

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).




5 credits	30.0 h + 30.0 h	Q2
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Teacher(s)	Absil Pierre-Antoine ;Vandendorpe Luc (coordinator) ;
Language :	English
Place of the course	Louvain-la-Neuve
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.
Aims	<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. <p>----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Evaluation methods	<p>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</p> <ul style="list-style-type: none"> • Project during the course semester • Exam • Other activities, such as quizzes and homework exercises, can be taken into account in the final grade <p>Precisions are given in the course outline (plan de cours) available on Moodle.</p>
Teaching methods	<p>Due to the COVID-19 crisis, the information in this section is particularly likely to change.</p> <p>Learning will be based on courses interlaced with practical exercise sessions (exercises 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.</p>
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	http://moodleucl.uclouvain.be/course/view.php?id=4753
Bibliography	Les notes de cours des co-titulaires sont disponibles.
Faculty or entity in charge	MAP

Force majeure

Teaching methods	If the sanitary conditions allow, courses and exercise sessions will be held in presence.
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	<p>If the sanitary conditions require it, courses and exercise sessions will be organised remotely or in comodal. Students may also be invited to watch podcasts.</p>
Evaluation methods	<p>The evaluation will be based on the content of the courses, the exercise sessions and the project (independently on whether they are held in presence or remotely), and of the podcasts if applicable.</p> <p>The evaluation will be written and individual.</p> <p>The exam may consist in a combination of open and closed questions.</p> <p>If the sanitary conditions allow, the exam will be closed book. A personal summary of one two sided A4 sheet will be allowed.</p> <p>If the sanitary conditions require remote examination, the examination will be open book.</p> <p>The project will also be evaluated by group, on the basis of a report and of homeworks.</p>

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