of supply chain management.

**Week 14:** Supply chain management modeled as a transportation problem. The Greedy Heuristic. The linear programming formulation. Distribution resource planning. Vehicle routing. Warehousing. Multilevel distribution systems.

## Computer Usage

Students need computers with webcam, speakers and microphone in order to follow the lectures and recitations which will be conducted by web-conferencing tools. Computer packages might be required for some homework assignments.

## Grading

Homework	60%
Final Exam	40%

## Lecture Hours

<b>Section 1:</b>	Monday	09:20—12:10 (online lecture)
	Wednesday	13:20—15:10 (online recitation)
<b>Section 2:</b>	Tuesday	13:20—16:10 (online lecture)
	Friday	13:20—15:10 (online recitation)

## Lecturer

Hakan Özaktaş, Ph.D in Industrial Engineering  
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## Assistant

Funda Güner, Ph.D in Industrial Engineering  
Office: L-310, x1359, [fkarakabak@cankaya.edu.tr](mailto:fkarakabak@cankaya.edu.tr)

## Office Hours

Office hours with the lecturer or teaching assistant will be only through web-conferencing tools and with appointment. Students should not visit the offices of the lecturer and the teaching assistant to ask questions.

## IMPORTANT NOTES

- Lectures, recitations and office hours will be through web-conferencing tools for this course. There will not be any in-class sessions with the exception of the final exam.
- Lecture invitations and any communication will be made from <http://webonline.cankaya.edu.tr> Announcements should be checked daily. Students should check their accounts to make sure that they can access the page of IE 365 through webonline.
- Lecture and recitation presentations will be live (as given in the schedule for each section) and there will not be any lecture/recitation videos to be stored on webonline. Students are welcome to record any lecture/recitation presentation on their own computers and share them with their classmates. Please do not ask for any lecture or recitation videos from your lecturer or teaching assistant.
- Students can enter the lecture and recitation sessions in either section depending on their timetable or their own convenience.
- Every student should study regularly from the textbook. Some of the lecture notes and handouts will be made available from webonline.
- Formal attendance for lectures as well as recitation hours will be taken at the beginning of each session. Attendance percentage will not have any effect on the letter grade. It is the responsibility of the students to catch up with the subject matter for any missed lectures or recitations.
- Homework is individual work. Please do not prepare homework assignments in groups. Homework submission guidelines will be announced later. There are no makeups for any homework assignment which is not submitted on time.
- Students are welcome for office hours which will be conducted through web-conferencing tools. Please contact your lecturer or teaching assistant with email so that an appointment will be made for you. Allow for a few days for the office hour appointment after your email. Do not visit the offices of your lecturer or teaching assistants. Further announcements on office hour appointments will also be made.
- Final exams will be comprehensive (including the entire subject matter covered throughout the semester) and scheduled to be in-class exams. Please do not leave studying for the final exams until the end of the semester.