Details of syllabus

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Even though it was not asked, I have also included details of the syllabus for "Mathematics 2 for Economics", in case it is needed.

1 Mathematics 1 for Economics - Course catalogue number: 6011P0236Y

Book: Sydsaeter, K. and P. Hammond compiled by G.J.M. Marée (2012). Essential Mathematics for Economic Analysis. Prentice Hall, 4^{th} edition, ISBN 978-1-787-26025-2

The specific objectives are:

- Analysis of the main important characteristics a function of one variable and visualisation of the graph of the function. Investigation of invertibility of a function and computation of the inverse. Knowledge of the important properties of polynomials, rational functions, power functions, exponential and logarithmic functions. Solving linear, quadratic, exponential and logarithmic and other related equalities and inequalities

- Determination of the (partial) derivative(s) of a function of one variable or more variables. Understanding the applications of the derivative(s). Constructing the equation of the tangent line (or plane) to the graph of the function of one variable (of two variables). Approximation of (percentage) changes by using differentials and (partial) elasticities. Construction of linear and quadratic approximations of a function.

- Computation of definite, indefinite and improper integrals and applying integration techniques in economic problems

- Finding (partial) derivatives along a level curve or plane, using implicit differentiation

- Optimisation of function(s) of one or two variables without any constraint. Optimisation of a function of two variables under a given constraint, using the method of Lagrange
- Solving systems of 2 or 3 linear equations by using matrix algebra
- Summation of finite or infinite geometric series.

Topics covered: Implicit function theorem, (partial) derivatives on level curves, homogeneity of functions, Euler's theorem for homogeneous functions; Investigation of a function of one variable and visualisation of the graph of the function: domain and range, taking into consideration the mathematical and economical restrictions, zero's, asymptotes, maxima and minima, inflection point and invertible functions; Important properties of polynomials of degree, rational functions, power functions, exponential functions and logarithmic equalities and inequalities; (partial) derivatives by using the limit definition of the derivative function and by using the differentiation rules; Construction of tangent lines and tangent planes in a certain point in a graph; Differentials and (partial) elasticity's, approximation of (percentage) changes, linear and quadratic approximations; Definite, indefinite and improper integrals, and integration techniques; Optimisation of a function of two variables without any constraints by using the character of the stationary points and second order conditions; Optimisation of a function of two variables under a certain restriction by using the method of Lagrange, computation and interpretation of the Lagrange multiplier; Solving systems of 2 or 3 linear equations by using matrix algebra; Summation of finite or infinite geometric series.

2 Mathematics 2 for Economics - Course catalogue number: 6012B0461Y

Book: Sydsaeter, K. and P. Hammond compiled by G.J.M. Marée (2012). Essential Mathematics for Economic Analysis. Prentice Hall, 4^{th} edition, ISBN 978-1-787-26025-2

Having completed the course students are able to: Apply static optimisation techniques - especially the method of Lagrange - to micro-economic optimisation problems and give an economic interpretation of the results; Perform elementary matrix operations; Use matrix calculus to describe dynamic economic processes; Solve first and second order linear difference equations and differential equations and interpret the results; Calculate eigen-

values and eigenvectors of matrices and use these to analyse dynamic economic models (systems of linear difference equations and linear differential equations); Analyse the convergence/divergence of linear dynamic systems.Students should be able to apply the mathematical techniques in a broader economic context.

Topics covered:

- Optimisation techniques in a setting with constraints.
  - Connection between the primal and the dual problem
  - (in)direct utility functions, (quasi)-concave functions
  - Compensated and uncompensated demand functions
  - Slutsky relations, the elasticity of substitution
  - Production functions and homothetic functions
  - Homogeneous functions and Euler's theorem
  - Short-run and Long-run Total Cost functions
- The theory of Linear Algebra needed for the analysis of discrete and continuous dynamic systems.
  - Matrix Calculus
  - Linear difference/differential equations of the first and second order
  - Systems of linear difference equations
  - Parameter analysis and Stability of equilibria in dynamic models
  - Application of the theory in micro- and macro-economic models
- Solving dynamic models using the software package Matlab.

3 Econometrics - Course catalogue number: 6012B0453Y

Book: Stock, J.H. and Watson, M.W. Introduction to Econometrics. Pearson Education, updated 3^{rd} edition, ISBN 10: 1-292-07131-1 or ISBN 13: 978-1-292-07131-2

Topics covered:

- Simple and multiple regression model (OLS), properties of OLS-estimator, Gauss-Markov Theorem, Testing hypotheses manually and using STATA, Interpreting coefficients, Dummy variables (Chapter 1-5)
- Omitted variable bias, Standard errors, Coefficient of determination (R^2 and Adjusted R^2), Multicollinearity, Interaction effects, F-test, Redundant variables, Homoscedasticity versus Heteroscedasticity (Chapter 6 & 7)
- Nonlinear regression function, Internal and external validity, Threats to internal and external validity and solutions, Testing efficiency (Chapter 8 & 9)
- Endogenous regressors, Instrumental Variable estimation (IV), Two Stage Least Square estimation (TSLS), Testing instrument validity, J-test, Hausman-test (Chapter 12)
- Regression with Binary Dependent Variables, Maximum-Likelihood, Probit and Logit Regression (Chapter 11)
- Estimation techniques and testing procedures in *Stata*