SCUOLA	Scienze giuridiche ed economico sociali
ANNO ACCADEMICO	2014/2015
CORSO DI LAUREA MAGISTRALE	Sviluppo sostenibile delle organizzazioni pubbliche e private
INSEGNAMENTO	SYSTEM DYNAMICS MODELLING PROCESS
TIPO DI ATTIVITÀ	Affine
AMBITO DISCIPLINARE	Formazione interdisciplinare
CODICE INSEGNAMENTO	15585
ARTICOLAZIONE IN MODULI	NO
NUMERO MODULI	
SETTORI SCIENTIFICO DISCIPLINARI	ius/02
DOCENTE RESPONSABILE	David Wheat PA University of Bergen
CFU	10
NUMERO DI ORE RISERVATE ALLO STUDIO PERSONALE	180
NUMERO DI ORE RISERVATE ALLE ATTIVITÀ DIDATTICHE ASSISTITE	70
PROPEDEUTICITÀ	Nessuna
ANNO DI CORSO	Primo
SEDE DI SVOLGIMENTO DELLE LEZIONI	http://www.uib.no/en/course/GEO-SD304
ORGANIZZAZIONE DELLA DIDATTICA	Lezioni frontali, Esercitazioni in aula, Esercitazioni in aula informatica, redazione di un progetto Introduction to the System Dynamics method, dynamic system structure and behaviour, misperceptions of dynamic systems, policy design and implementation. Level: graduate; 10 ECTS points. The course is conducted entirely in English The course requires a Bachelor's degree in any subject. The course is open to students enrolled in the Erasmus Mundus master program and to graduate and undergraduate students at the University of Bergen.
MODALITÀ DI FREQUENZA	Obbligatoria
METODI DI VALUTAZIONE	Prova Scritta, Presentazione di un progetto The course is comprised of lectures, assignments, student assistant assistance on simulation software and assignments, and is completed by four hour written exam. Assessment is carried out by means of evaluation of individual assignment/s and an exam. To sit for the exam, the student must have pass marks on all the assignments. An ECTS grade is provided to the student at the end of the course according to the A—F scale.

	Students not successfully fulfilling all the course requirements within the regular time frame have the option of a re-sit once the following semester.
TIPO DI VALUTAZIONE	Voto in trentesimi
PERIODO DELLE LEZIONI	Primo semestre
CALENDARIO DELLE ATTIVITÀ DIDATTICHE	http://www.uib.no/en/course/GEO-SD304
ORARIO DI RICEVIMENTO DEGLI STUDENTI	http://www.uib.no/en/course/GEO-SD304

OBIETTIVI FORMATIVI DEL CORSO

In this course, students apply the System Dynamics method to problems in both the public and private sectors. Students will apply and gain reinforcement of skills learned in other system dynamics courses as they follow a structured process for simulation modelling of dynamic problems in both social and natural systems. Emphasis is on designing simulation models to explain problematic dynamic behaviour, and then re-designing the models to represent the implementation of policies to improve behaviour. Students learn to use the system dynamics modelling process: define the dynamics of problems, develop hypotheses for problematic dynamic behaviour, analyze and validate computer simulation models, and design policies to improve systemic behaviour. In addition to learning from the lectures, students gain hands-on experience through quick tasks, weekly assignments, and an in-depth project. The reading list includes a primary textbook and supplemental materials.

RISULTATI DI APPRENDIMENTO ATTESI

Knowledge and understanding

Students gain knowledge about the System Dynamics method (P'HAPI: Problem, Hypothesis, Analysis, Policy, Implementation) and its relation to standard science, operations research and management. They also get to know the four basic building blocks of all dynamics systems (a stock with in- and out-flows, local feedback from stock to own flows, nonlinearities, and major loops with delays) and the use of causal loop diagrams, stock and flow diagrams, table functions, and equations to represent building blocks. And they obtain knowledge about different ways to analyze and understand development over time (graphical integration, phase diagrams, simulation) as well as about misperceptions and simplified heuristics that people posses and use to manage complex dynamic systems.

Applying knowledge and understanding

Students have to hand in six assignments during the course. All assignments must have an acceptable quality for the students to sit for the final exam. Students try out their intuitive knowledge and acquired knowledge in computer based simulations. The last part of the class is devoted to applications of System Dynamics with a particular focus on showing that one basic model can be used to understand many important social challenges, the most familiar situation serving as an analogy for the less transparent problems.

Making judgements

Students learn to make judgements about both structure (relationships between variables) and behaviour of systems. They learn to understand the benefits of simple analogies and their shortcomings.

Communication

Students are encouraged to and do participate actively in class. The last question in each of the six assignments is particularly directed at being able to practise and communicate the method through

the steps of P'HAPI (Problem identification, Hypothesis formulation, Analysis, Policy design and Implementation).

Learning skills
This is an introductory course to interested students and a solid background for those that go on the follow-up courses to become a skilled system dynamicist.

CORSO	**SYSTEM DYNAMICS MODELLING PROCESS**
ORE FRONTALI	**LEZIONI FRONTALI**
7	Example application demonstrating all steps of the System Dynamics method
7	The history of System Dynamics
7	The steps of the System Dynamics method (P'HAPI)
7	Building block 1: Stock with in- and outflows
7	Building block 2: Local feedback (linear 1st order systems) – reinforcing and balancing
7	Building block 3: Nonlinearities
7	Building block 4: Major feedback loops with delays – reinforcing and balancing/delays
7	Summary
7	Applications
7	System Dynamics modelling philosophy
TESTI CONSIGLIATI	Basic reading list (more specific references will be provided in the introductory session): Selected parts of; Forrester, J.W. (1961). *Industrial Dynamics*. Cambridge: MIT Press. Appendix O: Beginners' Difficulties. Moss, A.C., Dyer, K.R., Albery, I.P., Allsop, S., Kypri, K., Erskine, J., and Mackintosh, D. (2010). "Alcohol pharmacokinetics, decision making and folk wisdom: A reply to Moxnes and Jensen (2009). Moxnes, E. (2004). "Misperceptions of basic dynamics, the case of renewable resource management." *System Dynamics Review* **20**(2):139-162. Moxnes, E., and Jensen, L.C. (2009). "Drunker than intended; misperceptions and information treatments." *Drug and Alcohol Dependence* **105**:63-70. Moxnes, E., and Jensen, L.C. (2010). "Complex alcohol pharmacokinetics: A response to Moss et al." *Drug and Alcohol Dependence* **109**(1-3):4-5. Sterman, J.D. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World*. Boston: Irwin/McGraw-Hill. Chapters 1 to 8 and 10. Suggested useful reading beginning of chapters 14, 15, and 21 plus chapters 17, 19 and 20. Sterman, J.D. (2002). "All models are wrong: reflections on becoming a systems scientist." *System Dynamics*

	Review **18**(4):501-531. Sweeney, L.B., and Sterman, J.D. (2000). "Bathtub dynamics: initial results of a systems thinking inventory." *System Dynamics Review* **16**(4):249-286. Lecture notes by Erling Moxnes: Instructions to download Powersim Studio Short introduction to Powersim Studio P'HAPI (five steps when solving problems) Course meetings include 36 lecture hours and 18 hours of lab assistance over a 6-7 week period (two lectures and one lab per week) from mid-August until the mid-October. The exam is in the middle of December.