expected frequencies; Limitations of Chi square; Using the goodness-of-fit test to test for normality; Contingency Table Analysis.

Analysis of Variance

Introduction, The F distribution; Comparing two population variances; ANOVA assumptions; ANOVA test; Inferences about pairs of treatment means; Two-way analysis of variance.

Recommended Books:

- Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2014). Essentials of statistics for business and economics. Cengage Learning.
- Anderson, D. R., Williams, T. A., & Sweeney, D. J. (2011). Statistics for Business and Economics. 12th. Cengage Learning.
- Lind, Douglas A., Marshal, William G. and Mason, Robert D., (2015) Statistical Techniques in Business and Economics (16th edition). Boston: McGraw Hill, 2003.

Code: MATH-111

Title: Calculus-I

Credit Hours: 03

Prerequisite: Mathematics at Secondary Level

Objectives:

To prepare the students with the essential tools of algebra/calculus to apply the concepts and the techniques in Economics

Course Contents

Preliminaries

Real-number system, introduction to sets, set operations, functions, types of functions.: quadratic, polynomial, power, exponential, logarithmic; Graphs of functions, sequences and series: convergence, algebraic properties and applications; continuous functions: characterizations, properties with respect to various operations and applications; differentiable functions: characterizations, properties with respect to various operations and applications; Economic applications of functions

Matrices

The Role of Linear Algebra; Definitions of the key terms; Matrices and Vectors; Vectors as Special Matrices; Addition and Subtraction of Matrices; Scalar Multiplication; Multiplication of Matrices; Commutative, Associative, and Distributive Laws in Matrix Algebra; Identity Matrix and Null Matrix; Scalar Matrix; Diagonal Matrix; Idempotent Matrix; Symmetric Matrix; Transpose of a Matrix and its properties; Inverse of a Matrix and its properties; Inverse Matrix and Solution of Linear-Equation System; Determinants-Definition and

Properties; Use of Determinant in Matrix Inversion; Rank of a Matrix; Minors and Cofactors; Conditions for Non-singularity of a Matrix; Test of Non-singularity by use of Determinants; Laplace Expansion and Higher Order Determinants; Cramer's Rule, Application to Market and National-Income Model; Leontief Input-Output Model.

Equations and Progressions

Derivations: Equation of a straight line and its forms: Two point, intercept, point slope and slope intercept.; Polynomial equations; Solution of quadratic equations, qualitative analysis of roots of a quadratic equation, equations reducible to quadratic equations, cube roots of unity, relation between roots and coefficients of quadratic equations. Arithmetic progression, geometric progression, harmonic progression; Introduction to mathematical induction, binomial theorem with rational and irrational indices

Differentiation

Limits and Continuity: Limit of a function, left-hand and right-hand limits, continuity, continuous functions, Derivative and rules of differentiation. Differentiation of a function of one variable. Sum-difference, product, quotient, chain, power, inverse, logarithmic & exponential functions Combinations of rules. Higher order derivatives. Economic applications of derivative. Concept of maxima & minima, elasticity and point of inflection. Profit & revenue maximization under perfect competition, under monopoly. Maximizing excise tax revenue in monopolistic competitive market, Minimization of cost

Partial & Total Differentiation

Partial differentiation & its rules. Higher order & cross partial derivatives (young's theorem). Total differential & total derivatives. Implicit functions rule of differentiation. Optimizing cubic functions & their economic application. Comparative static analysis: a linear Partial equilibrium market model, a linear National Income model. Partial elasticities. Production functions Analysis. Maximization & Minimization of unconstrained functions & their economic applications: Profit maximization by a multi-product firm under perfect Competition & monopoly, Price discrimination, Multi-plant monopoly, input decisions.

Recommended Books:

- 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 Edward T. Mathematics for Economics Schaum Series, Latest Edition
- Weber E. Jean, Mathematical Analysis, Business and Economic Application (latest edition), Harper and Row Publishers, New York