Course name:
Mathematical methods in Economics (Spring 2015).

Schedule
Lectures: Wednesdays, 16:00 – 19:00. Office hours: Wednesdays, 15:00 – 16:00. Midterm and final exams: TBA.

Instructor
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Course objective and structure
The purpose of the course is to familiarize students with the basic concepts of modern Economics. The course shows the application of optimization and regulation on the economic examples of consumer and producer theories, taxation, price regulation, growth theory, finance, auctions, and network industries. Students are expected to have elementary knowledge of calculus and the basics of Microeconomics.

The course starts with the revision of optimization techniques including linear and nonlinear programming. The constrained optimization problems include linear and nonlinear constraints (constraint qualification test and Kuhn-Tucker conditions). Next, using illustrative examples we will see how consumers and producers interact and the endogenous price vector is determined. After consumer and producer theories we will see further applications of matrix algebra in economics using input-output model for an energy sector, Markov processes including the transition matrix, and game theory.

Then we will review optimal control theory and phase diagrams in order to cover growth theory including the overlapping generations model, Solow model, and Ramsey model. These are economic models include using discrete and continuous time.

In finance topics we will cover valuing of cash flow, net present value, and internal rate of return. We will review probability density and cumulative distribution functions with the application to the VaR model.

During the last lectures we will look into the mathematical apparatus for the auction theory. We will also review liberalization in network industries and in particular electricity supply industry in Great Britain. Finally, we will look at the application of regression models in the energy sector. In particular we will review estimation of the demand equation for natural gas, hedging strategy, and stress test.

Grading
Midterm exam – 20%, final exam – 40%, two quizzes – 10%, two HW assignments – 10%, class participation – 20%.

Principal textbooks:
1. Doepke, M., Lehnert, A. and Sellgren, A. (1999). Macroeconomics.
2. Jehle, G. and Reny, P. (2011). Advanced Microeconomic Theory, 3rd ed.
3. Nicholson, W. and Snyder, C. (2008). Microeconomic Theory. Basic Principles and Extensions, 10th edition.

Additional textbooks:
1. Robert J. Barro and Xavier Sala-i-Martin (2004). Economic Growth.
2. Krishna, V. (2009). Auction Theory.
3. Bhattacharyya, S.C. (2011). Energy Economics: Concepts, Issues, Markets and Governance.
4. Tashpulatov S. (2014). Network industry liberalization: The case of the England and Wales electricity market

Journal articles will be provided in due course.