Code: ECON-209
Title: Mathematical Economics
Credit Hours: 03
Prerequisite: QUANTITATIVE REASONING (II)

Objective: To prepare the students with the economic applications of tools of algebra, differential and Integral calculus.

Course Contents

1. **Economic Applications of Functions and Matrices:** Demystifying Mathematics and Mathematical Economics, Mathematics vs. Non-Mathematical Economics, Mathematical Economics versus Econometrics. Partial Market Equilibrium and National Income Equilibrium using Algebra. Partial Market Equilibrium and National Income Equilibrium using Matrix Inversion Method. Partial Market Equilibrium and National Income Equilibrium using Cramer's Rule.

2. **Differentiation and its Economic Applications:** The Need and Nature of Comparative Statics, Rate of Change, Slope & Derivative, Differentiation Rules for Single Variable Functions: Constant Function Rule & Power Function Rule, Sum-Difference Rule of Differentiation, Product Rule of Differentiation, Quotient Rule of Differentiation, Marginal Cost, Marginal Revenue and Marginal Product Analysis. Chain Rule and Marginal Revenue Product of Labor (MRPL) Analysis.

3. **Partial & Total Differentiation and its Economic Applications:** Partial Differentiation. Marginal Physical Product of Labor and Capital. Marginal Utility Functions. Income Elasticity of Demand and Cross Price Elasticity of Demand using Partial Derivatives. Differentials versus Derivatives. Concept of Total Differentials. Utility Function and Total Differentials. Concept of Total Derivatives. Production Function with time-dependent Labor and Capital.

4. **Optimization and its Economic Applications:** Concept of Optimization: Calculus Approach to Optimization, Matrix Approach to Optimization (2^{nd} Order) Test: Hessian. Profit Maximization of Technically Related Goods, Economic Application on Multi-product Firm. Rationale for Constrained Optimization. Finding Stationary Values using Substitution-Elimination Method. Finding Stationary Values Method of Lagrange Multiplier. Matrix approach to Second Order Condition: The Bordered Hessian. Economic Applications: Utility Maximization, Production Function Maximization.

5. **Integral Calculus and its Economic Applications:** Dynamics and Integration. Basic Rules of Integration. Economic Applications of Integrals: Finding Total Functions from Marginal Functions. Definite Integrals, their properties and Economic Applications. Consumer Surplus using Integrals, Producer & Social Surplus using Integrals. Domar Growth Model: Framework, Solution and Numerical.

Evaluation Criteria:

Evaluation Method	Total Percentage
Quizzes/Assignments	25%
Mid-Term Exam	35%
Final-Term Exam	40%

Recommended Books:

- Bradley, T. Essential mathematics for economics and business. Latest edition. John Wiley & Sons.
- Budnick, Frank, Applied Mathematics for Business, Economics and Social Sciences. - Latest Edition.
- Chiang A.C. Fundamental Methods of Mathematical Economics McGraw Hill –Latest Edition.
- Dowling, E. T. Theory and Problems of Introduction to Mathematical Economics. Latest Edition, McGraw-Hill, New York.
- Hoffman, L. D., & Bradley, G. L. Calculus for business, economics, and the social and life sciences. McGraw-Hill. Latest edition.
- Kolman, B., & Beck, R. E. (1995). Elementary linear programming with applications. Academic Press.
- Sydsæter, K. and Hammond, P. Essential Mathematics for Economic Analysis. Latest edition, Pearson Education Limited, England.
- Weber E. Jean, Mathematical Analysis, Business and Economic Application (latest edition).