




5.00 credits

30.0 h + 30.0 h

Q2

Teacher(s)	Absil Pierre-Antoine ;Vandendorpe Luc ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	<ul style="list-style-type: none"> • LEPL1106 (or equivalent training in signals and systems) • LEPL1108 (or equivalent training in probabilities and statistics)
Main themes	The object of this course is to lead to a good understanding of stochastic processes, their most commonly used models and their properties, as well as the derivation of some of the most commonly used estimators for such processes : Wiener and Kalman filters, predictors and smoothers.
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>1.1; 1.2; 1.3 3.1; 3.2; 3.3 4.2</p> <p>At the end of this course, the students will be able to :</p> <p>1</p> <ul style="list-style-type: none"> • Have a good understanding of and familiarity with random variables and stochastic processes ; • Characterize and use stable processes and their spectral properties; • Use the major estimators, and characterize their performances ; • Synthesize predictors, filters and smoothers, in both Wiener or Kalman frameworks.
Evaluation methods	<ul style="list-style-type: none"> • Project during the course semester (40% of the final mark) • Exam (60% of the final mark) • Other activities, such as quizzes and homework exercises, can be taken into account in the project grade • In case of a second session the mark obtained for the project remains unchanged with respect to that of the first session; the project cannot be redone for the second session. <p>Precisions are given in the course outline (plan de cours) available on Moodle.</p>
Teaching methods	Learning will be based on courses interlaced with practical exercise sessions (exercices done in class or in the computer room using MATLAB). In addition, the training includes a project to be realized by groups of 2 or 3 students.
Content	<ul style="list-style-type: none"> • Part 1 - Estimation: probability theory (reminder), Fisher and Bayesian estimation, bias, covariance, mean square error, Cramér--Rao bound, asymptotic properties, classical estimators (maximum likelihood, best linear unbiased, maximum a posteriori, conditional mean...), hidden Markov model, nonlinear filtering, particle filtering, Kalman filter. • Part 2 - Stochastic Processes and LTI Filters: complex random variables, stochastic processes, stationarity, ergodism, autocovariance, power spectral density, transformation by LTI systems, white noise, spectral factorization, finite-dimensional models (AR, MA, ARMA...), Wiener filter.
Inline resources	https://moodle.uclouvain.be/course/view.php?id=714
Bibliography	Les notes de cours des co-titulaires sont disponibles.
Faculty or entity in charge	MAP

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Minor in Engineering Sciences: Applied Mathematics (only available for reenrolment)	MINMAP	5		
Minor in Applied Mathematics	LMINOMAP	5		
Specialization track in Applied Mathematics	FILMAP	5		
Master [120] in Electrical Engineering [Version 2020]	ELEC2M	5		