Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi, Navi Mumbai

(Autonomous)

Name of Program: Bachelor of Science

Program Outcomes (POs)

PO-1	Disciplinary Knowledge	Understand the basic concepts, fundamental principles, theoretical formulations and experimental findings and the scientific theories related to Physics, Chemistry, Mathematics, Microbiology, Computer Science, Biotechnology, Information Technology and its other fields related to the program.
PO-2	Communication Skills	Develop various communication skills such as reading, listening and speaking skills to express ideas and views clearly and effectively.
PO-3	Critical Thinking	Propose novel ideas in explaining the scientific data, facts and figures related to science and technology.
PO-4	Analytical Reasoning and Problem Solving	Hypothesize, analyze, formulate and interpret the data systematically and solve theoretical and numerical problems in the diverse areas of science and technology.
PO-5	Sense of Inquiry	Curiously ask relevant questions for better understanding of fundamental concepts and principles, scientific theories and applications related to the study.
PO-6	Use of Modern Tools	Operate modern tools, equipment, instruments and laboratory techniques to perform the experiments and write the programs in different languages (software).
PO-7	Research Skills	Understand to design, collect, analyze, interpret and evaluate information/data that is relevant to science and technology.
PO-8	Application of Knowledge	Develop scientific outlook and apply the knowledge with respect to subject.
PO-9	Ethical Awareness	Imbibe ethical, moral and social values and exercise it in day to day life.
PO-10	Teamwork	Work collectively and participate to take initiative for various field-

		based situations related to science, technology and society at large.
PO-11	**Environment and Sustainability**	Create social awareness about environment and develop sustainability for betterment of future.
PO-12	**Lifelong Learning**	Ability of self-driven to explore, learn and gain knowledge and new skills to improve the quality of life and sense of self-worth by paying attention to the ideas and goals throughout the life.

Program Coordinator

BOS Chairman
HEAD
Department of Mathematics
Karmaveer Bhaurao Patil College
Vashi, Navi Mumbai

Principal
I/C PRINCIPAL
KARMAVEER BHAURAO PATIL COLLEGE
VASHI, NAVI MUMBAI 400 703.

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(Autonomous)

Name of Program: Bachelor 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	To apply knowledge of Mathematics for pursuing higher studies at reputed national and international institutes including higher research.
PSO3	Apply Mathematics to interdisciplinary ways like statistician, mathematical finance, industry expertise and interpret quantitative ideas.

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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
UGMT101	**CALCULUS-I**	CO1: State the properties of real numbers.[2]* CO2: Apply properties of real numbers to prove some inequalities.[3]* CO3: Define a sequence and classify different types of sequence. [1]* CO4: State and apply properties of convergence and divergence to sequences and series. [2]*
UGMT102	**ALGEBRA-I**	CO1: Define logic statements. [2]* CO2: Identify and apply various properties relating to the integers. [4]* CO3: Apply different methods of proof to verify mathematical assertions.[3]* CO4: Apply Fundamental theorem of algebra for finding roots of given polynomial.[3]*
UGMTP01	**Practical Based on UGMT101 and UGMT102**	CO1: Compute various types of limits of functions of one variable.[5]* CO2: Determine the region of continuity and types of discontinuity of a function.[2]* CO3: Apply Fundamental theorem of algebra for finding roots of given polynomial.[3]* CO4: Identify and apply various properties relating to the integers.[4]*
		Semester-II
UGMT201	**CALCULUS-II**	CO1: Define limit, continuity and differentiability of real valued function. [1]* CO2: State and prove algebra of limits, continuous functions and differentiability. [2]* CO3: Construct discontinuous function to continuous function. [6]* CO4: Apply continuous function State and prove algebra of limits, continuous functions and differentiability. [3]* CO5: Apply differentiation to graph of function functions, L-Hospital Rule, higher derivative and Taylors Expansion. [3]*
UGMT202	**ALGEBRA-II**	CO1: Solve systems of linear equations and interpret their results. [3]* CO2: Compute and interpret determinants of matrices.[5]* CO3: Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra.[3]*

		CO4: Analyze and construct mathematical arguments that relate to the study of introductory group theory. (Proof and Reasoning). [4]*
UGMTP02	**Practical Based on UGMT201 and UGMT202**	CO1: Apply various methods to solve systems of linear equations and interpret their results. [3]* CO2: Compute and interpret determinants of matrices. [5]* CO3: Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra. [3]* CO4: Analyze the order structure of the elements of group. [4]*
	Semester-III	
UGMT301	**Multivariable Calculus-I**	CO-1: Understand Euclidean inner product on Rn. [2]* CO-2: Distinguish limit and continuity of one variable and severable functions. [4]* CO-3: State scalar field and vector fields and apply to find gradient, divergence and curl.[2]* CO-4: Find derivative and partial derivative of functions apply on Eulers theorem. [3]* CO-5: Apply derivative for Taylors Theorem, Jacobians, maxima and minima and Method of Lagrange Multipliers.[3]*
UGMT302	**Abstract Algebra-I**	CO-1: Analyze properties implied by the definitions of subgroup cyclic group, homomorphism, isomorphism and automorphism.[4]* CO-2: Find order of a subgroup using Lagrange's Theorem.[5]* CO-3: Use the concepts of isomorphism and homomorphism of groups to recognize the structures groups. [3]* CO-4: Demonstrate ability to think critically by recognizing types of abelian, non-abelian and cyclic groups. [[2]*
UGMT303	**Ordinary Differential** **Equation**	CO-1: Classify the Ordinary differential equations with respect to their order and linearity. [2]* CO-2: Identify different types of differential equations and solve those using appropriate methods. [2]* CO-3: Find the general solution of a homogeneous and non-homogeneous second-order ordinary differential equation. [5]* CO-4: Construct differential equation of problem and solve by using appropriate method. [5]* CO-5: Define a system of differential equations and solve the system. [1]*
UGMT304	**Foundation of Mathematics**	CO1: Properly use the vocabulary and symbolic notation of higher mathematics in definitions, theorems, and problems. [1]* CO2: Explain the different methods for representing the relationship between sets. [2]* CO3: Construct truth tables, prove or disprove a hypothesis, and evaluate the truth of a statement using the principles of logic. [5]* CO4: Analyze the logical structure of statements symbolically, including the proper use of logical connectives, predicates, and quantifiers. [4]*

		CO5-: Write proofs using the concepts of set theory, including the methods of Venn diagrams and truth tables, using the basic definitions and the fundamental properties of subsets and operations.[2]*
UGMTP01*	Practical Exam based on UGMT301, UGMT302 & UGMT303	CO1: Compute directional derivatives, partial derivatives and mean value theorem of scalar field. [5]* CO2: Evaluate first order differential equations including separable, homogenous, exact and linear. [5]* CO3: Solve second and higher order linear differential equations. [5]* CO4: To generate groups given specific conditions. [6]*
Semester-IV		
UGMT401	Integral Calculus	CO1: Define Upper and Lower sum, Improper Integrals, beta and Gamma functions. [1]* CO2: Solves problems on Riemann integration, Improper Integrations and beta and Gamma functions. [5]* CO3: Apply the concept of Riemann Integration to prove algebra and properties.[3]* CO4: Test for convergency of improper integrals.[4]* CO5: Solve problems on rectification of curves, area and volume of revolution. [5]*
UGMT402	Linear Algebra-I	CO1: Apply the subspace test to find whether a given set is a subspace of the vector space. [3]* CO2: Determine whether a set is linearly dependent or linearly independent. [4]* CO3: Define linear transformations, kernel, and image of a linear transformation. [1]* CO4: Define dot product, inner product, and general inner product space. [1]* CO5: Find the orthonormal basis of a vector space using the Gram-Schmidt orthogonalization process. [5]*
UGMT403	Partial Differential Equation	CO1: Understand difference between Ordinary and partial differential Equation. [2]* CO2: To formation of partial differential equation (by eliminating constant and function). [3]* CO3: To find solution of first and higher order partial differential equation. [5]* CO4: Analyse types of Partial differential Equation. [4]* CO5: Apply Partial differential Equation to wave and heat equation. [3]*
UGMT404	Discrete Mathematics	CO1.Understand the basic concepts of Mathematical reasoning and basic counting techniques, relations and Proofs. [2]* CO2.Use recursion formulae and counting principles for preliminary counting. [3]* CO3. Use iterative methods for solving homogeneous and non-homogeneous recurrence relations. [3]* CO4. Apply the concepts of divide and conquer method and principle of inclusion and exclusion to solve some simple algorithms in discrete mathematics. [3]*

		CO5. Apply various properties and principles for advanced counting. [3]*
UGMTP02*	Practical Exam based on UGMT401, UGMT402 & UGMT403	CO1: Compute upper sum, lower sum and Riemann integral. [5]* CO2: Solve problems on area, volume and length. [5]* CO3: To derive heat and wave equations. [5]* CO4: Define Linear Transformations and find the domain, range, kernel, rank and nullity of linear transformation. [2]*
Semester-V		
UGMT501	Integral Calculus	CO1: Define double and triple integral and explain geometrically area and volume. [1]* CO2: Explain Fubini's theorem and basic properties of double and triple integrals. [2]* CO3: Solve examples by converting it to polar, cylindrical and spherical coordinates. [5]* CO4: Find and interpret the gradient curl, divergence for a function at a given point. [5]* CO5: Interpret line, surface and volume integrals. [6]* CO6: Define surface integral over scalar and vector field. [1]*
UGMT502	Linear Algebra	CO1: Define Vector Space, Quotient space Direct sum, linear span and linear independence, basis and inner product. [1]* CO2: Prove first isomorphism theorem. [2]* CO3: Define orthogonal transformation, Isometries, reflections and rotations. [1]* CO4: Find the eigen values and eigen vectors of a matrix. [5]* CO5: Prove Cayley- Hamilton theorem, Schwartz inequality. [2]* CO6: Calculate algebraic and geometric multiplicity and deduce if a matrix is diagonalizable. [5]*
UGMT503	Topology of Metric Spaces	CO1: Define metric spaces, discrete metric space, metric subspace. [1]* CO2: Explain properties of metric space, open set, Hausdroff property. [2]* CO3: Define sequences, convergent sequences and Cauchy sequences in a metric space and solve examples. [1]* CO4: Characterize limit points and closure in terms of sequences. [2]* CO5: Define complete metric spaces and explain nested interval theorem and Cantor's. [1]* CO6: Define compact metric space, sequentially compact metric space and solve examples. [1]*
UGMT504A	Numerical Analysis I	CO1: Express system of linear equation in matrix representation and find solution to the system using appropriate methods. [2]* CO2: Have knowledge of iterative methods based on second degree equations. [2]* CO3: Find relative, absolute and percentage errors. Find errors in different iterative methods. [5]* CO4: Find rate of convergence of various iterative methods. [5]*
UGMT50AC5	Python -I	CO1: Understand why Python is a useful scripting language for developers. [2]*

		CO2: Apply the problem-solving skills using syntactically simple language i.e. Python (version: 3.X or higher). [3]* CO3: Learn how to design and program Python applications. [2]* CO4: Describe data with statistics, and visualize it with line graphs and scatter plots. [2]* CO5: Apply Python's symbolic math functions to solve algebraic problems. [3]*
UGMTP501	Based on UGMT501 and UGMT502	CO1: Evaluate of double and triple integrals. [5]* CO2: Solve examples by converting it to polar, cylindrical and spherical coordinates. [5]* CO3: Calculate algebraic and geometric multiplicity and deduce if a matrix is diagonalizable. [5]* CO4: Find quadratic forms. [5]*
UGMTP502	Based on UGMT503 and UGMT504A	CO1: Find distance of a point from a set. [5]* CO2: Solve example of compact metric space, sequentially compact metric space. [5]* CO3: Find errors in different iterative methods. [5]* CO4: Find rate of convergence of various iterative methods. [5]*
UGMTP503	Based on UGMTP503	CO1: Apply the problem-solving skills using syntactically simple language i.e. Python (version: 3.X or higher). [3]* CO2: Use lists, tuples and dictionaries in Python programs. [3]* CO3: Use indexing and slicing to access data in Python programs. CO4: Use class inheritance in Python for reusability. [3]* CO5: Use exception handling in Python application and error handling. [3]* CO6: Apply Python's symbolic math functions to solve algebraic problems. [3]*
Semester-VI		
UGMT601	Basic Complex Analysis	CO1: Explain limits and convergence of sequences of complex numbers and results using properties of real sequences. [2]* CO2: Compare the difference between differentiability in real and complex sense. [4]* CO3: Define harmonic functions, harmonic conjugate and find the same. [1]* CO4: Prove the Cauchy integral formula. [2]* CO5: State the Taylor's theorem for analytic functions. [2]* CO6: Define a mobius transformations and solve examples. [1]* CO7: Define power series of complex numbers and uniqueness of series representation. [1]* CO8: State residue theorem and calculate residues. [2]*
UGMT602	Algebra	CO1: Define normal subgroups, quotient groups and index of a subgroup. [1]* CO2: Define homomorphism, kernel of a homomorphism, isomorphism. [1]* CO3: Prove Cayley's theorem, the fundamental theorem of homomorphism for Groups, second and third isomorphism theorems. [2]*

		CO4: Define rings, zero divisors of a ring, integral domain, field, ideals and prove theorems. [1]* CO5: Define polynomial rings, prime and maximal ideals and prove theorems. [1]* CO6: Define irreducible polynomials. State the irreducibility tests and use it to solve problems. [1]*
UGMT603	Topology of Metric Spaces and Real Analysis	CO1: Define continuity of function from one metric space to another. [1]* CO2: Solve examples on open and closed sets of a metric space. [5]* CO3: Prove algebra of continuous real valued functions in a metric space. [2]* CO4: Define connected, separable sets in metric space. [1]* CO5: Define point wise and uniform convergence and solve examples. [2]* CO6: Find radius of convergence, region of convergence. [5]*
UGMT604A	Numerical Analysis II	CO1: Define Basic concepts of operators Δ, E, ∇ . [1]* CO2: Find the difference of polynomial. [5]* CO3: Solve problems using Newton forward formula and Newton backward formula. [5]* CO4: Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula. [3]* CO5: Derive Simpson's 1/3 ,3/8 rules , trapezoidal rule. [4]*
UGMT60AC5	Python - II	CO1: Understand how to read and write files using access modes in python. [2]* CO2: Create directories and perform various operations on them. [6]* CO3: Process text using regular expressions. [4]* CO4: Understand GUI controls and designing GUI applications. [2]* CO5: Access database using python programming. [3]* CO6: Implement algorithm and apply techniques for searching and sorting. [3]*
UGMTP601	Based on UGMT601 and UGMT602	CO1: Classify singularities and poles and find residues. [4]* CO2: Solve examples of a mobius transformations. [5]* CO3: Prove Cayley's theorem, the fundamental theorem of homomorphism for Groups, second and third isomorphism theorems. [2]* CO4: Solve problems using the irreducibility tests. [5]*
UGMTP602	Based on UGMT603 and UGMT604A	CO1: Solve examples on open and closed sets of a metric space. [5]* CO2: Solve examples based on the path connected sets. [5]* CO3: Find radius of convergence, region of convergence. [5]* CO4: Solve problems using Newton forward formula and Newton backward formula. [5]* CO4: Solve example using Simpson's 1/3 ,3/8 rules using trapezoidal rule, Simpson's rule. [5]*
UGMTP603	Based on UGMT60AC5	CO1: Create directories and perform various operations on them. [6]*

		CO2: Process text using regular expressions. [4]*
		CO3: Search text using regular expressions. [4]*
		CO4: Access database using python programming. [4]*
		CO5: Apply techniques for searching and sorting. [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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