Public Law

Comparative Law

**Code and Credits:** JOIK3012, 5 ECTS
**Time:** Spring semester.
**Learning outcomes:** The student knows the differences of various judicial systems and gets knowledge how to make comparative law studies.
**Content:** 1) Methods of comparative law 2) Classifications and knowledge of legal systems
**Teaching methods:** Lectures/seminar 8 hrs or self-study.
Assessment: Lecture journal and a written or oral presentation in seminar. In case there are no lectures a more deep written essay or wider presentation is required.

**Literature:**


**Grading:** On a scale of 1-5 / fail.
**Contact person:** Professor.

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Philosophy

**FILO2302 Philosophy of Multiculturalism (autumn)**

**Philosophy of Science**

**Code and credits:** FILO1011, 3 ECTS
**Period:** The 2nd period in the autumn term.
**Aim of the course:** On completing the course students will know basic questions of philosophy of science and ethics of science and problems related to concept and theory formation and explaining in science.
**Completion of the course:** 10 hours of lectures on the starting points, objectives and requirements of scientific thinking and research. A book exam.
**Course literature:**

1. A. F. Chalmers, What Is This Thing Called Science? or J. Elster, Explaining Social Behavior: More Nuts and Bolts for the Social Sciences and
Teacher: Professor Tommi Lehtonen.
Organiser: Faculty of Philosophy.
Grading: On a scale of 1–5 / fail.

- FILO2005 Ethics (spring)

Mathematics and Statistics

Operations Research

- Code: ORMS1020
- Credits: 5 ECTS
- Prerequisites: basic studies in mathematics
- Learning Outcomes: introduction to mathematical modelling of economic and technical phenomena appearing both in scientific study materials and real life
- Content: basic concepts and principles in mathematical modelling, different types of models, basic structure of a Linear Programming (LP) model, formulation and solving the LP model and interpreting its solution, sensitivity analysis, examples of other basic OR models (inventory models, dynamic programming, network models, simulation), examples of computer tools for OR models
- Study Materials: lecture and exercise material
- Teaching Methods: lectures 36 h and exercises 15 h
- Modes of Study: exercises and midterm exams or exam
- Languages: Language of Instruction English, Completion Language Finnish/English
- Grading: scale 1-5 or fail
- Responsible Person: Tommi Sottinen
- Teacher(s): Ehsan Azmoode
- Responsible Unit: Department of Mathematics and Statistics
- Additional Information: registration in advance, lectures held every other year in Finnish and every other year in English, 2015-2016 in English

Integral Transforms

- Code: MATH1130
- Credits: 5 ECTS
- Prerequisites: basic studies in mathematics (Calculus and Linear Algebra)
- Learning Outcomes: students learn basic facts on complex functions, their differential and integral calculus, in particular, get familiar with elementary complex functions, are able to differentiate and integrate such functions, as well as solve equations in complex domain involving such functions, students learn to check whether a function is analytic, calculate line integrals in the complex domain by means of parametric representations, Cauchy formulas, partial fractions and residue methods, students learn basic facts on Laurent series and their connection to residue calculus, they also learn basic facts on Fourier series, Laplace transforms, and Fourier transforms, in particular, students learn to calculate Fourier series, apply central properties connected with the convergence of Fourier series, they learn to
calculate Laplace and Fourier transforms, get familiar with their central properties and are able to apply Laplace and Fourier transforms in solving differential equations, and they learn to apply residue method in calculating integral transforms

Content: complex numbers, functions of a complex variable, continuity, differentiability, analytic function, Cauchy-Riemann equations, complex line integral, Cauchy integral formulas, Power series, Taylor and Laurent series in complex domain and their convergence properties, residue calculus, residue theorem.

Fourier series (trigonometric and complex versions) with approximation and applications, Laplace transform, inverse Laplace transform, transfer function, applications to differential equations appearing e.g. in modeling electrical circuits, Fourier transform with basic properties and applications, a part of exercises is solved and treated with computers applying mathematical programs.

Study Materials:

Teaching Methods: lectures 40 h (in Finnish), 10 h (in English), exercises 20 h (in Finnish / English).
Modes of Study: exams and exercises.
Language: Finnish/English.
Grading: 1-5 or fail.
Responsible Person: Seppo Hassi.
Teacher(s): Seppo Hassi, Dmytro Baidiuk and Marko Moisio.

Probability and Statistics

Code: MATH1170.
Credits: 5 ECTS.
Prerequisites: Basic differential and integral calculus.
Learning Outcomes: The student can summarize data in terms of statistics and diagrams, can calculate probabilities of events and conditional probabilities, can apply the most important discrete and continuous probability distributions, joint distributions, moment generating functions, and sampling distributions. The student can apply the method of least squares and conduct inference concerning one and two means, variances, and proportions, correlation, and concerning linear regression coefficients.
Content: Population and Sample, descriptive statistics, probability of events, conditional probability, continuous and discrete random variables and their distributions, joint distributions, moment generating functions, sampling distributions, inferences concerning one and two means, variances, and proportions, the method of least squares, correlation, and regression inference.

Study Materials:
Teaching Methods: lectures 40h and exercises 20h.
Modes of Study: Exam.
Language: English.
Grading: scale 1-5 or failed.
Responsible Person: Bernd Pape.
Teacher: Bernd Pape.
Responsible Unit: Department of Mathematics and Statistics.
Additional Information: This course with a main focus on probability calculus is targeted mainly at Faculty of Technology students as a replacement for Tilastotieteen perusteet (Introduction to Statistics STAT1030) which has a stronger focus on statistics. It is not possible to earn credits for both Tilastotieteen perusteet and Probability and Statistics (or Basic Course in Statistics STAT1020). This course is strongly recommended as a prerequisite for the course Probability and Stochastic Processes.

Numerical Methods

Code: MATH2030
Credits: 5 ECTS
Prerequisites: basic studies in mathematics
Learning Outcomes: concepts of numerical methods and softwares
Content: numerical methods, interpolation, approximation, numerical integration and derivation, numerical methods for differential equation, integral transforms, vector- and Fourier analysis, introduction of mathematics softwares (Matlab and Mathematica)
Study Materials:
Teaching Methods:
Modes of Study: exam
Languages: English, English
Grading: 1-5 or fail
Responsible Person: Marko Moisio
Teacher(s): Ehsan Azmoodeh
Responsible Unit: Department of Mathematics and Statistics

Statistical Analysis of Contingency and Regression

Code: STAT1010
Credits: 5 ECTS
Prerequisites: Introduction to Statistics
Learning Outcomes: provide the student with sufficient skills to analyze the dependence between statistical variables, introduce the student to the use of statistical software in multivariate statistical analysis
Content: contingency tables, non-parametric methods, ANOVA and regression analysis, statistical software used in the exercise: SAS Enterprise Guide
Study Materials:
3. Moore/McCabe: Introduction to the Practice of Statistics, Freeman
Teaching Methods: lectures 36 h and exercises 12 h
Modes of Study: exam
Statistical Data Processing SAS EG

**Code:** STAT2110  
**Credits:** 5 ECTS  
**Prerequisites:** introduction to statistics or basic course in statistics and data processing  
**Learning Outcomes:** the student will be able to choose and apply an appropriate statistical method, to use a statistical software, to interpret the results of statistical analyses  
**Content:** creating data sets, variable transformations, performing statistical analyses (univariate and bivariate descriptive statistics, statistical hypothesis testing: tests for the means, tests of the homogeneity of variances, tests related with statistical dependence non-parametric tests, linear regression, analysis of variance and factor analysis) with a statistical software, interpretation of the results of statistical analyses  
**Study material:** courses lecture notes and user guides of the software  
**Teaching Methods:** lectures 20 h and demonstrations 20 h  
**Modes of Study:** 1) attendance to demonstrations and lectures and practical work OR 2) exam and practical work  
**Languages:** language(s) of instruction: English; completion language(s): Finnish/English  
**Grading:** passed/fail (modes of study 2: scale 1-5 or fail)  
**Responsible Person:** Christina Gustafsson ([www.uva.fi/~chg/](http://www.uva.fi/~chg/))  
**Teacher(s):** Christina Gustafsson  
**Responsible Unit:** Department of Mathematics and Statistics  
**Additional Information:** the statistical software is SAS EG and the instruction language is English, courses web-page is [http://lipas.uwasa.fi/~chg/STAT2110.html](http://lipas.uwasa.fi/~chg/STAT2110.html)

Econometrics I

**Code:** STAT2020  
**Credits:** 5 ECTS  
**Timing:** fall 2015  
**Prerequisites:** Elementary statistics and probability (Wooldridge, Appendix B), covering basic concepts of statistical inference (estimation and hypothesis testing, Wooldridge, Appendix C). Basic mathematics (Wooldridge, Appendix A) including, differentiation, integration, solving elementary differential equations, elasticity concept, and continuously compounded interest rate calculus. Working knowledge of basic matrix algebra (Wooldridge, Appendix D) is a benefit but not a prerequisite. Appendices of the Wooldridge’s books are available in pdf-format at [http://academic.cengage.com/resource_uploads/downloads/1408093758_415141.pdf](http://academic.cengage.com/resource_uploads/downloads/1408093758_415141.pdf)
Learning Outcomes: The student knows basics of empirical econometric research methods and
approaches including types of econometric data, roles of variables, economic and econometric
modeling, estimation, statistical inference, interpretation of estimation results, model checking and
model evaluation, use of econometric models in practice. The course will develop students’ generic skills
including basics of statistical modeling, communication of estimation results in economic terms,
extracting relevant information from statistical software listings, and critical evaluation of empirical
results.

Content: Nature of econometrics and econometric data, simple regression model, multiple regression
analysis, regression with qualitative information, heteroscedasticity, time series regression. Introduction
to modern (econometric) software packages.

Study Materials: Wooldridge, Jeffrey, M (2006), Introductory Econometrics-A Modern Approach, 3e,
Thompson, South-West, chapters 1-12, Software: SAS, EViews, r.

Teaching Methods: lectures 40 h, exercises 12 h, home page:

Modes of Study: exam

Languages: English

Grading: 1-5/fail

Responsible Person: Seppo Pynnönen (www.uwasa.fi/~sip/)

Teacher(s):

Responsible Unit: Department of Mathematics and Statistics

Additional Information:

Probability and Stochastics Processes

Code: STAT3xxx

Credits: 5 ECTS

Prerequisites: basic studies in mathematics, and probability and/or statistics

Learning Outcomes: to complete the basic skills in probability theory and introduce to the field of
stochastic processes and their applications

Content: Probability and conditional probability, generating functions, Poisson, exponential and normal
distribution, Markov chains, Chapman-Kolmogorov equations, stationary distributions and ergodic
theorems, Poisson process, applications to queueing systems

Study Materials:
Sheldon Ross: Introduction to Probability Models, 10th edition

Teaching Methods: 40h lectures + 20h exercises

Modes of Study: exam

Languages: English

Grading: 1-5 or fail

Responsible Person: Ehsan Azmoodeh

Teacher(s): Ehsan Azmoodeh

Responsible Unit: Department of Mathematics and Statistics

Additional Information:
Econometrics II

**Code:** STAT3090  
**Credits:** 6 ECTS  
for PhD students (in particular economics) the course is possible to extend to 7 ECTS (7 op) with additional reading package described below  
**Timing:** spring  (January-February)  
**Prerequisites:** basic Econometrics (STAT2020) and Mathematic Analysis (ORMS1010) recommended (including working knowledge in differentiation, integration, solving elementary differential equations, elasticity concept and continuously compounded interest rate calculus, and matrix algebra)  
**Learning Outcomes:** The student gains skills to use modern econometric tools applied in empirical finance and economics, the topics cover econometric applications in empirical asset pricing and analysis of financial time series including risk measurement, panel data econometrics and introduction to multivariate time series analysis (impulse responses, cointegration), the emphasis is in empirical modeling and interpretation of the results with real data examples. As generic skills the student learns to interpret empirical estimation results and the potential of solving complicated estimation and modeling problems with modern software such as R, SAS, Stata, or EViews.  
**Content:** financial and economic data, panel data models, financial econometrics (multivariate) time series models  
**Study materials:**  
(1) Wooldridge, Introductory Econometrics: A Modern Approach, Ch 13&14;  
**Teaching Methods:** lectures 42 h, demonstration 12 h (classes and notes in English) home page  http://lipas.uwasa.fi/~sjp/Teaching/ecmii/lectures/index.html  
**Modes of Study:** exam  
**Languages:** English  
**Grading:** 1-5 or fail  
**Responsible Person:** Professor Seppo Pynnönen (www.uwasa.fi/~sjp/)  
**Teacher(s):** Seppo Pynnönen  
**Responsible Unit:** Department of Mathematics and Statistics  
**Additional Information:** course can be included to the minor in statistics/business mathematics

Mathematics of Financial Derivatives

**Code:** STAT3110  
**Credits:** 8 ECTS  
**Timing:** spring  
**Prerequisites:** basic courses in finance and economic mathematics  
**Learning Outcomes:** introduce the students to the mathematics utilized for the pricing of financial derivatives and to provide the student with a basic understanding of the mathematical ideas and
technical tools used in modeling the characteristics of derivatives, interest rates and currencies with
discrete as well as continuous time processes

**Content:** introduction to discrete and continuous time (and state space) pricing, complete and
incomplete markets, arbitrage, law of one price, etc.

**Study materials:**

2. PLISKA S R: Introduction to Mathematical Finance: Discrete Time Models, Blackwell Publishers
3. additional reading package

**Teaching Methods:** 42 h lectures

**Modes of Study:** written examination + term paper (research proposal for Ph.D. students)

**Languages:** English

**Grading:** scale 1-5, or fail

**Responsible Person:** Seppo Pynnönen and Johan Knif (Hanken)

**Teacher(s):** Seppo Pynnönen

**Responsible Unit:** Department of Mathematics and Statistics

**Additional Information:** joint course with Hanken Vaasa course is arranged every second year, next time
spring 2016

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**Automation Technology**

**Electronics**

**Code:** AUTO1020

**Credits:** 5 ECTS

**Prerequisites:** Safety at Electricity Works

**Learning Outcomes:** after completing this course the students will be able to describe the properties of
the semiconductor components, such as diodes, transistors and operational amplifier, design and
analyze typical electronic circuits used in the most common applications, by calculating and simulations
and in addition construct and test them

**Content:** circuit theory, semiconductor device characteristics, applications of analog signal processing,
rectifier circuits, low frequency transistor amplifiers, and operational amplifier basics, electronics
simulators and electronics measurements

**Study Materials:**

3. lecture notes and materials

**Teaching Methods:** lectures 24 hours, exercises 20 hours

**Modes of Study:** exam (AUTO 1021 3 ECTS), laboratory work (AUTO1023 2 ECTS.

**Languages:** English

**Grading:** scale 1-5 or fail
Responsible Person: Vladimir Bochko
Teacher(s): Vladimir Bochko
Responsible Unit: Department of Electrical Engineering and Energy Technology
Additional Information: every second year, will be arranged 2015-2016

Digital Control
Code: AUTO2090
Credits: 5 ECTS
Prerequisites: Integral Transforms in addition Digital Signal Processing is recommended
Learning Outcomes: after completing this course the student will be able to define the basic concepts and terminology of control theory; explain the principle of operation of the digital controller; use PID controller application; calculate and analyse feedback system in frequency plane; simulate simple control systems, knows typical applications of digital control such as electrical motor and diesel engine control
Content: Laplace transform, transfer functions, feedback, stability, functioning of a digital controller, principles of discrete control, simulation of a controller system with Matlab Control Toolbox, applications and examples of control in automation
Study Materials:
3. G. F. Franklin, J. David Powell, M. Workman: Digital Control of Dynamic Systems...
4. Lecture notes and materials

Teaching Methods: lectures 24 hours, exercises 16 hours, project work 20 hours
Modes of Study: exam (AUTO2091 3 ECTS) and project work AUTO2092 2 ECTS
Languages: language(s) of instruction: English; completion language(s): English
Grading: scale 1-5 or fail

Digital Signal Processing
Code: AUTO1030
Credits: 5 ECTS
Prerequisites: Programming and Digital Electronics
Learning Outcomes: introduction to basic of digital signal processing, after having passed the course the student has learned: the structure of a typical signal processing system; implement the most
common methods of signal processing: design, implement, test and document a simple signal processing task; include own modules to a larger image processing program; design, implement, test and document a hardware based (fpga) signal processing application

**Content:** most common filters, circuit diagram, FFT, design of digital filter and finite precision, image coding and processing, DSP processors and programs, design of FIR filter using IRT method, applications, Matlab and FPGA implementations

**Study Materials:**
4. lecture notes and materials: lipas.uwasa.fi/~TAU/AUTO1030/slides.php

**Teaching Methods:** lectures and project work

**Modes of Study:** exam and project work

**Languages:** Language of Instruction: Finnish/English (at need), Completion Language: Finnish/English

**Grading:** 1-5 or fail

**Responsible Person:** Jarmo Alander

**Teacher(s):** Jarmo Alander and Janne Koljonen

**Responsible Unit:** Department of Electrical Engineering and Energy Technology

**Additional Information:** http://teg.uwasa.fi/TLTE/AUTO1030/

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**Mechatronics**

**Code:** AUTO2040

**Credits:** 5 ECTS

**Prerequisites:** Programming, Linear Algebra and Mechanics

**Learning Outcomes:** after completing this course the student will able to explain the most important mechatronics components (sensors, actuators and their electronics) and their functions; explain the most important mechatronics applications; calculate the movements of mechanisms by homogenous coordinates; design, implement, test, and document a simple mechatronic device

**Content:** the structure of a mechatronic device, sensing and actuators; mathematical modeling of robots and actuator systems; electronics of sensors and actuators; prototyping of a mechatronic device; principles of working safety; application examples

**Study Materials:**

2. Mauri Airila: Mekatroniikka, Otatieto, 2000
Teaching Methods: lectures 24 hours, exercises 16 hours, project work 20 hours
Modes of Study: exam (AUTO2041 3 ECTS) and project work AUTO2042 2 ECTS)
Languages: language(s) of instruction: English; completion language(s) English/Finnish
Grading: scale 1-5 or fail
Responsible person: Jarmo Alander
Teacher(s): Jarmo Alander/Vladimir Bochko
Responsible Unit: Department of Electrical Engineering and Energy Technology
Additional Information: every second year

Soft Computing

Code: AUTO2050
Credits: 5 ECTS
Prerequisites: Programming, in addition Object Oriented Programming is recommended
Learning Outcomes: after completing this course the student will able to explain the principles of fuzzy logic; explain the principles of fuzzy reasoning; describe the most important applications and application areas of fuzzy logic; apply the principles of fuzzy sets theory; fuzzy rules and fuzzy control; explain the principles of neural networks; describe the most important neural network types; apply learning of neural networks; describe the most important applications of neural networks; describe the principles of evolutionary computation; apply the principles of multiparameter optimisation; describe the principles of global optimisation; describe the typical applications of genetic algorithms; implement an application of genetic algorithms; combine and apply different soft computing methods; design, implement, test and document a simple soft computing application
Content: neural networks, fuzzy logic, genetic algorithms, evolutionary strategies, interval arithmetics, applications from engineering and science, use of Matlab Soft Computing Toolboxes
Teaching Methods: lectures 24 hours, exercises 20 hours, project work 20 hours
Modes of Study: exam (AUTO2051 3 ECTS) and project work AUTO2052 2 ECTS)
Languages: language of instruction: teaching English / exercises English; completion language(s) English
Grading: scale 1-5 or fail
Responsible person: Jarmo Alander
Teacher(s): Jarmo Alander/Vladimir Bochko
Responsible Unit: Department of Electrical Engineering and Energy Technology
Additional Information: every year

Sound Processing

Code: AUTO3290
Credits: 5 ECTS
Prerequisites: basic knowledge in Signal Processing and Programming
Learning Outcomes: after completing the course the student can:
explain the basics common sound and signal processing methods,
implement and analyze sound and signal processing methods,
design, implement, test, and report a simple sound processing application

Content: digitalization, storing, and compression of sound; frequency analysis; audio signal restoration;
pitch shift; digital filters; sound effects; speech recognition; vibration analysis; independent component analysis (ICA), signal processing in Matlab

Study Materials: literature provided by the teacher

Teaching Methods: the course is mainly studied independently, there are additionally 26 h of lectures/exercises/guidance to assist learning

Modes of Study: exam, 8 sets of exercises, and project work

Languages: English

Grading: 1-5 or fail

Responsible Person: Janne Koljonen

Teacherr(s): Janne Koljonen

Additional Unit: Department of Electrical Engineering and Energy Technology

Digital Filters

Code: AUTO3330

Credits: 5 ECTS

Prerequisites: Programming and Integral Transforms, Digital Electronics

Learning Outcomes: after having passed the course the student has learned: the structure of a typical digital filter; calculate the most common transforms used in signal processing; design, implement (both software and hardware), test and document a digital filter

Content: design of digital filters with finite precision, using processors, DSP processors and FPGAs, design of FIR and IIR filter using IRT method, applications

Study Materials:

- lecture notes and materials: lipas.uwasa.fi/~TAU/AUTOXXXX/slides.php

Teaching Methods: lectures 24h, exercises 16h and labwork 20h

Modes of Study: exam and project work

Languages: Language of Instruction: Finnish/English (at need), Completion Language: Finnish/English

Grading: 1-5 or fail

Responsible Person: Jarmo Alander

Teacher(s): Jarmo Alander and Janne Koljonen

Additional Information: http://teg.uwasa.fi/TLTE/AUTOXXXX/
Electrical Engineering

**Energy Production**

**Code:** SATE2020  
**Credits:** 5 ECTS

**Prerequisites:** Sähköenergiatekniikan perusteet is recommended

**Learning Outcomes:** to get a rough view of the global possibilities of technology for energy sector now and in future

**Content:** global challenges and their implications for the energy sector, energy use, energy conservation technologies, energy resources, supply systems and scenarios on energy futures

**Study Materials:** Energy Visions 2050, VTT Editia, 380 pages, copies of the book are available in Tritonia Library

**Teaching Methods:** introduction lectures (4 hours) are given twice a year, an English exam, including the answering in English, detailed information via the WebOodi system for the registrated students

**Modes of Study:** exam in English

**Languages:** language(s) of instruction: English; completion language(s): English

**Grading:** scale 1-5 or fail

**Responsible Person:** Timo Vekara

**Teacher(s):** Timo Vekara, Svetlana Marmutova

**Responsible Unit:** Dept. of Electrical and Energy Engineering

**Additional Information:** suits not only for students of engineering but also for students aiming at the B.Sc. degree or those having for example economics as a major, finnish book “Energia Suomessa” may help to start