

**Code: ECON-307**

**Title: Advanced Mathematical Economics**

**Credit Hours: 03**

**Prerequisite: Calculus –I & Calculus -II**

**Objectives:**

This is the first of a compulsory two-course sequence. The objective of this sequence is to transmit the body of basic mathematics that enables the study of economic theory at the undergraduate level, specifically the courses on microeconomic theory, macroeconomic theory, statistics and econometrics set out in this syllabus. In this course, particular economic models are not the ends, but the means for illustrating the method of applying mathematical techniques to economic theory in general. The level of sophistication at which the material is to be taught is indicated by the Course Contents of the prescribed textbook.

**Course Contents**

**Higher Order Differential and Difference Equations**

Solution of Higher Order Differential Equations with Constant Coefficient and Constant Term. Convergence and the Routh Theorem. Higher Order Linear Difference Equations and their Solutions. Convergence and Schur Theorem.

**Simultaneous Differential and Difference Equations**

Solving Simultaneous Dynamic Equations, Dynamic Input-Output Models, Inflation-Unemployment Model, Two Variables Phase Diagrams

**Linear Programming**

Ingredients of linear Programming. Graphical approach, simplex method, economic application of linear programming. Concept of primal & dual. Duality theorems. Solving of Primal via dual. Economic interpretation of a dual

**Non-Linear Programming:**

The Nature of Non Linear Programming Non-Linearities in Economics. Kuhn Tucker Condition. Interpretation of Kuhn Tucker Condition. Kuhn Tucker Sufficiency Theorem: Concave Programming. Arrow Enthoven Sufficiency Theorem: Quasiconcave Programming.

Economic Application-Utility Maximization, Least Cost Combination. Solving a Nonlinear Program via the Kuhn-Tucker Conditions

### **The Calculus of Variations**

The Euler Equation, Some Special Cases, Two Generalizations of the Euler Equation, Dynamic Optimization of a Monopolist, Trading Off Inflation and Unemployment.

### **Optimal Control Theory**

The Simplest Problem of Optimal Control, The Maximum Principle, The Rationale of the Maximum Principle, Alternative Terminal Conditions, The Calculus of Variations and Optimal Control

### **Recommended Books:**

- Brian S. Ferguson and G. C. Lim. (1998). Introduction to Dynamic Economic Models. Manchester University Press.
- Alpha C. Chang Fundamental Methods of Mathematical Economics. Latest Edition, McGraw-Hill.
- Alpha C. Chang. Elements of Dynamic Optimization. Latest Edition.
- D. L. Leonard and N. V. Long. (1992). Optimal Control Theory and Static Optimization in Economics. Cambridge University Press