Department of Mathematics

M. Sc. Mathematics

Programme outcomes

Knowledge outcomes

After completing M.Sc. (Mathematics) Programme students will:

1. will get advanced knoeledge of principles, methods and clear perception of innumerous power of mathematical ideas and tools.

2. will be able to apply their skills and knowledge, that is translate information presented verbally into Mathematical form select and use appropriate mathematical formulae or techniques in order to process the information and draw relevant conclusion

3. will be able to find out or analyze scientific reasoning for various things.

4. Student will get knowledge about both pure as well as applied mathematics branches.

Skill outcomes

After completing B.Sc. (Mathematics) Programme students will :

1. get adequate exposure to global and local concerns that explore them many aspects of Mathematical sciences

2. get a relational understanding of mathematical concepts and concerned structures

3. Communicate scientific information in a clear and concise manner both orally and in writing or through audio video presentations

Generic outcomes:

Students will

1. Develop a positive attitude towards mathematics as an interesting and valuable subject of study

2. Develop capacity of critical reasoning, theoretical applied and communication skills.

3. Develop abilities for logical thinking and problem solving.

M. Sc. Part-I -Semester I (Autonomous)

Paper-I : 22-MTUT-111 : Linear Algebra

CO1. Student will learn the importance and applications of linear transformation.
CO2. Student will learn matrix and it's properties , system of equations which has wide variety of applications in various science subjects .
CO3. Student will learn concepts of vector space from various dimensions , which is used in other pure mathematical subjects and engineering.
CO4. Student will get introduction to finite dimensional spectral theorem.

Paper-II : 22-MTUT-112 : Real Analysis

CO1: The student will gain confidence in proving theorems and solving problems.
CO2: Student will understand the generalized concept of measure and integration.
CO3: Student will be able to understand Lebesgue integration and compare it with Riemann integration.
CO4: Student will learn the convergence theorems , which have wide variety of applications.

Paper-III : 22-MTUT-113 : Group Theory

CO1. Student will be able to recognize the mathematical objects that are groups and classify them as abelian , cyclic and permutation groups , etc.
CO2. This course will enhance abstract thinking of students.
CO3. Student will learn to compare two algebraic structures and study transfer of properties in-between these structures through homomorphism and isomorphism.
CO4. Student will understand the significance of sylow theorem , group action and their applications.
CO5. With this course students are prepared to learn about higher mathematical courses such as ring theory and field theory ,Galois theory etc.

Paper-IV : 22-MTUT-114 : Advanced Calculus

CO1. The basic concepts in multivariable calculus will be strengthened.
CO2. Student will learn the advanced concept in several variable calculus.
CO3. Student will learn to evaluate line integral , multiple integrals and surface integrals.
CO4. Student will learn Green's and Stoke's theorem which have wide applications in other physical sciences.

Paper-V : 22-MTUT-115 : Ordinary Differential Equations

CO1. Students will able to solve the problems using multiple approaches and will learn to classify ODEs.
CO2. Students will demonstrate an understanding of the theory of ODEs and will work with a variety of applications of ODE.
CO3. Students will learn to visualize ODEs in graphical, numerical form.
CO4. Student will have a working knowledge of basic application problems described by second order linear differential equations with constant coefficients.
CO5. Students will understand the concepts of existence and uniqueness of solutions.

Semester II (Autonomous)

Paper-I : 22-MTUT-121 : Complex Analysis

CO1. Student will understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations and it's applications.
CO2. Student will learn to evaluate the contour integrals and understand the role of Cauchy-Goursat theorem and Cauchy integral formula.
CO3. Student will study how to represent functions as Laurent series , classify singularities and poles , also evaluate complex integrals and improper integrals.
CO4. With this course students are prepared to learn about advance complex analysis.

Paper-II : 22-MTUT-122 : General Topology

CO1: Students will study a number of ways of constructing a topology on a set so as to make into a topological space.

CO2. Students will learn the elementary concepts associated with topological spaces.
CO3. Students will learn the notions of connectedness and compactness which are fundamental in higher analysis.
CO4. Students will be able to write cohesive and comprehensive solutions to exercises and be able to defend their arguments.
CO5. Students will understand the natural generalization of the previously learned ideas such as open sets , continuous functions , limit points etc.

Paper-III : 22-MTUT-123 : Ring Theory
CO1. Students will study the algebraic structure Ring and its properties in detail through various examples.
CO2. Student will know the notions of ideals , factorization domain and Module through various examples.
CO3. Student will learn the significance and interconnection of algebraic structures ranging from groups , rings , domains , Ideals to modules.
CO4. The thinking and analytical power of students in algebra will be strengthened.

Paper-IV : 22-MTUT-124 : Advance Numerical analysis
CO1. This course enhances theoretical view of students towards numerical methods.
CO2. This course gives different types of methods to calculate LU factorization, floating factorization , floating point numbers.
CO3. This course enhances the quality and standards of Mathematical Education.
CO4. This course takes care of fast development in the knowledge of Mathematics.

Paper-V : 22-MTUT-125 : **Partial Differential Equations**
CO1 .Classify partial differential equations and transform into canonical form.
CO2.Solve linear partial differential equations of both first and second order.
CO3. Identify real phenomena as models of partial derivative equations.
CO4. Solve Elliptic, parabolic and Hyperbolic differential equations.
CO5. Apply specific methodologies, techniques to conduct research and produce innovative results in the area of specialization.

M. Sc. Part-II - (2019 pattern)

Course: **MTUT 131 : (Functional Analysis)**
CO1: The student gets introduced to the basics that are required for analysis of continuous linear functions on Banach space.
CO 2 : The student acquire the knowledge about self adjoint, normal and unitary operators on Hilbert spaces.
CO 3 : Detailed study of finite dimensional spectral study.

Course: **MTUT 132 : (Field Theory)**

CO 1: Students learn concepts of Field structures and its properties also the concept of Galois field.

CO 2: Introduction to the concept of splitting field, irreducible polynomial and Eisenstein's criteria.

CO 3: Field is fundamental algebraic structure which is widely used in algebra, number theory and other fields of mathematics.

Course: **MTUT 133 : (Introduction to Data Science)**

After successful completion of this course, the student will be able to:

CO 1 : Understand the Python data science ecosystem and the various tools needed to continue developing as a data scientist.

CO 2 : Demonstrate the ability to make data-driven decisions.

CO 3: Demonstrate a solid understanding of the principles of data science;

CO 4 : Demonstrate practical knowledge in data preparation;

CO 5 : Use appropriate modelling, analyse techniques and visualization techniques for data science problems;

CO 6: Pre-process and wrangle noisy text data via stemming, lemmatization, tokenization, removal of stop-words and more.

Course: **MTUTO 134 : (Discrete Mathematics)**

CO 1 **:** To introduce the concept of Graphs, which is an important tool for Mathematical Modelling in computer science , biosciences and information technology.

CO 2 : Students learn concepts of tree, properties of tree and matching in graphs.

CO 3 : Students can acquire the skills of problem solving in fields like assignment, networking, chemical structures.

CO 4 : Students learn dijkstra's algorithm to find shortest path between two vertices in a graph, which is used in google map.

Course: **MTUTO 137 : (Integral Equations)**

CO 1 : Introduction to Integral equations and their types.

CO 2: Students learn variety of scientific applications.

CO 3 : The numerical and analytical skills of solving Linear and Non linear Integral equations is enhanced.

CO 4 : Students are able to handle the essential link between differential and integral operators.

Course: **MTUT 141 : (Fourier Series and Boundary Value Problems)**

CO 1: Students learn that every piecewise continuous function can be approximated by Fourier series.

CO 2 : Students are able to relate how series in real analysis are similar to Fourier series.

CO 3: The core part of the course was heat equation, and wave equation. While deriving

solutions of these equations students come across a very important problem Strum Liouville problem.

CO 4: The Strum Liouville problem has tremendous applications in Engineering , Fluid Mechanics , Atmospheric Science , Climate Physics ,Whether forecasting ,Option pricing Geophysics, and Solar physics.

Course: **MTUT 142 : (Differential Geometry)**

CO 1 : Students have developed aptitude to deal with the theoretical problems in Differential Geometry.

CO 2 : Students have acquired basic knowledge required for higher studies in pure Mathematics.

CO 3: Students are able to visualize and study graphs in higher dimensions and solve related problems.

CO 4 : Students are also introduced to software which can be used to draw graphs.

CO 5 : Students are able to relate various courses in Mathematics viz; Calculus, Differential equations, Topology, Functional Analysis, etc. with Differential Geometry and hence have understood the connect between them.

Course: **MTUT 143 : (Programming with Python)**

After successful completion of this course, the student will be able to:

CO 1: Understand the need of python programming.

CO 2 : Write, Test and Debug Python Programs

CO 3 : Implement Conditionals and Loops for Python Programs

CO 4 : Use functions and represent Compound data using Lists, Tuples and Dictionaries .

CO 5 : Read and write data from & to files in Python.

CO 6 : Apply the object-oriented programming to solve a real-world problem.

CO 7: Design and implement a program to solve a real-world problem. Also, Handle predefined and user-defined exceptions in python.

Course: **MTUTO 144 : (Number Theory)**

CO 1 : Student learn the concepts in unique factorization and congruence.

CO 2: The concept in quadratic reciprocity, some functions of number theory algebraic

numbers and their properties are studied.

CO 3 : Students learn the application of these concepts in various problems in other branches of mathematics.

Course: **MTUTO 148 : (Probability and Statistics)**

CO 1: Statistics is applicable in machine learning, data science and other courses which make the students aware about the applications.

CO 2 : Basic knowledge of statistics and mathematics make the student capable and competent as per industry needs.

CO 3 : Students learn about bay's theorem ,conditional probability , testing of hypothesis , regression, variance , probability distribution which is useful in analysing the data .