



THE UNIVERSITY OF THE WEST INDIES
DEPARTMENT OF ECONOMICS
ST. AUGUSTINE, REPUBLIC OF TRINIDAD & TOBAGO
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SEMESTER I (SEPT-DEC 2009)

COURSE TITLE: MATHEMATICAL METHODS OF ECONOMICS I

COURSE CODE: ECON 2015 (EC 24B)

LEVEL: UNDERGRADUATE LEVEL (SECOND YEAR)

NO OF CREDITS: 2

PREREQUISITES: ECON 1003, ECON 1001, ECON 1002

COURSE DESCRIPTION / RATIONALE:

This course will provide economics students with the tools required to undertake mathematical analysis in their field. The course covers a wide range of topics including mathematical induction and linear programming.

LEARNING OUTCOMES:

The course is designed to; establish elementary skills in Mathematical Methods and to initiate the development of an ability to apply these mathematical methods to problems in the field of economics.

CONTENT:

1. Propositional Calculus
 - i. Statements and Basic Operations
 - ii. The Construction of truth tables
 - iii. Some Basic Truth Tables
 - iv. Conditional $p \rightarrow q$
 - v. Conditional Statements and Variations

- vi. Converse Statements
- vii. Inverse Statements
- viii. Contra Positive Statements
- ix. Biconditional Statements
- x. Granger Causality
- xi. Tautologies and Contradictions
- xii. Logical Implication
- xiii. Arguments
- xiv. Arguments and Statements
- xv. Summary
- xvi. Associative Law
- xvii. Commutative Law
- xviii. Distributive Law

2. Mathematical Induction

- i. Steps
- ii. Worked examples

3. Operation on Vectors & Matrices

- i. Introduction
- ii. Matrix Addition
- iii. Matrix Multiplication
- iv. Scalar and Vector Multiplication
- v. Multiplication by a Scalar
- vi. Distributive Laws and Associative Laws of Multiplication of Matrices
- vii. Equality of Matrices
- viii. Transpose of a Matrix
- ix. Symmetric Matrices
- x. The Zero Matrix
- xi. Identity and Diagonal Matrices
- xii. Upper Triangular (UTM), Lower Triangular (LTM) and Diagonal Matrices
- xiii. Orthogonal Matrices
- xiv. Some Properties of Orthogonal Matrices
- xv. Invertible Matrices
- xvi. Power of Matrices
- xvii. Differences between Scalars and Matrices

4. Determinants of Matrices

- i. Evaluating the Determinant
- ii. Matrix of Minors
- iii. Matrix of Cofactors

- iv. Laplace Expansion Theorem
- v. Properties of Determinants
- vi. Other Worked Examples

5. Equivalence

- i. Rank of a Matrix
- ii. Elementary Transformations and their Inverses
- iii. Elementary Transformations (ET)
- iv. Inverse Elementary Transformation (IT)
- v. Equivalent Matrices
- vi. The Normal Form of a Matrix
- vii. Echelon Matrices and the Rank of a Matrix

6. The Inverse of a Matrix

- i. The Adjoint Matrix (A^{adj})
- ii. Inverse of a Matrix Using the Adjoint Method
- iii. Inverse of a Matrix using Elementary Row Operations
- iv. Applications of Inverse Matrices: Cryptography
- v. Some Properties of Inverses
- vi. Input – Output Analysis

7. Vectors

- i. Introduction
- ii. Vector Spaces
- iii. Spanning Set
- iv. Basis and Dimensions
- v. Dimension
- vi. Linear Transformation
- vii. Application of Linear Transformation
- viii. Some Basic Theorems on Linear Transformations
- ix. Linear Dependence of Vectors

8. Solving Linear Equations

- i. Introduction
- ii. Solving a system of simultaneous equations by the inverse method
- iii. Economic Application
- iv. Solving Linear Equations by Cramer's Rule
- v. Proof of Cramer's Theorem
- vi. Economic Application
- vii. Solving Linear Equations by the Elimination Method
- viii. Economic Application
- ix. Linear Equations: Homogenous and Non – Homogenous
- x. Homogenous System of Equation

- xi. Non – Homogeneous System of Equations
- xii. Finding the General Solution

9. Eigenvalues and Eigenvectors

- i. Introduction
- ii. Characteristic Vectors
- iii. Diagonalization
- iv. Orthogonal Diagonalization
- v. Some Properties of Eigenvalues and Eigenvectors

10. Symmetric and Skew-Symmetric Matrices

- i. Introduction
- ii. Properties of Symmetric and Skew-Symmetric Matrices
- iii. Quadratic Forms
- iv. QF and positive definite matrices

11. Linear Programming

- i. Introduction
- ii. Constrained Maximization: Setting up a LP Model
- iii. Extreme Point Theorem
- iv. The Basis Theorem
- v. Constrained Minimization: Setting up a LP Model

12. Linear programming: Simplex Method

TEACHING METHODOLOGY:

The mode of teaching is face to face lectures.

ASSESSMENT:

Final Examination 100%

REQUIRED READING:

Lecture notes prepared by Dr. Roger Hosein and Mr. Martin Franklin