Course Descriptions for the Joint Study Programme
"International Master of Science in Engineering, Entrepreneurship and Resources (MSc. ENTER)

Version 10.2019

Courses at **Lappeenranta-Lahti University of Technology**
with the Specialization "**Chemical and Process Engineering**"

Module Name	**Current Issues in Enabling Technologies for Circular Economy**
Code	BJ02A1500
ECTS Credits	**5**
Responsible	Jutta Nuortila-Jokinen, Docent, DSci (Tech), Associate Professor, LUT Mari Kallioinen, Docent, DSci (Tech), Associate Professor LUT Minna Tiainen, Docent, PhD, University lecturer, Oulu University
Institute(s)	LUT School of Engineering Science
Duration	4th period (02.03.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	By the end of the course, the students are expected to be able to: 1. Understand basic concepts of circular economy (raw materials, processing, manufacturing until end-of-life recycling and reuse) and the drivers for change from linear to circular economy. 2. Understand and evaluate the processing technologies of materials in context of circular economy. 3. Recognize and compare impacts (environmental, economic and social) of processing technologies when assessing the current (linear) practice of material processing vs circular value chains. 4. Apply the transferable skills of life cycle thinking (ecodesign) to evaluate processing technologies in circular value chains.
Contents	The course will introduce the most important processing technologies that enable the implementation of circular economy, such as recycling and recovery as well as separation and purification technologies. The approach of the course is mainly solution based and thus aims to show practical examples on the utilization of different technologies in solving different kind of challenges in circular economy. A special emphasis is laid on topical themes, such as recycling and upgrading of plastic, electric, packaging and textile waste as well as on the production of biofuels. The course will also introduce the concept of ecodesign as a tool to manage the complex value chains in circular economy.
Teaching Methods	The students will prepare a team portfolio on one specific subject during this course that will be assessed. In the preparation and assessment of the portfolios peer and self-evaluation will be utilized. In addition, students will answer individually to 2 compulsory questions (in the beginning and in the end of the course).

Assessment Methods	
Materials/literature	The course material and the guidance to supplementary material is provided in connection with the different topics.
Grading	Pass/fail (to be updated)
Note	Location: full digi The course is suitable for distance learning.

Module Name	**Process Intensification**
Code	BJ02A2051
ECTS Credits	**5**
Responsible	Arto Laari, Docent, D.Sc. (Tech.)
Institute(s)	LUT School of Engineering Science
Duration	4th period (02.03.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	Upon completion of the module, the student will be able to: - explain the principles and goals of process intensification, describe advantages of process intensification and typical intensification methods - explain and apply intensified reactors and separation equipment, combination of reaction and separation, hybrid separation, alternative energy sources, transformation of batch processes to continuous ones - recognize possibilities to intensify processes and apply novel technology in existing processes.
Contents	Teaching includes lectures, exercises and seminars. During the exercises, students will carry out a group work concerning intensification of some processes given by the lecturer.
Teaching Methods	Lectures, seminars and exercises 28 h, 4th period. Group work, self-studies, preparation for seminars and examination 102 h.
Assessment Methods	Written examination 50%, seminar report and exercises 50% Exam planned on 29.04.2020 (wed 16.15 – 19.15)
Grading	0-5
Materials/literature	Lecture notes
Workload	130 h
Note	Location: Lappeenranta

Module Name	**Knowledge Discovery and Process Data Analysis**
Code	BJ02A2000
ECTS Credits	**5**
Responsible	Professor, D.Sc. (Tech.) Satu-Pia Reinikainen M. Sc. Tuomas Sihvonen
Institute(s)	LUT School of Engineering Science
Duration	4th period (02.03.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	By the end of the course, the student is expected to

	• be aware of the effect of digitalization and automation on amount, nature, and quality of data from chemical engineering point of view • have acquired a basic knowledge of the main concept of knowledge discovery process concerning industrial data • be able to apply specified methods and methodology on data • be able to apply management and cooperation skills in implementation of project work.
Contents	The knowledge discovery is referring to the overall process of discovering useful knowledge from data. The knowledge discovery process is interactive and iterative and involves several steps starting from studying the application domain and ending to use of the information discovered. Process data analysis can be part of this process. Fundamental concepts - such as reliability of data, preprocessing (e.g., de-noising, handling missing data, and scaling strategy), data reduction, choosing methodology, validation, modelling, etc - will be addressed in tutorials, Moodle assignments, and discussions. A project work will be carried out in small groups that will define their working methodology. The course is suitable for distance learning.
Teaching Methods	Online tutorials 7 h, online discussions and peer feedback 7 h, Moodle exams 7 h, and assignments 20 h. Project work 40 h, online independent study 49 h. Total workload 130 h.
Assessment Methods	Numerical assessment (0-5), project work 40%, assignments 30%, Moodle exams and peer feedback 30%
Grading	0-5
Materials/literature	Tutorial videos, online material distributed or announced in Moodle
Prerequisites	Basic skills in Matlab programming and mathematics.
Workload	130 h
Note	Limitation for 50 students in Chemical Engineering M. Sc. programme

Module Name	**Academic Entrepreneurship**
Code	CS34A0060
ECTS Credits	**6**
Responsible	Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala
Lecturer(s)	D.Sc. (Econ. & Bus. Adm.) Suvi Konsti-Laakso D.Sc. (Econ. & Bus. Adm.) Tuuli Ikäheimonen Professor, D.Sc. (Econ. & Bus. Adm.) Timo Pihkala
Duration	3rd period (17.02.20 –19.02.20)
Learning Outcome (Competencies)	The course aims to develop the students' awareness of their entrepreneurial mindset. The aims also include enhancing the students' understanding of entrepreneurial opportunities and routes for grasping them. Furthermore, the students learn new ways to commercialize their knowledge, skills and research activities.
Contents	• The central concepts of entrepreneurship • The entrepreneurial mind-set, motivations, resources and opportunities • The anatomy of a start-up business and the venturing process • Commercializing academic skills and research activities • Communicating entrepreneurial ventures.

Teaching Methods	Three intensive days. Lectures and team work, tests and exercises, developing business ideas, homework exercises, practicing presentations of business cases, study visits or visitor lecturers. Total workload 156 h.
Assessment Methods	course assignments (50%) and examination in Moodle (50%)
Grading	1-5
Materials/literature	Handouts, recommended literature: • Barringer, B. & Ireland. D. (2006). Entrepreneurship: Successfully Launching New Ventures, Pearson Prentice Hall. (Edition 2006 or newer) • Bird, B. (1988). Implementing Entrepreneurial Ideas: The Case for Intention. Academy of Management Review, 13(3), 442-453. • Jayawarna, D., Jones, O. & Macpherson, A. (2014). Entrepreneurial potential: The role of human and cultural capitals. International Small Business Journal, 32(8), 918-943. • Krueger, N., Reilly M. & Carsrud, A. (2000). Competing models of entrepreneurial intention. Journal of Business Venturing, 15, 411-432. • Mauer, R., Neergaard, H. & Kirketerp Linstad, A. (2009). Self-Efficacy: Conditioning the Entrepreheurial Mindset. In. Carsrud, A.L. & Brännback M. (eds.), Understanding the Entrepreneurial Mind, International Studies in Entrepreneurship 24, DOI 10.1007/978-1-4419-0443-0_11. • Wright, M. (2014). Academic entrepreneurship, technology transfer and society: where next? The Journal of Technology Transfer, 39(3), 322-334. doi:10.1007/s10961-012-9286-3. • Wright, M., Lockett, A. Clarysse, B. & Binks, M. (2006). University spin-out companies and venture capital. Research Policy 35, 481-501. doi:10.1016/j.respol.2006.01.005
Note	To master level students. The course is especially suitable for those students interested in developing their entrepreneurial competences and enhancing their employability skills. The course will be organized for 8-25 persons. The priority is given for students of Master's Programme in Engineering, Entrepreneurship and Resources (ENTER) (max 20 places). The rest of the places will be distributed in the order of registration. Taught in Lappeenranta campus.

Module Name	**Business Start-ups and Spin-offs**
Code	CS34A0734
ECTS Credits	**6**
Responsible	Junior researcher, M.Sc. Katja Lahikainen Professor, D.Sc. Timo Pihkala
Duration	3rd period (30.01.20 – 21.02.20)
Learning Outcome (Competencies)	The course focuses on start-ups, spin-offs and especially on the planning of new ventures. After the course the student is familiar with business start-up theories and processes, is able to critically analyze different business ventures and is skilled in testing business ideas. In addition, the student is able to prepare a business plan with its calculations and present the businesses successfully.
Contents	Entrepreneurship theory and process, start-ups and spin-offs, lean start-up, start-up strategies, testing of business ideas, business plans, evaluation criteria.

Teaching Methods	Lectures 16 h and preparing for lectures (30h) Assignment, independent work (76h) Moodle-exam and literature (50 h) Total workload 156 h
Assessment Methods	Assignment 50%, Moodle-exam 50%.
Grading	Grades 0-5, evaluation 0-100 points
Materials/literature	Barringer, B.R. & Ireland, R.D. (2006 or later edition). Entrepreneurship: successfully launching new ventures. Pearson Prentice Hall.
Note	Location: Lahti

Elective courses:

Module Name	**Industrial Project Management**
Code	CS10A0875
ECTS Credits	**3**
Responsible	Daria Podmetina, Post-Doctoral Researcher, D.Sc. (Tech.)
Lecturer(s)	Associate Professor, D.Sc. (Tech.) Daria Podmetina Professor, D.Sc. (Tech.) Olli-Pekka Hilmola PhD Student Iryna Maliatsina
Institute(s)	LUT School of Engineering Science
Duration	4th period (02.03.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	The Industrial Project Management (PM) course has the following objectives: 1.To get familiar with a variety of industrial projects, multi-project environments and project management principles 2.To understand the needs, context and importance of PM in an industrial organization, and learn up-to-date tools and methods facilitating the effective planning, productivity and project workflow processes control 3.To learn resource-planning (people, time and costs) and budgeting as the foundation of project planning and control 4.To understand the steps, processes and risks involved in different industrial projects and their management 5.To understand the roles and responsibilities of HR manager, project leader and project manager The corporate challenge solving is expected to contribute to all the objectives by providing real-life experience in applying the students' project management and innovation skills and knowledge.
Contents	Industrial Project Management Course provides Master's students with theoretical insights and practical tools aiming at developing project management skills. Students revise the PM concepts and tools for organizing, planning, and controlling projects (PERT, Gantt, critical path, critical chain and DSM matrixes) using the software (MS Project, DSM) and learn to apply the work breakdown structures and networks for planning and scheduling the projects and project portfolios. Students also learn how to estimate the status of projects and how to finance technology development projects. Engaging with real-life project management and innovation challenges from companies allows the students to gain relevant practical experience, where they may

	apply their knowledge and skills, learn the actual issues faced by organizations that seek to benefit from new project tools, methods or new innovative solutions and strategies in project management. This course covers the fundamental concepts and applied techniques for cost effective management of both long-term development programs and short-term projects. Project management principles and methodologies are provided with special focus on planning, controlling, and managing projects. After successfully completing this course, the student will be able to: identify the elements of the PM lifecycle: plan, control, organize and allocate the resources; understand PM processes and comprehend basic tools and techniques to plan, organize and manage a project; optimize results while managing the constraints and stakeholder communications.
Teaching Methods	Lectures 14 h, computer exercises 4h, project analysis and report 35 h (includes presentation), individual work 27 h, total 80 h. Moodle is used in this course.
Pre-requisites	The course is targeted to the students of Global Management of Innovation and Technology (GMIT) master program, but other students can also participate. Number of participants is limited to 50.
Assessment Methods	0-5, based on the report (70 %), and home assignments/group work during the course (30 %).
Grading	0-5
Materials/literature	Kerzner, Harold R. (2013). Project Management: A Systems Approach to Planning, Scheduling, and Controlling. Wiley, New Jersey. Eppinger, Steven D. & Tyson R. Browning (2012). Design Structure Matrix Methods and Applications. MIT press, Boston.
Workload	80 h
Note	Location: Lappeenranta

Module Name	**Manufacturing Processes for Recyclable Products**
Code	BK90C2500
ECTS Credits	**5**
Responsible	Professor, D.Sc. (Agr. & For.) & D.Sc. (Tech.) Timo Kärki
Lecturer(s)	Timo Kärki Ville Lahtela
Institute(s)	LUT School of Energy Systems
Duration	4th period (02.03.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	Main aim of the course is to highlight the potential of recyclable materials for different end products. Global industrial waste recycling and services market is witnessing strong growth and an increasing importance on recovery of key materials resources in the industrial waste streams as well as in construction and demolition waste is reflected in recycling services with rapid growth. After having completed this course, the student should be able to: understand the potential of recyclable materials define technical processes for utilization of recyclable materials can put new ideas into action.
Contents	What are recyclable materials? Waste policy and waste hierarchy in EU and globally. Pre-treatment and sorting processes for recyclable materials. Extrusion and moulding as methods for recycled materials. Other potential

	manufacturing and production methods. Recycled end products and EoW legistlation.
Teaching Methods	Lectures 21 h, independent study 79 h, seminar 30 h. Total workload 130 h.
Assessment Methods	examination 70%, seminar 30%
Grading	0-5
Materials/literature	Course material in Moodle. Other literature to be announced during lectures.
Workload	130 h
Note	Location: Lappeenranta

Module Name	**Simulation, Laboratory Course**
Code	BK70A0102
ECTS Credits	**5**
Responsible	Aki, Mikkola, D.Sc. (Tech.), Professor
Lecturer(s)	Aki Mikkola
Institute(s)	LUT School of Energy Systems
Duration	3rd and 4th period (07.01.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	The student will learn the advanced theories and practices of the mathematical modelling and computer simulation of machine systems. The student will be able to utilise advanced simulations to solve a practical design assignment. The student will be able to verify and evaluate the accuracy of simulation models. The student will be able to conduct individual scientific work to analyse the dynamics of machine systems.
Contents	Spatial kinematics, modelling of flexible bodies in multibody applications, modal reduction methods, real-time simulation, embedded systems, contact modelling, multibody dynamics on failure analysis, vehicle modelling, model verifications, practical measurements.
Teaching Methods	Lectures 22 h, teamwork in a multi-cultural working environment 32 h, supervised tutorials 36 h, independent study 40 h. Total 130 h
Pre-requisites	Recommended: Course “Simulation of a mechatronic machine” completed.
Assessment Methods	examination or mid-course examinations 45%, simulation work 45%, in class quizzes 10%
Grading	0-5
Materials/literature	Lecture notes. Shabana, A. A.: Dynamics of Multibody Systems, Cambridge University Press, 3rd edition, 2005. ISBN 0-521-85011-8.
Workload	130 h
Note	Location: Lappeenranta, full digi

Module Name	**Advanced Course in Life Cycle Assessment**
Code	BH60A2101
ECTS Credits	**7**
Responsible	Risto Soukka, D.Sc (Tech.), Professor
Lecturer(s)	Sanni Väisänen, Risto Soukka
Institute(s)	LUT School of Energy Systems

Duration	3rd and 4th period (07.01.20 -17.04.20)
Teaching Language	English
Learning Outcome (Competencies)	Upon completion of the course the student is expected to be able to 1. explain the basic life cycle concepts, 2. plan, implement and analyse assessments to select products and services which fulfil the requirements of sustainable development, 3. plan, implement and analyse assessments to reveal development needs of products and services, 4. recognise the most inexpensive ways to reduce the environmental impact, and 5. perform life cycle assessments using software 6. apply theories to find and develop the most sustainable product, process or system design.
Contents	Introduction to life cycle assessment, carrying out life cycle assessment, aspects related to inventory analysis, aspects related to impact assessment, calculating a carbon footprint, introduction to life cycle costing, aspects related to life cycle costing, LCA and LCC examples. This course is also suitable for postgraduate students.
Teaching Methods	3rd period: 10 h of lectures, 3 h of computer training. Assignment 1 with a Quiz, literature and computational part, individual and pair work (approx. 38 h). 4th period: 4 h of lectures, 4 h of computer training. Assignment 2 with Life cycle modelling task, final report and result presentation meeting, group work (approx. 82 h). Examination and preparation for it (approx. 41 h). Total workload 182 h.
Assessment Methods	assignment 75%, examination 25%
Grading	0-5
Materials/literature	Walter Klöpffer, Birgit Grahl Life Cycle Assessment (LCA), A Guide to Best Practice. Standards ISO 14040 and ISO 14044.
Workload	182 h
Note	Location: Lappeenranta, Lahti *In order to take the course, the student should have own laptop computer with Windows (limited number of computers in classroom available)*