# GIRIJANANDA CHOWDHURY UNIVERSITY

Hathkhowapara, Azara, Guwahati-781017, Assam

## CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

| BMA23101T | ALGEBRA AND CALCULUS-I | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Pre-requisite: Knowledge of Mathematics at Class XI & XII**

**Course Objectives:**

- To achieve conceptual understanding of basic number theory, connection of complex numbers and trigonometry, matrices.
- To have a deeper insight of the developments of the generalized notions of trigonometry.
- To use matrix methods for solving linear equations.
- To gain proficiency in calculus computations and to calculate the higher order derivatives and apply them in proper situations.

**Course Outcome:**

After successful completion of the course, the students will be able to

CO1: explain basic number theory, well ordering property of positive integers and congruence relations.

CO2: describe the essential tool of matrices and linear algebra in a comprehensive manner.

CO 3: demonstrate De Moivre's theorem in a number of applications and estimate the roots of complex numbers.

CO4: apply the concept of limit, continuity, ordinary and partial differentiation and mean value theorems in extreme value problems.

| **Module 1: Basic Number Theory** | **12 Hours** |
|---|---|

Cardinality of a set, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Fundamental Theorem of Arithmetic, Congruence relation between integers.

| **Module 2: Matrices** | **14 Hours** |
|---|---|

Symmetric, Skew-symmetric and Orthogonal matrices, Rank of a Matrix, Row reduction andEchelon form, Inverse of a matrix, System of linear equations.

| **Module 3: Complex Numbers** | **12 Hours** |
|---|---|

Polar representation of complex numbers, De Moivre's theorem and its applications. Roots ofa complex number, Trigonometrical and exponential functions of complex arguments, Hyperbolic Functions.

| **Module 4: Differential Calculus** | **22 Hours** |
|---|---|

Limit, Continuity and Differentiation, Indeterminate forms and L' Hospital's rule, Asymptotes, Curvature, Successive differentiation, Leibnitz' theorem, Rolle's Theorem, Lagrange's Mean Value Theorem, Taylor's and Maclaurin's series, Partial derivatives, Extreme values of functions (of single and multiple variables), Error approximation, Euler's theorem on Homogeneous functions, Total derivatives.

| **Total Lecture hours** | **60 hours** |
|---|---|

**Text Book(s)**

| | |
|---|---|
| 1. | Dickson, L. E., First Course in The Theory of Equations. John Wiley & Sons, Inc. New York. The Project Gutenberg **EBook** (1922) |
| 2. | Hoffman K., Kunze R. A., Linear Algebra, 2nd Ed, Prentice-Hall, Inc., Englewood Cliffs, NewJersey (1971) |
| 3. | Anton H., Bivens I. and Davis S., Calculus (10th Edition), John Wiley and sons (Asia), Pt Ltd.,Singapore (2012) |
| 4. | Bartle Robert G., Sherbert Donald R., Introduction to Real Analysis, John Wiley & Sons, Inc. NewYork (2000) |
| **Reference Books** | |
| 1. | Mapa S.K., Higher Algebra (Classical), Asoke Prakashan, Calcutta (2000) |
| 2. | Andreescu T, and Andrica D., Complex Numbers from A to Z, Birkhauser, Boston, USA (2000) |
| 3. | Das B. C.& Mukherjee B. N., Differential Calculus, U. N. Dhur and Sons Pvt. Ltd, Kolkata (2014) |

## CORE COURSES OFFERED BY DEPT. OF MATHEMATICS

| BMA23102T | NUMERICAL ANALYSIS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 4 |

**Pre-requisite: Knowledge of Mathematics at Class XI & XII**

**Course Objectives:**

- To train students to understand why the methods work, what type of errors to expect, and when an application might lead to difficulties
- To learn well-known numerical techniques to solve physical problems and evaluate the results

**Course Outcome:**

After successful completion of the course, the students will be able to

CO 1: understand errors, source of errors and its effect on any numerical computations.
CO2: compute the values of a tabulated function at points not in the table.
CO3: evaluate definite integrals numerically.
CO4: apply numerical methods to obtain approximate solutions to mathematical problems

**Module 1: Error Analysis** — **6 Hours**

Errors, Different type of errors. Representation of numbers in computer, Computer arithmetic, Zeros in floating point number.

**Module 2: Finite Differences** — **20 Hours**

Operators –finite differences, average, differential, etc., their inter-relations. Difference of polynomials, Interpolation, Uniqueness of interpolating polynomial, Newton's forward and backward interpolation formulae, Newton's divided difference formula, Lagrange's interpolation formula, Inverse interpolation, Central difference, Errors in different interpolation formulae.

**Module 3: Numerical Integration** — **10 Hours**

Quadrature: Trapezoidal rule, Simpson's quadrature (1/3 and 3/8 rule). Error in Quadrature formulae.

**Module 4: Solutions of Equations** — **24 Hours**

Solution of algebraic and transcendental equation: Bisection method, Regula-falsi method, Iteration method, Newton-Raphson method and its geometrical interpretation. Solution of system of equations: Gauss elimination method, Gauss Seidal Method, Gauss Jordan method.

**Total Lecture hours** — **60 hours**

**Text Book(s)**

1. Gerald C. F. and Wheatley P. O., Applied Numerical Analysis, Pearson, 7th Edition (2004)
2. Jain M. K., Iyengar S .R. K. and Jain R. K., Numerical Methods for Scientific and Engineering Computation, New Age International Publishers, 6th edition (2012)

**Reference Books**

1. Grewal B. S., Numerical Methods in Engineering & Science, Khanna Publishers, Delhi (2013)
2. F. Scheid, Schaum's outline of theory and problems of numerical analysis, McGraw Hill Professional, (1988)

## MULTIDISCIPLINARY COURSES (MDC) OFFERED BY DEPT. OF MATHEMATICS

| BMA23141T | Foundation of Mathematics | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**Pre-requisite: Knowledge of Mathematics at high school**

**Course Objectives:**

- To describe the relations between sets regarding membership, equality, subset, and proper subset using proper notation
- To draw and interpret set relations and operations and use those to solve problems
- To explain and interpret the concepts of divisibility and number theorems.

**Course Outcome:**

After successful completion of the course, the students will be able to

CO1: understand basics definitions of set operations, use of Venn diagrams, and related problems.

CO2: explain the concept of relations and functions.

CO3: apply Division algorithm, Fundamental Theorem of Arithmetic and Principles of Mathematical Induction to solve basic problems associated to real systems.

**Module 1: Sets** — **15 Hours**

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections.

**Module 2: Relations and Functions** — **15 Hours**

Product set, Composition of relations, Types of relations, Functions, types of functions and their properties, Composition of functions.

**Module 3: Basic Number Theory** — **15 Hours**

Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Fundamental Theorem of Arithmetic, Principles of Mathematical Induction.

**Total Lecture Hours** — **45 hours**

**Text Book(s)**

1. Lipschutz S., Schaum's Outline-Theory and Problems of Set Theory and realted topics (Ebook), McGraw Hill Companies Inc. (1964)
2. Conradie, W., Goranko, V., Logic and Discrete Mathematics: A Concise Introduction, Wiley

**Reference Book(s)**

3. Sarkar, S.K. A Textbook of Discrete Mathematics, S. Chand & Co. Ltd, New Delhi