

ADDITIONAL REQUIREMENTS FOR ECONOMETRICS AND MANAGEMENT SCIENCE

Mathematics

Divide the courses into the clusters Mathematics, Statistics, Economics, Econometrics, Operations Research and Informatics/programming

Analysis (FEB21021X)

Include the course name and course code as mentioned on your transcript

Goal

- Getting sufficiently familiar with those concepts and methods of differential and integral calculus that an econometrist should know, by means of a leading international textbook.
- Being able to solve both all routine as well as the most challenging exercises and problems from a leading international textbook on the subject.
- Being able to carry out well-founded calculations of various types of limits.
- Being able to use the rules of differential respectively integral calculus in order to compute derivatives respectively anti-derivatives and integrals.
- Being able to construct proofs of statements.

Content

- Functions, limits, and continuity
- Differentiation
- Sequences and series
- Taylor series
- Differential equations
- Multiple integrals

Include the literature list for every course

Literature

James Stewart, Calculus - Early Transcendentals, 8th edition, metric version, 2015, Cengage Learning (ISBN: 978-1-305-27237-8)

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21021X>

Vector Calculus (FEB21023X)

Include the source if the document is not an official document

Goal

- Acquiring basic knowledge of eigenvalues, eigenvectors, orthogonality, projections, diagonalization, quadratic forms, vector spaces, inner products, norms, distances and vector differentiation.
- Acquiring the basic skills to determine eigenvalues, eigenvectors, diagonalizations, orthogonal bases, orthogonal decompositions, QR factorizations, spectral decompositions, optimal values of quadratic forms and vector derivatives.
- Acquiring insight in abstract structures at the required level for Econometrics.
- Acquiring basic skills in proving theorems in matrix algebra and vector calculus.

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21023X>

Matrix Algebra (FEB21019X)

Goal

- Acquiring insight into the abstract underlying structure of matrix algebra.
- Acquiring the basic skills in matrix algebra that are required for the econometric program.

- Acquiring skills of calculating with matrices.
- Acquiring skills in constructing elementary proofs in matrix algebra.

Content

- Length and Angles: The Dot Product
- Lines and Planes
- Methods to Solve Linear Systems
- Spanning Sets and Linear Independence
- Matrix Operations
- The Inverse of a Matrix
- Subspaces, Basis, Dimension and Rank
- Determinants

Literature

David Poole, Linear Algebra: A Modern Introduction, Thomson, Brooks/Cole (2011), 3rd Edition. (ISBN: 0-538-73544-9)

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21019X>

Mathematical Methods (FEB21010X)

Goal

- Students are familiar with the mathematical methods and skills that are required for studying Econometrics.
- Students understand the basic concepts in graph theory.
- Students understand the basic concepts in combinatorics and are able to prove combinatorial theorems.

Content

The topics that are discussed focus on:

- Developing mathematical methods and skills
- Thinking algorithmically
- Acquiring mathematical intuition

The following topics are included:

- Combinatorics
- Recurrence relations
- Graph theory
- Computational complexity

Literature

Discrete Mathematics, Pearson Custom Publishing, 2013. (ISBN: 978-1-78016-382-6)

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21010X>

Statistics

Probability Theory (FEB21005X)

Goal

- Understands the basics of probability theory, including central concepts and proofs of central results.
- Obtains knowledge of and proficiency in reasoning and calculating with probabilities: continuous and discrete random variables, functions of random variables, transformation methods, joint and conditional distributions.
- Obtains insight and experience in the use of probability theory in statistics: sampling distributions, central limit theorem.
- Gets insight into basic results in probability theory that are important in econometrics.
- Gets experience in applying mathematical concepts and techniques of probability theory.

Content

Continuous random variables, continuous distributions, moment generating functions, discrete and continuous joint distributions, independence, conditional distributions, conditional expectations, variance, covariance, functions of random variables, transformation methods, Central Limit Theorem, stochastic convergence, sampling distributions.

Literature

Wackerly, Mendenhall, Scheaffer, Bain, Engelhardt: Custom Edition Introduction to Probability and Mathematical Statistics. Cengage, 2014. (ISBN: 9781408092149)

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21005X>

Statistics (FEB21007X)

Goal

- Students learn the basic principles of statistical estimation: point estimation, interval estimation, as well as properties of estimators such as bias, variance and consistency.
- Students learn the basic principles of statistical testing: formulating statistical hypotheses, constructing appropriate tests and the corresponding critical region, calculating p-values and properties of tests such as type I and type II errors, and the power of a test.
- Students are introduced to the theory of sufficient and complete statistics in order to apply those concepts in the construction of estimators with desirable properties.
- Students learn how to construct maximum likelihood estimators, method of moment estimators, most powerful tests and likelihood ratio tests.

Content

A typical phenomenon in empirical research is the wish to make statements about an unobservable population on the basis of an observed sample.

The course Statistics aims to facilitate the construction of statistical statements about the population on the basis of a random sample. The statements may concern statistical estimates or statistical hypothesis tests. Moreover, the statistical statements are typically accompanied by information concerning the level of (un)certainty.

In this course, the construction of "good" estimators and "good" tests in parametrical statistical models is considered. In particular, we will focus on the construction of method of moments estimators, maximum likelihood estimators, (uniformly) most powerful tests and likelihood ratio tests.

Literature

Custom Edition: Bain and Wackerley, Mathematical Statistics and Probability Bundle.

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB21007X>

Markov Processes (FEB22008X)

Goal

- To understand elementary stochastic processes (Markov chains, Markov processes).
- Being able to model a problem with randomness as stochastic process and solve it analytically.
- Know how to apply a model within econometrics and operations research.

Content

- Conditional probabilities and expectations
- Random arrival processes (in(homogene) Poisson processes)
- Discrete-time Markov chains
- Markov decision chains
- Continuous-time Markov processes
- Basic queueing theory (M/M/c models and variants)
- Brownian motion and other Gaussian processes
- Applications within econometrics and operations research

Literature

S.M.Ross, Introduction to Probability Models (11th edition), Academic Press, 2014

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB22008X>

Economics

Microeconomics (FEB11001X)

Goal

Reproduce and interpret concepts in key areas of microeconomics:

- choice and decision-making; information and uncertainty;
- household and firm behaviour;
- organisations and markets;
- allocation and welfare and behavioural economics.

Reproduce and interpret concepts in key areas of meso-economics:

- market structure and performance;
- firm strategy;
- firm objectives and performance;

Use basic, standard mathematical methods commonly employed in microeconomics.

Content

- The first part of the course deals with the theory of the consumer. Topics covered include consumer choice under certainty and uncertainty, and individual and market demand;
- The second part focuses on the theory of the firm, and includes the topics of firm production and firm cost;
- The last part of the course turns to market structures (monopoly, imperfect competition and perfect competition), to the joint analysis of firm and consumer behavior within a market (general equilibrium theory) and to factor markets (especially labor).

Literature

Microeconomics and Behavior, 2nd edition (2016), Frank and Cartwright, McGraw Hill.

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB11001X>

Macroeconomics (FEB11002X)

Goal

- Obtaining theoretical understanding of the way (micro) economic interactions between producers, consumers and government lead to the macro-economic situation.
- To gain empirical knowledge of the workings of the economy at the macroeconomic level (for individual countries and the world as a whole).
- Analysing the impact of government policy on the macro economy.

Content

The course includes:

- Interactions between money markets and goods markets;
- The impact of government policy on aggregate employment and output;
- Interaction between national economies through international trade and capital flows;

- Insights into the ways that the micro- and macroeconomic features of the economy interact through production, consumption, and economic policy.

Literature

Burda, M., and C. Wyplosz, *Macroeconomics: a European text*, 6th edition, Oxford University Press

Source: <https://courses.eur.nl/#/2016-2017/detail/FEB11002X>