TU-A1300 – Introduction to Industrial Engineering and Management

Credits	5	v.1.01
Teaching periods	I-II	
Teacher in charge	Mikael Öhman, Paul Lillrank	
Contact information	Inquiries regarding practical issues and questions should be addressed to tu-a1300@aalto.fi. Inquiries regarding the course exercise can be addressed to your group assistant. Inquiries regarding course contents and course development can be addressed to: mikael.ohman@aalto.fi	
Learning objectives	The aim of the course is to give students a basic proficiency in production economic thinking, argumentation and analysis. Upon completing the course, the student masters the basic concepts and key dynamics of production as an economic activity, and is through these able to understand and evaluate business-opportunities, design and evaluate business-processes, and analyze the financial state of a business. Further, throughout the course, the student learns basic skills of engineering work, such as project planning, -organizing and -management.	
Contents	Industrial engineering and management as a science; Value as the foundation of business; Production systems and organizations; The production process and production control; Production as part of the value chain; Project business; Accounting and profitability; Investments.	
Variable contents	-	
Materials	Lecture materials, pre-lecture materials, exercise materials, TUTAwiki, recommended literature.	
Evaluation	Lectures, lecture pre-assignments, course project, calculation assignments and exam, of which the three latter are compulsory.	
Workload	Lectures 16 h, tutored teamwork 14 h, non-tutored teamwork 30 h, independent studies 74 h.	
Replacements	No course replacements.	
Web pages	https://mycourses.aalto.fi/course/search.php?search=TU-A1300	
Prerequisite knowledge	No prerequisite knowledge.	
Language	The course is taught in English. The course is also available in Finnish (TU-A1100) and Swedish (TU-A1200)	
Target audience	Students majoring or minoring in Industrial Engineering and Management. Students in the Bachelor program of the School of Science, and other Aalto and HU students interested in the subject.	
Teachers	Paul Lillrank, Mikko Jääskeläinen, Petri Parvinen, Mikael Öhman, Tuukka Kostamo, Riikka Kaipia, Lauri Saarinen, Karlos Artto, Jouko Karjalainen	
Additional information	No additional information.	

TU-A1300 – Introduction to Industrial Engineering and Management

13.9.2021 – 13.12.2021

Notice!

This syllabus will not be updated during the course. Up-to-date information on how Corona affects teaching in this course can be found on the course MyCourses-page.

General Corona-guidelines in Aalto-university can be found here: https://into.aalto.fi/display/enopisk/Coronavirus+-+information+for+students

Details of course contents

Lectures

Before the lecture, the student is expected to go through the pre-lecture materials which cover the basic concepts and key dynamics of the subjects discussed in the lecture. In the lectures, subjects are elaborated more in-depth, and related to practice, while seeking to create classroom interaction. Most lectures are divided into two parts, with a 5-minute break in between (13:05-13:10).

The lecture subjects and timetable are as follows:

Lecture	Time	Place	Teacher[i]
L0: Course introduction and practicalities	Video	MyCo	
Course introduction and information about the course exercise			*MÖ*
L1: IEM as a science	Mon 13.9, at 12:15-14:00	Zoom	
Industrial engineering and management as a science. The institutional foundations of economic activity. The nature of technology and trends in production			*PL*
L2: Value as the foundation of business	Mon 20.9, at 12:15-14:00	Zoom	
The nature of value. Market structure and firm boundaries. Competition and the business environment. Business models. Pre-lecture material: • *Where does business begin?* • *How to cope with competition?*			*MJ*
The basics of sales and marketing. Pre-lecture material: • *How does one become a customer?*			*PP*
L3: Production systems and organizations	Mon 27.9, at 12:15-14:00	Zoom	
The archetypes of production, capacity and customer interaction. Different production environments. Pre-lecture materials: • *What makes the production system economic?*			*MÖ*
Organizations and their structure. How to coordinate work and leverage knowledge. The impact of leadership. Pre-lecture material: • *How does a human become part of economic activity?*			*TK*

[i] JK = Jouko Karjalainen, KA = Karlos Artto, LS = Lauri Saarinen, MJ = Mikko Jääskeläinen, MÖ = Mikael Öhman, PL = Paul Lillrank, PP = Petri Parvinen, RK = Riikka Kaipia, TK = Tuukka Kostamo

L4: Production process and control	Mon 4.10, at 12:15-14:00	Zoom	
Production process description, production flow and - planning. Inventories and buffers as part of production. Pre-lecture materials: • *How do you design a production system?*			*PL*
Variation and its control. The effect of batch size in production. Production planning and control. Pre-lecture materials: • *How does one control production?*			*PL*
L5: Production as part of the value-chain	Mon 11.10, at 12:15-14:00	Zoom	
The concept of value chain, and its structure. Procurement as part of economic activity. Pre-lecture materials: • *What should you produce yourself?*			*RK*
The concept of supply chain and its structure. Supply chain management ja demand forecasting. Pre-lecture materials: • *How do you function as part of a supply chain?*			*LS*
L6: Project business and midterm 1 preparation	Mon 19.10, at 12:15-14:00	Zoom	
Project lifecycle, -objectives and -organization. Project planning and control. Pre-lecture materials: • *How do you make sure a project is successful?*			*KA*
Recap and preparation for the first mid-term exam			*MÖ*
L7: Accounting and profitability	Mon 2.11, at 12:15-14:00	Zoom	
The financial state of the firm, and the key figures describing it. Pre-lecture materials: • *How to measure actual periodic profitability?*			*JK*
The difference between result and cash flow. The structure of the firm's financial statement. Pre-lecture materials: • *How do the key financial statements interconnect?*			*JK*
L8: Investments	Mon 9.11, at 12:15-14:00	Zoom	
Analyzing investment opportunities, opportunity cost. Calculation of net present value. Pre-lecture materials: • *How to you estimate the profitability of an investment project?*			*JK*
L9: Midterm 2 preparation	Tue 7.12, at 10:15-11:00	Zoom	
Recap and preparation for the second mid-term exam.			MÖ

Exercises and course project

In the exercises, we go through the basics of establishing and managing a business, though case examples (Video lecture). The exercises are paced with the course lectures, and will, if the situation allows, provide an opportunity for tutored group work on the course project. Related to each exercise, except for the recap exercise, course project teams complete a part assignment (totaling 7), which is submitted for evaluation before the next exercise.

Course project teams are formed before the first exercise. Each exercise group has an assistant, who leads the exercise, and to whom the team submits the part assignments, and eventually the course project report, for evaluation. The course project report is compiled from the six part assignments, while taking into consideration the improvement suggestions put forth in the part assignment evaluations. The expected extent of the course project report is 20-30 pages, and it will be evaluated as a business plan, from the perspective of an investor.

The subject of the course project is to create a business plan for a new restaurant in Otaniemi. If the team wants to do the course project on a topic of its own choice, it needs to prepare a 1-2 page motivation letter to the group assistant. This letter should contain (1) a motivation why the team wants to do the course project on the chosen subject, and an elaboration of (2) the sources of information the team is going to use, in order to understand the industry, market, production process, etc. (including references) of the chosen subject. The motivation letter is to be delivered to the group assistant the day before the first exercise, at latest. Based on the letter, the assistant decides whether he or she accepts the subject.

The exercise subjects' schedules are as follows:

Exercise	Period
H1: Business plan	Mon 13.9 – Sun 26.9

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Sketching the business plan (ca. 1 page)*
- *Analysis of the business environment (ca. 1 page)*
- *Creating a marketing strategy (ca. 1-2 pages)*

H2: Design of the production system	Mon 27.9 – Sun 3.10

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Design of production (ca. 2 pages)*
- *Capacity-analysis (ca. 1-2 pages)*

H3: Process design and production control	Mon 4.10 – Sun 10.10

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Material flows and production layout (ca. 1-2 pages)*
- *The flow of production (ca. 1 page)*
- *Minimizing waste (ca. 1 page)*

H4: Production as part of the value chain	Mon 11.10 – Sun 17.10

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Core activities and procurement (ca. 1-2 pages)*
- *Estimating demand (ca. 2 pages)*

H5: Founding project	Mon 18.10 – Sun 31.10

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *The project of founding the business (ca. 1-2 pages)*

H6: The financial statement and key financial figures	Mon 1.11 – Sun 14.11

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Financial statement calculations (Excel-file)*
- *Assessment of profitability, liquidity and solvency (ca. 1 page)*

H7: Investment profitability	Mon 8.11 – Sun 14.11

The case example is presented as video lectures, preparing the student for the part assignment. If the situation allows, we will strive to arrange the possibility for classroom teamwork, with the assistant offering guidance to those in need of it. Part assignment to be submitted before the next exercise:

- *Analysis of investment profitability (Excel-file)*

H8: Compilation of the project report Mon 15.11 – Fri 3.12

No part assignment. The subject of the exercise is on compiling and finalizing the course project report.

Calculation assignments

The course includes two rounds of calculation assignments, which the students are expected to complete independently. They will be published in MyCourses, so that the first round will open at the beginning of the II period, and the second round will open one week after the first. The assignments are closed accordingly, so that the second round closes on Monday before the exam week of the II period, and the first round closes one week earlier. If the situation allows, in connection to the calculation assignments, we will arrange a number of tutor-sessions, where the students can seek help and guidance in completing the exercises. Unfortunately, we cannot guarantee the teaching language in these sessions – more information about this will be available once it becomes clear which assistant is present during a given session. The assistants will also answer questions through Telegram / e-mail. The timeline of the calculation exercises is as follows:

	Week 44	Week 45	Week 46	Week 47	Week 48	Week 49
1st round	Opens mon 1.11, at.00:00			Closes sun 28.11, at 23:59		
2nd round		Opens mon 8.11, at 00:00			Closes sun 5.12, at.23:59	
Tutored sessions (If possible)	TBA	TBA	TBA	TBA	TBA	

You have three attempts for each task in both rounds. The highest score is taken into account. There is no time limit for completing single tasks, so you can interrupt your work and return to it later, before the round closes. For each attempt, new (randomized) starting values are given. It is practical to do the tasks and the questions within them in numerical order, as concepts and models covered in prior tasks are needed in latter tasks.

Details of course evaluation

Passing the course requires passing each mandatory course components: calculation assignments, course project and the exam. In addition, you can earn extra points for pre-lectures assignments and for giving feedback on the course. The limits for passing, the maximum points and the weighing factors for each evaluated course component are as follows:

Evaluated course component	Limit to pass	Maximum points	Weight factor
Course project points (H)	12,0 p.	26,0 p.	1,2
Calculation assignment points (N)	40,0 p.	60,0 p.	0,3
Mid-term / Course exam points (T)	12,5 p[ii].	30,0 p.	1,7

[ii] Note that the limits for passing mid-term exams is 7,5 p for mid-term 1, and 5,0 p for midterm 2. The maximum points for each mid-term exam is 15,0 p. You can retake a mid-term exam during the course exam.

Pre-lecture assignment points (L)	-	3,0 p.	1,0
Feedback point (P)	-	1,0 p.	1,0

If the student's points exceed the limit to pass in all evaluated course components with such a limit, the student receives a grade for the course. The grade is determined though multiplying each evaluated course component with its weighing factor (which is based on the workload of respective component), and then adding together the weighted points:

$$Course\ points^{iii} = (H \times 1{,}2) + (N \times 0{,}3) + (T \times 1{,}7) + L + P$$

after which the final grade is determined according to the following limits:

Grade	1	2	3	4	5
Course points, no less than	51,9	60	70	80	90

Students have the opportunity to acquaint themselves with the grading of the exam in a post-exam session, which is announced when the exam results are published. The exercise group assistant evaluates the course project, and verbally motivates his or her evaluation when awarding points for the part assignments. Upon request, the assistant will further motivate his or her evaluation.

If the student is dissatisfied with how his or her course project or its part assignments have been evaluated, the dispute is in first hand settled with the evaluator (exercise group assistant). If these do not reach consensus, the dispute is resolved with the main course assistant who consults the teacher in charge if necessary.

If the student is dissatisfied with the evaluation of his or her exam, the dispute is in first hand resolved with the main course assistant. If these do not reach consensus, the dispute is resolved with the teacher in charge.

Details of course workload

The extent of the course is 5 credits, which corresponds to a workload of 133,3 hours of study (1 credit = 26,66h). The computational workload is divided between course components and periods as follows:

Course component	workload		I period	II period
Lectures	17 h	→	12 h	5 h
Preparation for lectures	7 h	→	5,5 h	1,5 h
Exercises	7 h	→	5,5 h	1,5 h
Course project	30 h	→	20 h	12 h
Calculation assignments	28 h	→	0 h	28 h
Independent study	40 h	→	21 h	17 h
Mid-term exams	6 h	→	3 h	2 h
Tot.	134 h		67 h	67 h

Details of course materials

Pre-lecture materials

[iii] $where\ H \geq 12, N \geq 40\ and\ T \geq 12{,}5$

Can be found on the course home page in MyCourses. We strive to publish pre-lecture materials on the week prior to the lecture, at latest.

Lecture- and exercise slides

Can be found on the course home page in MyCourses. We strive to publish them as soon as possible after respective lecture/exercise.

TUTAwiki

Beginning in the II period, we will make the TUTAwiki-workspace available, mainly intended to support the calculation assignments: https://wiki.aalto.fi/display/TUTAwiki/TUTAwiki.

Course book

While there is no official course book, we recommend a number of books, according to course subjects:

	Teollisuustalous kehittyvässä liiketoiminnassa	Produktions-ekonomi	Operations management	The Nature of Technology
	Martinsuo et al. (2016)	Olhager (2013)	Stevenson (2009)	Arthur (2009)
Subject				
L1: Industrial engineering and management as a science		s.22-24, 44-46		s.9-67,167-216
L2 (H1): Value as the foundation of business	s.22-24, 28-33, 42-45, 49-89, 169-179, 207-231, 334-345, 349-357	s.26-27, 71-74	s.40-48	
L3 (H2): Production systems and organizations	s.180-189, 268-278, 293-308, 321-333, 373-380	s.24-26, 28-33, 49-66, 154-161, 163-200	s.143-147, 185-207, 237-275, 321-330	
L4 (H3): The production process and production control	s.134-168, 281-291, 358-372	s.87-95, 136-141, 151-154, 225-312, 331-390, 449-484	s.405-421, 427-440, 457-485, 549-586,611-618, 647-649, 670-673, 693-717, 735-755	
L5 (H4): Production as part of the value-chain	s.279-281, 291-292, 309-320	s.97-130, 132-136, 393-424, 442-443	s.71-77, 511-543	
L6 (H5): Projects and investments	s.190-204, 254-257		s.775-809	
L7 (H6): Accounting and profitability	s.90-133			

These books are available as follows:

Teollisuustalous kehittyvässä liiketoiminnassa (Martinsuo et al. 2016):

- Library (https://aalto.finna.fi/Record/alli.729510), and
- Electronic (https://www.editapublishing.fi/oppimateriaalit/tuote/teollisuustalous-kehittyvassa-liiketoiminnassa)

Produktionsekonomi : principer och metoder för utformning, styrning och utveckling av industriell produktion (Olhager 2013):

- Library (https://aalto.finna.fi/Record/alli.683294)

Operations management (Stevenson 2009)

- Library (https://aalto.finna.fi/Record/alli.458505)

The Nature of Technology (Arthur, 2009)

- Library (https://aalto.finna.fi/Record/alli.551438)
- We will strive to make an electronic version available in MyCourses

Additional information

No additional information