LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Kvantitativa metoder för styrning av försörjningskedjor
Supply Chain Analytics

MION02, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED I
Date of Decision: 2023-04-14

General Information

Compulsory for: MLOG1
Elective for: I4-pr, I4-lf, M4-lp
Language of instruction: The course will be given in English

Aim

The course aims to deepen the students' knowledge and understanding of methods for management of production and inventory systems, both from a theoretical and applied perspective. An important aspect is to enhance the students' ability to structure and manage complex tasks, processes and assignments in the form of projects.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to use advanced quantitative methods for management and evaluation of production and inventory systems,
- show the ability to independently structure and solve project assignments of investigative nature.

This means that the student is required to:

- understand the basic principles of the Toyota Production System which is the basis for

lean production.
- understand the challenges and impact of uncertainty and variability on the management of manufacturing systems and to deal with these issues through the use of relevant methods.
- understand the limitations in commonly used production control models, and quantitative modelling of these systems. An important issue is to be able to analyse is the strengths and weaknesses with “Pull” oriented CONWIP systems in relation to “Push” oriented MRP systems.
- understand the principles for hierarchical planning scheduling and shop floor planning within a “Pull” oriented production system. Moreover, to be able to apply quantitative models to improve the control.
- critically examine and choose an appropriate model description to effectively manage commonly seen production systems. A special focus is placed on generalised KANBAN systems (CONWIP systems). This is contrasted to the MRP based systems studied in the course MIOF10 Production and Inventory Control.
- be able to explain, apply and evaluate different types of quantitative models for efficient control of CONWIP systems.
- correctly perform statistical analysis of data from stochastic processes that constitute input data to quantitative production and inventory control models. A special focus is placed on analysis of customer demand data and different types of process and activity times. This involves, among other things, fitting of distribution functions and various types of hypothesis testing.
- understand different principles for determining cost parameters (such as holding costs, shortage costs and set up costs) commonly used in production and inventory control models.
- be able to explain and apply quantitative models for control of single echelon inventory systems, with uncertain demand, and/or uncertain lead-times. This involves the computation of various types of service levels and expected costs, and the optimisation of control parameters like reorder points, order quantities and order-up-to levels.
- be able to explain and apply quantitative models for control of multi-echelon inventory systems, with uncertain demand. This involves the computation of various types of service levels and expected costs, and the optimization of control parameters like reorder points, order quantities and order-up-to levels.
- be able to explain and use quantitative methods for analysis of echelon- and installation-stock inventory control policies.
- independently manage and solve project assignments of investigative nature with high demands on reporting/documentation of results, both in terms of oral presentations and written reports.

Competences and skills
For a passing grade the student must

have the skills and abilities to independently formulate, solve, and use relevant quantitative models for analysis and control. Concrete areas and model types that the student should master include:

- Aggregate production planning.
- Scheduling and shop floor planning with focus on CONWIP systems (deterministic and stochastic models).

- Stochastic models for evaluation and optimization of single-echelon systems under different assumptions: continuous review, periodic review, continuous normally distributed demand, discrete compound Poisson demand, single and multi-periods, complete backordering and lost sales, service levels (S1, S2 and S3) and backorder costs, (R,Q), (S-1,S) and (s,S) systems, deterministic and stochastic lead-times (dependent and independent).
- Stochastic models for evaluation and optimization of multi-echelon (supply chain) inventory systems under different assumptions: serial and distribution systems, the METRIC approximation versus exact evaluation, (S-1,S) and (R,Q) policies, echelon-stock versus installation-stock policies.
- Methods, approaches and considerations for implementation of inventory and production control systems.

Moreover, the student must be able to use established terms and concepts to clearly communicate problem formulation and interpretation of quantitative production and inventory models. After completing the course, the student should be able to independently read and understand literature in the field and complement his/her knowledge as required.

For a passing grade, the student must also show ability to solve investigative project assignments. This involves skills and abilities in framing and solving unstructured problems. Important aspects are problem formulation, identifying project objectives, choose appropriate methods, and performing in depth analysis. Furthermore, reporting project results requires skills in oral and written presentation techniques.

Judgement and approach
For a passing grade the student must

- Understand and be able to explain the underlying assumptions and limitations of the studied models and the trade-offs they imply.
- Understand the need for coordination and cooperation across functional disciplines within a company, and between companies in a supply chain to achieve sustainable development and resource utilization.
- Understand that shared goals, values and ethics are important pillars in successful and sustainable operations management together with environmental and economic considerations.

Contents

The course focuses on advanced methods for production and inventory management, particularly advanced quantitative methods for management of single- and multi-echelon production and inventory systems.

The goal is to deepen and expand the students' knowledge in quantitative modelling of production and inventory systems both from a theoretical and applied perspective. The starting point for the content treated in the course is the theories and methods studied in the course MIOF10 Production and Inventory Control. We discuss challenges associated with applying quantitative models in practice, for example, when it comes to determining cost parameters, control variables and distribution fitting.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Take home exams/assignments. The examination is designed to assess the students' ability to independently solve loosely structured problems typically found in a production-inventory environment. An important aspect is for the students to clearly communicate the results and how the problems are solved, both orally, in well structured presentations, and in writing by producing well structured technical reports.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- MIO012/MIOA01/MIOA12/MIOA15 Managerial Economics Basic Course, FMS012 Mathematical Statistics Basic Course (or equivalent)

Assumed prior knowledge: MIO310/MIOF30 Operations Research Basic Course, MIO040/MIOF25 Managerial Economics Advanced Course, MIOF10 Production and Inventory Control,
The number of participants is limited to: No
The course overlaps following course/s: MIO331, MION01

Reading list

- Axsäter S. Inventory Control, Second edition. Springer, New York, 2006.
- (available free of charge as e-book through the university library).
- -.
- Hopp, W. J. and M. L. Spearman, Factory Physics, third edition, Irwin McGraw-Hill, New York, 2008.
- -.

Contact and other information

Course coordinator: Professor Johan Marklund, johan.marklund@iml.lth.se
Course homepage: http://www.pm.lth.se/Education