

**GOVERNMENT OF MANIPUR  
KAKCHING KHUNOU COLLEGE  
DEPARTMENT OF MATHEMATICS  
BACHELOR OF SCIENCE (B.Sc.) NEP**

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**Programme Outcomes (PO):** By the end of the program the students will be able to gain the following skills.

- ✓ **Disciplinary knowledge:** A bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, Real analysis, Differential equations and several other branches of pure and applied mathematics, this also leads to the study of relevant areas such as computer science and other disciplines.
- ✓ **Communication Skills:** Ability to communicate the various mathematical concepts effectively using a variety of examples mostly having real-life applications and their geometric visualization. The skills and knowledge gained in this programme will lead to proficiency in analytical reasoning which can be used to express thoughts and views in mathematically or logically correct statements.
- ✓ **Critical thinking and analytical reasoning:** The students undergoing this programme acquire the ability of critical thinking and logical reasoning and will apply in formulating or generalizing specific hypothesis, conclusion. The learner will be able to recognize and distinguish the various aspects of real-life problems.
- ✓ **Problem solving:** The Mathematical knowledge gained by the student through this programme develops an ability to solve the problems, identify and define appropriate computing requirements for its solutions. This programme will enhance the overall development.
- ✓ **Research related skills:** After the completion of this programme, the student will develop the capability of inquiring about appropriate questions relating to the Mathematical concepts, arguments. He/she will be able to define problems, formulate hypothesis, proofs, write the results obtained clearly.
- ✓ **Information/ digital literacy:** The completion of this programme will enable the learner to use appropriate software to solve the system of algebraic and differential equations.
- ✓ **Self-directed learning:** The student after the completion of the programme will be able to work independently, make an in-depth search of various areas of Mathematics and resources for self-learning in order to enhance knowledge in mathematics.
- ✓ **Moral and ethical awareness/reasoning:** The student after the completion of the course will develop an ability to identify unethical behaviour such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in particular.
- ✓ **Lifelong learning:** This programme provides self-directed learning and lifelong learning skills. With these skills, the learner will be able to think independently, and improve personal development.

## SEMESTER-I

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### 1. MAT-501: Calculus

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Sketch curves in a plane in the different coordinate systems of reference.
- ✓ Understand the Calculus of vector valued functions.
- ✓ Apply calculus to develop basic principles of planetary motions.

### 2. MAT-502: Algebra

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Employ De Moivre's theorem in a number of applications to solve numerical problems.
- ✓ Apply Euclid's algorithm and backwards substitution to find the greatest common divisor.
- ✓ Recognize consistent and inconsistent systems of linear equations by using rank.

### 3. MAT-501 A: *LaTeX*

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Typeset mathematical formulas, use nested list, tabular & array environments.
- ✓ Create or import graphics.
- ✓ Use beamer to create presentation.

## SEMESTER-II

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### 1. MAT 503: Real Analysis

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Understand many properties of the real line  $\mathbb{R}$  and learn to define sequence in terms of functions from to a subset of  $\mathbb{R}$ .
- ✓ Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- ✓ Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

### 2. MAT 504: Differential Equations

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Formulate Differential Equations for various Mathematical models.
- ✓ Solve first order non-linear differential equation and linear differential equations of higher order using various techniques.
- ✓ Apply these techniques to solve and analyse various mathematical models.

### 3. MAT 502 A: Python Programming

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Develop, document, and debug modular python programs to solve computational problems.
- ✓ Select a suitable programming construct and data structure for a situation.
- ✓ Use built-in strings, lists, sets, tuples and dictionary in applications.
- ✓ Define classes and use them in applications.
- ✓ Use files for I/O operations.

## SEMESTER-III

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### 1. MAT 605: Theory of Real Functions

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ A rigorous approach of the concept of limit of a function.
- ✓ About continuity and uniform continuity of functions defined on intervals.
- ✓ The geometrical properties of continuous functions on closed and bounded intervals.
- ✓ The applications of mean value theorem and Taylor's theorem.

### 2. MAT 606: Group Theory

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Understand the basic concepts of groups and links with symmetric figures.
- ✓ Learn concepts of normal subgroups, cosets and quotient groups.
- ✓ Learn the concepts of group homomorphisms and isomorphisms.

### 3. MAT 607: Multivariate Calculus

**Course Learning Outcomes:** Upon completing this course, students will be able to learn:

- ✓ The conceptual variations when advancing in calculus from one variable to multivariable discussions.
- ✓ Inter-relationship amongst the line integral, double and triple integral formulations.
- ✓ Applications of multi variable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

### 4. MAT 601 G: Quantitative Aptitude

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Gain sufficient ideas of mental and arithmetic abilities.
- ✓ Handle mental/quantitative aptitude test questions with great ease.
- ✓ Acquire the skill of solving problems of daily life quickly.

## SEMESTER-IV

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### 1. MAT 608: Partial Differential Equations

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Formulate, classify and transform partial differential equations into canonical form.
- ✓ Solve linear and non-linear partial differential equations using various methods: and apply these methods in solving some physical problems rigorous approach of the concept of limit of a function.

### 2. MAT 609: Riemann Integration

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Some of the families and properties of Riemann integrable functions, and the applications of the fundamental theorems of integration.
- ✓ Beta and Gamma functions and their properties.
- ✓ The valid situations for the inter-changeability of differentiability and integrability with infinite sum, and approximation of transcendental functions in terms of power series.

### 3. MAT 610: Numerical Analysis

**Course Learning Outcomes:** Upon completing this course, students will be able to learn:

- ✓ Some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- ✓ Interpolation techniques to compute the values for a tabulated function at points not in the table.
- ✓ Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

### 4. MAT 602 G: Basic Tools of Mathematics

**Course Learning Outcomes:** Upon completing this course, students will be able to understand:

- ✓ The basic concepts of Geometry and Vectors Analysis.
- ✓ Some topics of Algebra and Differential Calculus.
- ✓ Application of partial differentiation in daily life problems.
- ✓ Properties and methods of Integration, solving of definite and indefinite integrals.
- ✓ Basic ideas of probability such as probability distribution, expectations, Binomial Distribution, Poisson distribution, etc.

## SEMESTER-V

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### 1. MAT 711: Metric Spaces

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Understand the basic concepts of metric spaces and the concept such as open balls, closed balls.
- ✓ Learn concepts of convergence of sequences, compactness, connectedness and their interrelations.
- ✓ Correlate the concepts of Metric Space with the Analytical concepts such as Continuity and uniform continuity.

### 2. MAT 712: Mechanics

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles.
- ✓ Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.
- ✓ Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.

### 3. MAT 703 G: Recreational Mathematics

**Course Learning Outcomes:** Upon completing this course, students will be able to:

- ✓ Understand basic set theory, mathematical puzzles, beauty of figurate numbers and to solve real- life problems.
- ✓ Understated CRT, Fermat's Little Theorem, Euler's Theorem, Wilson's Theorem, application of congruences, application of Mathematics in Nature, Geometric shapes, patterns, etc.
- ✓ Understand the application of Number Theory in ISSN, ISBN, UPC, Credit card check and have a knowledge about some mathematicians viz, Ramanujan, Hardy, Erdos etc.

