R.E. Society's

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

Bachelor of Science (B.Sc.) Mathematics Programme

Three Year Integrated Programme

Six Semesters

Syllabus for Semester : V & VI

Under Choice Based Credit System (CBCS)

To be implemented from Academic Year- 2023-2024

Name of Programme	**B.Sc. Mathematics**
Level	UG
No of Semesters	06
Year of Implementation	**2023-24**
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	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.

Bachelor of Science (B.Sc) Mathematics Programme

Under Choice Based Credit System

Course Structure

T.Y.B.Sc.

(To be implemented from Academic Year- 2023-24)

Course Code	Semester V	Credits	Course Code	Semester VI	Credits
USMT501	Multivariable Calculus II	2.5	USMT601	Basic Complex Analysis	2.5
USMT502	Group Theory	2.5	USMT602	Ring Theory	2.5
USMT503	Mathematics Practical-1 Based on USMT501 & USMT502	3	USMT603	Mathematics Practical-3 Based on USMT601 & USMT602	3
USMT504	Topology of Metric Spaces	2.5	USMT604	Topology of Metric Spaces and Real Analysis	2.5
USMT505	Graph Theory	2.5	USMT605	Graph Theory-II and Combinatorics	2.5
USMT506	Mathematics Practical-2 Based on USMT504 & USMT505	3	USMT606	Mathematics Practical-4 Based on USMT604 & USMT605	3
USMT507	Computer Programming and System Analysis-I	2	USMT607	Computer Programming and System Analysis-II	2
USMT508	Applied Practical-1 Practical Based on USMT507	2	USMT608	Applied Practical-1 Practical Based on USMT607	2
Total Credits		20	Total Credits		20

Teaching Pattern :

1. Three lectures per week per course (Core Theory)
2. Three lectures per week per course (Core Practical)
3. Four lectures per week per course (Applied Theory)
4. Four lectures per batch per week per course (Applied Practical)

Revised Syllabus of Courses of
Bachelor of Science (B.Sc.) Mathematics Programme at Semester V
with Effect from the Academic Year 2023-2024

Course Code	Semester V	Credits
USMT501	Multivariable Calculus II	2.5
USMT502	Group Theory	2.5
USMT503	Mathematics Practical-1 Based on USMT501 & USMT502	3
USMT504	Topology of Metric Spaces	2.5
USMT505	Graph Theory	2.5
USMT506	Mathematics Practical-2 Based on USMT504 & USMT505	3
USMT507	Computer Programming and System Analysis-I	2
USMT508	Applied Practical-1 Practical Based on USMT507	2
Total Credits		20

Name of the Course	Multivariable Calculus II
Course Code	USMT501
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	

Unit No.	Units	No. of Lectures
1	Multiple Integrals	15
2	Line Integrals	15
3	Surface Integrals	15

Nomenclature : Multivariable Calculus II

Course Outcomes :

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

1. Learn the basic ideas, tools and techniques of integral calculus and use them to solve problems from real-life applications.
2. Examine vector fields and define and evaluate line integrals.

Curriculum :

Unit No.	Title and Learning Points	
1	Multiple Integrals	15 Lectures
	1.1 Double and Triple Integral, 1.2 Integrability of the sums, scalar multiples, products 1.3 Integrability of continuous functions	
2	Line Integrals	15 Lectures
	2.1 Review of Scalar and Vector fields on R^n 2.2 Basic Properties of Line Integrals 2.3 Applications to evaluation of line integrals	
3	Surface Integrals	15 Lectures
	3.1 Curl and Divergence of a vector field 3.2 Stoke's Theorem 3.3 Gauss' Divergence Theorem	

Learning Resources Recommended :

1. Apostol, Calculus, Vol. 2, Second Ed., John Wiley, New York, 1969 Section 1.1 to 1.8
2. James Stewart, Calculus with Early Transcendental Functions-Section 16.5 to 16.9
3. Marsden and Jerrold E. Tromba, Vector Calculus, Fourth Ed., W.H. Freeman and Co., New York, 1996 Section 6.2 to 6.4

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Group Theory
Course Code	USMT502
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course gives introduction to group theory, one of the most important topic from Abstract Algebra with rigor and prepares students to study further courses in Abstract Algebra and related fields.

Unit No.	Units	No. of Lectures
1	Groups and Subgroups	15
2	Normal subgroups	15
3	Cyclic Groups and Cyclic Subgroups	15

Nomenclature : Group Theory

Course Outcomes :

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

1. demonstrate knowledge of important mathematical concepts in abstract algebra such as definition of a Group order of a finite group and order of an element.
2. explain the significance of the notion of cosets, normal subgroups.
3. identify cyclic group.

Curriculum :

Unit No.	Title and Learning Points
1	Groups and Subgroups 15 Lectures
	1.1 Definition and elementary properties of a group. Order of a group. Subgroups. Criterion for a subset to be a subgroup. Abelian groups. Center of a group. Homomorphisms and isomorphisms. 1.2 Examples of Groups 1.3 Order of an Element, Subgroup generated by a subset of the group.
2	Normal Subgroups 15 Lectures
	2.1 Cosets of a Subgroup in a Group 2.2 Normal Subgroups 2.3 External direct products of groups, Examples 2.4 Cayley's Theorem for finite Groups.
3	Cyclic Groups and Cyclic Subgroups 15 Lectures
	3.1 Properties, Examples of Cyclic Groups and Cyclic Subgroups. 3.2 Finite Cyclic groups, infinite Cyclic groups and their generators, Properties of generators 3.3 The group Z/nZ of residue classes (mod n). Characterization of Cyclic Groups (as being isomorphic to Z or Z/nZ for some n in N)

Learning Resources Recommended :

1. Israel Herstein; Topics in Algebra; Second Edition, Wiley Eastern Limited.
2. P. B. Bhattacharya, S.K. Jain, S. Nagpaul; Abstract Algebra; Second Edition, Foundation Books, New Delhi, 1995.
3. N. S. Gopalkrishnan, University Algebra, Wiley Eastern Limited.
4. Michael Artin; Algebra; Prentice Hall of India, New Delhi.
5. John Fraleigh; A First Course in Abstract Algebra; Third Edition, Narosa, New Delhi.
6. Joseph Gallian; Contemporary Abstract Algebra; Narosa, New Delhi.

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Mathematics Practical-1
Course Code	USMT503
Class	T.Y.B.Sc.
Semester	V
No. of Credits	3
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 USMT501 and USMT502

Unit No.	Units	No. of Lectures
1	Multiple Integrals	15
2	Line Integrals	15
3	Surface Integrals	15
4	Groups and Subgroups	15
5	Normal Subgroups	15
6	Cyclic Groups and Cyclic Subgroups	15

Nomenclature : Mathematics Practical-1

Course Outcomes :

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

1. solve problems on concepts from Multivariable Calculus.
2. solve problems on concepts from Group Theory.

Curriculum :

Unit No.	Title and Learning Points	
1,2,3	Multiple Integrals, Line Integrals, Surface Integrals	45 Lectures
	1. Evaluation of double and triple integrals 2. Change of variables in double and triple integrals and applications 3. Line Integrals of scalar and vector fields 4. Green's theorem, conservative field and applications 5. Evaluation of surface integrals 6. Stoke's and Gauss divergence theorem 7. Miscellaneous theory questions on unit 1,2,3.	
4,5,6	Groups and Subgroups, Normal Subgroups, Cyclic Groups and Cyclic Subgroups	45 Lectures
	1. Examples of groups and groups of symmetries of equilateral triangle, square and rectangle. 2. Examples of determining centers of different groups. Examples of subgroups of various groups and orders of elements in a group. 3. Left and Right cosets of a group and Lagrange's Theorem 4. Normal subgroups and quotient groups. Direct products of groups. 5. Finite cyclic groups and their generators 6. Infinite cyclic groups and their generators 7. Miscellaneous Theory Questions on unit 4,5,6.	

Learning Resources Recommended :

1. All resources recommended for USMT501 and USMT502
2. USMT501 Practical Question Bank Designed by Department of Mathematics, GJC
3. USMT502 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of USMT501	18
2	Objective on Unit 1,2,3 of USMT502	18
3	Descriptive on Unit 1,2,3 of USMT501	12
4	Descriptive on Unit 1,2,3 of USMT502	12

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Name of the Course	Topology of Metric Spaces
Course Code	USMT504
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	Metrics Space is the base of Real Analysis. This course develops basic skills of learning Mathematics at Undergraduate level.

Unit No.	Units	No. of Lectures
1	Metrics Spaces	15
2	Sequences and Complete Metric Spaces	15
3	Compact Spaces	15

Nomenclature : Topology of Metric Spaces

Course Outcomes :

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

1. solve the problems on Metric Spaces, open sets.
2. Understand the idea of sequences and Complete metric space, Compact Metric Space
3. know the foundation to advanced courses in Analysis.

Curriculum :

Unit No.	Title and Learning Points	
1	Metric Spaces	15 Lectures
	1.1 Definition and examples of metric spaces 1.2 Open balls and open sets in a metric space 1.3 Limit Point	
2	Sequences and Complete Metric Space	15 Lectures
	2.1 Sequences in a metric space 2.2 Convergent sequence 2.3 Cauchy sequence 2.4 Complete metric space	
3	Compact Spaces	15 Lectures
	3.1 Compact Metric Space using open cover 3.2 Properties of Compact Sets	

Learning Resources Recommended :

1. S. Kumaresan; Topology of Metric Spaces
2. E. T. Copson; Metric Spaces; Universal Book Stall, New Delhi, 1996.
3. P. K. Jain, K. Ahmed; Metric Spaces; Narosa, New Delhi, 1996

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Graph Theory-I
Course Code	USMT505
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2.5
Nature	Theory
Type	Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	This course contains the concepts of Graph Theory which are used for Research in Mathematics. With this, learner can create useful Mathematical Models for society.

Unit No.	Units	No. of Lectures
1	Basics of Graphs	15
2	Trees	15
3	Eulerian and Hamiltonian Graphs	15

Nomenclature : Graph Theory-I

Course Outcomes :

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

1. demonstrate the knowledge of fundamental concepts in Graph Theory, including properties and characterization of graphs and trees.
2. solve problems based on various algorithms
3. understand the concept of Eulerian graphs and Hamiltonian graphs.
4. describe real-world applications of Graph Theory.

Curriculum :

Unit No.	Title and Learning Points
1	Basics of Graphs 15 Lectures
	1.1 Definition of Graph, Types of Graphs, Basic Terminologies- Degree of vertex 1.2 Walk, Trail, Circuit, Path, Cycle, Isomorphism of Graphs, Handshaking Lemma 1.3 Self-Complementary Graphs, Connected, Disconnected, Connected Components 1.4 Bipartite Graph and Results, Degree sequence, Havel-Hakimi Algorithm, Adjacency Matrix, Incidence Matrix and results 1.5 Shortest Path Problems, Dijkstra's Theorem
2	Trees 15 Lectures
	2.1 Definition of Tree - Characterization, Cut Vertex, Cut Edge, its results, 2.2 Rooted Trees, Binary Trees, Traversing Tree, Spanning Trees, Recurrence Relation of Spanning trees 2.3 Minium Spanning Tree, Kruskal's, Prim's Algorithms 2.4 Prufer Sequence, Cayley's Formula, 2.5 Huffman Coding, Huffman Algorithm
3	Eulerian and Hamiltonian Graphs 15 Lectures
	3.1 Line Graphs, Hypercube Graphs and results 3.2 Eulerian Graphs - Characterization, Fleury's Algorithm, Chinese Postman Problem 3.3 Hamiltonian Graph - Characterization, Dirac's Theorem, Ore's Theorem 3.4 Hamiltonian Closure, Eulerian and Hamiltonian Nature of Line & Hypercube graph

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Learning Resources Recommended :

1. Bondy and Murty; Graph Theory with Applications
2. Balkrishnan and Ranganathan; Graph Theory and Applications
3. Douglas B. West; Introduction to Graph Theory, 2nd Ed., Pearson, 2000
4. Behzad and Chartrand; Graph Theory

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Mathematics Practical-2
Course Code	USMT506
Class	T.Y.B.Sc.
Semester	V
No. of Credits	3
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 USMT504 and USMT505

Unit No.	Units	No. of Lectures
1	Metrics Spaces	15
2	Sequences and Complete Metric Spaces	15
3	Compact Spaces	15
4	Basics of Graphs	15
5	Trees	15
6	Eulerian and Hamiltonian Graphs	15

Nomenclature : Mathematics Practical-2

Course Outcomes :

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

1. solve problems on concepts from Topology of Metric Spaces.
2. solve problems on concepts from Graph Theory.

Curriculum :

Unit No.	Title and Learning Points
1,2,3	Metrics Spaces, Sequences and Complete Metric Spaces, Compact Spaces 45 Lectures
	1. Examples of Metric Spaces, Normed Linear Spaces 2. Sketching of Open Balls in R^2, Open and Closed sets, Equivalent Metrics 3. Subspaces, Interior Points, Limit Points, Dense Sets and Separability, Diameter of a set, Closure 4. Limit Points, Sequences, Bounded, Convergent and Cauchy Sequences in a Metric Space 5. Complete Metric Spaces and Applications 6. Examples of Compact Sets 7. Miscellaneous theory questions on unit 1,2,3.
4,5,6	Basics of Graphs, Trees, Eulerian and Hamiltonian Graphs 45 Lectures
	1. Handshaking Lemma and Isomorphism 2. Degree sequence and Dijkstra's Algorithm 3. Trees, Cayley Formula 4. Applications of Trees 5. Eulerian Graphs 6. Hamiltonian Graphs 7. Miscellaneous Theory Questions on unit 4,5,6.

Learning Resources Recommended :

1. All resources recommended for USMT503 and USMT504
2. USMT503 Practical Question Bank Designed by Department of Mathematics, GJC
3. USMT504 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of USMT504	18
2	Objective on Unit 1,2,3 of USMT505	18
3	Descriptive on Unit 1,2,3 of USMT504	12
4	Descriptive on Unit 1,2,3 of SMT505	12

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Name of the Course	Computer Programming and System Analysis-I
Course Code	USMT507
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2
Nature	Theory
Type	Compulsory
Highlight revision specific to employability/ entrepreneurship/ skill development	After learning this course learners can create databases, write programs. Learners can get jobs in IT industries also jobs with profile Database administrator.

Unit No.	Units	No. of Lectures
1	Relational Database Management System	15
2	Introduction to PL/SQL	15
3	Introduction to JAVA Programming	15
4	Inheritance, Exception Handling	15

Nomenclature : Computer Programming and System Analysis-I

Course Outcomes :

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

1. understand knowledge of the processes of Database Development and Administration using SQL and PL/SQL.
2. adopt Programming and Software Engineering skills and techniques using SQL and PL/SQL.
3. write programs using PL/SQL Blocks.
4. use an integrated development environment to write, compile, run and test simple object-oriented JAVA programs.
5. Read and make elementary modifications to JAVA programs that solve real-world problems.

Curriculum :

Unit No.	Title and Learning Points
1	Relational Database Management System 15 Lectures
	1.1 Introduction to database concepts-Overview of DBMS, Database Definition Languages, Data Manipulation Languages 1.2 Entity Relation Model-Entity, Attributes, Designing ER Diagrams, Integrity Constraints, Conversion of ER to Relations 1.3 Creating & Altering Tables, Handling data using SQL, In-Built Functions-Numeric, String, Date and Time, Joining tables-Inner Join, Outer Cross Joins, Union
2	Introduction to PL/SQL 15 Lectures
	2.1 Fundamentals of PL/SQL-Defining Variables, Constants, Expressions, Operators, Conditional Statements 2.2 PL/SQL Data Types-Number, Character, Boolean, Date and Time 2.3 PL/SQL Control Structures-Conditional and CASE Statements-IF-THEN, IF-THEN-ELSE, IF-THEN-ELSIF, 2.4 Iterative Control-LOOP, EXIT Statement, WHILE, FOR, Sequential Control-GOTO and NULL Statements
3	Introduction to JAVA Programming 15 Lectures
	3.1 Object Oriented Approach- Features of object-orientations: Abstraction, Inheritance, Encapsulation and Polymorphism 3.2 Introduction to JAVA-History of Java features, different types of Java programs, Java Virtual Machine 3.3 JAVA Basics-Variables, Data Types, Keywords, Type Conversion, Operators, Loop and Controls 3.4 Classes- Defining a class, creating instance and class members, Calling Methods, Method Overloading, Constructor, This Keyword 3.5 Arrays- one and two-dimensional array, declaring array variables, creating array objects, accessing array elements 3.6 Access Control- public access, friendly access, protected access, private access

4	Inheritance, Exception Handling 15 Lectures
	4.1 Inheritance-Types of Inheritance, Keywords-Extends, Super, Method Overriding, Final and Abstract Class, Concept of interface 4.2 Exception Handling and Packages-Need for Exception Handling, Techniques- try and catch, multiple catch statements, finally block, us age of throw and throws, Concept of packages, Inter Class Method-ParseInt()

Learning Resources Recommended :

1. Database Management System, RamKrishnam, Gehrke, McGraw-Hill
2. Ivan Bayross, "SQL,PL/SQL-The Programming Languages of Oracle" B.P.B Publications, 3rd Revised Edition
3. C. J. Date, Longman, "Introduction Database System", Pearson Education
4. Programming with JAVA: A Primer 4th Edition by E. Balagurusamy, Tata McGraw Hill
5. JAVA The Complete Reference, 8th Edition, Herbert Schildt, Tata McGraw Hill

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Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I	15
2	II	15
3	III	15
4	IV	15

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Name of the Course	Applied Practical-1
Course Code	USMT508
Class	T.Y.B.Sc.
Semester	V
No. of Credits	2
Nature	Practical
Type	Compulsory
Highlight revision specific to employability/ entrepreneurship/ skill development	After learning this course learners can create databases, write programs. Learners can get jobs in IT industries also jobs with profile Database administrator.

Unit No.	Units	No. of Lectures
1	Relational Database Management System	15
2	Introduction to PL/SQL	15
3	Introduction to JAVA Programming	15
4	Inheritance, Exception Handling	15

Nomenclature : Applied Practical-1

Course Outcomes :

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

1. create database, retrieve and delete data using SQL.
2. write, run programs using PL/SQL Blocks.
3. write, compile, run programs using JAVA.

Curriculum :

Unit No.	Title and Learning Points
1,2	Relational Database Management System, Introduction to PL/SQL 45 ectures
	1. Creating a single table with/without constraints and executing queries. Queries containing aggregate, string and date functions fired on a single table. 2. Updating tables, altering table structure and deleting table. Creating and altering a single table and executing queries. Joining tables and processing queries. 3. Write PL/SQL Blocks with basic programming constructs. 4. Write PL/SQL Blocks with control structures.
3,4	Introduction to JAVA Programming, Inheritance, Exception Handling 45 Lectures
	5. Write JAVA program to create a JAVA class : a) Without instance variables and Methods, b) With instance variables and without methods, c) Without instance variables and with methods d) With instance variables and with methods. 6. Write a JAVA program to illustrate the concepts of one, two dimensional arrays. 7. Write a JAVA program to illustrate the concepts of JAVA Class that includes a) Constructor with and without parameters b) Overloading Methods 8. Write a JAVA program to demonstrate inheritance by creating suitable classes 9. Write a JAVA program that illustrates the error handling using exception handling.

Learning Resources Recommended :

1. All resources recommended for USMT507

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	1 Program on Unit 1	15
2	1 Program on Unit 2	15
3	1 Program on Unit 3	15
4	1 Program on Unit 4	15

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Revised Syllabus of Courses of
Bachelor of Science (B.Sc.) Mathematics Programme at Semester VI
with Effect from the Academic Year 2023-2024

CourseCode	Semester VI	Credits
USMT601	Basic Complex Analysis	2.5
USMT602	Ring Theory	2.5
USMT603	Mathematics Practical-3 Based on USMT601 and USMT602	3
USMT604	Topology of Metric Spaces and Real Analysis	2.5
USMT605	Graph Theory and Combinatorics	2.5
USMT606	Mathematics Practical-4 Practical Based on USMT604 and USMT605	3
USMT607	Computer Programming and System Analysis-II	2
USMT608	Applied Practical-2 Based on USMT607	2
Total Credits		20

Name of the Course	Basic Complex Analysis
Course Code	USMT601
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	

Unit No.	Units	No. of Lectures
1	Introduction to Complex Analysis	15
2	Cauchy Integral Formula	15
3	Power Series and Singularities	15

Nomenclature : Basic Complex Analysis

Course Outcomes :

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

1. analyze sequences and series of analytic functions and types of convergence.
2. evaluate complex contour integrals directly and by the fundamental theorem.
3. represent functions as Taylor, Power and Laurent Series.

Curriculum :

Unit No.	Title and Learning Points	
1	Introduction to Complex Analysis	15 Lectures
	1.1 Review of Complex Numbers 1.2 Convergence of sequences of complex numbers and related results 1.3 Cauchy-Riemann Equations, Sufficient conditions for differentiability, analytic function	
2	Cauchy Integral Formula	15 Lectures
	2.1 Cauchy Integral Formula 2.2 Taylor's Theorem for analytic function 2.3 Mobius Transformations	
3	Power Series and Singularities	15 Lectures
	3.1 Power Series of complex numbers and related results 3.2 Laurent Series 3.3 Singularity, Poles Calculation of residue	

Learning Resources Recommended :

1. J. W. Brown and R. V. Churchill, Complex Analysis and Applications: Sections 18 to 25, 28, 33,34,47,48,53,54,55, Chapter 5, Section 65,66,71 and 72
2. Robert E. Greene and Steven G. Krantz, Function theory of one complex variable
3. T. W. Gamelin, Complex Analysis

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Ring Theory
Course Code	USMT602
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course gives introduction to Ring Theory which is an extension of Group Theory, wide areas of current research in Mathematics, Computer Science and Mathematical/Theoretical Physics. They have many applications to the study of geometric objects, to topology and in many cases their links to other branches of Algebra are quite well understood.

Unit No.	Units	No. of Lectures
1	Rings	15
2	Ideals and Special Rings	15
3	Factorization	15

Nomenclature : Ring Theory

Course Outcomes :

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

1. define fundamental concepts of rings, fields, subrings, integral domains with suitable examples
2. describe polynomial rings, Euclidean domain, Principal ideal domain and unique factorization domain and their relationship.
3. check reducibility of a polynomial by applying various related results.

Curriculum :

Unit No.	Title and Learning Points
1	Rings 15 Lectures
	1.1 Definition and elementary properties of rings, commutative rings, integral domains and fields with examples 1.2 Units in a ring, description of the units in Z/nZ 1.3 Characteristic of a ring and examples
2	Ideals and Special Rings 15 Lectures
	2.1 Ideals in a ring, Sums and products of ideals. Quotient rings 2.2 Homomorphisms and Isomorphisms of rings. Kernel and the image of a homomorphism 2.3 Notions of Euclidean domain(ED), Principal ideal domain(PID)
3	Factorization 15 Lectures
	3.1 Divisibility in a ring. Irreducible and prime elements. Examples. 3.2 Division algorithm in F[X] (Where F is a field) MonicPolynomials, greatest common divisor of f(x), g(x) in f[X] (not both 0) 3.3 Irreducible polynomial in F[X] 3.4 Notion of unique factorization domain (UFD). Elementary properties. Relation between the three notions (ED ---> PID → UFD)

Learning Resources Recommended :

1. Israel Herstein; Topics in Algebra; 2nd Edition, Wiley Limited, 2nd Edition
2. P.B. Bhattacharya, S. K. Jain and S. R. Nagpaul; Abstract Algebra; 2nd Ed. Foundation books, New Delhi, 1995
3. N. S. Gopalakrishnan; University Algebra; Wiley Eastern Limited
4. Michael Artin; Algebra; Prentice Hall of India, New Delhi
5. John B. Fraleigh; A First Course in Abstract Algebra; 3rd Edition, Narosa
6. Joseph A. Gallian; Contemporary Abstract Algebra; Narosa, New Delhi.

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Mathematics Practical-3
Course Code	USMT603
Class	T.Y.B.Sc.
Semester	V
No. of Credits	3
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 USMT601 and USMT602

Unit No.	Units	No. of Lectures
1	Introduction to Complex Analysis	15
2	Cauchy Integral Formula	15
3	Power Series and Singularities	15
4	Rings	15
5	Ideals and Special Rings	15
6	Factorization	15

Nomenclature : Mathematics Practical-3

Course Outcomes :

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

1. solve problems on concepts from Basic Complex Analysis.
2. solve problems on concepts from Ring Theory.

Curriculum :

Unit No.	Title and Learning Points	
1,2,3	Introduction to Complex Analysis, Cauchy Integral Formula, Power Series and Singularities	45 Lectures
	1. Limits continuity and derivatives of functions of complex variable 2. Stereographic Projection, Analytic Function, finding harmonic conjugate 3. Contour Integral, Cauchy Integral Formula, Mobius Transformations 4. Taylor's Theorem, Exponential, Trigonometric, Hyperbolic Functions 5. Power Series, Radius of Convergence, Laurents Series 6. Finding Isolated Singularities, Removable, Pole and Essential, Cauchy Residue Theorem 7. Miscellaneous theory questions on unit 1,2,3.	
4,5,6	Rings, Ideals and Special Rings, Factorization	45 Lectures
	1. Examples of rings(Commutative and Non-Commutative) Integral Domains and fields 2. Units in various Rings, Determining characteristics of rings 3. Prime Ideals and Maximal Ideals, Examples on various Rings 4. Euclidean domains and principal ideal domains (Examples) 5. Examples of irreducible and prime elements 6. Applications of division algorithm and Eisenstein's Criterion 7. Miscellaneous Theory Questions on unit 4,5,6.	

Learning Resources Recommended :

1. All resources recommended for USMT601 and USMT602
2. UMAT05CR18 Practical Question Bank Designed by Department of Mathematics, GJC
3. UMAT05EL19 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of USMT601	18
2	Objective on Unit 1,2,3 of USMT602	18
3	Descriptive on Unit 1,2,3 of USMT601	12
4	Descriptive on Unit 1,2,3 of USMT602	12

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Name of the Course	Topology of Metric Spaces and Real Analysis
Course Code	USMT604
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2.5
Nature	Theory
Type	Core
Highlight revision specific to employability/ entrepreneurship/ skill development	This course deals with the metric spaces and real analysis. It is useful in understanding basic Mathematical concepts of a learner and further applying that to learn higher Mathematics.

Unit No.	Units	No. of Lectures
1	Continuous Functions on Metric Spaces	15
2	Connected Spaces	15
3	Sequence and Series of functions	15

Nomenclature : Topology of Metric Spaces and Real Analysis

Course Outcomes :

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

1. understand the idea of continuous functions, connected spaces, sequence and series of functions
2. solve problems based on sequence and series of functions
3. explain their reasoning about analysis with clarity and rigor.

Curriculum :

Unit No.	Title and Learning Points	
1	Continuous functions on metric spaces	15 Lectures
	1.1 Definition of Continuity of a function 1.2 Continuity at a point in terms of Sequences, open sets and closed sets and examples 1.3 Uniform Continuity	
2	Connected Spaces	15 Lectures
	2.1 Separated Sets 2.2 Connected and Disconnected Metric Spaces 2.3 Path Connectedness	
3	Sequence and Series of Functions	15 Lectures
	3.1 Sequence of functions 3.2 Properties of Uniform Convergence 3.3 Power Series	

Learning Resources Recommended :

1. R. R. Goldberg; Methods of Real Analysis; Oxford and International Book House (IBH) Publishers, New Delhi
2. S. Kumaresan; Topology of Metric Spaces
3. E. T. Copson; Metric Spaces Universal Book Stall, New Delhi, 1996
4. Robert Bartle and Donald R. Sherbert; Introduction to Real Analysis; Second Edition, John Wiley and Sons

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Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Graph Theory-II and Combinatorics
Course Code	USMT605
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2.5
Nature	Theory
Type	Elective
Highlight revision specific to employability/ entrepreneurship/ skill development	This course contains the concepts of Graph Theory which are used for Research in Mathematics. With this, learner can create useful Mathematical models for society.

Unit No.	Units	No. of Lectures
1	Coloring of Graph	15
2	Planar Graph and Flow Theory	15
3	Combinatorics	15

Nomenclature : Graph Theory-II and Combinatorics

Course Outcomes :

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

1. learn and apply the basic concepts of Graph Theory, including coloring of graph, to find chromatic number and chromatic polynomials for graphs.
2. learn concept of vertex connectivity, edge connectivity in graphs.
3. derive some properties of planarity
4. solve problems based on Inclusion-Exclusion Principle, Generating function, System of Distinct Representatives, Rook Polynomials.

Curriculum :

Unit No.	Title and Learning Points
1	Coloring of Graphs 15 ectures
	1.1 Vertex Coloring, Vertex Chromatic Number, Upper and lower bound of chromatic number, Statement of Brook's Theorem, Edge coloring, Edge chromatic number/Chromatic Index, Statement of Vizing Theorem 1.2 Chromatic Polynomial of graphs, Recurrence relation of chromatic polynomials 1.3 Vertex and Edge connectivity and relation between them, Results 1.4 Whitney's Theorem on 2-vertex connected graphs
2	Planar Graph and Flow Theory 15 Lectures
	2.1 Definition of Planar Graph, Euler formula and its consequences, Non Planarity of K_5, $K_{3,3}$, Dual of a graph, 5 Color Theorem and statement of 4 Color Theorem 2.2 Polyhedron in R^3 and Existence of exactly 5 regular polyhedon 2.3 Transport Network, Flow, Value of the flow Cut in Network and Capacity of Cut in network, Relation between flow and cut Ford and Fulkerson Algorithm
3	Factorization 15 Lectures
	3.1 Applications of Inclusion-Exclusion Principle, Forbidden Position Problems 3.2 Generating Functions, Solving Recurrence Relation, System of Distinct Representatives, Hall's Theorem 3.3 Rook Polynomial

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Learning Resources Recommended :

1. Bondy and Murty; Graph Theory with Applications
2. Balkrishnan and Ranganathan; Graph Theory and Applications
3. Douglas B. West, Introduction to Graph Theory, 2nd Ed., Pearson, 2000
4. Richard Brualdi; Introduction to Combinatorics

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I II III	05 05 05
2	I	15
3	II	15
4	III	15

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Name of the Course	Mathematics Practical-4
Course Code	USMT606
Class	T.Y.B.Sc.
Semester	V
No. of Credits	3
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 USMT604 and USMT605

Unit No.	Units	No. of Lectures
1	Continuous Functions on Metric Spaces	15
2	Connected Spaces	15
3	Sequence and Series of Functions	15
4	Coloring of Graphs	15
5	Planar Graph and Flow Theory	15
6	Combinatorics	15

Nomenclature : Mathematics Practical-4

Course Outcomes :

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

1. solve problems on concepts from Topology of Metric Spaces and Real Analysis
2. solve problems on concepts from Graph Theory-II and Combinatorics

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Curriculum :

Unit No.	Title and Learning Points	
1,2,3	Continuous Functions on Metric Spaces, Connected Spaces, Sequence and Series of Functions	45 Lectures
	1. Continuity in a Metric Spaces 2. Uniform Continuity, Contraction Maps, Fixed Point theorem 3. Connected Sets, Connected Metric Spaces 4. Path Connectedness, Convex sets, Continuity and Connectedness 5. Pointwise and uniform convergence of sequence functions, properties 6. Pointwise and uniform convergence of series of functions and properties 7. Miscellaneous theory questions on unit 1,2,3.	
4,5,6	Coloring of Graphs, Planar Graph and Flow Theory, Combinatorics	45 Lectures
	1. Coloring of Graphs 2. Chromatic Polynomials and connectivity 3. Planar Graphs 4. Flow Theory 5. Application of Inclusion-Exclusion Principle, Rook Polynomial, Recurrence Relation 6. Generating Function and SDR 7. Miscellaneous Theory Questions on unit 4,5,6.	

Learning Resources Recommended :

1. All resources recommended for USMT604 and USMT605
2. USMT604 Practical Question Bank Designed by Department of Mathematics, GJC
3. USMT605 Practical Question Bank Designed by Department of Mathematics, GJC

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	Objective on Unit 1,2,3 of USMT604	18
2	Objective on Unit 1,2,3 of USMT605	18
3	Descriptive on Unit 1,2,3 of USMT604	12
4	Descriptive on Unit 1,2,3 of USMT605	12

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Name of the Course	Computer Programming and System Analysis-II
Course Code	USMT607
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2
Nature	Theory
Type	Compulsory
Highlight revision specific to employability/ entrepreneurship/ skill development	After learning this course learners can create databases, write programs. Learners can get jobs in IT industries also jobs with profile Database administrator.

Unit No.	Units	No. of Lectures
1	JAVA Graphics Programming	15
2	Python 3.x	15
3	Data Types	15
4	Doing Math with Python	15

Nomenclature : Computer Programming and System Analysis-II

Course Outcomes :

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

1. design event driven GUI and web related applications which mimic the real-world scenarios
2. set up Python to develop simple applications using strings, list, tuple, dictionary
3. extend the knowledge of Python programming to solve Mathematical problems

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Curriculum :

Unit No.	Title and Learning Points	
1	JAVA Graphics Programming	15 Lectures
	1.1 Applets-Difference of applet and application, creating applets, applet life cycle 1.2 Graphics, Fonts and Color-Graphics class, drawing graphical figures, Font class, Working with colors-color methods 1.3 AWT Package-Containers-Frame and Dialog classes, components-Label, Button, Checkbox, Text Field, Text Area	
2	Python 3.x	15 Lectures
	2.1 Introduction-Python Programming Language, History, Features, Installing Python, IDLE, running a Python Script, Errors, Debugging 2.2 Data Types and Expression-Variables, Comments, Docstrings, Data Types, Arithmetic Expressions, Type conversion 2.3 Loops --For, While loop, Operators and expressions, Conditional statements-If, if-else, if-elif-else, nested if, Break statement, Random Numbers	
3	Data Types	15 Lectures
	3.1 Strings, List, Dictionary-indexing, slicing, replacing. in operator, String methods, Basic operations, List membership, Dictionary methods, Traversing a dictionary 3.2 Design with functions-Defining simple functions, parameters and arguments, return statement, Boolean functions, Recursive functions, Exception Handling-try-except	
4	Doing Math with Python	15 Lectures
	4.1 Working with numbers-Factors of integer, Generating multiplication table, Roots 4.2 SymPy Library Functions-Symbol, Simplify, Simpify, solve, Substiture, Plot	

Learning Resources Recommended :

1. Java The Complete Reference, 8th Edition, Herbert Schildt, Tata McGraw Hill
2. Fundamentals of Python First programs 2nd edition-Kenneth A Lambert, Cengage Learning India
3. Doing Math with Python; Amit Saha, No starch Press

Evaluation Scheme :

A. Continuous Evaluation (40 Marks)

Method	Marks
Unit Test - (MCQ / Descriptive - Based on Theory and/or Problems - Online/Offline – 1 Unit test of 20 marks / 2 Unit tests of 10 marks each / 3 Unit tests of 10 marks each and best two out of three will be considered)	20
Assignments / Seminar / Group discussion	10
Attendance and active participation in classroom	10

B. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions, short answer questions and descriptive type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	I	15
2	II	15
3	III	15
4	IV	15

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Name of the Course	Applied Practical-2
Course Code	USMT608
Class	T.Y.B.Sc.
Semester	VI
No. of Credits	2
Nature	Practical
Type	Compulsory
Highlight revision specific to employability/ entrepreneurship/ skill development	After learning this course learners can create databases, write programs. Learners can get jobs in IT industries also jobs with profile Database administrator.

Unit No.	Units	No. of Lectures
1	JAVA Graphics Programming	15
2	Python 3.x	15
3	Data Types	15
4	Doing Math with Python	15

Nomenclature : Applied Practical-2

Course Outcomes :

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

1. create graphics using JAVA
2. write, compile, run programs using Python.
3. write, compile, run Mathematical programs using SymPy library

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Curriculum :

Unit No.	Title and Learning Points
1,2	JAVA Graphics Programming, Python 3.x 46 ectures
	1. Write a program to demonstrate the use of input from the user using parseInt() 2. Write a JAVA applet to demonstrate graphics, Font and Color classes 3. Write a JAVA program to illustrate AWT package 4. Write simple Python programs 5. Write Python programs to demonstrate loops 6. Write Python programs to demonstrate selection statements
3,4	Strings, List and Dictionaries, Doing Math with Python 45 Lectures
	7. Write a Python program to demonstrate string, list methods 8. Write a Python program to demonstrate dictionary methods 9. Write Python programs to display Enhanced Multiplication Table Generator, Unit Converter, Fraction Calculator 10. Write Python programs for factor finder, Graphical Equation Solver 11. Write Python programs for summing a series, solving single-variable inequalities

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Learning Resources Recommended :

1. All resources recommended for USMT607

Evaluation Scheme :

C. Continuous Evaluation (40 Marks)

Method	Marks
Journal + Viva	30
Overall Performance (Attendance, Punctuality, Sincerity, Timely Submission)	10

D. Semester End Evaluation (60 Marks - 2 Hours)

Comprehensive written examination of 2-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 multiple-choice questions and descriptive (Problems) type questions.

Question Paper Pattern :

Question No.	Unit	Marks
1	1 Program on Unit 1	15
2	1 Program on Unit 2	15
3	1 Program on Unit 3	15
4	1 Program on Unit 4	15

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

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