Department of Mathematics

Babasaheb Bhimrao Ambedkar University, Lucknow

Programme Name: M.Sc. (Mathematics)

PROGRAMME OUTCOMES (POs)

At the end of the programme, the students will be able to:

1. Apply knowledge of Mathematics, in all the fields of learning including higher research.
2. Design the methodology suitable to the problem encountered.
3. Explain the knowledge of contemporary issues in the field of Mathematics and applied sciences.
4. Innovate and solve complex mathematical problems using the knowledge of pure and applied mathematics.
5. Work effectively as an individual, and also as a member or leader in multi-disciplinary teams.
6. Adjust themselves completely to the demands of the growing field of Mathematics by lifelong learning.
7. Crack lectureship and fellowship exams approved by UGC like CSIR – NET and GATE.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. To develop problem-solving skills and apply them independently to problems in pure and applied mathematics.
2. To assimilate complex mathematical ideas and arguments.
3. To improve analytical and logical skills.
4. To develop abstract mathematical thinking.
5. To perform research in conjunction with others as well as individually.

COURSE OUTCOMES (COs)

Semester-I

Abstract Algebra-(MAM-101)

After completing this course, the student will be able to:

1. Identify the concept of groups and series of groups.
2. Explain Sylow's theorem and its applications.
3. Provide information on ideals, Quotient rings and Field of fractions.
4. Explain Euclidean ring and other forms of Polynomial rings.

Real Analysis–(MAM-102)

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

1. Describe basic concepts of metric spaces including completeness, compactness and connectedness.
2. Understand concepts of continuity, uniform continuity and differentiability of real valued functions.
3. Determine the Riemann inerrability of bounded functions.
4. Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.

Ordinary Differential Equations-(MAM-103)

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

1. Describe existence and uniqueness and solutions of ordinary differential equation and apply various methods to solve linear and nonlinear differential equations.
2. Solve boundary value problems through construction of Green function
3. Find power series solution of differential equations.
4. Apply concepts of ordinary differential equation to solve various real world problems.

Analytic Dynamics-(MAM-104)

After completing this course, the student will be able to:

1. Understand Euler dynamic and geometrical equations of motion.
2. Explain Lagrange approach and Lagrange equations for constrained motion under finite forces.
3. Describe Hamilton principle and principle of least action.
4. Apply canonical transformations to the various real world problems.

Computer programming in C- (MAM-105)

After completing this course, the student will be able to:

1. Identify the basic concept of algorithms, data type and functions in C++.
2. Understand logical and conditional operators.
3. Prepare algorithms and programs to analyze statistical data.
4. Write codes for numerical techniques to solve transcendental equations.

Mathematical Methods- (MAM-106)

After completing this course, the student will be able to:

1. Solve the system of linear equations by direct and numerical approaches.
2. Find the roots of transcendental equations using numerical techniques.
3. Describe Laplace transform and its application to partial differential equations.
4. Understand various types of approximations.

Semester-II

Linear Algebra-(MAM-201)

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

1. Describe basic concepts of vector space, the linear transformations on vector spaces, concept of dual space and reflexivity.
2. Describe diagonalizable operators, direct sum decompositions, the rational and Jordan canonical forms.
3. Explain basic geometry of finite dimensional Inner product spaces.
4. Explain the bilinear forms.

Complex Analysis-(MAM-202)

After completing this course, the student will be able to:

1. Apply the concept of analyticity of complex valued functions and evaluate of complex contour integrals.
2. Describe the basic properties of singularities and zeros of analytic functions and calculate residues and use these to calculate integrals.
3. Apply bilinear transformations; evaluate branches of many valued functions.
4. Describe the basic properties of entire functions, meromorphic functions, functions and represent entire function as product involving its zeroes, find order and exponent of convergence of entire function.
5. Apply the idea of continuation of the domain of a complex analytic function.

Advanced Abstract Algebra-(MAM-203)

After completing this course, the student will be able to:

1. Discuss Extension fields and Roots of polynomials.
2. Understand the elements of Galois Theory.
3. Identify simple and semi-simple modules.
4. Explain difference between projective and injective modules.

Partial Differential Equations-(MAM-204)

After completing this course, the student will be able to:

1. Describe the origin of first order partial differential equations.
2. Explain the solution of first order partial differential equations using Lagrange's, Charpit's and Jacobi's method.
3. Identify the second order equations and solve them using separation of variable method.
4. Provide information on Monge's method for second order partial differential equations.

Advanced Numerical Analysis-(MAM-205)

After completing this course, the student will be able to:

1. Understand interpolation, extrapolation and various types of approximations.
2. Solve the system of linear equations by direct and numerical approaches.
3. Find the value of integral and derivatives by using numerical techniques.
4. Explain finite difference method for solving boundary value problems.

Mathematical Modeling-(MAM-206)

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

1. Describe the techniques, characteristics and limitations of mathematical modelling to model real world problems.
2. Formulate mathematical models of problems arising in different areas of physical sciences, medicine and economics using differential equations and difference equations.
3. Apply the tools and techniques to analyze the differential equation and difference equation models.
4. Formulate and analyze linear and nonlinear programming models.

Semester-III

Topology-(MAM-301)

After completing this course, the student will be able to:

1. Understand topologies, open bases and open sub bases.
2. Explain connected, locally connected spaces and continuity in topological space.
3. Distinguish Urysohn's lemma and the Tietze extension theorem.
4. Study compactness, local compactness and one point compactification.

Mathematical Methods-(MAM-302)

After completing this course, the student will be able to:

1. Understand the concept of calculus of variation for the Brachistocrone, isoperimetric and geodesics problems.
2. Convert ordinary differential equation into Fredholm and Volterra type integral equations.
3. Explain the solution of integral equations by successive approximation.
4. Use Laplace transform for the solution of integral equations.

Fluid Dynamics-(MAM-303)

After completing this course, the student will be able to:

1. Derive the equation of continuity in various geometries.
2. Explain the momentum equation and Bernoulli's equation for fluid flow.
3. Understand two-dimensional irrotational motion produced by the motion of a cylinder.
4. Develop the relation of stresses and strains.

Operations Research-(MAM-304)

After completing this course, the student will be able to:

1. Construct linear programming models and discuss the solution techniques.
2. Set up decision models and use some solution methods for transportation and nonlinear optimization problems.
3. Understand and compute quantitative metrics of performance for queuing systems
4. Propose the best strategy using decision making methods under uncertainty and game theory.

Finite Element Method-(MAM-305)

After completing this course, the student will be able to:

1. Apply weighted residual methods to solve differential equations.
2. Understand the construction of functional.
3. Formulate shape function using Lagrange polynomials.
4. Find the solution of differential equation by finite element method.

Dynamical Systems-(MAM-306)

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

1. Solve dynamical systems and interpret phase portrait in several applications from biology, physics, chemistry and engineering.
2. Describe qualitatively the behavior of the solution of a dynamical system without necessarily finding the exact solution using stability theory of differential equations.
3. Explain the basic results of stability theory including stable manifold theorem, Hartman-Grobman theorem, Center manifold theorem and Normal form theory.
4. Identify various types of bifurcations (saddle-node, transcritical, super- and sub-critical pitchfork, Hopf) arising in dynamical systems.

Semester-IV

Functional Analysis-(MAM-401)

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

1. Describe the properties of a normed linear space, Banach space and linear transformations on Banach space.
2. Explain central theorems of functional analysis, including the Hahn-Banach theorem, the open mapping theorem and closed graph theorem.
3. Describe the properties of Hilbert space and and linear operator on Hilbert space.
4. Produce examples and counterexamples illustrating the mathematical concepts presented in the course.

Measure Theory- (MAM-402)

After completing this course, the student will be able to:

1. Identify the countable and uncountable sets.
2. Analyze measurable sets and Lebesgue outer measure.
3. Describe the measurable functions and convergence of measure.
4. Apply the concept of measurability in L^p – space.

Probability and Probability Distributions-(MAM-403)

After completing this course, the student will be able to:

1. Understand the concept of probability and random variables.
2. Describe various types of probability distributions.
3. Distinguish between partial and multiple correlations.
4. Explain the analysis of bi-variate data.

Discrete Mathematics-(MAM-404)

After completing this course, the student will be able to:

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Understand lattices as algebraic structures
3. Find homomorphisms between lattices and Boolean Algebra
4. Develop an understanding of how graph concepts are used to solve real world problems.

Advanced Fluid Dynamics-(MAM-405)

After completing this course, the student will be able to:

1. Analyze the flow problems using dimensionless form.
2. Compute the velocity and temperature profile for various types of flows.
3. Understand the boundary layer theory.
4. Solve the problems arising in gas dynamics.

Number theory and Cryptography-(MAM-406)

After completing this course, the student will be able to:

1. Understand the concepts of divisibility and Primes.
2. Describe power residue, multiplicative groups.
3. Discuss Quadratic residues and Jacobi symbol.
4. Study greatest integer function and recurrence functions.