UCLouvain

# lecon2600

*2025*

# Dynamical Methods in Economics

The version you're consulting is not final. This course description may change. The final version will be published on 1st June.

| 5.00 credits | 30.0 h | Q1 |
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| Teacher(s) | Oikonomou Rigas ; |
| Language : | English |
| Place of the course | Louvain-la-Neuve |
| Main themes | The lectures start with a short characterization of the dynamic systems encountered in economics (differential or difference systems, discrete and continuous time systems, stochastic or deterministic), and introduce to the reso-lution techniques, with a special emphasis on differential systems. Stability theory is then developed in detail, including some advanced materiel (Lyapunov theory, local and global stability, linearization and the Hartman-Grobman theorem, Barbashin-Krasovskii theorem, Barbalat lemma<br>etc<br>). The lack of stability may give rise to irregular and even strange dynamics, and the third part of the course precisely develops the techniques al-lowing to detect such complex dynamics (bifurcation theory mainly). The last lectures are devoted to dynamic optimisation tools: calculus of variations and optimal control, plus some elementary notions on dynamic pro-gramming. |
| Learning outcomes | **At the end of this learning unit, the student is able to :**<br>1 This course is designed to rigorously present the main methods needed to analyze the standard models of eco-nomic dynamics. It principally emphasizes three major sets of methods : those needed for a proper study of sta-bility of dynamic systems, those usually applied to detect complex dynamics, and finally the optimization techniques in dynamic frameworks (specially optimal control). The final assessment will require the assimila-tion of both the theoretical foundations and the applied aspects related to these methods. |
| Evaluation methods | For each section the students are asked to solve and hand in one problem set. The problem sets carry 20% of the overall grade. The final exam 80%. |
| Content | This course has four main sections. The first section concerns dynamic optimization in continuous time and it is closely related to growth theory. In this context, systems of differential equations, their stability and solution techniques, will be discussed in class. The second section concerns discrete time models (both deterministic and stochastic) and is related to the theory of real business cycles. In the context of stochastic models notions of stability in linearized systems of difference equations with forward looking variables are introduced. The third section is devoted to dynamic programming and in particular to solving dynamic problems in economics with the Bellman equation. Finally, the last part of the course is devoted to simple search theoretic models of the labor market in discrete and continuous time.<br>**Aims**: The aim of this course is first to familiarize the students with the tools of dynamic optimization in economics and the methodologies needed to solve dynamic problems, and second to present applications of these tools and methodologies. Each of the topics listed above will be accompanied with an introduction to suitable numerical techniques. In particular numerical algorithms will be employed to solve systems of deterministic differential equations, linear systems of stochastic difference equations. Algorithms to solve Bellman equations will also be discussed extensively. |
| Inline resources | Slides, Problem Sets, Past Exams and Computer Programs are available on Moodle |
| Bibliography | Barro, R. and Sala i Martin (2003) Economic Growth, **MIT Press second edition**.<br>Lars Ljungqvist and Thomas J. Sargent (2012) Recursive Macroeconomic Theory**, MIT Press, 3rd Edition**<br>Adda, J. and Cooper, R. (2003) 'Dynamic Economics', **MIT Press.** |
| Faculty or entity in charge | ECON |

## Programmes containing this learning unit (UE)

| Program title | Acronym | Credits | Prerequisite | Learning outcomes |
|---|---|---|---|---|
| Master [120] in Economics: Econometrics | ETRI2M | 5 | | |
| Master [60] in Economics : General | ECON2M1 | 5 | | |
| Master [120] in Economics: General | ECON2M | 5 | | |