R.E. Society's

R. P. Gogate College of Arts & Science and R. V. Jogalekar College of Commerce(Autonomous), Ratnagiri

Bachelor of Science (B.Sc.) Mathematics Programme

Three Year Integrated Programme

Six Semesters

Syllabus for Semester : III & IV

Under Choice Based Credit System (CBCS)

To be implemented from Academic Year- 2024-2025

Name of Programme	**B.Sc. Mathematics**
Level	UG
No of Semesters	06
Year of Implementation	**2024-25**
Programme Specific Outcomes (PSO)	1. Learner shall able to develop positive attitude towards mathematics as an interesting and valuable subject. 2. Enhancing students' overall development and to equip them with mathematical modelling, abilities, problem solving skills, creative talent. 3. Learner should be able to acquire good knowledge and understanding in advanced areas of mathematics. 4. Learner should apply Mathematical models to the problems of society.
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	Mathematics is useful at Global, Regional and local level. Better understanding of mathematics helps the student to visualize the solution of the problems in society. The application part is taken care of so that the learner should be able to create mathematical models to the problems in society. The skill set, knowledge acquired during the completion of programme shall make him employable in fields like Teaching, Banking, Research analyst, various IT industries.

Revised Syllabus of Courses of

Bachelor of Science (B.Sc.) Mathematics Programme

Under Choice Based Credit System

Course Structure

S.Y.B.Sc.

(To be implemented from Academic Year- 2024-25)

Course Code	Semester III	Credits	Course Code	Semester IV	Credits
Major			Major		
USMT301	Real Analysis I	2	USMT401	Calculus III	2
USMT302	Linear Algebra I	2	USMT402	Linear Algebra II	2
USMT303	Differential Equations I	2	USMT403	Differential Equations II	2
USMT304	Mathematics Practical-1 Based on USMT301, USMT302 and USMT303	2	USMT404	Mathematics Practical-2 Based on USMT401, USMT402 and USMT403	2
Minor			Minor		
USMT305	Numerical Methods I	2	USMT405	Numerical Methods II	2
USMT306	Practical-A based on USMT305	2	USMT406	Practical-B based on USMT405	2
Skill Enhancement Course			Skill Enhancement Course		
USMT307	Set Theory and Logic	2	USMT407	Computational Geometry	2
Open Elective			Open Elective		
USOEMT305	Commercial Mathematics	2	USOEMT405	Financial Mathematics	2
-	-	-	USOEMT406	Research Analyst in Stock Market	2
Total Credits		12+4	Total Credits		12+4

Teaching Pattern :

1. Two lectures per week per course (Theory)
2. Two lectures per week per course (Practical) for USMT301, USMT302, USMT303, USMT401 and USMT402, USMT403

Revised Syllabus of Courses of
Bachelor of Science (B.Sc.) Mathematics Programme at Semester III
with Effect from the Academic Year 2024-2025

Course Code	Semester III	Credits
Major		
USMT301	Real Analysis I	2
USMT302	Linear Algebra I	2
USMT303	Differential Equations I	2
USMT304	Mathematics Practical-1 Based on USMT301, USMT302 and USMT303	2
Minor		
USMT305	Numerical Methods I	2
USMT306	Practical-A based on USMT305	2
Skill Enhancement Course		
USMT307	Set Theory and Logic	2
Open Elective		
USOEMT305	Commercial Mathematics	2
Total Credits		12+4

Name of the Course	Real Analysis I
Course Code	USMT301
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	Calculus has importance in real life according to its valuable applications. Many real-life situations can be modelled using sequences and series. The Riemann Integral is used in measuring distances, also it is used in solving many interesting problems in the fields like Economics, Finance etc. This course will improve the required calculation skills among the learners.

Unit No.	Units	No. of Lectures
1	Infinite Series	10
2	Riemann Integration	10
3	Applications of Integration	10

Nomenclature : Real Analysis I

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. Solve the problems on various types of convergence of series.
2. solve problems on Riemann integrable functions, integration by parts formula, Leibnitz's rule, Gamma and Beta functions, absolute convergence
3. write proofs of properties of Riemann integrable functions, Riemann integrability of continuous functions, fundamental theorems of calculus, Mean Value Theorem

Curriculum :

Unit No.	Title and Learning Points	
1	Infinite Series	**10 Lectures**
	1.1 Infinite Series in R. Definition of Convergence and Divergence. Basic Examples including Geometric Series. Elementary results such as if $\sum_{n=1}^{\infty} a_n$ is convergent, then $a_n \to o$ but converse not true. Cauchy Criterion. Algebra of convergent Series 1.2 Tests for convergence (Without Proof): Comparison Test, Limit Comparison Test, Ratio Test, Root Test, Abel Test and Dirichlet Test. 1.3 Alternating Series, Leibnitz's Test. Absolute Convergence.	
2	Riemann Integration	**10 Lectures**
	2.1 Partitions of an interval. Refinement of a partition. Upper and Lower Sums for a bounded real-valued function on a closed and bounded interval. 2.2 Riemann integrability and the Riemann Integral, Criterion for Riemann integrability. Characterization of the Riemann integral as the limit of a sum. Examples. 2.3 Algebra of Riemann integrable functions and basic results such as if f: [a, b] → R is integrable then $\int_a^b f(x)\,dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ etc. 2.4 Riemann Integrability of a continuous function 2.5 Riemann Integrability of a continuous function and more generally of a bounded function whose set of discontinuities has only finitely many points. Riemann Integrability of monotone functions.	
3	Applications of Integrations	**10 Lectures**
	3.1 Area between the two curves. Lengths of plane curves, Surface area of surfaces of revolution. 3.2 Continuity of the function $F(x) = \int_a^x f(t)dt, x \in [a,b]. when\ f: [a,b] \to R$ is Riemann Integrable. First and Second Fundamental Theorem of Calculus. 3.3 Mean Value Theorem. Integration by parts formula. Leibnitz's Rule. Improper Integrals.	

Learning Resources Recommended :

1. Sudhir Ghorpade, Balmohan Limaye; A Course in Calculus and Real Analysis (2nd Edition); Springer
2. R. R. Goldberg; Methods of Real Analysis; Oxford and IBH Pub. Co., New Delhi, 1970
3. Calculus and Analytic Geometry (9th Edition); Thomas and Finney; Addison-Wesley, Reading Mass., 1998
4. T. Apostol; Calculus Vol. 2; John Wiley
5. Bartle and Sherbert; Introduction to Real Analysis.

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Linear Algebra I
Course Code	USMT302
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course gives brief introduction of Linear Algebra, considered a basic concept in the modern presentation of Geometry which prepares learners to study further courses related to Algebra.

Unit No.	Units	No. of Lectures
1	System of equations and Matrices	10
2	Vector Space over $\mathbb{R}$	10
3	Determinants, Linear Equations (Revisited)	10

Nomenclature : Linear Algebra I

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve system of linear equations using Gaussian elimination and matrix inversion.
2. demonstrate understanding of the concepts of vector space and subspace, linear independence, span and basis.
3. solve problems on Determinant and its applications.

Curriculum :

Unit No.	Title and Learning Points	
1	System of equations and Matrices	**10 Lectures**
	1.1 Systems of homogeneous and non-homogeneous linear equations, Matrix representation of system of homogeneous and non-homogeneous linear equations. Algebra of solutions of systems of homogeneous linear equations 1.2 Elementary row and column operations. Row equivalent matrices, Row Reduction (of a matrix to its row echelon form), Gaussian Elimination, applications to solving system of linear equations. Examples. 1.3 Elementary matrices. Relation of elementary row operations with elementary matrices. Invertibility of elementary matrices. Examples of the computation of the inverse of a matrix using Gauss elimination method.	
2	Vector Space over $\mathbb{R}$	**10 Lectures**
	2.1 Definition of a vector space over $\mathbb{R}$, Subspaces, criterion for a non-empty subset to be a subspace of a vector space. Examples of vector spaces, including the Euclidean space $\mathbb{R}^n$,lines, planes and hyperplanes in $\mathbb{R}^n$ passing through the origin, space of system of homogeneous linear equations, space of polynomials, space of various types of matrices, space of real valued functions on a set. 2.2 Intersections and sums of subspaces. Direct sums, Quotient space of a vector space by its subspace. 2.3 Linear combination of vectors, Linear span of a subset of a vector space. Definition of a finitely generated vector space. Linear dependence and independence of subsets of a vector space. 2.4 Basis of a vector space, Basic results that any two bases of a finitely generated vector space have the same number of elements. dimension of a vector space, examples, Bases of a vector space as a maximal linearly independent sets and as minimal generating sets.	
3	Determinants, Linear Equations (Revisited)	**10 Lectures**
	3.1 Inductive definition of the determinant of a n × n matrix (e.g.in terms of expansion along the first row). Example of a lower triangular matrix, Laplace expansions along an arbitrary row or column. Determinant expansions using permutations. 3.2 Basic properties of determinants (Statement only) 3.3 Row space & the column space of a matrix examples as	

	examples of vector space. Notion of row rank and the column rank. Equivalence of the row rank and the column rank. Invariance of rank upon elementary row or column operations. Examples of computing the rank using row reduction. 3.4 Relation between the solutions of a system of non-homogeneous linear equations and the associated system of homogeneous linear equations. Necessary and sufficient condition for a system of non-homogeneous linear equations to have a solution [viz., the rank of the coefficient matrix equals the rank of the augmented matrix $[A\|B]$]. Equivalence of statements (in which A denotes an $n \times n$ matrix) such as the following. i. The system $A\boldsymbol{x} = \boldsymbol{b}$ of non-homogeneous linear equations has a unique solution ii. The system Ax = 0 of homogeneous linear equations has no nontrivial solution iii. A is invertible iv. det A /= 0 v. Rank (A) = n 3.5 Cramer's Rule. LU Decomposition. If a square matrix A is a matrix that can be reduced to row echelon form U by Gauss elimination without row interchanges, then A can be factored as A = LU where L is a lower triangular matrix.

Learning Resources Recommended :

1. Howard Anton, Chris Rorres, Elementary Linear Algebra, Wiley Student Edition.
2. Sege Lang, Introduction to Linear Algebra, Springer
3. S Kumaresan, Linear Algebra- A geometric Approach, PHI Learning
4. Sheldon Axler, Linear Algebra don right, Springer
5. Gareth Williams, Linear Algebra with Applications, Jones and Bartlett Publishers.
6. David W. Lewis, Matrix theory.

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Differential Equations I
Course Code	USMT303
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	ODEs are used in many models to determine how the state of this model is changing (regarding time or another variable). Thus, ODEs are important for many scientific fields because they arise whenever a relation is given for the change of a model/system.

Unit No.	Units	No. of Lectures
1	Homogeneous Second Order Linear Differential Equations	10
2	Non-homogeneous Second Order Linear Differential Equations	10
3	Higher Order Differential Equations	10

Nomenclature : Differential Equations I

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve higher order linear differential equations.
2. solve systems of first order linear differential equations.
3. find the numerical solution of ordinary differential equations.

Curriculum :

Unit No.	Title and Learning Points
1	Homogeneous Second Order Linear Differential Equations **10 Lectures**
	1.1 Second order linear differential equation 1.2 Vector space 1.3 Wronskian and linear independence 1.4 General solution of homogeneous differential equation 1.5 Homogeneous differential equations with constant coefficients
2	Non-homogeneous Second Order Linear Differential Equations **10 Lectures**
	2.1 Non-homogeneous second order linear differential equation-complementary function and particular integral 2.2 Method of undetermined coefficients 2.3 Method of variation of parameters 2.4 Differential Operators with properties
3	Higher Order Differential Equations **10 Lectures**
	3.1 n-th order linear differential equation 3.2 Existence and uniqueness theorem 3.3 Homogeneous linear differential equations with constant coefficients 3.4 Auxiliary equation with real and distinct roots, with repeated roots, with unequal complex roots, with repeated complex roots.

Learning Resources Recommended :

1. E. D. Rainville and P. E. Bedient; Elementary Differential Equations; Macmillan
2. M. D. Raisinghania; Ordinary and Partial Differential Equations; S. Chand
3. G. F. Simmons; Differential Equations with Applications and Historical Notes; Taylor's and Francis

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Mathematics Practical-1
Course Code	USMT304
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	A practical approach to teaching Mathematics allows learners to explore the material in a more hands-on manner. This course allows learners to apply problem-solving techniques and gain an understanding of the application of the courses USMT301, USMT302 and USMT303

Unit No.	Units	No. of Lectures
1	Infinite Series	10
2	Riemann Integration	10
3	Applications of Integration	10
4	System of equations and Matrices	10
5	Vector Space over $\mathbb{R}$	10
6	Determinants, Linear Equations (Revisited)	10
7	Homogeneous Second Order Linear Differential Equations	10
8	Non-homogeneous Second Order Linear Differential Equations	10
9	Higher Order Differential Equations	10

Nomenclature : Mathematics Practical-1

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve problems on concepts from Real Analysis I
2. solve problems on concepts from Linear Algebra I
3. solve problems on concepts from Ordinary Differential Equations

Curriculum :

Unit No.	Title and Learning Points	
1,2,3	Infinite Series, Riemann Integration, Applications of Integration and Improper Integrals	**30 Lectures**
	1. Examples of convergent/divergent series and algebra of convergent series 2. Tests for convergence of series 3. Calculation of upper sum, lower sum and Riemann integral 4. Problems on properties of Riemann integral 5. Problems on fundamental theorem of calculus, mean value theorems, integration by parts, Leibnitz Rule 6. Convergence of Improper integrals, different tests for convergence. 7. Miscellaneous theoretical questions based on full course USMT301	
4,5,6	System of equations and Matrices, Vector Space over $\mathbb{R}$, Determinants, Linear Equations (Revisited)	**30 Lectures**
	1. System of homogeneous and non-homogeneous linear equations 2. Elementary row/column operations and Elementary matrices 3. Vector spaces, subspaces 4. Linear dependence/independence, Basis, Dimension 5. Determinant and Rank of a matrix 6. Solution to a system of linear equations, LU decomposition 7. Miscellaneous theoretical questions based on full course USMT302	
7,8,9	Homogeneous Second Order Linear Differential Equations, Non-homogeneous Second Order Linear Differential Equations, Higher Order Differential Equations	**30 Lectures**

	1. Verifying the given function as a solution of given differential equation and hence finding particular solution using initial conditions, 2. Solving homogeneous differential equations with constant coefficients 3. Solving non-homogeneous differential equations using method of undetermined coefficients 4. Solving non-homogeneous differential equations using method of variation of parameters 5. Finding the general solution of homogeneous higher order linear differential equations. 6. Miscellaneous theoretical questions based on full course USMT303

Learning Resources Recommended :

1. All resources recommended for USMT301, USMT302 and USMT303
2. USMT301 Practical Question Bank Designed by Department of Mathematics, GJC
3. USMT302 Practical Question Bank Designed by Department of Mathematics, GJC
4. USMT303 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Journal	10
Viva	05
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	05

B. Semester End Evaluation (Paper Pattern) (30 Marks-1 hour)

Comprehensive written examination of 1-hour duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of both the papers	Objective (18)
2	Descriptive on Unit 1,2,3 of One Paper	Descriptive (06)
3	Descriptive on Unit 1,2,3 of Second Paper	Descriptive (06)

Name of the Course	Numerical Methods I
Course Code	USMT305
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Theory
Type	Core(Minor)
Highlight revision specific to employability/ entrepreneurship/ skill development	Numerical Analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis. It is the study of numerical methods that attempt to find approximate solution of a problem rather than the exact ones. Numerical analysis find application in all fields of engineering and the physical sciences, and in the 21st century also the life and social sciences, medicine, business and even the arts.

Unit No.	Units	No. of Lectures
1	Errors in Numerical Calculations and Computer Arithmetic	10
2	Solution of Algebraic and Transcendental Equations	10
3	Interpolation	10

Nomenclature : Numerical Methods I

Course Outcomes :

On successful completion of this course, a learner will be able to:

Interpolate measures of Errors along with its types in numerical computation

1. Find a root of the given equation using numerical methods
2. Outline concept of Interpolation and solve problems based on Numerical Interpolation.

Curriculum :

Unit No.	Title and Learning Points	
1	Errors in Numerical Calculations and Computer Arithmetic	**10 Lectures**
	1.1 Interpolation Measures of Errors: Relative, absolute and percentage errors 1.2 Rounding and chopping of a number 1.3 Types of Errors: Inherent error, Round-off error and Truncation error 1.4 Computer Arithmetic: Binary, Octal, Decimal, Hexadecimal Number Systems with conversions.	
2	Solution of Algebraic and Transcendental Equations	**10 Lectures**
	2.1 Bisection method 2.2 Regula-Falsi method 2.3 Newton Raphson method 2.4 Secant Method Derivations of all above methods to be covered. 2.5 General Iteration Method: Fixed point iteration method	
3	Interpolation	**10 Lectures**
	3.1 Lagrange's Interpolation 3.2 Finite difference operators: Forward difference operator, Backward difference operator, Shift operator. 3.3 Newton's Forward difference interpolation formula 3.4 Newton's Backward difference interpolation formula Derivations of all above methods to be covered.	

Learning Resources Recommended:

1. S. S. Sastry; Introductory Methods of Numerical Analysis, PHI
2. Kendall E. and Atkinson: An Introduction to Numerical Analysis; Wiley.
3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.

Evaluation Pattern :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Practical-A based on USMT 305
Course Code	USMT306
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Practical
Type	Core(Minor)
Highlight revision specific to employability/ entrepreneurship/ skill development	A practical approach to teaching Mathematics allows learners to explore the material in a more hands-on manner. This course allows learners to apply problem-solving techniques and gain an understanding of the application of the courses USMT305

Unit No.	Units	No. of Lectures
1	Errors in Numerical Calculations and Computer Arithmetic	10
2	Solution of Algebraic and Transcendental Equations	10
3	Interpolation	10

Nomenclature : Practical-A based on USMT 305

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve problems on concepts from Numerical Methods I

Curriculum :

Unit No.	Title and Learning Points	
1	Errors in Numerical Calculations and Computer Arithmetic	**10 Lectures**
	1. Examples on measurement of errors and types of errors 2. Examples on conversion of numbers from different number systems.	
2	Solution of Algebraic and Transcendental Equations	**10 Lectures**
	1. Examples on Bisection method, Regula Falsi Method and Newton Raphson Method 2. Examples on Secant Method and Fixed Point Iteration Method	
3	Interpolation	**10 Lectures**
	1. Interpolation polynomial by Lagrange's Interpolation and examples on difference operators 2. Examples on Newton's forward and backward difference Interpolation 3. Miscellaneous theoretical questions based on full course USMT306	

Learning Resources Recommended :

1. All resources recommended for USMT305
2. USMT305 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Journal	10
Viva	05
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	05

B. Semester End Evaluation (Paper Pattern) (30 Marks-1 hour)

Comprehensive written examination of 1-hour duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3	Objective (18)
2	Descriptive on Unit 1,2,3	Descriptive (12)

Name of the Course	Set Theory and Logic
Course Code	USMT307
Class	S.Y.B.Sc.
Semester	III
Number of Credits	2
Nature	Theory
Type	Skill Enhancement Course
Highlight revision specific to employability/ entrepreneurship/ skill development	The course is a set theory and mathematical logic, giving the student an exposure to the foundations of mathematics, and indicating how various mathematical theories dealt with in other courses are examples of formal logical systems.

Unit No.	Units	No. of Lectures
1	Introduction to logic	10
2	Equivalence and Quantifiers	10
3	Sets	10

Nomenclature: Set Theory and Logic

Course Outcomes:

On successful completion of this course, a learner will be able to:
CO1 : solve the problems based on truth tables
CO2 : identify the logical equivalence of two statements
CO3 : understand the concept of sets and solve problems based on it
CO4 : solved the problems based on units I, II and III.

Curriculum:

Unit No.	Title and Learning Points
1	Introduction to logic **10 Lectures**
	1.1 Introduction, propositions 1.2 truth table, negation, conjunction and disjunction. 1.3 Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.
2	Equivalence and Quantifiers **10 Lectures**
	2.1 Propositional equivalence: Logical equivalences. 2.2 Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations. 2.3 Methods of Proofs
3	Sets **10 Lectures**
	3.1 Sets, subsets, Set operations 3.2 the laws of set theory and Venn diagrams 3.3 Examples of finite and infinite sets

Learning Resources recommended:

1. Robert R. Stoll: Set Theory and Logic, Freeman & Co.
2. Larry J. Gerstein: Introduction to Mathematical Structures and Proofs, Undergraduate texts in Mathematics, Springer Second Edition.

Evaluation Pattern :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Commercial Mathematics
Course Code	USOEMT305
Class	S.Y.B.Sc.
Semester	III
Number of Credits	2
Nature	Theory
Type	Open Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	The mutual fund industry is full of complex terminologies like NFO, TER, Sharpe Ratio, SIP, STP, SWP, Alpha, Beta and a multitude of funds like Equity, Debt & Hybrid funds, Active and Passive funds, and many more. Whether you are an absolute beginner who wants to improve his knowledge about investing in mutual funds or a student aspiring for a career in the mutual fund industry, this course will help you learn the basics and start your journey. The course starts with an shares and mutual funds and goes on to explain concept of insurance also.

Unit No.	Units	No. of Lectures
1	Shares	10
2	Mutual Funds	10
3	Concept of Insurance	10

Nomenclature: Commercial Mathematics

Course Outcomes:

On successful completion of this course, a learner will be able to:
CO1 : learn basic concepts of shares and their types
CO2 : solve the problems on mutual funds
CO3 : solve the problems on insurance

Curriculum:

Unit No.	Title and Learning Points	
1	Shares	**10 Lectures**
	1.1 Shares-concept, face value, market value, dividend 1.2 Equity shares, preference shares, bonus shares	
2	Mutual Funds	**10 Lectures**
	2.1 Problems on calculation of net income after considering entry load, exit load, dividend, change in net asset value	
3	Concept of Insurance	**10 Lectures**
	1.1 Insurance (evolved and works) 1.2 Types of Insurance 1.3 Importance of Insurance Industry 1.4 The Business of Insurance: how risk is managed by individuals and insurers 1.5 Premium 1.6 Importance of reinsurance 1.7 Role of reinsurance in economic and social development	

Learning Resources recommended:

1. Business Mathematics: A P Verma, Asian Books Pvt. Limited.
2. Business Mathematics: D C Sancheti &V K Kapoor, Sultan Chand & Sons
3. Dorfman S. Mark, introduction to risk management and insurance, Prentice hall India 2005

Evaluation Pattern :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Revised Syllabus of Courses of
Bachelor of Science (B.Sc.) Mathematics Programme at Semester IV
with Effect from the Academic Year 2024-2025

Course Code	Semester IV	Credits
Major		
USMT401	Calculus III	2
USMT402	Linear Algebra II	2
USMT403	Differential Equations II	2
USMT404	Mathematics Practical-2 Based on USMT401, USMT402 and USMT403	2
Minor		
USMT405	Numerical Methods II	2
USMT406	Practical-B based on USMT405	2
Skill Enhancement Course		
USMT407	Computational Geometry	2
Open Elective		
USOEMT406	Financial Mathematics	2
USOEMT407	Research Analyst in Stock Market	2
Total Credits		12+6

Name of the Course	Calculus III
Course Code	USMT401
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course is important in many areas of real-life like to calculate the profit and loss in business using graphs, to check the temperature variation, to determine the speed or distance covered such as miles per hour, kilometer per hour etc. This course improves the required calculation skills among the learners.

Unit No.	Units	No. of Lectures
1	Analytic Geometry	10
2	Differential Calculus-I	10
3	Differential Calculus-II	10

Nomenclature : Calculus III

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve problems on limit and continuity of scalar fields, limit and continuity of vector field, partial and directional derivative of scalar fields
2. write the proofs of theorems related to differentiation of scalar fields, applications of differentiation of scalar fields, differentiability of vector fields
3. solve problems on applications of differentiation of scalar fields and vector fields

Curriculum :

Unit No.	Title and Learning Points	
1	Analytic Geometry	**10 Lectures**
	1.1 Review of vectors in R^2 and R^3, Component form of vectors, basic notions such as addition and scalar multiplication of vectors, dot product of vectors, orthogonal vectors, Scalar triple product. 1.2 Lines and Planes in space, equation of sphere 1.3 Polar coordinates in R^2, Relation between Polar and Cartesian Coordinates in R^2	
2	Differential Calculus-I	**10 Lectures**
	2.1 Real-valued functions of several variables(Scalar Fields), Graph of a function. Level sets(level curves, level surface) Examples, Vector Valued functions of several variables. Component function. 2.2 Sequences, Limit and Continuity: Sequence in Rn and their limits. Neighborhood in Rn, Limits and continuity of scalar fields, Composition of continuous functions. Sequential characterization 2.3 Algebra of limits and continuity vector fields	
3	Differential Calculus-II	**10 Lectures**
	3.1 Partial and directional derivatives of scalar fields, The concept of Total derivative, Increment theorem. 3.2 The operator del, Gradient of s scalar point function, Relation between total derivative and gradient of a function. Chain Rule, Geometric properties of gradient. 3.3 Tangent planes, Euler's theorem, Higher order partial derivatives, Mixed partial theorem.	

Learning Resources Recommended :

1. T. Apostol; Calculus, Vol.2 (2nd Edition); John Wiley
2. Sudhir Ghorpade, Balmohan Limaye; A course in Multivariable Calculus and Analysis (2nd Edition); Springer
3. Calculus and Analytical Geometry, Sheth Publication Text Book for F.Y.B.Sc.
4. J. E. Marsden, A. J. Tromband A. Weinstein, Basic Multivariable Calculus; Springer
5. D. Somasundaram and B. Choudhary: A First Course in Mathematical Analysis, Narosa, New Delhi, 1996

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Linear Algebra II
Course Code	USMT402
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course gives brief introduction to Linear Algebra, considered as basic concept in the modern presentation of geometry which prepares learners to study further courses related to Algebra.

Unit No.	Units	No. of Lectures
1	Linear Transformation	10
2	Inner Product Spaces and Orthogonality	10
3	Eigen Values, Eigen Vectors and Diagonalizable Matrix	10

Nomenclature : Linear Algebra II

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. explain the concept of linear transformation and their properties
2. identify inner product spaces and outline properties of inner products
3. explain the concept of orthogonalization and apply the concepts of eigen values and eigen vectors to geometry

Curriculum :

Unit No.	Title and Learning Points	
1	Linear Transformation	**10 Lectures**
	1.1 Definition of a Linear Transformation of vector spaces; Elementary Properties, Examples. Sums and scalar multiples of linear transformations. Composites of linear transformations A Linear transformation of $V \to W$, where V, W are vector spaces over $\mathbb{R}$ and V is a finite-dimensional vector space is completely determined by its action on an ordered basis of V. 1.2 Null-Space (kernel) and Image (Rank) of LT, Nullity and rank of a linear transformation. Rank-Nullity Theorem (Fundamental Theorem of Homomorphism). 1.3 Matrix associated with Linear Transformation., Matrix of composite of two Linear Transformation., Invertible Linear Transformation (isomorphisms), Linear operator, Effect of change of bases on matrices of linear operator. 1.4 Equivalence of the rank of a matrix and the rank of the associated linear transformation. Similar matrices.	
2	Inner Product Spaces and Orthogonality	**10 Lectures**
	2.1 Inner product spaces (over $\mathbb{R}$). Examples, including the Euclidean space R^n and the space of real valued continuous functions on a closed and bounded interval. Norm associated to an inner product. Cauchy-Schwarz inequality. Triangle inequality. 2.2 Angle between two vectors, Orthogonality of Vectors, Pythagoras theorem and some Geometric Applications in R^2, Orthogonal sets, Orthonormal sets. 2.3 Orthogonal complement of any set of vectors in an inner product space. Orthogonal complement of a set is a vector subspace of the inner product space, Orthogonal decomposition of an inner product space with respect to its subspace., Orthogonal projection of a vector onto a line (one dimensional subspace). Orthogonal projection of an inner product space onto its subspace.	
3	Eigen Values, Eigen Vectors and Diagonalizable Matrix	**10 Lectures**

	3.1 Eigenvalues and eigenvectors of a linear transformation of a vector space into itself and of square matrices. The eigenvectors corresponding to distinct eigenvalues of a linear transformation are linearly independent. Eigen spaces. Algebraic and geometric multiplicity of an eigenvalue 3.2 Characteristic polynomial. Properties of characteristic polynomials (only statements). Examples. Cayley-Hamilton Theorem. Applications. 3.3 Invariance of the characteristic polynomial and eigenvalues of similar matrices. 3.4 Diagonalizable matrix. A real square matrix A is diagonalizable if and only if there is a basis of Rn consisting of eigenvectors of A. (Statement only - An×n is diagonalizable if and only if sum of algebraic multiplicities is equal to sum of geometric multiplicities of all the eigenvalues of A = n). Procedure for diagonalizing a matrix. 3.5 Spectral Theorem for Real Symmetric Matrices (Statement only). Examples of orthogonal diagonalization of real symmetric matrices. Applications to quadratic forms and classification of conic sections.	

Learning Resources Recommended :

1. Howard Anton, Chris Rores; Elementary Linear Algebra; Wiley Student Edition
2. Serge Lang; Introduction to Linear Algebra; Springer
3. S. Kumaresan; Linear Algebra-A geometric Approach; PHI Learning
4. David W. Lewis; Matrix Theory

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	1
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Differential Equations II
Course Code	USMT403
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	ODEs are used in many models to determine how the state of this model is changing (regarding time or another variable). Thus, ODEs are important for many scientific fields because they arise whenever a relation is given for the change of a model/system.

Unit No.	Units	No. of Lectures
1	Linear System of Ordinary Differential Equations I	10
2	Linear System of Ordinary Differential Equations II	10
3	Linear System of Ordinary Differential Equations III	10

Nomenclature : Differential Equations II

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. Solve the problems on linear system
2. Find the numerical solution of ordinary differential equations

Curriculum :

Unit No.	Title and Learning Points	
1	Linear System of Ordinary Differential Equations I	**10 Lectures**
	1.1 System of first order linear equations 1.2 System of differential equations and existence and uniqueness theorem	
2	Linear System of Ordinary Differential Equations II	**10 Lectures**
	2.1 Wronskian of solutions to system of ordinary differential equations 2.2 General and particular solution to system of ordinary differential equations	
3	Linear System of Ordinary Differential Equations III	**10 Lectures**
	3.1 Homogeneous linear system with constant coefficients 3.2 General solution of non-homogeneous linear system 3.3 Method of variation of parameters	

Learning Resources Recommended :

1. E. D. Rainville and P. E. Bedient; Elementary Differential Equations; Macmillan
2. M. D. Raisinghania; Ordinary and Partial Differential Equations; S. Chand
3. G. F. Simmons; Differential Equations with Applications and Historical Notes; Taylor's and Francis

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit	10

tests of 10 marks each and best one out of three will be considered)	
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Mathematics Practical-2
Course Code	USMT404
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Practical
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	A practical approach to teaching Mathematics allows learners to explore the material in a more hands-on manner. This course allows learners to apply problem-solving techniques and gain an understanding of the application of the courses USMT401, USMT402 and USMT403

Unit No.	Units	No. of Lectures
1	Analytic Geometry	10
2	Differential Calculus-I	10
3	Differential Calculus-II	10
4	Linear Transformation	10
5	Inner Product Spaces and Orthogonality	10
6	Eigen Values, Eigen Vectors and Diagonalizable Matrix	10
7	Linear System of Ordinary Differential Equations I	10
8	Linear System of Ordinary Differential Equations II	10
9	Linear System of Ordinary Differential Equations III	10

Nomenclature : Mathematics Practical-2

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve problems on concepts from Calculus III
2. solve problems on concepts from Linear Algebra II
3. solve problems on concepts from Differential Equations II

Curriculum :

Unit No.	Title and Learning Points	
1,2,3	Analytic Geometry, Differential Calculus-I, Differential Calculus-II	**30 Lectures**
	1. Problems based on Analytic Geometry 2. Limits and Continuity of scalar and Vector fields, Integral limits 3. Computing directional derivatives, partial derivatives and MVT of scalar fields 4. Differentiability of Scalar field, Total derivative, Gradient, Level sets. 5. Chain Rule, Higher order derivatives and Mixed Partial Derivatives 6. Finding Maxima, Minima and Saddle Points, Second Derivative Test for Extrema of Functions of two variables and methods of Lagrange multipliers. 7. Miscellaneous theoretical questions based on full course USMT401	
4,5,6	Linear Transformation, Inner Product Spaces and Orthogonality, Eigen Values, Eigen Vectors and Diagonalizable Matrix	**30 Lectures**
	1. Linear Transformation, Kernel, Rank-Nullity theorem 2. Linear Isomorphism, Matrix associated with LT 3. Inner product and properties, Projection, Orthogonal Complements 4. Orthogonal, Orthonormal Sets, Gram-Schmidt Orthogonalization 5. Eigen Values, vectors, Characteristic Polynomial, App. of Cayley-Hamilton T 6. Diagonalization of matrix, Orthogonal diagonalization of Symmetric Matrix 7. Miscellaneous theoretical questions based on full course USMT402	
7,8,9	Linear System of Ordinary Differential Equations I, Linear System of Ordinary Differential Equations II, Numerical solution of ordinary differential equations	**30 Lectures**

	1. Finding the system of linear differential equations from given differential equation. 2. Solving homogeneous system of ordinary differential equations. 3. Solving non-homogeneous system of ordinary differential equations. 4. Miscellaneous theoretical questions based on full course USMT403

Learning Resources Recommended :

1. All resources recommended for USMT401, USMT402 and USMT403
2. USMT401 Practical Question Bank Designed by Department of Mathematics, GJC
3. USMT402 Practical Question Bank Designed by Department of Mathematics, GJC
4. USMT403 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Journal	10
Viva	05
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	05

B. Semester End Evaluation (Paper Pattern) (30 Marks-1 hour)

Comprehensive written examination of 1-hour duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of both the papers	Objective (18)
2	Descriptive on Unit 1,2,3 of One Paper	Descriptive (06)
3	Descriptive on Unit 1,2,3 of Second Paper	Descriptive (06)

Name of the Course	Numerical Methods II
Course Code	USMT405
Class	S.Y.B.Sc.
Semester	III
No. of Credits	2
Nature	Theory
Type	Core(Minor)
Highlight revision specific to employability/ entrepreneurship/ skill development	Numerical Analysis is the study of algorithms that use numerical approximation for the problems of mathematical analysis. It is the study of numerical methods that attempt to find approximate solution of a problem rather than the exact ones. Numerical analysis find application in all fields of engineering and the physical sciences, and in the 21st century also the life and social sciences, medicine, business and even the arts.

Unit No.	Units	No. of Lectures
1	Curve fitting	10
2	Numerical Integration	10
3	Numerical Solution of Linear System of Equations	10

Nomenclature : Numerical Methods II

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. Apply numerical method to fit a given curve
2. Find integration of given function using numerical methods
3. Find numerical solution of a given system of equations .

Curriculum :

Unit No.	Title and Learning Points	
1	Curve fitting	**10 Lectures**
	1.1 Least square method of fitting a straight line 1.2 Multiple linear least squares 1.3 Curve fitting by polynomials of degree 2 or 3	
2	Numerical Integration	**10 Lectures**
	2.1 Newton-Cotes Quadrature formula with derivation 2.2 Trapezoidal Rule with derivation and problems 2.3 Simpson's 1/3 Rule with derivation and problems 2.4 Simpson's 3/8 Rule with derivation and problems	
3	Numerical Solution of Linear System of Equations	**10 Lectures**
	3.1 Linear system of Equations: LU decomposition method (Dolittle's Method and Crout's Method) 3.2 Gauss Seidel Iteration Method	

Learning Resources Recommended:

1. S. S. Sastry; Introductory Methods of Numerical Analysis, PHI
2. Kendall E. and Atkinson: An Introduction to Numerical Analysis; Wiley.
3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Practical-A based on USMT 405
Course Code	USMT406
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Practical
Type	Core(Minor)
Highlight revision specific to employability/ entrepreneurship/ skill development	A practical approach to teaching Mathematics allows learners to explore the material in a more hands-on manner. This course allows learners to apply problem-solving techniques and gain an understanding of the application of the courses USMT305

Unit No.	Units	No. of Lectures
1	Curve fitting	10
2	Numerical Integration	10
3	Numerical Solution of Linear System of Equations	10

Nomenclature : Practical-A based on USMT 405

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. solve problems on concepts from Numerical Methods I

Curriculum :

Unit No.	Title and Learning Points	
1	Curve fitting	**10 Lectures**
	1. Examples on Least square method of fitting a straight line and multiple linear equations 2. Examples on curve fitting of quadratic and cubic polynomials	
2	Numerical Integration	**10 Lectures**
	3. Examples on Trapezoidal and Simpson's 1/3 Rule 4. Examples on Simpson's 3/8 Rule	
3	Numerical Solution of Linear System of Equations	**10 Lectures**
	5. Examples on Dolittle LU Decomposition Method and Crout's Decomposition Method 6. Examples on Gauss Seidel Iterative Method 7. Miscellaneous theoretical questions based on full course USMT406	

Learning Resources Recommended :

1. All resources recommended for USMT305
2. USMT305 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Journal	10
Viva	05
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	05

B. Semester End Evaluation (Paper Pattern) (30 Marks-1 hour)

Comprehensive written examination of 1-hour duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3	Objective (18)
2	Descriptive on Unit 1,2,3	Descriptive (12)

Name of the Course	Computational Geometry
Course Code	USMT407
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Skill Enhancement Course
Highlight revision specific to employability/ entrepreneurship/ skill development	The aim of this course is to develop sketching skills of mathematical shapes, classify the quadratic equations and learn about shperes.

Unit No.	Units	No. of Lectures
1	Sketching Techniques	10
2	Classification of quadratic equations	10
3	Spheres	10

Nomenclature : Computational Geometry

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. Sketch parabola, ellipse, hyperbola and accordingly learn its properties
2. Classify quadratic equations
3. Geometry of spheres

Curriculum :

Unit No.	Title and Learning Points	
1	Sketching Techniques	**10 Lectures**
	1.1 Techniques for sketching parabola, ellipse and hyperbola 1.2 Reflection properties of parabola, ellipse and hyperbola	
2	Classification of quadratic equations	**10 Lectures**
	2.1 Classification of quadratic equations representing lines, parabola, ellipse and hyperbola.	
3	Spheres	**10 Lectures**
	3.1 Sphere. Plane section of a sphere. Sphere through a given circle. 3.2 Intersection of two spheres. 3.3 Radical plane. Radical line and Radical point in spheres.	

Learning Resources Recommended:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.
3. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Financial Mathematics
Course Code	USOEMT406
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Open Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	The aim of this course is to develop basic financial mathematics skills among learners like ratio, proportion, profit, loss, interest and annuity

Unit No.	Units	No. of Lectures
1	Ratio, Proportion	10
2	Profit and Loss	10
3	Computational Applications	10

Nomenclature : Financial Mathematics

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. Define concepts like ratio, proportion and solve problems on it.
2. Identify profit and loss in real life situations and solve the problems based on it.
3. Solve problems on amount and present value of an Annuity Immediate

Curriculum :

Unit No.	Title and Learning Points	
1	Ratio, Proportion	**10Lectures**
	1.1 Ratio – Definition, continued ratio, Inverse Ratio 1.2 Proportion – Continued proportion, Direct proportion, Inverse Proportion 1.3 Variation – Inverse Variation, Joint Variation	
2	Profit and Loss	**10Lectures**
	2.2 Profit and Loss: Terms and formulae, Trade discount, cash discount, problems involving cost price, selling price, trade discount, cash discount. 2.3 Introduction to Commission and Brokerage-Problems on Commission and Brokerage	
3	Computational Applications	**10Lectures**
	3.1 Use of Excel for computation of points in unit 1 and unit 2.	

Learning Resources Recommended:

1. Dr. R. S. Aggarwal; Quantitative Aptitude.
2. D.C. Sancheti and V.K.Kapoor; Business Mathematics; Sultan Chand and Sons
3. A.P. Verma; Business Mathematics; Asian Books Pvt. Ltd.

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name of the Course	Research Analyst in Stock Market
Course Code	USOEMT407
Class	S.Y.B.Sc.
Semester	IV
No. of Credits	2
Nature	Theory
Type	Open Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	After successful completion of this course learner will get knowledge about stock market and it will helpful to attempt the NISM certification Examination. After clearing this examination student can apply for a job in financial companies.

Unit No.	Units	No. of Lectures
1	Introduction	10
2	Terminologies	10
3	Analysis	10

Nomenclature : Research Analyst in Stock Market

Course Outcomes :

On successful completion of this course, a learner will be able to:

1. attempt Research Analyst NISM Certification exam.
2. learn basic concepts from stock market.
3. get knowledge about investment in stock market.

Curriculum :

Unit No.	Title and Learning Points	
1	Introduction	**10Lectures**
	1.1 Primary Role, Responsibilities, qualities of Research Analyst 1.2 Introduction to securities and securities market, Various market participants and activities	
2	Terminologies	**10Lectures**
	2.1 Terminology in equity and debt market, Types of bonds 2.2 Basics of stock market, corporate actions 2.3 Investing meaning, Fundamental and Technical Analysis	
3	Analysis	**10Lectures**
	3.1 Economic Analysis: Principles of Microeconomics, Macroeconomics, Trends 3.2 Industry Analysis: Defining industry, Industry Landscape 3.3 Company Analysis: Financial Analysis	

Learning Resources Recommended:

1. Workbook for NISM-Series-XV: Research Analyst Certification Examination

Evaluation Scheme :

A. Continuous Evaluation (20 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 10 marks / 3 Unit tests of 10 marks each and best one out of three will be considered)	10
Assignments / Seminar / Group discussion	05
Attendance and active participation in classroom	05

B. Semester End Evaluation (30 Marks - 1 Hour)

Comprehensive written examination of 1-hours duration will be conducted at the end of each semester to evaluate learner's understanding of the course material. The examination will cover the entire syllabus and include a mix of short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Unit 1	Short/Long Answers (10)
2	Unit 2	Short/Long Answers (10)
3	Unit 3	Short/Long Answers (10)

Name and Signature: Dr. Diwakar P. Karwanje
Chairman of BoS of Mathematics