

ME-419

Production management

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Cursus	Sem.	Type
Managmt, tech et entr.	MA1, MA3	Opt.
Mechanical engineering minor	H	Opt.
Mechanical engineering	MA1, MA3	Opt.
Robotics	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Withdrawal Session	Unauthorized Winter
Semester	Fall
Exam	During the semester
Workload	150h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Project	2 weekly

Number of positions

Il n'est pas autorisé de se retirer de cette matière après le délai d'inscription.

Summary

Production management deals with producing goods sustainably at the right time, quantity, and quality with the minimum cost. This course equips students with practical skills and tools for effectively managing demand, supply, and implementing advanced analytics in manufacturing companies.

Content

This course is based on the following three modules:

Module 1) Introduction to Production Management

- **Production Management:** What is Production Management, and why do all manufacturing companies need it?
- **From Customer Needs to Plan, Purchase, Make, and Delivery (/Return):** How a manufacturing company captures, creates, and adds value, What challenges it faces, How successful manufacturing companies navigate the journey
- **From Strategy to Execution:** How to connect operations strategy to the tactical and operational plan efficiently, How to navigate the journey from products to platforms and ecosystems
- **Simulation:** How to map value adding network of a manufacturing company

Module 2) Demand Management

- **Disruptions:** Demand Disruptions, Risks, Bullwhip Effect
- **Demand Forecasting & Analytics:** Data Analytics, Identifying Key Demand Drivers, Building, Validating and Improving Forecasting Models/Processes
- **Forecasting Methods:** Model selection roadmap, Assumptions, Context, Forecasting Steps
- **Qualitative Methods:** Brain and Forecasting Biases, Executive Opinion, Salesforce Opinion, Consumer Survey, Delphi Method
- **Quantitative Methods:** Casual models, Time Series, Advanced Analytics
- Casual models: Correlation & causation, Linear trend, Regression models
- Time Series - Stationary: Naïve, Moving Average, Weighted Moving Average, Exponential Smoothing
- Time Series - Trend: Linear Trend Model, Holt Model
- Time Series - Trend and Seasonality: Autocorrelation, Hotel-Winter Model

- **Advanced Demand Analytics:** Demand Sensing & Shaping, Predictive Analytics, Machine Learning Models, Real-time Monitoring & Visualization
- **Effective Demand Management:** Key Performance Indicators (KPIs), Demand Visibility & Transparency, Practical Tips, Demand Plan/Sales Forecast
- **Simulation:** How to tame bullwhip effect, reduce uncertainty, demand variability

Module 3) Supply Management

- **Disruptions:** Supply Disruptions, Risks, Reverse Bullwhip Effect
- **Supply analytics:** Data Analytics, Identifying Key Supply Drivers, Building, Validating, and Improving Production and Inventory Models/Processes
- **Production Planning:** AP, MPS, RCCP, MRP
- AP: Aggregate production planning strategies (Level Plan, Chase Plan, Hybrid Plan)
- MPS: Master Production Schedule
- RCCP: Capacity Planning (Rough-Cut Capacity Planning, Capacity Planning using Overall)
- MRP: Material Requirement Planning
- **Inventory Management:** Inventory Classification, Types, Costs, Decision Variables, Instability and Oscillation, Inventory Dynamics
- **Inventory Planning Models:** Economic Order Quantity (EOQ), Economic Production Quantity (EPQ), Quantity Discount Model, Procurement and Negotiation with Suppliers, Safety Stock (SS), Periodic Review Model, Promotion Model/Christmas tree/Single Period Inventory Model
- **Advanced Supply Analytics:** Predictive Analytics, Machine Learning Models, Real-time Monitoring & Visualization
- **Effective Supply management:** Key Performance Indicators (KPIs), Supply Visibility & Transparency, Practical Tips, Supply Plan/Shipment plan
- **Simulation:** How to manage inventory and match demand amidst demand variability

Module 4) Advanced Topics in Production Management

- What are the latest trends in Production Management
- How to effectively orchestrate supply chain (demand and supply) analytics
- What are the main tools in use and which key digital technologies are driving the future of manufacturing/production

Keywords

Demand management, Supply management, Forecasting, Inventory management, Production planning, Simulation, Supply Chain Analytics.

Learning Prerequisites

Required courses

- Probability and Statistics

Recommended courses

- Continuous Improvement of Manufacturing Systems
- Supply Chain Management
- Data Science for Business

Important concepts to start the course

- Data analysis using Excel
- Active engagement and teamwork
- Advanced level of probability and statistics

Learning Outcomes

By the end of the course, the student must be able to:

- Choose production tools and methods based on performance and cost requirements and needs, taking into consideration applicability limits and associated hypotheses, CP8
- Model , analyse and optimize the internal logistics of a production and distribution system and the dynamic behaviour of a network of companies, CP9
- Design a system based on engineering specifications utilizing suitable numerical and analytical tools for optimizing the design parameters, CP10
- a system based on engineering specifications utilizing suitable numerical and analytical tools for optimizing the design parameters, CP10
- , analyse and optimize the internal logistics of a production and distribution system and the dynamic behaviour of a network of companies, CP9
- production tools and methods based on performance and cost requirements and needs, taking into consideration applicability limits and associated hypotheses, CP8

Transversal skills

- Assess progress against the plan, and adapt the plan as appropriate.
- Communicate effectively, being understood, including across different languages and cultures.
- Manage priorities.
- Negotiate effectively within the group.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Demonstrate the capacity for critical thinking
- Write a scientific or technical report.
- Take feedback (critique) and respond in an appropriate manner.
- Take account of the social and human dimensions of the engineering profession.
- Take responsibility for environmental impacts of her/ his actions and decisions.
- Resolve conflicts in ways that are productive for the task and the people concerned.
- Use both general and domain specific IT resources and tools

Teaching methods

- Formal lectures
- Group activities
- Class discussions
- Hands-on exercises
- Project-based learning
- Games and simulations
- Guest lectures by leading academic and industry figures

Expected student activities

- **Individual:** Self-study, Active class discussions, case evaluations, Q&A
- **In-group:** Teamwork (respect, brainstorming, involvement and constructive feedback)
- **Presentation:** Share your findings weekly in class/group coaching sessions

Assessment methods

Continuous evaluation of case reports, projects, individual and group presentations, class discussions, during the semester. More precisely:

- **25%** Participation, and class engagement,
- **45%** Class assignments, presentations, projects, and case reports,
- **30%** Final (Final report and presentation and understanding of the case)

Supervision

Forum	Yes
Others	<ul style="list-style-type: none"> • Meetings by appointment. • All information sharing and communication regarding the course must be through Moodle.

Resources

Virtual desktop infrastructure (VDI)

Yes

Bibliography

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Ressources en bibliothèque

- [Manufacturing operations management / Yoo](#)
- [Manufacturing Planning and Control for Supply Chain Management / Vollman](#)
- [Operations Management / Stevenson](#)
- [Operations Management / Slack](#)
- [Demand-Driven Forecasting / Chase](#)
- [Next generation demand management / Chase](#)
- [Business dynamics / Sterman](#)
- [Data science for business / Provost](#)
- [Thinking Fast and Slow / Kahneman](#)
- [Noise / Kahneman](#)
- [The Black Swan / Taleb](#)
- [Driving Digital Strategy / Gupta](#)
- [How smart, connected products are transforming companies / Porter](#)
- [How smart, connected products are transforming competition / Porter](#)
- [Prediction machines / Agrawal](#)
- [Competing in the Age of AI / Iansiti](#)
- [The signal and the noise / Silver](#)

Notes/Handbook

- Course slides (main material)
- Videos
- Hand-outs during the semester

Moodle Link

- <https://go.epfl.ch/ME-419>