ENGineering and INdustry Innovative Training for Engineers (ENGINITE)

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Programme Specifications

Contributors
The ENGINITE Consortium,
led by CUBEIE and ThinkUP

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Consortium

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

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Overview

The European ENGINITE project (https://www.enginite.eu/) invites the submission of applications of interest by graduate engineers to participate in a postgraduate vocational training programme which will be held during 2018-19. The postgraduate vocational training programme will be based on Problem Based Learning (PBL) pedagogy and will combine advanced applied academic topics with hands-on aspects, to endorse the needs of graduate engineers, preparing them for the industry of the 21st century. Grounded on the PBL approach, the ENGINITE postgraduate vocational training programme will contribute to the career and employability skills development of the new engineers – among others: innovation, entrepreneurial skills, efficient quality, health and safety management, problem solving, communication and presentation skills – while it will enhance technical knowledge in critical fields of engineering. Upon the completion of the training programme, participants will be able to enter the labor market, lead multidisciplinary teams, and provide added-value and substantial contribution to their organizations (e.g. engineering companies and industries).

Target groups

The postgraduate vocational training programme is addressed to graduate engineers with a degree in biochemical, chemical, electrical, electronic, environmental, food, industrial, mechanical, petroleum, safety engineering and/or of a relevant field. Eligible will also be Chemists and Food Technicians graduates.

The target group postgraduate vocational training programme includes:

- Graduate Engineers, who seek for a job and/or who wish to follow a post graduate/vocational training programme;
- Junior Engineers, who are partly-employed and/or working in a different field and wish to follow a post graduate/vocational training programme.

During the program, Industrial Partners in the engineering sector are going to provide internship placements and the following categories are welcome and eligible:

- Companies which seek for professional graduate/ junior engineers for employment;
- Companies which experience lack of innovative ideas and seek for talented engineers who can provide solutions to existing problems and/or promote new ideas/products towards helping the companies to enhance their competitiveness and further grow.

The maximum number of participants is twenty-five (25) graduate engineers per session/country.

Participant selection criteria

The selection of the participating graduate engineers will be based on the following criteria:

- the submission date of the application (first comes/first served)
- the possibility of full and active participation in both parts of the postgraduate vocational training programme (see more information in the following section)
- the relevance of the bachelor's degree with the engineering areas on which the postgraduate vocational training programme will focus on
- the background knowledge of the applicants on the engineering areas on which the programme will focus on

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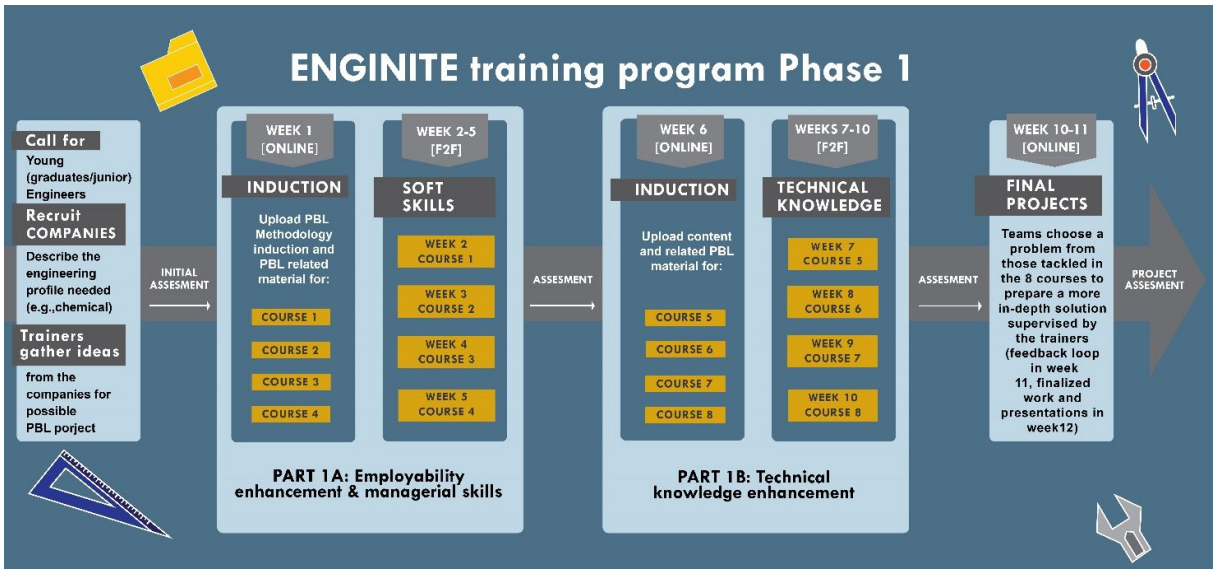
Description of the postgraduate vocational training programme

The postgraduate vocational training programme will have a total duration of 6 months and will be composed of two parts:

Part A (3 months)

Eight training courses will be provided aiming at the development of (a) employability enhancement & managerial (soft) skills [4 courses], and (b) technical knowledge enhancement [4 courses]. The courses will be based on the model of Problem-Based Learning. Each course will have a duration of six days (one day online and a week face to face) and will be implemented through a blended model based on the use of an online learning platform combined with face-to-face meetings. All the courses will be delivered by academics, practitioners and experts in the field.



Part B (3 months)

Structured internship via the placement of the graduate engineers in Industrial Partners/Companies for accelerating their hands-on experiences in the industry and consolidating the technical knowledge/soft skills, which will be gained during the first part of the program. During the internship, the engineering graduates will have the opportunity (a) to become familiar with the operations, equipment, process of the companies/industrial units which will be placed in, (b) to work on small scale projects as indicated by their mentors and company representatives, and (c) to work on self-initiated projects/proposals in collaboration with their mentors and company representatives.

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PART 1: The ENGINITE courses: Overview & learning goals

1.1. Teaching Methodology

The ENGINITE courses will be taught using Problem Based Learning (PBL) methodology, during which trainees will be exposed to realistic industrial problems that provide the context and driver for learning.

In traditional learning settings, students usually learn the theory and then apply it to problems chosen to test the theory. One of the shortcomings of this traditional approach is that it focuses more on theory rather than practical application, and so it is harder for students to recall and apply the theory when it matters in context.

ENGINITE teaching uses PBL, which starts from the context of a problem that needs to be solved, through which students/trainee engineers discover what knowledge they need and can map that knowledge directly to real contexts. Real problems that are derived directly from SME/industry and are relevant to the subject of the course will be used as case studies. These problems define the broad area of study that the trainees will be working on - within which they will be able to define specific problems themselves that they will need to study.

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.

The training will be delivered by a mixture of university academic staff and industry practitioners. The role of the instructors is not to teach, but to guide the trainees as they make their own way through the problem scenarios. As in the professional workplace, what is valued is not the knowledge itself, but the ability to develop strategies for solving problems, assessing progress towards solving these problems, changing strategy as needed and be able to achieve a goal and/or deliver a problem solution. These are skills that industry values highly.

Reflective learning is at the core of the training. In this approach, at every stage, students are considering what are they trying to do, assessing whether what they are doing is helping them make progress, and regularly updating their plan of action based on their experiences. This reflective approach is supported by the course instructor and peers in the classroom.

Overall, research has shown that the PBL approach is:

- More motivating for the trainees
- Helps trainees map new knowledge to existing understanding and knowledge
- Increases long term retention and ability to recall knowledge later
- Builds trainees' ability to work autonomously

Having spent three months in the training sessions, the trainees will then complete a three-month structured internship. During the internship phase, trainees will spend the first month getting to know the company. During the second month the trainees will work on problems that their company mentors have chosen for them. In the third month trainees will identify on their own a business problem that needs solving. At this stage, the trainees will be drawing on all their training and problem-based learning skills that they have been

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developing during the training. Throughout the placement, the trainees will work with a mentor who will support their reflective learning and problem solving. They will keep a reflective learning diary which will help them structure their thinking and will help their mentor keep track of their progress.

1.2. Blended learning

Each course of the program will be composed of 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. 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) as well as the expected learning outcomes. Moreover, possible problems/case studies will be presented for 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.

1.3. 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 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 to complete the deliverables in the time-frame given.

1.4. 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.

1.5. 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.

An important part of the assessment will be to consider 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

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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.

1.6 Duration & indicative timetable

The postgraduate vocational training programme will be held from October 2018 to May 2019. The tentative schedule is presented below:

- The kickoff meeting of the postgraduate vocational training programme will take place the first week of October, aiming at providing further information to the graduate engineers, who will be selected to participate.
- From October-December 2018, the eight courses will be delivered during a sequence of face-to-face weekly meetings. All these meetings will be held in afternoon time (between 17: 00 - 20: 00.)
- An informative meeting will take place by the mid of January in relation to the structured internship
- Structured internships will take place from February-May 2019.
- A final public event will be held by the end of the project, where the results of the program will be disseminated, and attendance certificates will be awarded to the participating graduate engineers.

**The exact dates and venues for the postgraduate vocational training programme will be defined at a later stage.*

1.7 Learning gains & expected outcomes

The participation in the ENGINITE program will provide the engineers with a competitive advantage, equipping them with the necessary skills to successfully meet the needs of the 21st century industry and the labor market. Through the participation in the program they will have the opportunity to:

- Getting valuable experience and professional guidance from practitioners and experts in the field
- Improve technical knowledge, skills and practical experience
- Participate in an emerging vibrant community that will bring industry and graduate engineers closer
- Develop employability skills

1.8 Certificates

Upon completion of the program, certificates will be awarded to all the graduate engineers that will accomplish successfully the requirements of the postgraduate vocational training programme.

The certificates will be awarded by the coordinator of the ENGINITE consortium, Dr. Andri Ioannou, of the Cyprus University of Technology (CUT) which coordinates the program at European level.

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PART 2 - Overview of courses

The aim of this part is to present a comprehensive description of the eight courses which will be developed through the ENGINITE project, according to the Problem Based Learning (PBL) methodology.

The courses are divided into two categories (a) Employability Enhancement & Managerial Skills and (b) Technical Knowledge Enhancement. Each category includes four courses which aim to cover a wide range of hands-on knowledge and skills required by the industry.

All eight courses have been identified during a previous market research and literature review which was conducted by CUBEIE. The market research was performed using mirrored questionnaires with the scope to explore the needs of both companies and graduates Engineers in terms of needs, knowledge and skills. More than 50 companies and more than 200 engineers have participated in this research.

The table below presents the eight courses and the partner of the consortium who is responsible for the development of each course. The allocation of the courses has been done by CUBEIE based on each partner's expertise and background.

Table 1: Courses titles and responsible partner

A	**Employability Enhancement & Managerial Skills**	**Responsible Partner**
A1	Engineering Systems Thinking: Re-engineering by Simplifying	CUT
A2	Project Management in Action	CUBEIE
A3	Innovation, Entrepreneurial and Intrapreneurial skills	GrantXpert
A4	Applied Efficient Quality and Health & Safety Management Systems	CUT
B	**Technical Knowledge Enhancement**	**Responsible Partner**
B1	Engineering Logistics and Supply Chain Analysis in practice	TUC
B2	Engineering Economics	CUT
B3	Applied Process and Production Optimization	TUC
B4	Product Development: From Concept to Market	CUT

2.1 Employability Enhancement & Managerial Skills

The first part of the training, named: *"Employability Enhancement & Managerial Skills"* focuses on capitalizing holistic technical engineering knowledge, as well as managerial and soft skills. These are essential

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requirements for professional excellence and efficient collaboration in corporate and multi-disciplinary environments. Four courses are included in this part and brief description is provided below.

A1. Engineering Systems Thinking: Re-engineering by Simplifying

Systems thinking is a holistic approach to analysis that focuses on the way that a system's constituent parts interrelate and how systems work over time and within the context of larger systems. The engineers will be trained how to employ their engineering knowledge to identify the problem by viewing the big picture and provide alternative solutions. Analytical thinking and the ability to break down complex processes, problems and situations into single units and find the interrelations among them is an essential competence for each engineer and that is the focus of the course. This is what industry needs for today to overcome everyday problems, evolve and conquer its marker. The course provides a tool-box of applied system thinking, to help the engineers improve analytical thinking, problem solving and decision-making skills. Through an appreciation of multiple viewpoints, perspectives and systems, thinking analysis is taken to a new level.

Key learning outcomes:

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

- Recognize the fundamentals of systems thinking.
- Utilize system thinking tools.
- Holistically approach any working situation.
- Come up with robust solutions to complex problems through critical thinking and problem-solving skills.
- Assess, organize long term strategies for systemic changes.

A2. Project Management in Action

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 must 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.

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.

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A3. Innovation, Entrepreneurial and Intrapreneurial Skills

In this course the participating engineers will be introduced to the driving forces of our era: innovation coupled with creative business development. Participants shall be requested to foster their interpersonal skills with a creative utilization of their background. Communication, presentation and negotiation skills development is a core element and success facilitator within this course. A challenging and fascinating environment will be established by using motivating problems, team exercises, and guest speakers to turn the course into a lifetime experience. The learning outcomes will boost engineers in their future career. Engineers may employ the gained knowledge within a startup or a multinational company; in a cutting-edge project or in some traditional sector challenged by present market conditions; during routine or crisis situations. Whatever the scenario, the engineers will be well equipped and ready to handle the situation with creativity and professionalism.

Key learning outcomes:

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

- Demonstrate the fundamental principles and methods of innovation, entrepreneurship and intrapreneurship.
- Develop and apply business models.
- Utilize tools to explore and create innovative business ideas.
- Develop and introduce of innovation and entrepreneurship/intrapreneurship culture in an organization.

Communicate, finance, or market a new idea, product, or initiative.

A4. Applied Efficient Quality and Health & Safety Management Systems

This course introduces the participants to the world of standardization and management to the all-important engineering activities in everyday practice. Efficient development and implementation of management systems requires understanding of their necessity, based on sound knowledge of legislation and customers' demands. Engineers will be presented with and asked to find solutions to problems arising from inefficient management systems. They shall develop their own toolbox for overcoming such problems in their future career. As a second main theme, the course shall elaborate on the importance of nurturing an integrated health and safety culture. Based on practical examples, engineers will become acquainted with hands-on techniques for establishing, maintaining and developing a corporate culture for all involved parties: the organization, the employees, the customers, the suppliers, the associates and the society. Different topics and models are analyzed by employing case studies and real problems from the industry.

Key learning outcomes:

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

- Identify and apply the principles of the Quality and Health and Safety Management Systems (Q&HSE MS).
- Develop in-depth knowledge on various tools and techniques of the Management Systems.
- Evaluate the principles of quality management and explain how these principles can be
- applied in the industrial sector.
- Develop a road map for implementing and maintaining the Q&HSE MS in an organization.

2.2 Technical Knowledge Enhancement

The second part of the training, named: *"B. Technical knowledge Enhancement"* focuses on providing professional technical knowledge and its utilization in the competitive and demanding environment of the industry sector. Four courses are included in this part and brief description is provided below.

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B.1. Engineering Logistics and Supply Chain Analysis in Practice

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 of the supply change optimization, narrowing down the logistics cost and even to set up new processes.

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

B.2. Engineering Economics

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 economy-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.

Key learning outcomes:

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

- Define, estimate and analyze engineering - industrial project costs.
- Compline 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 considering rational assumptions, interest factors and data from the industry underlying these models.

B.3. Applied Process and Production Optimization

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 to capture a realistic process analysis and achieve optimization of resources and cost.

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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 regarding 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

B.4. Product Development. From Concept to Market

During this course, engineers will learn how to create, develop and lunch new products in established industrial firms. Innovative or improved products are required for ensuring competitive advantage and growth of every company and this is what the course is focused on. A combination of marketing, design, manufacturing knowledge and skills will be gained through workshops and real case studies.

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 develop of new proposed product.
- Evaluate and assess the risk and the cost of the new product production.

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