Name of Teacher- Mr Arvind Shankarrao Salve

Programme (Name) - B. Sc. Code-1S00145, 1S00146

Programme Specific Name-B. Sc. in Mathematics Code-

Sr. No.	Course Name	Course code	Class
1	Algebra I & Calculus I	USMT101	F. Y. B. Sc.
2	Basic in Python Programming		
3	Discrete Mathematics & Calculus II	USMT201	F. Y. B. Sc.
4	Computing with Python		
5	Linear Algebra I	USMT302	S. Y. B. Sc.
6	Ordinary Differential Equations	USMT303	S. Y. B. Sc.
7	Linear Algebra II	USMT402	S. Y. B. Sc.
8	Numerical Methods (Elective A)	USMT403	S. Y. B. Sc.
9	Group Theory	USMT502	T. Y. B. Sc.
10	Partial Differential Equations	USMT5A4	T. Y. B. Sc.
11	Ring Theory	USMT602	T. Y. B. Sc.
12	Integral Transform	USMT6A4	T. Y. B. Sc.

Course outcome (2024-25)-

Sr. No.	Course Name	Course code	Outcomes
			FYBSc
1	Algebra I and Calculus I	Major	1. Understand the real number system, differential equations, the integer and rational number system and illustrate examples of polynomials. 2. explain the properties and theorems of polynomials with suitable examples and also explain the concepts of modulus, infimum and supremum.. 3. verify the concepts related to sequences, like bounded, convergent, divergent, Cauchy, etc. and also to verify the statements of theorems by applying them in problem-solving. 4. evaluate the limits of convergent sequences and find solutions of differential equations. 5. apply differential equations to solve problems related to population growth and develop an understanding of the abstract part of algebra required for higher order thinking in pure mathematics in the higher classes. 6. construct counter examples related to bounded sets, bounded sequence, Cauchy sequence and convergent sequence.

2	Basic in Python Programming	VSC	1.To learn and understand algorithms. 2. To define the structure and components of algorithm and python program. 3. To learn and understand python looping and control statements manipulations. 4. To learn about inbuilt input/output operations and compound data types in Python 5. To learn about searching, sorting and recursion with python programming.
3	Discrete Mathematics & Calculus II	Major	1. understand the concepts of limit and continuity of functions and various counting techniques which are used to handle problems on finite sets and apply them in day-to-day life. 2. explain the concept differentiability of a function, addition and multiplication principles, two-way counting, inclusion and exclusion principles. 3. apply the derivatives and obtain maxima/minima of functions and other various applications, also mathematical logic to solve problems. 4. verify existence of limit, continuity and differentiability of a function. 5. find the limits and derivatives and the number of partitions using Sterling numbers. 6. construct counter examples related to continuous and discontinuous functions etc. and design problems based on the pigeonhole principle.
4	Computing with Python	VSC	1.To understand why Python is a useful scripting language for developers. 2. To learn how to use lists, tuples, and dictionaries in Python programs. 3. To learn how to use indexing and slicing to access data in Python programs. 4. To develop the skill of designing Mathematical user Interfaces with SymPy package in Python 5. To develop SymPy code for different areas of mathematical concepts including calculus, plotting graphs, derivatives and solving simultaneous equations.
SYBSc			
5	Linear Algebra I	USMT 302	1. Student will knows 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.
6	Ordinary Differential Equations	USMT 303	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. 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.
7	Linear Algebra II	USMT 402	1. Student will knows basic concepts of linear transformation, Rank-Nullity theorem, Matritrx 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 angel between the two vectors, understand the concepts of Gram Schmidt Orthogonalization process. 3. Student will find the eign values using Cayley Hamilton theorem.
8	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 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, Guass-Seidel iterative method. Solve the problems on eign value method Jacobi iterative method and Rutishauser method etc.
TYBSc			
9	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, S1, GLn(R), SLn(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.
10	Partial Differential Equations	USMT 5A4	1. Curves and Surfaces, Genesis of first order pde, Classification of first order pde, Cauchy problem, Lagrange's equation, Pfaffian differential equation 2. Necessary and sufficient condition of integrability, Charpit's method, Some standard types, Jacobi's method, The Cauchy Problem 3. Semilinear equations, Quasi-linear equations, first order quasi-linear pde, Initial Valued Problem for quasi linear equation, non-linear first order pde, Monge cone, Analytic expression for Monge cone, characteristics strip.
11	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.
12	Integral Transform	USMT 6A4	1. Definition of Laplace transform, properties, derivatives and integrals, Inverse Laplace transform and its properties, convolution theorem, Inverse LT by partial fraction method. 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.2024-25

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 – 2024-25

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 tripled 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 inEuclidean 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 tripled 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 inEuclidean 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 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 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 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 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	Data Analytics I	SEC I	On completion of this unit successfully students will able to: 1. Remember and recall key statistical terminologies and concepts. 2. Understand the foundational principles of statistics and data representation. 3. Apply statistical concepts and measures to real-world datasets. 4. Analyze data patterns, relationships, and distributions using statistical tools. 5. Evaluate statistical measures for different types of data and scenarios. 6. Develop the ability to create various graphical representations for qualitative and quantitative data.
18	Data Analytics II	SEC II	On completion of this unit successfully students will able to: 1. Recall advanced statistical terminologies, probability distributions, and the concepts of bivariate data. 2. Explain the foundational principles of correlation, linear regression, and inferential statistics. 3. Apply advanced analytical tools and functions in Excel or R software to manipulate complex datasets. 4. Analyze relationships, trends, and dependencies

			between multiple variables within a dataset. 5. Evaluate the strength of statistical models, regression lines, and basic hypothesis tests for real-world scenarios. 6. Develop comprehensive data analysis reports, predictive models, and custom dashboards to convey analytical insights.
19	Practical Statistics for Commerce – I	SEC I	On completion of this unit successfully students will able to: 1. Understand the concept of central tendency, measures of dispersion and be able to calculate mean, median, mode, range, variance, and standard deviation for raw and grouped data. 2. Learn to compute measures of central tendency for both discrete and continuous random variables. 3. Analyze data variability using measures of dispersion. 4. Making situations, courses of action, and states of nature. 5. Construct pay-off matrices and use them for decision-making skills under uncertainty using techniques like Maximin, Maximax, Expected Monetary Value (EMV), Expected Opportunity Loss (EOL) and Laplace criteria.
20	Practical Statistics for Commerce – II	SEC II	On completion of this unit successfully students will able to: 1. Calculate cost of living index numbers and real income, thereby understanding their practical implications in

			economic analysis and policy-making. 2. Understand the relationship between variables through correlation analysis and also, to explore the significance of index numbers related to economics and other fields. 3. Analyze scattered data and fit appropriate models using the Method of Least Squares. 4. Develop skills in time series analysis, including trend estimation and forecasting techniques. 5. Perform regression analysis effectively, including deriving regression lines and interpreting regression outputs.