



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	USMT101	F. Y. B. Sc.
2	Discrete Mathematics	USMT201	F. Y. B. Sc.
3	Linear Algebra I	USMT302	S. Y. B. Sc.
4	Ordinary Differential Equations	USMT303	S. Y. B. Sc.
5	Linear Algebra II	USMT402	S. Y. B. Sc.
6	Numerical Methods (Elective A)	USMT403	S. Y. B. Sc.
7	Group Theory	USMT502	T. Y. B. Sc.
8	Partial Differential Equation	USMT5A4	T. Y. B. Sc.
9	Ring Theory	USMT602	T. Y. B. Sc.
10	Integral Transform	USMT6A4	T. Y. B. Sc.

Course outcome (2022-23)-

Sr. No.	Course Name	Course code	Outcomes
FYBSc			
1	Algebra I	USMT 101	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	Linear Algebra I	USMT 302	1. Student will know basic concepts of types of systems of linear equations in Matrix form, Vector space, Subspaces, Basis and Dimensions. 2. Students understand various methods of solving system of equations such as Echelon form, Gaussian elimination method. 3. With the help of above concepts and necessities, Student can find various things such as linearly dependence/independence, basis set, Dimension of vector space 4. Student will understand and uses the properties of determinant. Student will easily solve problems on Cramer's Rule and LU decomposition.
4	Ordinary Differential Equations	USMT 303	1. Student will know 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. 4. Student will understand the methods of numerical solution of first order differential equations with various methods such as Taylor's method, Euler's method, modified Euler's method, Runge-Kutta methods etc.
5	Linear Algebra II	USMT 402	1. Student will know basic concepts of linear transformation, Rank-Nullity theorem, Matrix associated to linear transformation, change of basis, equivalence of similar matrices. 2. Student understand inner product space and its examples. Also knows concepts of Triangle inequality and Cauchy-Schwartz inequality etc. Student can find angle between the two vectors, understand the concepts of Gram Schmidt Orthogonalization process. 3. Student will find the eigen values using Cayley Hamilton theorem.
6	Numerical Methods	USMT 403	1. Student will understand the concepts of errors, also knows types of errors. 2. Student understand iterative methods ex. Newton Rapson method, Secant method & Fix point method and solves the problems related to it. 3. Student will be able to interpolate the polynomial using Lagrange's interpolation method. Student understand finite difference operators. 4. Student will solve linear system of equations by LU decomposition method, Gauss-Seidel iterative method. Solve the problems on eigen value method Jacobi iterative method and Rutishauser method etc.
TYBSc			
7	Group Theory	USMT 502	1. Definition and elementary properties of a group, Subgroups, criterion for subgroup. Abelian group, centre of group. Homomorphism and isomorphism. 2. Example of groups including Z, Q, R, C, Klein 4-group, symmetric and alternating groups, S_1, $GL_n(R)$, $SL_n(R)$ and group of symmetries of plane figures. Order of element, Subgroup generated by a subset of the group.

			3. Coset of a subgroup, Lagrange's Theorem, Normal Subgroup, Alternating group. Quotient group, External direct products of groups, Cayley's Theorem for finite groups. 4. Examples of cyclic groups, properties of cyclic groups, finite cyclic groups, infinite cyclic groups and their generators, Properties of generators.
8	Partial differential equations	USMT 5A4	1 Students will able to understand the various analytical methods for solving first order partial differential equations. 2. Students will able to understand the classification of first order partial differential equations. 3. Students will able to grasp the linear and non linear partial differential equations.
9	Ring Theory	USMT 602	1. Definition and elementary properties of ring, commutative rings, integral domain and fields examples. Units in ring, Characteristics of ring and examples. 2. Ideals in ring, Sum and products of ideals, quotient rings and examples. Prime ideals and maximal ideals. Characterization of prime ideals and maximal ideals in commutative ring, homomorphism and isomorphism of rings 3. Divisibility in a ring, Irreducible and prime elements, Division algorithm, Monic polynomials, greatest common divisor and examples of irreducible polynomials, Eigenstein criterion.
10	Integral Transform	USMT 6A4	1. 1. Definition of Laplace transform, properties, derivatives and integrals, Inverse Laplace transform and its properties, convolution theorem, Inverse LT by partial fraction method. 2. 2. Fourier integral representation, fourier integral transform, fourier sine & cosine integral representation, Fourier Sine and Cosine transform pairs, FT of elementary functions, properties of fourier transform, convolution theorem. 3. Relation between the Fourier and Laplace transform. Application of laplace transform to evaluation of integrals and solutions of higher order ode. Application of LT to solution of one-dimensional heat equation & wave equation. Application of Fourier transform to the solution of initial and boundary value problem.



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Course outcomes
A.Y. 2022-23

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 – 2022-23

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	Practical 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	Practical 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	Practical 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	Practical 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	Practical 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 convergent and divergent series. 2. Demonstrate accurate and efficient use of Riemann integral 3. Have familiarity with Indefinite and improper integrals. Apply these ideas to other areas of mathematics
14	Practicals based on USMT 301	USMTP03	On completion of this unit successfully students will be able to: 1. Understand convergent and divergent series. 2. Demonstrate accurate and efficient use of Riemann integral 3. Have familiarity with Indefinite and improper integrals. Apply these ideas to other areas of mathematics
15	Calculus IV	USMT 401	On completion of this unit successfully students will be able to: 1. Understand limit and continuity of scalar and vector field. Able to demonstrate Directional and partial derivative 2. Differentiate scalar and vector field 3. Apply these ideas to other areas of mathematics
16	Practical based on USMT 401	USMTP04	On completion of this unit successfully students will be able to: 1. Demonstrate accurate and efficient use of Riemann integral 2. Differentiate scalar and vector field 3. Apply these ideas to other areas of mathematics

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	Practical 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 be 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 be 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