ME-498

Continuous improvement of manufacturing systems

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

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

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

Summary

Continuous Improvement encompasses the ongoing effort to capture, create, and deliver value to internal and external customers. This course empowers students to lead teams and harness technology to improve products, services, and processes.

Content

This course is based on the following four modules:

Module 1- Introduction to Continuous Improvement

- What is Continuous Improvement
- Why do all manufacturing/service companies need it
- What is value, and how can it be captured, created, and delivered, particularly in manufacturing systems?
- What are the main pillars of Continuous Improvement

Module 2- People

- **Leading Self** (self-awareness, growth mindset, emotional intelligence)
- **Leading Teams** (Bonding, nurturing trust, fostering positive team dynamics, cultivating psychological safety, driving effective communication and facilitating adept conflict resolution)
- **Leading Complex Projects** (System dynamics, systems thinking, Social responsibility and awareness)

Module 3- Process

- **Process Strategy** (Process types, Volume vs. flexibility, Standardization vs. competence)
- **Lean Operations** (Principle of lean system, Lean building blocks, , Lean tools)
- **Capacity & Constraint Management** (Capacity planning, Bottleneck analysis, Theory of constraints (TOC))
- **Quality Management & Analytics** (Product/Service quality, Quality costs, Quality control, Process capability, Six Sigma, Quality tools)
- **Facility Location & Layout** (Product & process layouts, Line Balancing, Minimizing transportation Costs/Distances)

Module 4- Technology

- Understanding the pitfalls of change projects and why they often fail

- Mapping industries and digital transformation frameworks to define a comprehensive digital roadmap
- Harnessing disruptive technologies for improvement in product, service, and process domains
- Simplifying the user experience to enhance digital adoption and engagement
- Managing change effectively and articulating a robust plan for sustainable change
- Navigating the transformative journey from products to platforms and ecosystems

Keywords

Continuous improvement, Operational Excellence, Leading Change.

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

Learning Outcomes

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

- Understand the fundamentals of change initiatives (from continuous improvement to transformation)
- Learning how to communicate change and manage emotions of change
- Evaluate and analyze a system performance
- Design and execute a change plan for a system with people and not for them

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Assess progress against the plan, and adapt the plan as appropriate.
- 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
- Group activities
- Class discussions
- Simulation/Games
- Hands-on exercises
- Project-based learning
- Real-world case studies
- Guest lectures by leading academic and industry figuers

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
Assistant.e.s	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;

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.

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.

Ressources en bibliothèque

- Find the references at the Library

Notes/Handbook

- Course slides (main material)
- Videos
- Hand-outs

Moodle Link

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