

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	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Project	2 weekly
Number of positions	50

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

Summary

Continuous Improvement (CIP) deals with creating and delivering value to customers; internal and external. This course will arm students with practical skills and hands-on tools to lead sustainable change in manufacturing/service companies and make a difference.

Content

This course is based on the following four modules:

Module 1- Introduction to Continuous Improvement

- What is Continuous Improvement (CIP) and why all manufacturing/service companies need it?
- What is value and how to create and deliver it?
- What are the main pillars of driving and leading sustainable change?

Module 2- People (Leadership for Engineers)

- **Leading Self** (Growth mindset, emotional intelligence, building connection and trust)
- **Leading Others** (Effective communication, conflict resolution, developing your leadership style, leading teams)
- **Leading Complex Systems** (System dynamics & systems thinking, sustainability & business ethics, social responsibility & awareness, responsible engineering practises)

Module 3- Process (Leading Operational Excellence)

- **Operations Improvement/Operational Excellence** (Problem solving vs appreciative inquiry, design thinking, operations improvement tools)
- **Lean Operations** (Principle of lean system, lean building blocks, lean tools)
- **Capacity & Constraint Management** (Capacity planning, bottleneck analysis, Theory of Constraints (TOC))
- **Facility Layout** (Product and process layouts, line balancing)
- **Quality Management** (Product and service quality, quality costs, quality tools, Total Quality Management (TQM), quality tools, quality control)
- **Quality Control** (Inspection, acceptance sampling, control process (Variables: mean charts, R charts, Attributes: P-chart, C-chart), process capability, six sigma)
- **Leading Sustainable Change** (Why change projects fail, emotions of change, change management, change models, communicating a change plan, effective crisis management)

Module 4- Technology (Leading Digital Transformation)

- **Smart Manufacturing/Industry 4.0** (Innovation and Disruption, Connectivity, Cyber-Physical Systems)
- **Platforms & Digital Ecosystems** (From Product to Platforms, Benefits, Challenges, Role out, Governance)
- **Defining a Digital Roadmap** (Mapping Industries, Digital Transformation Frameworks, Defining Your Roadmap, Simplifying the User Experience)
- **Disruptive Technologies in Manufacturing** (Artificial Intelligence and Machine Learning, Data Analytics, Automation and Robotics, Augmented Reality and Virtual Reality, Block Chain Technology, Cloud Computing, Cybersecurity, Drones, Digital Twins, 3D Printing/Additive Manufacturing, Industrial Internet of Things (IIoT), Human-Machine Interaction, Wearables, 5G, ...)
- **Moving From Lean to Digital Lean** (Agile, Scrum, Digital Technologies Boosting Operational Excellence)
- **Cybersecurity & Cyberattack** (Digital Trust, Cyber Resilience, Digital Crisis Management)

Keywords

Continuous improvement, Operational Excellence, Value, Flow, Leadership for Engineers, Emotional Intelligence, Leading Sustainable Change, Change, Transformation, Transition, Value Chain, Lean Management, Value Stream Mapping, Process Mapping, Quality Management, Leading Digital Transformation.

Learning Prerequisites

Required courses

- Probability and Statistics

Recommended courses

- Production Management
- Machine Learning & Deep Learning
- Data Science for Business
- Supply Chain Management

Important concepts to start the course

- Data analysis with Excel
- Active engagement
- Advanced level of probability and statistics
- Openness and willingness to make change and transformation

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
- Case studies
- Project-based learning
- Games and simulations
- Videos
- Articles and research papers
- 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 engagement and class discussions, case evaluations, Q&A
- **In-group:** Teamwork (respect, brainstorming, engagement and giving effective feedback)

Assessment methods

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

- **25%** presence, participation, and class engagement,
- **45%** class assignments, presentations, projects, and case reports,
- **30%** final exam (final report and presentation and understanding of the case)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes
Others	• Meetings by appointment.

- All information sharing and communications regarding the course must be through Moodle.

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:

1. Daniel Kahneman, "Thinking Fast and Slow", Farrar, Straus and Giroux, 2013
2. Daniel Goleman, "Emotional Intelligence", Random House, 2007
3. Chade-Meng Tan, "Search inside Yourself", HarperOne, 2014
4. George Kohlrieser, "Hostage at the Table", John Wiley & Sons Inc, 2006
5. Douglas Stone, Bruce Patton, Sheila Heen, "Difficult Conversations", Penguin, 2011
6. Peter Senge, "The Fifth Discipline", Doubleday, 2006
7. John Sterman, "Business Dynamics: Systems thinking and modeling for a complex world", McGraw Hill, 2000
8. John Kotter, "Leading Change", Harvard Business Review Press, 2012
9. Provost, "Data Science for Business", O'Reilly Media; 1st edition, 2013
10. Nigel Slack, Alistair Brandon-Jones, "Operations Management", 2018
11. Sunil Gupta, "Driving Digital Strategy", Harvard Business Review Press, 2018
12. David Rogers, "The Digital Transformation Playbook", Columbia Business School Publishing, 2016
13. Ajay Agrawal, Avi Goldfarb, Joshua Gans, "Prediction Machines: The Simple Economics of Artificial Intelligence", Harvard Business Review Press, 2018
14. Karim R. Lakhani and Marco Iansiti, "Competing in the Age of AI: Strategy and Leadership When Algorithms and Networks Run the World", Harvard Business Review Press; 2020.

Ressources en bibliothèque

- [Hostage at the table / Kohlrieser](#)
- [The Fifth Discipline / Senge](#)
- [Leading Change / Kotter](#)
- [Driving Digital strategy / Gupta](#)
- [Operations Management / Slack](#)
- [Emotional Intelligence / Goleman](#)
- [Business Dynamics: Systems thinking and modeling for a complex world / Sterman](#)
- [Difficult Conversations / Stone](#)
- [The Digital Transformation Playbook / Rodgers](#)
- [Thinking Fast and Slow / Kahneman](#)
- [Search inside Yourself / Tan](#)
- [Data science for business / Provost](#)
- [Driving Digital Strategy / Gupta](#)
- [Competing in the Age of AI: Strategy and Leadership When Algorithms and Networks Run the World / Lakhani](#)
- [Prediction Machines: The Simple Economics of Artificial Intelligence / Agrawal](#)

Notes/Handbook

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