**Masaryk University in Brno**
**Faculty of Science**
**Department of Mathematics and Statistics**

*Course syllabus*

**Course name:**
Mathematical methods in Economics (Spring 2017).

**Schedule**
Lectures: Thursdays. Office hours: Thursdays. Midterm and final exams: TBA.

**Instructor**
Mgr. Sherzod Tashpulatov, M.A., Ph.D. Email: stashpul@cerge-ei.cz

**Course objective and structure**
The purpose of the course is to familiarize students with the fundamental concepts and methods 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 Economics.

The first block of the course starts with the consumer choice theory using graphical and formal approaches. Next, using illustrative examples we will see how consumers and producers interact and the endogenous price vector is determined. Then we start game theory applications. In particular we cover the following types of games: static, dynamic, (in)complete, and (im)perfect information games. We will also cover dominating strategies, pure strategies, mixed strategies, normal and extensive form representations, Nash equilibrium, subgame perfection.

In the second block we cover Fisher's intertemporal choice model under various settings. Then we review consumption and money multiplier models, which are followed by growth accounting and Solow residual. Before starting Solow growth model we study phase diagrams for continuous time. A numerical example will be presented in Excel and MatLab.

In the third block we study shorter economic models and problems. They are trade, input-output, ratings, and Markov transition matrix models. We will also consider constrained optimization problem in electricity economics.

In the fourth block we study finance topics: 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 value at risk (VaR) model. We will also cover option valuing. The last topic in this block is devoted to risk analysis and measurement. We conclude this topic by the capital asset pricing model (CAPM) and estimate systematic risk in EViews.

In the last block we will look into the mathematical apparatus for the auction theory and market design. 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 in EViews.

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

**Principal textbooks:**
1. Varian H. Intermediate Microeconomics: A Modern Approach (any edition)
2. Gibbons (1992). A Primer in Game Theory
3. Doepke, M., Lehnert, A. and Sellgren, A. (1999). Macroeconomics

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

Journal articles will be provided in due course.