ENGINITE Modules

Contributors

The ENGINITE Consortium,
led by CUBEIE

ENGineering and INdustry Innovative Training for Engineers (ENGINITE)

PROJECT NUMBER
2017-1-CY01-KA202-026728

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Consortium

This document has been produced by the consortium of the ENGINITE project

Cyprus University of Technology	**CYRPRUS UNIVERSITY OF TECHNOLOGY [CUT]**
AALBORG UNIVERSITY DENMARK	**AALBORG UNIVERSITET [AAU]**
CUBE INTEGRATED ENGINEERING	**CUBEIE L.L.C. [CUBEIE]**
	TECHNICAL UNIVERSITY OF CRETE [TUC]
GrantXpert consulting	**GRANTXPERT CONSULTING LTD [GrantXpert]**
think up	**USEFUL SIMPLE PROJECTS LTD [ThinkUP]**

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Contributors

(ThinkUp) Oliver Broadbent
(AAU) Søren Willert
(CUBEIE) Andreas Andreou, Panayiotis Andreou
(CUT) Andri Ioannou, Yiannis Georgiou, Stelios Yiatros, Ioannis Vyrides
(TUC) Nikos Xekoukoulotakis, Konstantinos Komnitsas
(GrantXpert) Christina Achilleos, Stephanie Apserou

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Table of Contents

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

1. Introduction

This document includes the courses syllabi and all relevant information regarding the ENGINITE training courses. The syllabi aim to gather all relevant information for the eight courses and ensure that the responsible partners are well prepared for the training on the Problem based learning. After the training is expected that the syllabi will be updated accordingly.
The table below presents all eight courses and the partner of the consortium who is responsible for the design, development and improvement of each course.

Table 1: Courses titles and responsible partner

A	**Employability Enhancement & Managerial Skills**
A1 Week 2	Engineering Systems Thinking: Re-engineering by Simplifying
A2 Week 3	Project Management in Action
A3 Week 4	Innovation, Entrepreneurial and Intrapreneurial skills
A4 Week 5	Applied Efficient Quality and Health & Safety Management Systems
B	**Technical Knowledge Enhancement**
B1 Week 7	Engineering Logistics and Supply Chain Analysis in practice
B2 Week 8	Engineering Economics
B3 Week 9	Applied Process and Production Optimization
B4 Week 10	Product Development: From Concept to Market

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

2. Courses concept

a. Teaching Methodology

The courses will be taught with the use of Problem Based Learning methodology. Real cases which are derived directly from SME/industry and are relevant to the subject of the course will be used as case studies. The problems may be defined from each industry/SME partner organization, yet young engineers and/or instructors will be able to suggest alternative problems/case studies as well. Trainees, under the guidance of their instructors, need to approach and tackle problems by offering tangible solutions, and present their findings and suggestions to their instructor and industry/SME partner organization. The success will depend heavily on students' preparation and on active participation during the learning process.

b. Blended learning

Each course of the program will be composed by both online and face to face sessions. Thus, each course will be carried out using blended learning approach.

The first session of each course will be carried out online; in this session trainees will be introduced to the course. In particular, this introductory session aims to inform the trainee engineers about the course's scope and its learning approach, the resources that will be used (e.g., online presentations and/or videos) as well as the expected learning outcomes. Moreover, possible problems/case studies will be presented for the purpose of each course. Thus, at this point participants will be able to brainstorm and suggest further/ alternative problems as well.

After the introduction, one-week face-to-face meetings between engineers and the instructors will take place. During that week, the engineers are expected to analyze the given problems/case studies, as well as to develop and present their proposed solution, for accomplishing successfully the desirable learning goals.

Participation to both, online session and face-to-face meetings are obligatory for the successful completion of each course.

c. Duration

The total duration of each course will be 6 days and it is comprised of one online session of approximate three hours (1 day) and five face-to-face meetings (5 weekdays).

The online introduction to all of the courses will be clustered at the start of the programme. Each course will then be delivered one-after-the-other.

During each face-to-face meeting, the instructor will provide guidance and support to trainees for approximately three hours. It is noted that the trainees will be responsible to manage their time efficiently in order to complete the deliverables in the time-frame given.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

d. Team working

Trainees will work in groups of 4-5 to identify the problems that they will have to solve; they will also work together to reach the most appropriate and evidence-based solutions. Finally, the trainees will collaborate to reflect on their learning to agree shared learning objectives.

e. Assessment

In alignment with the PBL methodology, assessment will be flexible course-by-course and will include a mixture of formative assessment (to help trainees guide their own learning) and summative assessment (to give the trainees a grade). Since learning outcomes will vary, a certain degree of negotiation is expected between trainees and facilitator on what is going to be assessed and how.

Nevertheless, an important part of the assessment will be considering how the trainees have participated in reflective learning. To support reflective learning itself, and assessment of engagement with reflective learning, trainees will be expected to keep a reflective diary, for providing evidence of their work as they progress through the programme. The exact content of these reflective diaries will be agreed with the trainers for each module, but these diaries should necessarily demonstrate how reflection has caused the trainee to decide upon and subsequently modify their plans and actions during the learning process.

All courses will include an output (final artifact) based on the problem that participants have tried to solve. This output will form part of the evidence for assessment.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

3. Courses Syllabi

A. Employability Enhancement & Managerial Skills

Applied Efficient Quality and Health & Safety Management Systems

I. Courses Description

The course aims to enrich engineers' knowledge and capabilities in *Applied Efficient Quality and Health & Safety Management Systems: Theory, Applications, Cooperative Culture Integration* and enable them to successfully participate in or lead complex projects with tight schedule, limited resources, yet with high quality results. Besides, in real-world industrial workplaces parameters constantly change and problems have to be overcome, thus the engineers need to be properly trained. For this purpose, real industrial projects in combination with the Problem Based Learning (PBL) approach will be used during the course, to equip the engineers with the required skills. Great organizational and analytical skills, understanding of leadership, management and teamwork, along with a holistic grasp of the project-at-hand are just some of the capabilities that engineers need and will acquire through this course. Good practices will also be available as participants' tools.

I. Key learning outcomes:

Upon completion of the course, participants will be able to:

- Understand what a *Quality Management System* (QMS) is and its benefits for the business (with particular emphasis on SMEs) and the employees
- Understand what a *Health and Safety Management System* (HSMS) is and its benefits (with particular emphasis on SMEs) for the business and the employees.
- Realize why a QMS and a HSMS is an approach to improve *Quality* (Q) and *Health and Safety* (H&S) at workplace, improve its market profile and prevent accidents and injuries.
- Learn about requirements, regulations and key elements of each system.
- Design QMS and HSMS in practice.
- Recognize the important elements of efficient team working and leadership in such system design and operation.
- Carry out a SWOT analysis pertinent to QMS and HSMS.
- Validate existing systems with the use of Key Performance Indicators (KPIs) and propose improvements.
- Introduce environmental aspects in both QM and HSM Systems.

II. Course Material / Software

- Young engineers may use their own laptops
- Internet access is required during training

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

III. Problems/ Case studies

A sample of possible problems/case studies to be used for the training of the young engineers may be the following (this can be finalized when the background of the trainees and the industries/SMEs are known):

- Design / Improvement of a QMS and a HSMS in a quarry in Crete/Greece
- Design / Improvement of a QMS and a HSMS in a wastewater treatment plant in Crete/Greece
- Design / Improvement of a QMS and a HSMS in road construction in Crete/Greece
- Design / Improvement of a QMS and a HSMS in a chemical laboratory in Crete/Greece
- Design / Improvement of a QMS and a HSMS in a food processing unit in Crete/Greece
- Any other proposed project from young engineers and/or industrial/SME partner.

IV. Preparation

No prior preparation is needed by trainees.

V. References

1. Adi, F.M., Phang, F.A., Yusof, K.M. 2012. Student Perceptions Change in a Chemical Engineering Class using Cooperative Problem Based Learning (CPBL), *Procedia - Social and Behavioral Sciences*, 56, 627-635, https://doi.org/10.1016/j.sbspro.2012.09.697
2. Alwi, S.R.W., Yusof, K.M., Hashim, H., Zainon, Z. 2012. Sustainability Education for First Year Engineering Students using Cooperative Problem Based Learning, *Procedia - Social and Behavioral Sciences*, 56, 52-58, https://doi.org/10.1016/j.sbspro.2012.09.631
3. Ates, O., Eryilmaz, A. 2010. Factors affecting performance of tutors during problem-based learning implementation, *Procedia - Social and Behavioral Sciences*, 2(2), 2325-2329, https://doi.org/10.1016/j.sbspro.2010.03.330
4. Baharom, S., Hamid, R., Hamzah, N. 2012. Development of a Problem based Learning in Concrete Technology Laboratory Work, *Procedia - Social and Behavioral Sciences*, 60, 8-13, https://doi.org/10.1016/j.sbspro.2012.09.339
5. Basri, N.E.A., Zain, S.Md., Jaafar, O., Basri, H., Suja, F. 2012. Introduction to Environmental Engineering: A Problem-based Learning Approach to Enhance Environmental Awareness among Civil Engineering Students, *Procedia - Social and Behavioral Sciences*, 60, 36-41, https://doi.org/10.1016/j.sbspro.2012.09.343
6. Carriger, M.S. 2015. Problem-based learning and management development – Empirical and theoretical considerations, *The International Journal of Management Education*, 13(3), 249-259, https://doi.org/10.1016/j.ijme.2015.07.003
7. Harris, A.T., Briscoe-Andrews, S. 2008. Development of a problem-based learning elective in "green engineering", *Education for Chemical Engineers*, 3(1), 15-21, https://doi.org/10.1016/j.ece.2007.12.001
8. Harun, N.F., Yusof, K.M., Jamaludin, M.Z., Hassan, S.A.H.S. 2012. Motivation in Problem-based Learning Implementation. *Procedia - Social and Behavioral Sciences*, 56, 233-242, https://doi.org/10.1016/j.sbspro.2012.09.650
9. Ivicek, K., de Castro, A.B., Salazar, M.K., Murphy, H.H., Keifer, M. 2011. Using Problem-Based Learning for Occupational and Environmental Health Nursing Education: Pesticide

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Exposures Among Migrant Agricultural Workers, *AAOHN J.*, 59(3), 127–133. doi:10.3928/08910162-20110216-02
10. Jamaludin, M.Z., Yusof, K.M., Harun, N.F., Hassan, S.A.H.S. 2012. Crafting Engineering Problems for Problem-Based Learning Curriculum, International Conference on Teaching and Learning in Higher Education (ICTLHE 2012), in conjunction with RCEE & RHED 2012, *Procedia - Social and Behavioral Sciences* 56, 377 – 387.
11. Promentilla, M.A.B., Lucas, R.I.G., Aviso, K.B., Raymond R. Tan, R.R. 2017. Problem-based learning of process systems engineering and process integration concepts with metacognitive strategies: The case of P-graphs for polygeneration systems, *Applied Thermal Engineering*, 127, 1317-1325, https://doi.org/10.1016/j.applthermaleng.2017.08.086
12. Ramsay, J., Sorrell. E. 2006. Problem-Based Learning: A Novel Approach to Teaching Safety, Health and Environmental Courses, *Journal of SH&E Research*, 3(2), 1-8
13. Stanley, T., Marsden, S. 2012. Problem-based learning: Does accounting education need it? *Journal of Accounting Education*, 30(3-4), 267-289, https://doi.org/10.1016/j.jaccedu.2012.08.005
14. Topalli, D., Nergiz Ercil Cagiltay, N.E. 2018. Improving programming skills in engineering education through problem-based game projects with Scratch, *Computers and Education*, 120, 64-74, https://doi.org/10.1016/j.compedu.2018.01.011
15. Yusof, K.M., Hassan, S.A.H.S., Jamaludin, M.Z., Harun, N.F. 2012. Cooperative Problem-based Learning (CPBL): Framework for Integrating Cooperative Learning and Problem-based Learning, *Procedia - Social and Behavioral Sciences*, 56, 223-232, https://doi.org/10.1016/j.sbspro.2012.09.649

Innovation, Entrepreneurial and Intrapreneurial Skills

I. Courses Description

The course aims to introduce young engineers to the concept of Innovation, and particularly in understanding how to manage innovation under the creative process of creating new innovative products/services, or participating effectively in corporate innovative processes. Upon completion of the course, young engineers will have explored the necessary *Entrepreneurial* and *Intrapreneurial* skills and capabilities essential to enable them to successfully participate in or lead complex projects with tight schedules, limited resources, yet at the same time with high quality results. The parameters of the real-world industrial workplaces are constantly changing and problems need to be overcome; thus, young engineers need to be properly trained. For this purpose, this course will prepare the engineers to solve their everyday work challenges with an entrepreneurial zest! The course is applicable to young engineers who will either run their own business or work for another business. Given the opportunity to address real industry cases in combination with the infused Problem Based Learning (PBL) approach which will be used during the course, it is expected that engineers will gain the desired innovation and entrepreneurial skillset. Creative and critical thinking skills, understanding leadership and adopting effective innovation culture, embracing creative processes that lead to new innovative products/services/processes, self-management and teamwork skillset, applying proven business models to boost innovation, along with a holistic grasp of the project-at-hand are just some of the capabilities that engineers need and will acquire through this course. Good practices and live talk sessions from industry leaders will also be available as participants' tools.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union
THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

II. Key learning outcomes:

Upon completion of the course, participants should be able to:

- Understand the concept of Innovation, particularly Innovation Management.
- Enable young engineers to develop their analytical skills through introducing them to a real innovation management design project.
- Enable young engineers develop critical thinking and insight to improve their effectiveness as engineers working with solving real work problems.
- Enhance entrepreneurial and intrapreneurial knowledge and skills through theoretical and practical application either by working on cases individually or in teams.
- Recognise the key drivers of innovation and understand the critical role of effective leadership
- Strategise about how to create an organisational culture to support innovation.
- Understand how innovation fits the Business Model Canvas, and how essential it is for effective Innovation Management.

*At the end of the course, each participant will have the opportunity to create their personal list of entrepreneurial skills needed to cope within an ever changing innovative and complex industry. Therefore, trainees will have the opportunity-after being exposed to the course material and exercises- to think creatively and derive to their own skillset, which will be a proof of how they have indulged to critical thinking introduced to them.

III. Course Material / Software

- Young engineers may use their own PCs/laptops.
- Internet access is required for the efficient and effective delivery of the course.

IV. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is presented below:

- Introduce young engineers to the EU official platform 'Improve Innovation Academy' to help them understand the importance of Innovation Management on an EU and global level, while also exposing them to an ever-growing innovation management ecosystem. (https://www.improve-innovation.eu)
- Analyse the example of Engino; a real CY business case which applies effective Innovation Management designs.
- Solve a real problem faced at Engino to enhance trainees' creative & critical thinking skills.
- Work through a series of exercises to learn how to cope with solving problems alone or as part of a team. This will include brainstorming sessions, outdoor activities, negotiation exercises, critical and analytical thinking practical exercises, etc.
- Play the 'Where do you fit in?' game inspired by Jonathan Greehan[1] to help young engineers recognise their organizational identity, and enhance their intra-environmental communication

[1] https://fi.co/insight/where-do-you-fit-in-a-founder-s-guide-to-startup-roles

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

with peers. Current skillset will be recognized, while also drawing the gaps in current skillset for each participant.

- Participate in live talk sessions with leading industry examples that will showcase to young engineers how these leaders differentiated in the global market by adopting: 1) an effective leadership identity 2) an organisational culture that drives innovation. Examples of speakers: Savvas Savvides, International Professional Registrations Advisor at The Institution of Engineering and Technology, Costas Sisamos, CEO at Engino, Dr. Panayiotis Phlimis, CEO of CyRIC, Tasos Kounoudes, CEO and Co-founder of SignalGeneriX.
- Introducing Young Engineers to the Business Model Canvas and the lean start-up methodology. Working with analysing the BMCs of Google and IBM and other local companies of smaller size to understand the principles of this model and how it enhances innovation.

VI. Preparation

No prior preparation is needed by participants.

VII. References

- Adair, J. (2009). Leadership for innovation. London: Kogan Page.
- Davis K. (1977). *Human Behavior at Work Organizational Behavior*. McGraw Hill
- Drucker, P. and Maciariello, J. (2015). *Innovation and entrepreneurship*. Oxfordshire, England: Routledge Classics.
- Fisk, P. (2011). *Creative genius.* Chichester: Capstone.
- Gassmann, O., Frankenberger, K. and Csik, M. (2014). *The business model navigator*. Harlow [etc.]: Pearson Education.
- Green, K. (2014), Creative-thinking exercises for entrepreneurship class. *Journal of Business Cases and Applications*. 12, pp.1-10
- Robbins S. P., *Organizational Behavior*. Prentice Hall, latest edition New Jersey: Pearson international, latest edition

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Engineering Systems Thinking: Re-engineering by Simplifying

I. Courses Description

This course aims at shifting graduates' mindset in engineering problem solving, moving away from solving 'part'-problems and focusing on optimal solutions of the overall system. The solutions emanating from systems thinking usually lead to "doing more with less", globally optimal solutions. The participants will be introduced to the concepts of systems thinking through problem-based learning techniques which will be applied on relevant engineering systems. The graduate engineers participating in this module will gain much needed entrepreneurial and 21st century business skills that will help them develop a prosperous career.

II. Key learning outcomes

Upon completion of the course, participants should be able to:

- Develop an appreciation of systems concepts.
- Recognize the important elements of systems thinking in solving problems across scales, sectors and disciplines.
- Appreciate the merits of Problem Based Learning for learning new techniques.
- Develop a sound understanding of particular systems thinking methodologies and tools
- Frame problems with a systems thinking approach.
- Develop Entrepreneurial and innovation skills by challenging conventional solutions.
- Gain experience in multi-disciplinary systems thinking problem solving through case studies.
- Define and assess the positive outcome through a systems thinking problem solving approach.

III. Course Material / Software

- All participants need to use their own PCs/laptops.

IV. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is following:

- Climate Change effects on flooding risk for coastal cities
- Design and execution of a circular economy system for the construction industry on an island
- Waste management on a campus.
- Novel business models for the construction/property development industry
- Any other proposed project from engineers and/or industrial partner.

VIII. Preparation

No prior preparation is needed by participants.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

IX. References

- D. Meadows. 2015. Thinking in Systems: a Primer, Chelsea Green Publishing Co.
- D. Sherwood. 2002. Seeing the Forest for the Trees. A Manager's Guide to Applying Systems thinking, Nicholas Brealy International
- A. Engel. 2018. Practival Creativity and Innovation in Systems Engineering, Wiley Series in Systems Engineering & Managements, Wiley-Blackwell.

Project Management in Action

I. Courses Description

The course aims to enrich engineers' knowledge and capabilities in Project Management and enable them to successfully participate in or lead complex projects with tight schedule, limited resources, yet with high quality results. Besides in real-world industrial workplaces, parameters constantly change and problems have to be overcome, thus the engineers need to be properly trained. For this purpose, real industrial projects in combination with the Problem Based Learning (PBL) approach will be used during the course, to equip the engineers with the required skills. Great organizational and analytic skills, understanding of leadership, management and teamwork, along with a holistic grasp of the project-at-hand are just some of the capabilities that engineers need and will acquire through this course. Good practices and user-friendly software will also be available as participants' tools.

II. Key learning outcomes:

Upon completion of the course, participants should be able to:

- Apply Project Management design and development in real projects.
- Recognize the important elements of efficient team working and leadership in project management.
- Manage effectively any project in terms of cost, timeframes, quality, and deliverables.
- Perform risk assessment for the main parameters of the project.
- Learn how to monitor project activities and assess progress.
- Define and monitor Key Performance Indicators (KPIs) as well as take corrective measures for the project success.
- Employ scheduling software productively along with applied technics.

III. Course Material / Software

- All participants need to use their own PCs/laptops.
- The MS Project 2016 will be used during the course.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

V. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is following:

- Project management and time schedule of the design and construction of an oil tank farm in Cyprus
- Project management and time schedule of the design and production of a new industrial product
- Project management and time schedule of the design and deliver of the health and safety training of the industrial workers.

VI. Preparation

No prior preparation is needed by participants.

VII. References

- A Guide to the Project Management Body of Knowledge (PMBoK®)
- Project Management Journal (Wiley – PMI)
- Project Management: A quick reference guide (Andreas Solomou – ISBN 978-9963-2208-1-6)
- PMP® Project Management Professional Study Guide, Eighth Edition (Kim Heldman - ISBN 978-1-932-73565-9)
- PMP® Exam Prep, 8th Edition (Rita Malcahy - ISBN 978-1-119-17967-2)
- Managing Successful Projects with PRINCE2® (OGC - ISBN 978-0-11-331059-3)

B. Technical Knowledge Enhancement

Engineering Economics

I. Courses Description

This course emphasizes the economic principles and the analysis of engineering decisions. Thus, the strong relationship between engineering design and manufacturing of products/systems and the evolved economic aspects, along with applied concepts of the time value of money and equivalence, will be highlighted in the course. It is essential for both industry and engineers to be able to transform a concept and/or project into requirements, equipment and a reliable estimation for resources and critical parameters such as cash flows, capital, operational and maintenance costs and cost of money. The correct assumptions, the capability of investigation and location of the right partner and provider, along with the magic of creating a realistic economo-technical model are the core elements of this course. Real problems and cases from the industry will be introduced and the Engineers will be called to propose their engineering economic analysis report.

II. Key learning outcomes

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Upon completion of the course, participants should be able to:

- Define, estimate and analyse engineering - industrial project costs.
- Combine creatively knowledge of mathematics, economics, and engineering principles to solve engineering industrial problems.
- Efficiently perform money management and use gained knowledge to make economic assessments of alternative engineering designs, solutions or projects.
- Understand, formulate and employ cash flow models in practical situations, by taking into account rational assumptions, interest factors and data from the industry underlying these models.

III. Course Material / Software

- All participants need to use their own PCs/laptops.
- Excel for simple calculations will be used during the course.
- Statistical software – for more complicated analysis.

IV. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is following:

- Estimation of Fixed-Capital Investment using Ranges of Process-Plant Components
- Examples based on Initial costs, initial investment and final profit for alternative-energy (biomass-based) power plants.
- Examples based on cost, investments and final production benefits for new nuclear plants.
- Any other proposed project from engineers and/or industrial partner.

V. Preparation

- Engineering Mathematics
- Basic skills with Excel, computing tools.

VI. References

- Chan. S. Park, 2013. Fundamentals of Engineering Economics (3rd Edition) 3rd Edition, Pearson. ISBN-13: 978-0132775427.
- James Riley Couper, 2003. Process Engineering Economics (Chemical Industries) 1st Edition.
- S Peters, KD Timmerhaus, Process Design and Economics for Chemical Engineers (5th Ed.), McGraw-Hill, 2002.

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Product development. From concept to market

I. Courses Description

As competition among companies and industries is getting tougher as the number of products on the market increases, many are realizing the importance of product development as a competitive means. Big and small businesses alike have an increasing need to integrate the steps of the product and production chain. This creates a need for engineers with specialist knowledge who at the same times have an insight in the whole product development process.
The aim of this course is to provide an operational experience in the development of innovative and realistic customer-driven engineered products. Design concepts and techniques are introduced, and the student's design ability is developed in a design project chosen to emphasize ingenuity and provide wide coverage of engineering and business topics. Innovative thinking is nurtured through this course and through PBL.

II. Key learning outcomes

Upon completion of the course, participants should be able to:

- Understand the importance of new products development in industry market.
- Propose new products to satisfy the needs of customers and the industry.
- To successfully implement the steps required from concept generation to design and development of new proposed product.
- Evaluate and assess the risk and the cost of the new product production.
- Competence with a set of tools and methods for product design and development.
- Confidence in their own abilities to create a new product.
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.
- Enhanced team working skills.
- Recognize the important elements of systems thinking in solving problems across scales, sectors and disciplines.
- Appreciate the merits of Problem Based Learning for learning new techniques.
- Develop a sound understanding of particular systems thinking methodologies and tools
- Frame problems with a systems thinking approach.
- Develop Entrepreneurial and innovation skills by challenging conventional solutions.

III. Course Material / Software

- All participants need to use their own PCs/laptops.

IV. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is following:

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Several processes or new potential products at Technology Readiness Level at TRL 2-4 will be explained to students. Then, the students should proposed methods for process/product improvement and they should also propose strategies for how this process/product can be commercialized. Several examples of processes or products at TRL level 3 are:

- Microbial fuel cells https://www.youtube.com/watch?v=521NYzBCTvA
- Biogas upgrading using methanogens and hydrogen from electrolysis.
- Self-healing Bioconcrete https://www.youtube.com/watch?v=laqACVY1U_k
- CO2 conversion to CH4 using waste metals and anaerobic microbes
- Recovery of metals from electronic waste using biohydrometallurgy
- Bio-refinery concept for recovery of high value added products from coffee waste
- Bio-refinery concept for recovery of high value added products from organe waste
- Bio-refinery concept for recovery of high value added products from organe waste
- From egg shells to high value added product.

V. Preparation

No prior preparation is needed by participants.

VI. References

- Design and Develop, by J.A. Wesselingh, S. Zinck Kiil and M.E. Vigild
- Innovation Management and New Product Development by Paul Trott, Kindle Edition
- The Art of Product Development: From Concept to Market by Erwin A. Frand Publisher: McGraw-Hill Inc.,US (1 May 1989)
- From Concept To Commercialization: A Strategic Approach for Bringing Everyday Ideas to Market by Dick J. Liou

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Applied Process and Production Optimization

I. Courses Description

This course will enhance the engineering capabilities and provide hands-on skills to optimize an industrial process or manufacturing line. Engineers will learn to select the correct assumptions and parameters for their problems in order to capture a realistic process analysis and achieve optimization of resources and cost.

II. Key learning outcomes

Upon completion of the course, participants should be able to:

- Detect and outline the key issues of the design and optimization of a production line.
- Utilize a critical-thinking and problem-solving approach in regards to the main principles of production engineering.
- Explore, assess and adopt best practices of production industry to existing or new production facilities.
- Report engineering calculations in a professional manner.

III. Course Material / Software

- All participants need to use their own PCs/laptops.
- Excel will be used during the course. MATLAB or any other relevant software for process design can be used from the participants.

IV. Problems/ Case studies

A sample of possible problems/ case studies to be used for the training of the participants is following:

- Hydrodealkylation (HAD Process) of toluene for the production of benzene
- Methanol production from natural gas
- Construction of an Oxo process
- Design of a bio-ethanol pilot plant
- Any other proposed project from engineers and/or industrial partner.

V. Preparation

Engineering Mathematics, Material and Energy Balances, and Reaction Engineering are pre-requisites

VI. References

- Douglas (1988), Conceptual design of chemical processes, McGraw-Hill, pp 8ff
- R K Sinnott, Coulson & Richardson's Chemical Engineering, Volume 6 (Design), (4th Ed.),
- Chemical Process Technology; Moulijn, Makkee, van Diepen; Wiley; 2001

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

- R Smith, Chemical Process Design and Integration, Wiley 2005 PMP® Exam Prep, 8th Edition (Rita Malcahy - ISBN 978-1-119-17967-2)
- MS Peters, KD Timmerhaus, Process Design and Economics for Chemical Engineers (5th
- Ed.), McGraw-Hill, 2002.

Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

Engineering Logistics and Supply Chain Analysis in Practice

I. Courses Description

This course aims to provide practical knowledge and technical skills for understanding, analyzing and managing logistics and supply chain of the industrial sector. Engineers will learn practically how products and services end-up to the final customer including transportation and logistics processes, all involved parties and the relevant legislation requirements. Moreover, Engineers will be able to contribute effectively to the supply change optimization, narrowing down the logistics cost and even setting up new processes.

II. Key learning outcomes

Upon completion of the course, participants should be able to:

- Understand the concept and the structure of supply chains.
- Employ fundamental models to make trade-offs between forecasting, inventory, and transportation.
- Identify ways through which supply chains can become competitive in the market.
- Introduce the concepts of integrated logistics support for the industry.
- Conduct engineering logistics analysis.

III. Course Material / Software

- All participants need to use their own PCs/laptops

IV. Problems/ Case studies

An “umbrella” supply chain problem will be given to all participants. The problem will be as follows: propose actions and measures to reduce the CO2 emissions in the atmosphere related to the design and operation of the supply chain of the company/factory that you will work.
Then, each participant (or group of participants) will formulate each own problem, within the framework of the umbrella problem mentioned above.

V. Preparation

- No prior preparation is needed by participants.

VI. References

- Global Logistics and Supply Chain Management, by John Mangan and Chandra L. Lalwani, John Wiley & Sons, 3rd Edition, 2016 (ISBN-13: 978-1119117827).
- Logistics and Supply Chain Management, by Martin Christopher, FT Publishing International, 5th edition, 2016 (ISBN-13: 978-1292083797).

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN

- Essentials of Supply Chain Management, by Michael H. Hugos, Wiley, 3rd Edition, 2011 (ISBN-13: 978-0470942185).
- Supply Chain Management: Strategy, Planning, and Operation, by Sunil Chopra and Peter Meindl, Pearson, 6th edition, Global Edition, 2015 (ISBN-13: 978-1292093567).
- Operations and Supply Chain Management, by Roberta S. Russell, Bernard W. Taylor, John Wiley & Sons, 8th, Edition, International Student edition, 2014 (ISBN-13: 978-1118808900)
- Operations and Supply Chain Management, by F. Robert Jacobs and Richard B. Chase, McGraw-Hill Education, 15th edition, International student edition, 2017 (ISBN-13: 978-1259921797).

Erasmus+ Co-funded by the Erasmus+ Programme of the European Union

THIS PROJECT HAS BEEN FUNDED WITH SUPPORT FROM THE EUROPEAN COMMISSION UNDER THE ERASMUS+ PROGRAMME. THIS PUBLICATION [COMMUNICATION] REFLECTS THE VIEWS ONLY OF THE AUTHOR, AND THE COMMISSION CANNOT BE HELD RESPONSIBLE FOR ANY USE WHICH MAY BE MADE OFTHE INFORMATION CONTAINED THEREIN