

## System Design Engineering

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**Subject area:** Computer Science/ICT

<b>University:</b>	TU/e
<b>Level:</b>	MA all years
<b>Teaching mode:</b>	hybrid: some students participate online, other students attend real-life
<b>Instructor(s):</b>	dr. ir. Ion Barosan

### Short description

Modern cars, intelligent buildings, complex medical systems, commercial aircraft, etc., are products that contain many parts and have to perform many functions.

### Full description

The course contains the following modules:

1. Foundation of the System Engineering - the definitions of the terms and the system thinking are introduced. Also, the state of System engineering practice, challenges and opportunities are presented.
2. System Thinking - this modules presents the system's philosophy, principles and methodology based on a holistic thinking approach.
3. System Engineering Analysis - I - the system's attributes, properties and characteristics are presented. Here we emphasize the need of the system's analysis based on a TRIZ approach.
4. System Engineering Analysis - II - this module presents the requirements and functional analysis of a system. Also, the system concepts formulation and development are discuss in the context of system architecture.
5. System Engineering development Practice - I - here we introduce the system's development strategies and the system's verification and validation concepts. Further, the module presents the development process models.
6. System Engineering Development Practice - II - this module introduces the system's specification concept and the system's development approaches. The requirements development is presented.
7. System Engineering Development Practice - III - further, we present the system's specification analysis based on a user-centred system design. The system interfaces and system integration are introduced and explained.
8. Analytical Decision - the module introduces the system performance analysis and evaluation based on the analysis of alternatives. Also, the system's modeling and simulations approaches are presented together with the necessary tool for system engineering and for model bases system engineering approach.

There is also a practical module of the course. The students have to develop a Digital Twin for a smart room using SysML modeling and a Virtual Reality Environment based on Unity Game Engine. The students can work in teams of maximum three members.

## Learning outcomes

Upon completion of this course students will :

Effectively understand and evaluate the significant aspects of Model-Based Systems Engineering (MBSE) including concepts, modeling and frameworks, based on ISO15288, ISO 42010.

Learn how to model complex systems using Systems Design and Engineering Patterns; create, validate and execute the models using the modeling language SysML.

Detect how problem-solving can be improved by utilizing thinking algorithms, creativity methods, and problem-solving heuristics; evaluate the problem-solving stage by identifying and understanding the problem as the key towards a creative solution.

## General information

<b>Contact hours per week:</b>	4
<b>Total workload:</b>	150 (in student hours for the whole course)
<b>ECTS credits:</b>	5
<b>Language:</b>	English
<b>Course start date:</b>	24 April 2023
<b>Course end date:</b>	09 July 2023
<b>Add. info about start date:</b>	
<b>Weekly teaching day/time:</b>	Monday morning/Thursday afternoon
<b>Time zone:</b>	CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)
<b>Further information:</b>	N/A
<b>Prerequisites:</b>	OO programming!
<b>Activities and methods:</b>	Lectures, Group work, Lab-work, Self-study
<b>Presence on campus:</b>	We have created a VR environment, which can be used on-line!

## Final examination

<b>Form:</b>	written + project
<b>Date:</b>	27/07/2023
<b>Location/format:</b>	on campus of home institution
<b>Re-sit possibility:</b>	yes
<b>Transcript available:</b>	on request
<b>Transcript available:</b>	N/A
<b>Add. info/requirements:</b>	

## Registration

To register for this course, follow the registration requirements of your **home university** as specified here: [www.euroteq.eu/courses-registration](http://www.euroteq.eu/courses-registration).

## Administration

<b>Number of places:</b>	No limit
<b>Minimum participants:</b>	15
<b>Internal course code:</b>	2IMP30
<b>Contact:</b>	i.barosan@tue.nl

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*This course is part of the EuroTeQ Engineering University joint course catalogue 2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit [www.euroteq.eu](http://www.euroteq.eu) or get in touch with the above-mentioned point of contact.*