KTH Industriell teknik och management

Course Syllabus ML2302 VT20

Course name: Modelling, Simulation and Optimization of Sustainable Production

Course code: ML2302

HP/ECTS:	9.0
Teachers:	Albin Eriksson Östman (albin01@kth.se) Karoly Szipka (szipka@kth.se) Amita Singh (amitas@kth.se) Yongkuk Jeong (yongkuk@kth.se) Jannicke Baalsrud Hauge (jmbh@kth.se) (course responsible) Seyoum Eshetu Birkie (seyoume@kth.se)
Industry engagement:	Problem owner for course project task as well as input for the labs Guest lectures from industry for the project work
Examiner:	Jannicke Baalsrud Hauge
Grading:	A-F
Language:	English

Learning objectives and course content

Intended learning objectives (ILOs) of the course (Swedish is binding- the English is the corresponding non-binding translation).

Upon successful completion of this course, the student shall be able to:

- Describe the central elements in and main application fields for modelling, simulation and optimisation at development of sustainable production and logistic.
- Apply analytical heuristic and experimental methods and tools to analyse resource and flow efficiency of system for sustainable production and logistic.
- Create analyse and critically evaluate different production and logistics solutions by modelling, simulate optimise and evaluate developments also with limited information, as well as considering sustainable development and to the preconditions and needs of people.

- Reflect on difficulties with to model simulate and optimise during the different stages in a development process regarding production and logistic.
- Reflect on role of modelling simulation and optimisation in a future development towards a digitalized production and logistic.

Course main content

Course's major aim is to learn student link an understanding of analytical, heuristic and simulation based methods for the analysis of production and logistics systems with industrial application fields and needs. Thereby prepare course student for tasks as developers of a sustainable production and logistics operations.

The work in the course is built around lectures laboratory sessions and project work concerning course's central fields. Through laboratory sessions students will get acquainted with a number of methods to analyse typical problems regarding resource and glow efficiency of system for production and logistic. Further give laboratory sessions and understanding of different software to simulate resource and flow efficiency of system for production and logistic. Through a project work obtain student an understanding of how a simulation model are designed, are verified and is validated and how this thereafter can be a basis for relevant experiments analysis and conclusions. Students are trained to reflect on difficulties experienced during the different stages of a simulation study and which requirements are requested for implementation. Course create also a basis for the analysis of environmental and social positions at modelling simulation and optimisation of production and logistic.

The student will get an introduction to five different simulation tools as lab exercises: Arena, Anylogic, ExendSim, MatLab, SUMO

Disposition

The course is delivered in diverse formats including: lectures, group exercises (project work) and lab activities. Guest lectures are held on selected topics as a part of the project work. Students shall communicate their understanding of the subject matter through oral presentation, written project reports, as well as providing logically coherent reflections in INL1 as well as in the project reports.

Course assessment and grading

Assessment

INL1 - Assignment, 3.0 credits, Grading scale: A, B, C, D, E, FX, F

LAB1 - Laboratory work, 2.0 credits, Grading scale: P, F

PRO1 - Project work, 4.0 credits, Grading scale: A, B, C, D, E, FX, F

The INL1 is divided in two parts and is individual work. The Lab exercises are examination on site. Each lab module needs to be passed.
The project work is a group delivery. It is scored based on the written report and the final presentation. The contribution of each group member needs to be clearly stated in the report and in the project presentation and will be assessed according to expectation of what 120h work for each student should comprise.

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Course is assessed through a written assignment compulsory laboratory sessions concerning methods and tools as well as through project work where student should show his ability to analyse different solutions based on a broad evaluation

Grading criteria

The overall grading of the course shall be a combination of INL1 and TEN1 according to the rule set in the table below. The final passing grade is assigned on condition that all mandatory activities are completed.

ILOs	*INL1*	*LAB1*	*PRO1*
ILO1	X		
ILO2		X	
ILO3			X
ILO4	X		X
ILO5			X

Course literature

Selected book

Main book will be Jerry Banks et al.: Discrete-event system simulation, 5.th edition,

Paperback, Publisher: Pearson Education Limited; 5th edition,
ISBN-10: 1292024372, ISBN-13: 978-1292024370

In addition, there will be a set of articles for specific area that are not sufficiently covered in the main book as well as information related software.

Adapted examination for students with disabilities

The application for compensatory assistance in case of disability is made via KTH FUNKA, more information can be found via the link:

https://www.kth.se/en/student/studentliv/funktionsnedsattning/stod-for-studenter-med-funktionsnedsattning-1.39736

For students with disabilities who have a statement from KTH's FUNKA unit on recommended support measures in the examination, the following applies in this course:

All support actions under code R (i.e. adjustments relating to space, time and physical circumstances) are granted without special decision by the examiner

Support measures under code P (educational adaptation) must be actively granted or rejected by the examiner after contact has been made by the student in accordance with KTH's rules. Normally, support actions under code P will also be approved.

Schedule

Kurs	Ml2302				
Week	Day	F/L/R	No. hours	Time	Topic
202003	20200116	F	3	08.00-11-00	Introduction, overview of Simulation software, summary of chap. Stats.5
202004	20200121	F	4	08.00-12.00	Ch. 1-4, typical logistics problems & different approaches. Optimisation Ch. 10 Verification…

202004	20200123	F	4	08.00-12.00	Ch. 9.2, Sensitive analysis Ch. 6 queuing theory and models
202005	20200127	INL 1a		12.00	INL1a Basics
202005	20200128	L	4	08.00-12.00	Queing models, output models for single
202005	20200129	F	4	08.00-12.00	optimisation thoughts, project work
202006	20200204	L	4	08.00-12.00	Milkrun,transport simulation.
202006	20200206	F	4	08.00-12.00	Ch. 5.3 and 5.4 (particular distribution) Ch. 9 input modeling Ch. 13.4
202007	20200211	L	4	08.00-12.00	Simpliefied production lines, performance of the systems, using logistics as input, with output analysis and improvements.
202007	20200213	F	4	08.00-12.00	Ch. 12
202008	20200218	L	4	08.00-12.00	Scoring function and goal function,traffic generation, sumo input simulation, Södertälje model, focus on sustainability.
202008	20200215	F	4	08.00-12.00	Ch. 13.3 Ch. 10.3
202009	20200225	L	4	08.00-12.00	fault detection for industrial , remaining life time estimation (stats), safety and risk

202009	20200227	F	4	08.00-12.00	Summary and feedback Project
202009	20200228			18:00	draft presentation of project objective, preliminary results and first experience
202010	20200303	R	4	13.00-17.00	Redovisning 1
202010	20200305	INL 1b			INL1b Reflections from the course
202011	20200310			17.00	Submission of final presentation, project work
202011	20200312	R	6	09.00-16.00	Final redovisning
202011	20200313			18.00	Submission final project report (group)