MTH - 201 : Basic Mathematics

Module Objectives

This module aims to provide the students with the basic mathematical skills required to understand management, IT and computing courses.

Course contents

Numbers and their properties. Algebraic representation. Operations with rational expressions including polynomials. Algebraic and graphic methods for solving linear and quadratic equations. Introduction to complex numbers, exponents and radical expressions. Differential Equations. Concept of vectors and matrices.

Detailed Course

Unit 1: Set Theory and Real Number System **LH 6**

Concept, notation and specification of sets, Types of sets, Relation between sets and their Venn diagrams, Operations on sets. Laws of algebra of sets (without proof), Number of elements in a set and the problems relating upto three sets.

Sets of numbers (Natural numbers, Integers, Rational numbers, Irrational numbers, Real numbers), Representation of real numbers on the real line. Properties (addition multiplication, cancellation, distributive, order) of real numbers (without proof), Inequalities and their properties. Intervals, Modulus of a real number and its properties.

Numerical Exercises.

Unit 2: Complex Numbers **LH 4**

Definition of a complex number, Integral powers of i, Algebra of complex numbers (sum, difference, multiplication, division), Properties of complex numbers, Conjugate of a complex number and its properties, Modulus of a complex number and its properties, Representation of a complex number by a point in a plane (Argand's diagram), Polar representation of a complex number, Square roots of a complex number, DeMoivre's theorem (statement only) and its application to find upto cube roots of a complex number.

Numerical Exercises.

Unit 3: Functions, Limits and Continuity **LH 6**

Constant and variable, Concept of functions, Types of functions, Graphic representation of algebraic, logarithmic and exponential functions, Computation of functional values, Domain and range of a function. Application of functions to business and economics.

Idea of a limit, Limit of a function at a particular point and at infinity, Properties of limits (without proof) and use in evaluating limits involving algebraic functions.

Concept of continuity and discontinuity, Test of continuity and discontinuity for simple algebraic functions.

Numerical Exercises

Unit 4: Differentiation and Its Application **LH 9**

Average rate of change, Definition of derivative, Derivative as a slope of tangent to the curve, Differentiation by the first principle of algebraic, logarithmic and exponential functions, Methods of differentiation (power rule, sum rule, product rule, quotient rule chain rule), Differentiation of implicit and parametric functions, Higher order derivatives (upto 3^{rd} order).

Unit 5: Integration and Its Application **LH 6**

Concept of integration, Techniques of integration (Standard forms, Substitution method, Integration by parts), Integration of algebraic, logarithmic and exponential functions. Definite integral, Methods of evaluating definite integrals, Area under a curve, Application of integration in business and economics (including consumer's surplus and producers surplus).

Numerical Exercises

Unit 6: Differential Equations **LH 6**

Introduction: Differential equation: Ordinary differential equation, Order and degree of a differential equation, Solution of a differential equation, General and particular solutions.

Equations of the first order and first degree:

a) variables separated from
b) homogeneous equations
c) linear equations

Numerical Exercises (without involving trigonometric functions).

Unit 7: Vectors **LH 5**

Definition of a vector in a plane and space, Directed line segment, Magnitude of a vector, Types of vectors, Multiplication of a vector by a scalar, Addition of vectors, Parallelogram law of addition of vectors, Collinear and coplanar vectors, Linearly dependent and independent vectors, Scalar product of two vectors, Orthogonal vectors, Vector product of two vectors.

Numerical Exercises

Unit 8: Matrices and Determinants **LH 8**

Introduction of matrices, Types of matrices, Equality of matrices, Algebra of matrices, Transpose of a matrix. Determinant of a matrix, Minors and cofactors of matrix, Properties of determinants (without proof) and some simple problems. Singular and non-singular matrix, Adjoint and inverse of matrices.

Solution of a system of non-homogeneous linear equations upto three variables (Cramer's rule, Inverse matrix method, Gaussian elimination method).

Unit 9: Transformation **LH**

2D/3D Transformations, Matrix Representation of Transformation, Successive and Composite Transformation

References

Computer Graphics, Hearn and Baker, Prentice Hill, 2nd Edition.

Mathematics for Economics, Taro Yamane, Prentice-Hall of India, New Delhi, 2nd Edition (An Elementary Survey)

Calculus with Analytic Geometry, George B. Thomas and Ross L Finney, Addison – Wesley, 9th Edition.

Basic Mathematics – B.C. Bajracharya, M.K. Publishers.