Mathematical Methods of Economics

The objective of this course is to endow first year masters students with requisite tools needed in advanced courses on microeconomics, macroeconomics and econometrics. This would essentially provide students with a review of some of the mathematical techniques described below. The evaluation for the course will comprise of a mid-term and an end-term exam and assignments.

Section I

Linear Algebra

1) Systems of Linear Equations: Gauss-Jordan Elimination, Elementary Row Operations, Solution Concepts.
2) Matrix Algebra: Laws of Matrix Algebra, Some Special Matrices, Computing the Determinant and Inverse of Square Matrices, Cramer's Rule, Linear transformations
3) Vector Spaces: Linear dependence and independence, Vector Algebra, Basis and Span, Inner Product and Norms of Vectors, Orthogonality.
4) Finite Dimensional Subspaces: Dimensions of Subspaces attached to a Matrix, Row and Null Space, Orthogonal bases and orthogonal projections.
5) Spectral Theory: Eigenvalues and Eigen Vectors, Diagonalization and Decomposition of Matrices, Definiteness of Quadratic Forms.

Section II

Real Analysis

1) Basic set theory.
2) Fields, ordered fields, least upper bounds, the real numbers
3) Sequences: convergence, subsequences
4) Metric spaces, ball neighborhoods, open subsets
5) Open, closed, and compact sets of real numbers.
6) Continuous functions.
7) Differentiation and Mean Value theorems. The Fundamental Theorem of Calculus
8) Derivatives, the chain rule; Rolle's theorem, Mean Value Theorem

Section III

Static Optimization

1) Functions and Calculus of Several Variables: Functions between Euclidean Spaces, Total Derivative, Directional Derivative, the Gradient Vector and Hessian Matrix, The Implicit Function Theorem.
2) Unconstrained Optimization
3) Constrained Optimization: Equality and Inequality Constraints, The Kuhn-Tucker Formulation.

Readings:

Core Texts:
*A First Course in Optimization Theory***,** by Rangarajan K. Sundaram, 1996, Cambridge University Press..
Mathematics for Economists, by Carl P. Simon and Lawrence Blume, 1994, W. W. Norton & Company.

Additional Readings:

Linear Algebra and Its Applications by Strang, G**.**, Fourth Edition, Thompson Press.
Mathematical Methods and Models for Economists by Angel De La Fuente.
Fundamental Concepts of Analysis, by Smith, A.H. and Albrecht, W.A, Prentice Hall India, 1995