

SCIENCE DES SYSTÈMES (SYS)

SYS 5100 Systems Engineering (3 units)

Controllability and observability, Euler-Lagrange equations, Pontryagin maximum principle, dynamic programming, linear quadratic regulator problem, matrix Riccati differential equations and properties of their solution, design of optimal regulator based on steady state solution of the Riccati differential equation, time optimal control, LaSalle bang-bang principle, applications to motor speed control, satellite attitude control, etc.

Course Component: Lecture, Tutorial, Laboratory

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5110 Foundation of Modelling and Simulation (3 units)

Fundamental aspects of systems modelling and the simulation process. Elements of continuous system simulation. Issues relating to the numerical solution of ordinary differential equations. Elements of discrete event simulation Generation of random numbers and variates. Simulation validation and quality assurance. Introduction to simulation languages.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5120 Applied Probability (3 units)

An introduction to stochastic processes, with emphasis on regenerative phenomena. Review of limit theorems and conditioning. The Poisson process. Renewal theory and limit theorems for regenerative processes; Discrete-time and continuous-time Markov processes with countable state space. Applications to queueing.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5130 Systems Optimization and Management (3 units)

Analysis of user requirements and model design. Data mining. Use of optimization software. Systems thinking and its application to economic systems and hierarchical systems. Applications to economic systems simulation, modeling, optimization and management.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5140 Economic System Design (3 units)

Introduction to the epistemology of systems thinking and its application to economic systems. Basic concepts of complex systems thinking including hierarchical systems and economic systems simulation and behaviour. Soft systems thinking. Examples from other fields of application will be reviewed from an interdisciplinary perspective.

Course Component: Lecture

The following courses are recommended as prerequisites: CSI 1100, MAT 2341, (MAT 2324 or MAT 2331), MAT 2371, MAT 2375.

SYS 5160 Systems Integration (3 units)

Planning, design of complex systems from continuous to discrete time. Synthesis of systems methodology. State estimation. Parameters identification. Discretization and stochastic effects. Dynamic, logic control. Modelling, discrete event, simulation examples.

Course Component: Lecture

Prerequisites: 6 course units from SYS 5100, SYS 5110, SYS 5120, SYS 5130, SYS 5140.

SYS 5190 Directed Readings in Systems Science (3 units)

Directed Readings in Systems Science

Course Component: Research

Courses SYS 5190, SYS 5975 cannot be combined for units.

SYS 5975 Projet en science des systèmes / Project in Systems Science (6 crédits / 6 units)

Volet / Course Component: Recherche / Research

Les cours SYS 5190, SYS 5975 ne peuvent être combinés pour l'obtention de crédits. / Courses SYS 5190, SYS 5975 cannot be combined for units.

SYS 7990 Proposition de thèse de maîtrise / Master Thesis Proposal

Volet / Course Component: Recherche / Research