

ME-498

**Continuous improvement of manufacturing systems**

Kaboli Amin

Cursus	Sem.	Type
Managmt, tech et entr.	MA2, MA4	Opt.
Mechanical engineering minor	E	Opt.
Mechanical engineering	MA2, MA4	Opt.
Microtechnics	MA2, MA4	Opt.
Robotics	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Withdrawal Session	Unauthorized Summer
Semester Exam	Spring During the semester
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
Project	2 weekly
<b>Number of positions</b>	<b>50</b>

**It is not allowed to withdraw from this subject after the registration deadline.**

**Summary**

Continuous Improvement encompasses the ongoing effort to capture, create, and deliver value to internal and external customers. This course equips students with practical skills and tools to improve products/services/processes with the support of technology and empowering people.

**Content**

This course is based on the following four modules:

**Module 1- Introduction to Continuous Improvement**

- What is Continuous Improvement and why do all manufacturing/service companies need it
- What is value and how to capture, create, and deliver it
- What are the main pillars of Continuous Improvement

**Module 2- Process (Operational Excellence)**

- **Operations Improvement:** Improvement Mindset, Skillset and Tools, Operational Excellence
- **Process Strategy:** Process Types, Volume vs. Flexibility, Standardization vs. Competence
- **Capacity & Constraint Management:** Capacity Planning, Bottleneck Analysis, Theory of Constraints (TOC), Capacity Simulation
- **Quality Management & Analytics:** Product/Service Quality, Quality Costs, Quality Tools, Quality Control, Process Capability, Six Sigma, Quality Simulation
- **Facility Layout:** Product and Process Layouts, Line Balancing, Minimizing Transportation Costs/Distances, Facility Layout Design Simulation
- **Lean Operations:** Principle of Lean System, Building blocks, Lean Tools

**Module 3- Technology (Digital Process Improvement)**

- **Disruptive Technologies for Product/Service/Process Improvement:** Artificial Intelligence and Machine Learning, Data Analytics, Process Mining, ...
- **Platforms & Digital Ecosystems:** Innovation and Disruption, Connectivity, Cyber-Physical Systems, From Product to Platforms, Benefits, Challenges, Roll out, Governance

- **Defining a Digital Roadmap:** Mapping Industries, Digital Transformation Frameworks, Simplifying the User Experience
- **Leading Sustainable Change:** Why Change Projects Fail, Managing Change, Articulating a Sustainable Change Plan, Emotions of Change, Change Models, Effective Communication of a Change Plan, Effective Digital Crisis Management

#### Module 4- People (Engineering Leadership)

- **Engineering Leadership:** How engineers become leaders, Why it matters, What are the main building blocks
- **Leading Self:** Growth Mindset, Emotional Intelligence, Connecting and Bonding, Building and Maintaining Trust
- **Leading Teams:** Leadership Styles, Effective Communication, Conflict Resolution, Team Dynamics, Psychological Safety
- **Leading Complex Projects:** Seeing the Big Picture, System Dynamics & Systems Thinking, Social Responsibility & Awareness, Sustainability & Engineering Ethics, Responsible Engineering Practises

#### Keywords

Continuous improvement, Value Chain, Product/Service, Process, Technology, People, Operational Excellence, Engineering Leadership.

#### Learning Prerequisites

##### Required courses

- Probability and Statistics

##### Recommended courses

- Production Management
- 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

#### Objective of this course

- Understanding how a manufacturing company captures, creates, and adds value for its customers
- Analyzing the product/service/process of a manufacturing company
- Developing and driving improvement plans for the product/service/process

#### Learning Outcomes

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

#### Transversal skills

- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Write a scientific or technical report.

- Communicate effectively, being understood, including across different languages and cultures.
- Negotiate effectively within the group.
- Set objectives and design an action plan to reach those objectives.
- Chair a meeting to achieve a particular agenda, maximising participation.
- Resolve conflicts in ways that are productive for the task and the people concerned.
- Make an oral presentation.
- Take account of the social and human dimensions of the engineering profession.
- Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.
- Take responsibility for environmental impacts of her/ his actions and decisions.

### Teaching methods

- Formal lectures
- Case studies
- Project-based learning
- Games and simulations
- Videos
- Book chapters, hand-outs, and notes
- Guest speakers

The course is based on the implementation of theoretical concepts and models to practical cases. Students work in a group on multiple cases during the whole semester.

### 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

Office hours	Yes
Assistants	Yes
Forum	Yes

### Resources

#### Virtual desktop infrastructure (VDI)

Yes

### Bibliography

Series of book chapters, hand-outs, and notes will be shared in the class. The following books are recommended for further reading (and not mandatory);

**Process:**

1. Stevenson, W. J. (2020). *Operations management*. McGraw Hill.
2. Slack, N., Chambers, S., & Johnston, R. (2016). *Operations management*. Pearson education.
3. Sterman, J. (2010). *Business dynamics*. Irwin/McGraw-Hill c2000.
4. Senge, P. M. (2006). *The fifth discipline: The art and practice of the learning organization*. Doubleday.
5. Kotter, J. P. (2012). *Leading change*. Harvard business press.

**Technology:**

1. Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard business review*, 92(11), 64-88.
2. Porter, M. E., & Heppelmann, J. E. (2015). How smart, connected products are transforming companies. *Harvard business review*, 93(10), 96-114.
3. Agrawal, A., Gans, J., & Goldfarb, A. (2018). *Prediction machines: the simple economics of artificial intelligence*. Harvard Business Press.
4. Rogers, D. L. (2016). *The digital transformation playbook: Rethink your business for the digital age*. Columbia University Press.
5. Gupta, S. (2018). *Driving digital strategy: A guide to reimagining your business*. Harvard Business Press. Chicago
6. Iansiti, M., & Lakhani, K. R. (2020). *Competing in the age of AI: strategy and leadership when algorithms and networks run the world*. Harvard Business Press.

**People:**

1. Dweck, C., (2007). *Mindset: The New Psychology of Success*. Ballantine Books
2. Goleman, D., (2005). *Emotional Intelligence: Why It Can Matter More Than IQ*. Random House Publishing Group.
3. Tan, C. M. (2018). *Search inside yourself*. HarperOne; Reprint edition.
4. Kahneman, D. (2011). *Thinking, fast and slow*. Macmillan.
5. Kahneman, D., Sibony, O., & Sunstein, C. R. (2021). *Noise: A flaw in human judgment*. Little, Brown.
6. Kohlrieser, G. (2006). *Hostage at the table: How leaders can overcome conflict, influence others, and raise performance*(Vol. 145). John Wiley & Sons.
7. Rosenberg, M. B. (2002). *Nonviolent communication: A language of compassion*. Encinitas, CA: Puddledancer press.
8. Stone, D., Patton, B., & Heen, S. (2010). *Difficult conversations: How to discuss what matters most*. Penguin.

**Ressources en bibliothèque**

- [Rosenberg, M. B. \(2002\). Nonviolent communication: A language of compassion](#)
- [The digital transformation playbook / Rogers](#)
- [Tan, C. M. \(2018\). Search inside yourself](#)
- [Goleman, D., \(2005\). Emotional Intelligence: Why It Can Matter More Than IQ](#)
- [Stone, D., Patton, B., & Heen, S. \(2010\). Difficult conversations: How to discuss what matters most](#)
- [Dweck, C., \(2007\). Mindset: The New Psychology of Success](#)
- [Competing in the age of AI / Iansiti](#)
- [How smart, connected products are transforming competition / Porter](#)
- [Business dynamics / Sterman](#)
- [How smart, connected products are transforming companies / Porter](#)
- [Prediction machines / Agrawal](#)
- [Kahneman, D. \(2011\). Thinking, fast and slow](#)
- [Driving digital strategy / Gupta](#)
- [Operations management / Stevenson](#)
- [The fifth discipline / Senge](#)
- [Kahneman, D., Sibony, O., Sunstein, C.R. \(2021\). Noise : A flaw in human judgment](#)
- [Operations management / Slack](#)
- [Leading Change / Kotter](#)

- Kohlrieser, G. (2006). Hostage at the table: How leaders can overcome conflict, influence others, and raise performance

**Moodle Link**

- <https://go.epfl.ch/ME-498>