Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai

(Autonomous)

Name of Program: Master of Science

Program Outcomes (POs)

PO1	**Disciplinary Knowledge**	Acquire the comprehensive and in-depth knowledge of various subjects in sciences such as Physics, Chemistry, Mathematics, Microbiology, Bio-analytical Science, Computer Science, Data Science, Information Technology and disciplinary skills and ability to apply these skills in the field of science, technology and its allied branches.
PO2	**Communication Skills and Presentation skills**	Develop various communication skills including presentation to express ideas evidently to achieve common goals of the organization.
PO3	**Creativity and Critical Judgement**	Facilitate solutions to current issues based on investigations, evaluation and justification using evidence-based approach.
PO4	**Analytical Reasoning and Problem Solving**	Build critical and analytical attitude in handling the problems and situations.
PO5	**Sense of Inquiry**	Curiously raise relevant questions based on highly developed ideas, scientific theories and its applications including research.
PO6	**Use of Modern Tools**	Use various digital technologies to explore information/data for business, scientific research and related purposes.
PO7	**Research Skills**	Construct, collect, investigates, evaluate and interpret information/data relevant to science and technology to adapt, evolve and shape the future.
PO8	**Application of Knowledge**	Develop scientific outlook to create consciousness against the social myths and blind faith.
PO9	**Moral and Ethical Reasoning**	Imbibe ethical, moral and social values to develop virtues such as justice, generosity and charity as beneficial to individuals and society at large.
PO10	**Leadership and Teamwork**	Work cooperatively and lead proactively to achieve the goals of the organization by implementing the plans and projects in various field-based situations related to science, technology and society at large.
PO11	**Environment and Sustainability**	Create social awareness about environment and develop sustainability for betterment of future.
PO12	**Lifelong Learning**	Realize that pursuit of knowledge is a lifelong activity and in combination with determined efforts, positive attitude and other qualities to lead a successful life.

Program Coordinator

BOS Chairman

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Department of Mathematics
Karmaveer Bhaurao Patil College
Vashi, Navi Mumbai

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Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai

(Autonomous)

Name of Program: Master of Science

Program Outcomes (PSO)

At the end of the three- year program, the student will understand and be able to-

PSO1	Recalling the concepts of mathematics and applying them to the various courses like algebra, analysis, Differential equations, statistics, etc to form mathematical models.
PSO2	Apply Mathematics to interdisciplinary ways like statistician, mathematical finance, industry expertise and interpret quantitative ideas.
PSO3	Apply knowledge of Mathematics for research and engineering.

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Title of Specific Program: B.Sc. Mathematics		
Course Code	**Name of the Course**	**Course outcomes**
		After successful completion of each course in learner will be able to:
Semester-I		
PGMT101	**ALGEBRA I**	CO1: Define dual space and calculate the dual basis of a finite-dimensional vector space.[1]* CO2: Explain the relation between matrices representing a linear transformation and its transpose. [2]* CO3: Explain different operators like normal, self-adjoint, and symmetric operators.[2]* CO4: Compute the Eigenvalue and Eigenvectors and minimal polynomial of a matrix.[5]* CO5: Compute Jordan Canonical form of a matrix.[5]*
PGMT102	**ANALYSIS I**	CO1: Recall Inner product space, norm linear space and vector space.[1]* CO2: Distinguish among open and closed sets on different topologies of $\mathbb{R}^n$.[2]* CO3: Determine whether a function is Riemann integrable using definition and Riemann criteria. [1]* CO4: List the results on total derivative. [2]* CO5: Compare Taylor's theorem for one and more variables.[2]* CO6: Apply second derivative to find maxima and minima of a differentiable functions.[3]*
PGMT103	**COMPLEX ANALYSIS**	CO1: Represent complex numbers algebraically and geometrically.[1]* CO2: Define and analyse limits and continuity for complex functions as well as consequences of continuity.[1]* CO3: Apply the Cauchy-Riemann equations and results on harmonic and entire functions including the fundamental theorem of algebra.[3]* CO4: Analyse sequences and series of analytic functions and types of convergence.[4]* CO5: Evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions.[5]* CO6: Represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.[2]*
PGMT104A	**DISCRETE MATHEMATICS**	CO1: Solve discrete mathematics problems that involve computing permutations and combinations of a set.[5]* CO2: Explain Polya's theory of counting, Orbit stabilizer theorem, Burnside lemma and its applications, applications of Polya's formula.[1]* CO3: Apply the knowledge of Number theory to attain specific maturity.[3]*

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		CO4: Apply fundamental enumeration principles to solve appropriate problems.[3]*
PGMT105	**INTRODUCTION TO R PROGRAMMING -I**	CO1: Study of fundamentals of R.[1]* CO2: Use different functions, variables and operators in R [3]* CO3: Write and execute programming in R by using loop and string [3]* CO4: Analysed and visualized mathematical statistical functions using R.[4]*
	Semester-II	
PGMT201	**ALGEBRA-II**	CO1: Understand the concept of group homomorphism, isomorphism and automorphism and apply it for constructing groups. [2]* CO2: Analyze Class equation, Sylow's theorems and apply them for describing structures of finite groups. [4]* CO3: Demonstrate the knowledge of Rings, ideals of Rings and Quotient rings, Polynomial ring over field and its extension. [2]* CO4: Learn Fundamental theorem of algebra, Burnside theorem and Kronecker's theorem and solve the problems.[1]* CO5: Derive and apply Gauss Lemma, and Eisenstein criterion for irreducibility of Polynomials. [3]* CO6: Demonstrate Field extensions and characterization of finite fields.[4]*
PGMT202	**TOPOLOGY**	CO1:Identify topologies and form a topological space using basis and sub-basis.[2]* CO2: Define connected space and find its components and path components of a topological space. [5]* CO3: Study of theorems on connectedness, compactness and completeness.[2]* CO4: State the first, second countability and separable axioms. List the results based on first and second countability. [1]* CO5: Apply metric space concept to compactness and completeness. [3]*
PGMT203	**RESEARCH METHODOLOGY**	CO1: Understand fundamental concept of research and define appropriate hypothesis.[2]* CO2: Collect data and apply different methods for sampling data [3]* CO3: Analyse data and form report [4]* CO4: Understand Intellectual Property Rights, patenting and copy right to develop research skill [2]* CO5: Construct project research report [6]*
PGMT204A	**DIFFERENTIAL EQUATIONS**	CO1: Apply Picard's method for finding solutions of first order differential equations.[3]* CO2: Expresses the existence and uniqueness results for an n^{th} order linear Ordinary Differential Equations.[2]* CO3: Apply the method of 'variation of parameters' to find solution of higher order linear differential equations with variable coefficients. [3]*

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		CO4: Define Fourier series and apply for periodic functions. [1]* CO5: Construct Fourier analysis of daily life periodic functions.[6]*
PGMT205	**INTRODUCTION TO R PROGRAMMING-II**	CO-1: Create different types of data frames in R [6]* CO-2: Handel and analyse various files in R [4]* CO-3: Analyse and visualize statistical functions using R.[4]* CO-4: Apply R programming to machine learning and big data analysis.[3]*
Semester-III		
PGMT301	**Algebra-III**	CO1: Define character of a linear representation and list the properties exhibited by them.[1]* CO2: Find the character table of groups of small order.[5]* CO3: Explain the structure theorem for finitely generated modules over a ring and its applications to abelian groups and matrices.[1]* CO4: Design, analyze and implement the concepts of homomorphism and isomorphism between modules for solving different types of problems, for example, Isomorphism theorems, quotient modules etc. [4]*,[5]* CO5: Identify and analyze different types of algebraic structures such as solvable groups, simple groups and alternate groups to understand and use the fundamental results in algebra.[4]*
PGMT302	**ANALYSIS II**	CO1: Understand how measures may be used to construct integrals.[2]* CO2: Establish measurability or non-measurability of sets and functions.[1]* CO3: Compute Lebesgue integral and have knowledge of its applications to volume calculations and Fourier analysis.[4]* CO4: Understanding that Lebesgue integration can solve certain problems for which Riemann integration does not provide adequate answers.[2]* CO5: Know the basic convergence theorems for the Lebesgue integral.[2]*
PGMT303	**DIFFERENTIAL GEOMETRY**	CO1: Understand and solve problems which require the use of differential geometry [2]* CO2: Recognize the basis of notions of the local theory of space curves and the local theory of surfaces.[1]* CO3: Compute the curvature and torsion of space curves.[6]* CO4: Understand the curvature and torsion of a space curve, how to compute them, and how they suffice to determine the shape of the curve.[2]*,[6]* CO5: Analyse and solve complex problems using appropriate techniques from differential geometry.[4]*,[5]*
PGMT 304 A	**NUMERICAL METHODS**	CO-1: understand the concepts of Numerical Differentiation and Integration [2]* CO-2: perform calculations to solve problems. [5]*

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		CO-3: Solve differential equations & Boundary value problems for ODE and PDE using various methods [5]* CO-4: Design, analyze and implement of numerical methods for solving different types of problems. [4]* CO-5: select numerical methods with the understanding of their limitations so that they can be implemented in order to get acceptable results. [2]* CO-6: Develop programming using python for various numerical methods. [1]*
SEC PGMT305A	**INTEGRAL TRANSFORMS**	CO1: Define integral transforms and Z-Transform [1]* CO2: State properties of Laplace, Fourier, Mellin and Z-Transform [1]* CO3: Apply Fourier transforms to find the solution of initial and boundary value problems. [3]* CO4: Find solutions of difference equations using Z-transform [5]* CO5: Apply Laplace transform to find solutions of differential equation [3]*
Semester-IV		
PGMT401	**FIELD THEORY**	CO1: Understand the notion of extension of field.[2]* CO2: Define straightedge and compass construction and explain few results. [1]* CO3: Define radical extension and give examples of a radical extension. [1]* CO4: Identify and analyze different types of algebraic structures such as Algebraically closed fields, Splitting fields, Finite field extensions.[4]* CO5: Create and apply appropriate algebraic structures such as Galois extensions, Automorphisms of groups and fixed fields. [3]*
PGMT402	**FUNCTIONAL ANALYSIS**	CO1: Explain the fundamental concepts of Functional analysis and their role in modern mathematics.[1]* CO2: Understand and apply ideas from the theory of Hilbert spaces to other areas.[2]* CO3: Utilize the concepts of functional analysis, for example, continuous and bounded operators, normed spaces, and Hilbert spaces. [1]* CO4: Define bounded linear transformation and give its equivalent characterizations.[1]* CO5: Understand and apply fundamental theorems from the theory of normed and Banach spaces including the Hahn-Banach theorem, the open mapping theorem, the closed graph theorem, and the uniform boundedness theorem. [2]*
PGMT403	**PARTIAL DIFFERENTIAL EQUATION**	CO-1: Solve the First order quasi-linear PDE by Cauchy's method [5]* CO-2: Solve linear and non-linear partial differential equation of first order by using Lagrange's and Charpit's method.[5]* CO-3: Classify second order PDE and solve standard PDE using separation of variable method.[2]*

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		CO-4: Explain the properties of the Gaussian kernel.[2]* CO-5: Find the solution of the initial value problems of wave and heat equation. [5]*
PGMT404A	**FOURIER ANALYSIS**	CO1: Define Fourier series and find Fourier coefficient [1]* CO2: Solve problems on different periods 2π, L 1and L2-periodic functions [5]* CO3: Find Fejer's Kernel and apply Fejer's Theorem [3]* CO4: Apply Fourier series to partial differential equation [3]*

Note: Numbers in bracket[ ] indicates cognitive levels of revised Blooms Taxonomy as follows: **[1]: Remembering, [2]: Understanding, [3]: Applying, [4]: Analysing, [5]: Evaluating, [6]: Creating**

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