



Name of Teacher- Mr Arvind Shankarrao Salve

Programme (Name) - B. Sc.

Code-

Programme Specific Name-B. Sc. in Mathematics

Code-

Sr. No.	Course Name	Course code	Class
1	Algebra I	USMT102	F. Y. B. Sc.
2	Discrete Mathematics	USMT202	F. Y. B. Sc.
3	Algebra III	USMT302	S. Y. B. Sc.
4	Discrete Mathematics	USMT303	S. Y. B. Sc.
5	Algebra IV	USMT402	S. Y. B. Sc.
6	Ordinary Differential Equations	USMT403	S. Y. B. Sc.
7	Linear Algebra	USMT502	T. Y. B. Sc.
8	Numerical Analysis I	USMT5A4	T. Y. B. Sc.
9	Algebra	USMT602	T. Y. B. Sc.
10	Numerical Analysis II	USMT6A4	T. Y. B. Sc.

Course outcome (2020-21)-

Sr. No.	Course Name	Course code	Outcomes
FYBSc			
1	Algebra I	USMT 102	1. Student will know basic concepts of functions, set, finite set, types of relations, congruence and equivalence relations, polynomials over field and related theorems. 2. Student can apply above concepts on the theorems as Euler's theorem, Fermat's theorem, Wilson theorem, Remainder theorem, Factor theorem. 3. Student will solve problem on the basis of concepts and its applications (theorems) such as finding root of polynomials, evaluate properties of binary functions etc.
2	Discrete Mathematics	USMT 202	1. Student will know basic concepts of permutations and recurrence relations, Binomial and Multinomial Theorem, Pascal identity, Permutation and combination of sets and multi-sets, circular permutations, Principle of inclusion and exclusion, Finite and Infinite sets.

			2. Student understands properties related to above concepts such as cycles, disjoint cycles, homogeneous and non-homogeneous recurrence relations, Addition and multiplication Principle, Stirling numbers of second kind, application of exclusion principle etc. 3. Student will evaluate problems based on above concepts and its properties such as rank and signature of a permutation, homogeneous recurrence relation of second degree using algebraic method, Simple recursion of $S(n; k)$.
SYBSc			
3	Algebra III	USMT 302	1. Student will knows basic concepts of linear transformation, Rank-Nullity theorem, Row space, Column space, system of non-homogeneous equations, Determinants and its existence, general inner product space over $\mathbb{R}$, Norm vector in IPS. 2. Student understand results based on mentioned concepts above as existence of solution on $\text{rank}(A)=\text{rank}(A:B)$, existence of determinant by properties and Vandermonde's determinant, linear dependence/independence using determinants, inner product of continuous real valued functions, Cauchy-Schwartz inequality etc. 3. Student will evaluate Rank, Dimension of basis. Area, Volume, IPS of examples, Orthogonal and orthonormal bases.
4	Discrete Mathematics	USMT 303	1. Student will knows basic concepts of permutations and recurrence relations, Binomial and Multinomial Theorem, Pascal identity, Permutation and combination of sets and multi-sets, circular permutations, Principle of inclusion and exclusion, Finite and Infinite sets. 2. Student understands properties related to above concepts such as cycles, disjoint cycles, homogeneous and non-homogeneous recurrence relations, Addition and multiplication Principle, Stirling numbers of second kind, application of exclusion principle etc. 3. Student will evaluate problems based on above concepts and its properties such as rank and signature of a permutation, homogeneous recurrence relation of second degree using algebraic method, Simple recursion of $S(n; k)$
5	Algebra IV	USMT 402	1. Student will knows basic concepts of groups, subgroups, cyclic group and subgroups, cosets and its properties and group homomorphism's etc. 2. Student understands related theorems based on above concepts and properties namely Lagrange's theorem, Group homomorphism, order of element etc. 3. Student can show group, subgroup, cyclic group and subgroup, group homomorphism, order of element, Verify Lagrange's theorem.
6	Ordinary Differential Equations	USMT 403	1. Student will knows basic concepts of differential equation, order, degree, ordinary differential equation and partial differential equation, linear and non-linear ODE. Homogeneous and non-homogeneous second order linear differentiable equation and numerical differentiation & integration. 2. Student understands Wronskian and its properties, general solution of DE, Variation of parameters and Iterative methods. 3. Student can find Wronskian and show it is LI/LD, C. F., P. I., general solution, Picard's method etc.
TYBSc			
7	Linear Algebra	USMT 502	1. Student will knows concepts of Quotient spaces, Orthogonal transformations and isometries, Characteristic polynomial, properties of a group, Diagonalizability, Geometric multiplicity and Algebraic multiplicity etc.

			2. Student will understand First Isomorphism theorem, Characterization of isometries as composites of orthogonal transformations and isometries, Orthogonal diagonalization, Lagrange's theorem, Centre of a group and Group homomorphism and isomorphism etc. 3. Student will solve examples related to above theorems and understanding concepts such as finding basis of quotient space, Application to real quadratic forms. Positive definite, semi definite matrices, application of Cayley Hamilton Theorem, examples on cyclic groups & subgroups, symmetric group S_n, Dihedral group D_n, Klein 4-group, Matrix groups, $GL_n(R)$, Examples and properties of Automorphisms of a group, inner automorphisms.
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S. N.	Course Name	Course code	Outcomes
8	Numerical Analysis I	USMT 5A4	1. Student will know following methods as Newton-Raphson method, Secant method, Regula-Falsi method and their rate of convergence, Triangularization method, Cholesky method, Birge-vieta method, Graeffe's roots squaring method, Jacobi iteration method, Rutishauser method for arbitrary matrices, Power method, Inverse Power method, Muller method, Fixed point iteration method. 2. Student will understand above mentioned methods theoretically well. 3. Student will solve the problems related to above stated method and can find rate of convergence, truncation error, eigen values, eigen vectors, sturm sequence etc.
9	Algebra	USMT 602	1. Student will know concepts Normal subgroups of a group, Centre of a group, Quotient group, Alternating group A_n, cycles, ring, ideal of ring, integral domain, prime ideal, polynomial ring, Euclidean domain (ED), Principal Ideal Domain (PID), Unique Factorization and its relations. 2. Student will understand First Isomorphism theorem, Cayley's theorem, finite integral domain is a field, Characteristic of an integral domain, Irreducible polynomials over an integral domain. Unique Factorization Theorem for polynomials over a field, Characterization in terms of quotient rings. 3. Student will solve examples based on above theoretical results and its properties such as Classification of groups of order ≤ 5, examples on Characterization in terms of quotient rings, Units of a ring, multiplicative group of units of a ring.
10	Numerical Analysis II	USMT 6A4	1. Student will know & understands methods Lagrange's Linear, quadratic and higher order Interpolation, Iterated interpolation, Newton's divided difference interpolation, Finite difference operators, Interpolating polynomial using finite differences, Interpolation, Numerical differentiation, Trapezoidal rule, Simpson's rule. 2. Student will solve examples based on above mentioned concepts and various numerical methods.


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Course outcomes
A.Y. 2020-21

Program Specific outcomes of B.Sc. in Mathematics:

After completion of B.Sc. in mathematics students are able to

1. Demonstrate a rigorous understanding of core theory of mathematics, which includes calculus, algebra, differential equation, metric topology, complex analysis and numerical methods.
2. Learn to solve multiple integral.
3. Understand the concept of metric topology.
4. Learn properties of analytic function.

Course Outcomes:

Year – 2020-21

Sr. No.	Course Name	Course code	Outcome
1	Multivariable Calculus II	USMT 501	On completion of this unit successfully students will be to: 1. Solve double and triple integrals 2. Handle Multiple, line and surface integral 3. Translate real life situations into symbolism of mathematics and find solution for the resulting models
2	Topology of Metric Spaces	USMT 503	On completion of this unit successfully students will be to:

			1. Deal with various examples of metric spaces 2. Have some familiarity with open and closed sets. 3. Work with compact sets in Euclidean spaces
3	Elements Of Operations Research – I	USACOR501	On completion of this unit successfully students will be to: 1. Solve LPP problems using graphical method, Simplex method and Big-M method etc 2. Handle Dual Simplex Method 3. Have some familiarity with Uniform, Binomial, Poisson, Exponential, Normal Distribution
4	Practicals based on USMT501	USMTP05	On completion of this unit successfully students will be to: 1. Solve double and triple integrals 2. Handle Multiple, line and surface integral 3. Translate real life situations into symbolism of mathematics and find solution for the resulting models
5	Practicals based on USMT503	USMTP06	On completion of this unit successfully students will be to: 1. Deal with various examples of metric spaces 2. Have some familiarity with open and closed sets. 3. Work with compact sets in Euclidean spaces

6	Practicals based on USACOR501	USACOR5P1	On completion of this unit successfully students will be to: 1. Solve LPP problems using graphical method, Simplex method and Big-M method etc 2. Handle Dual Simplex Method 3. Have some familiarity with Uniform, Binomial, Poisson, Exponential, Normal Distribution
7	Basic Complex Analysis	USMT 601	On completion of this unit successfully students will be to: 1. Explain the fundamental concepts of complex analysis and their role in modern mathematics and applied contexts 2. Apply problem solving using complex analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts
8	Topology of Metric Spaces and Real Analysis	USMT 603	On completion of this unit successfully students will be to: 1. Demonstrate accurate and efficient use of Metric Spaces techniques. 2. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from metric spaces

			3. Apply the ideas of metric spaces to other areas of mathematics
9	Elements Of Operations Research – II	USACOR601	On completion of this unit successfully students will be able to: 1. Take decision under uncertainty using Laplace criterion, Maximax (Minimin) criterion etc. 2. Have familiarity with Simple and compound interest 3) Understand stock market.
10	Practicals based on USMT601	USMTP07	On completion of this unit successfully students will be to: 1. Explain the fundamental concepts of complex analysis and their role in modern mathematics and applied contexts 2. Apply problem solving using complex analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts
11	Practicals based on USMT603	USMTP08	On completion of this unit successfully students will be to: 1. Demonstrate accurate and efficient use of Metric Spaces techniques. 2. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from metric spaces

			3. Apply the ideas of metric spaces to other areas of mathematics
12	Practical based on USACOR601	USACOR6P1	On completion of this unit successfully students will able to: 1. Take decision under uncertainty using Laplace criterion, Maximax (Minimin) criterion etc. 2. Have familiarity with Simple and compound interest 3) Understand stock market.
13	Calculus III	USMT 301	On completion of this unit successfully students will able to: 1. Understand scalar and vector field 2. Differentiate scalar and vector field 3. Apply these ideas to other areas of mathematics
14	Practicals based on USMT 301	USMTP03	On completion of this unit successfully students will able to: 1. Understand scalar and vector field 2. Differentiate scalar and vector field 3. Apply these ideas to other areas of mathematics
15	Calculus IV	USMT 401	On completion of this unit successfully students will able to: 1. Demonstrate accurate and efficient use of Riemann integral 2. Have familiarity with Indefinite and improper integrals 3. Translate real life situations into

			symbolism of mathematics and find solution for the resulting models
16	Practical based on USMT 401	USMTP04	On completion of this unit successfully students will able to: 1. Demonstrate accurate and efficient use of Riemann integral 2. Have familiarity with Indefinite and improper integrals 3. Translate real life situations into symbolism of mathematics and find solution for the resulting models
17	Calculus I	USMT 101	On completion of this unit successfully students will able to: 1. Have familiarity with Real Number System, sequences, properties and ODE 2. Verify whether given functions are continuous and able to solve ODE. 3. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from calculus
18	Practicals based on USMT 101	USMTP01	On completion of this unit successfully students will able to: 1. Have familiarity with Real Number System, sequences, properties and ODE 2. Verify whether given functions are

			continuous and able to solve ODE. 3. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from calculus
19	Calculus II	USMT 201	On completion of this unit successfully students will able to: 1. Have familiarity with limit, continuity and differentiability. 2. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from calculus
20	Practicals based on USMT 201	USMTP02	On completion of this unit successfully students will able to: 1. Have familiarity with limit, continuity and differentiability. 2. Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concept from calculus
21	Mathematical and Statistical Techniques-I	UBCOMFSI.6	On completion of this unit successfully students will able to: 1. Understand Shares and Mutual Funds 2. Differentiate Permutation, Combination 3. Have familiarity with Summarization Measures, Probability

			Theory and Decision Theory
22	Mathematical and Statistical Techniques-II	UBCOMFSII.6	On completion of this unit successfully students will able to: 1. Understand Functions, Derivatives and Their Applications, Interest and Annuity 2. Differentiate Bivariate Linear Correlation and Regression 3. Have familiarity with Time series and Index Numbers