

System Dynamics

Study programme	YUFE Joint Bachelor in Urban Sustainability Studies
Academic year	2026/2027
Curriculum component	Minor: Urban Ecology
Year and semester	2nd year, 2nd semester
Course type	elective
ECTS credits	5
Contact hours (L+S+E)	15 + 30 + 15
Language of instruction	English

Contact

Course coordinator

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Prerequisites

No requirements.

Course objectives

The objective of the course is for students to acquire basic knowledge about system-based approach and apply system dynamics to predict the behaviour of simple systems.

Learning outcomes

- Describe fundamental simulation principles and elements and identify problems that can be modelled and solved through simulation.
- Identify feedback loops and determine types of feedback loops in the system.
- Create models of simple dynamic systems by applying system dynamics principles.
- Predict system behaviour based on system description. Conduct a simulation study (define a problem, collect data, design a model, evaluate and
- assess model validity, implement a model, and analyse simulation results).

Course content

- Concept of a system. System thinking. Causal loops. Flow diagrams. Using simulation to analyze loops. First-order feedback. Delays. Model validity. Combining
- flows. Adding constant flows. Oscillating systems. S-shaped growth. Higher-order feedback loops. Urban dynamics. Sensitivity analysis.

Teaching and learning methods

lectures, seminars and workshops and practical classes.

Assessment and grading

During the semester, students will take two mid-term exams, which will include multiple-choice questions, true/false statements, problem-solving tasks, and graphical representation exercises. Active participation in class discussions is mandatory. To successfully complete the course, students must achieve at least 50% of learning outcomes across all forms of assessment and must obtain a minimum of 50% on the final exam. Regular class participation is expected throughout the course. The final exam will involve conducting practical research project in which students, according to the set of instructions and evaluation criteria, analyse the chosen real dynamic system, and based on the analysis and data collected, create a system dynamics diagram using the computer program of their choice and formalize the system behaviour by entering and executing appropriate mathematical equations. By changing individual parameters or model structure, students simulate changes in the system and predict system behaviour (or behaviour of its individual components) over time. They propose at least two measures and simulate system behaviour with the proposed measures implemented. Students will be required to submit a seminar paper and present their work either in class or during the exam session.

Grading scale

Grade	Percentage
5 (A)	90-100%
4 (B)	75-89.9%
3 (C)	60-74.9%
2 (D)	50-59.9%
1 (F)	0-49.9%