(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (5)

Course Code	US05MAMTH01	Title of the Course	Real Analysis-1
Total Credits of the Course	4	Hours per Week	4 hours

Course Objectives:	1. To introduce fundamental properties of field of real numbers. 2. To provide set related fundamental concepts of real analysis. 3. To provide fundamentals of sequence and series.

Course Content		
Unit	Description	Weightage* (%)
1.	Algebraic Structure and Field Structure, Order Structure and Ordered Field, Bounded Sets, Supremum and Infimum of a Set, Completeness and Order Completeness in $\mathbb{R}$, Archimedean Property, Axioms of a Complete Ordered Field, Absolute Value and its Properties.	25%
2.	Neighbourhood of a point, Properties of neighbourhood, Interior Point and Interior of a Set, Limit Point of a Set, Bolzano-Weierstrass Theorem, Closed Sets, Closure of a Set.	25%
3.	Sequence and its Range, Bounded Sequences, Convergence of a Sequence, Limit Point of a Sequence, Bolzano-Weierstrass Theorem for Sequences, Limit Superior and Limit Inferior of a Sequence, Non-convergent Sequence, Cauchy's General Principle of Convergence, Cauchy Sequences, Algebra of Sequences, Monotonic Sequences.	25%
4	Infinite Series, A Necessary Condition for the Convergence, Cauchy's General Principle of Convergence, Some Preliminary Theorems, Positive Term Series, Comparison Tests for Positive Term Series, Cauchy's Root Test, D'Alembert Ratio Test, Integral Test, Alternating Series, Absolute Convergence.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand fundamental properties of the field of real numbers.
2.	understand set theoretic basics of real analysis.
3.	understand basics of sequences and series.
4.	acquire skills to apply the of concepts understood in solving relevant problem.

Suggested References:	
Sr. No.	References
1.	S. C. Malik, Principles of Real Analysis, Fifth Edition, New Age International, New Delhi, 2021.
2.	S. C. Malik and Savita Arora, Mathematical Analysis, Fifth Edition, New Age International, New Delhi, 2019.
3.	Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw-Hill, Inc, New Delhi, 2017.
4.	R. G. Bartle, D. R. Sherbert, Introduction to Real Analysis, Fourth Edition, Wiley India Pvt. Ltd., New Delhi, 2011.
5.	Gerald G. Bilodeau, Paul R. Thie, G. E. Keough, An Introduction to Analysis, 2nd Edition Jones and Barlett India Pvt. Ltd., 2009.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (5)

Course Code	US05MAMTH02	Title of the Course	Abstract Algebra
Total Credits of the Course	4	Hours per Week	4 hours

Course Objectives:	1. To introduce importance of the basic properties of groups. 2. To teach how to generate the group by giving specific conditions. 3. To introduce the fundamental concepts of ring theory such as ideals, quotient rings, integral domains and fields.

Course Content		
Unit	Description	Weightage* (%)
1.	Binary Operations, Semi group, Group, Finite Group, Infinite Group, Cancellation laws, Subgroups, Operations on Subgroups (Union and Intersection), Centre of the Group, Abelian Groups, Order of Elements, Cyclic Group, Generators of Cyclic Group, Laws of Exponents.	25%
2.	Cosets of Subgroup, Lagrange's Theorem, Index of Subgroup, Normal Subgroup, Euler's Theorem, Fermat's Theorem, Isomorphism, Isomorphic Groups, Automorphism, Inner Automorphism.	25%
3.	Rings, Properties of Ring, Zero Divisor, Integral Domains, Field, Ring, Isomorphism, Ring Homomorphism, Kernel of Ring Homomorphism, Quotient Fields.	25%
4	Ideals for Ring, Proper Ideal, Quotient Rings, First Isomorphism Theorem for Ring, Prime and Maximal Ideals, Factorization, Associate Elements, Irreducible Element, Prime Element, G.C.D.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand the fundamentals of groups and subgroups.
2.	develop an understanding of cosets, isomorphic groups, automorphism and homomorphism of groups.
3.	understand the fundamentals of rings and ideals.

Suggested References:	
Sr. No.	References
1.	N. S. Gopalkrishnan, University Algebra, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1994.
2.	I. N. Herstein, Topics in Algebra, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1975.
3.	Joseph A. Gallian, Contemporary Abstract Algebra, Ninth Edition, Narosa Publication House, New Delhi, 2017.
4.	AshaRani Singal, Algebra, R. Chand & Co., New Delhi, 2010.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MAMTH03	Title of the Course	Mathematical Algorithms with Python-1
Total Credits of the Course	4	Hours per Week	08 hours

Course Objectives:	1. To give introductory knowledge of programming using python. 2. To develop an understanding of expressions, conditional statements, built-in data structures and loops in python. 3. To equip students with basic programming skills for implementing mathematical algorithms, logical decision-making, and simple computational tasks.

Course Content		
PAYTHON		
Parts	Description	Weightage* (%)
Part-1	**Getting started with Python** Introduction to programming, Introduction to python, naming rules of variables, expressions, operator precedence rule, conditional statements: if statement, try/except statement, and its examples.	100% (50 Marks)
Part-2	**Python: Data Structures** Functions: Function definition and its usage, loops and iterations: for loop and while loop, strings, slicing strings, manipulating strings, lists, manipulating list, building list, comparison of lists and strings, dictionaries, tuples.	100% (50 Marks)

Teaching-Learning Methodology	Classroom teaching, Practical on Computers, Use of ICT whenever required.

Evaluation Pattern (In Each Part)		
Sr. No.	Details of the Evaluation	Weightage %
1.	Internal Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Practical Examination	50%

NOTE:

1. There would be a batch of problem-solving session will be of four hours per week and they will be conducted in batches of students of size 15 to 20 per batch.
2. The candidate shall have to produce at the time practical Examination the record of their prescribed Laboratory work, certified by the Head of the Department.

Course Outcomes: Having completed this course, the learner will be able to	
1.	expand their mathematical knowledge in the field of computer science.
2.	write python programs for mathematical problems.
3.	build a foundation for advanced topics like, numerical methods, data analysis and mathematical modelling.

Suggested References:	
Sr. No.	Suggested References:
1.	https://www.py4e.com/book
2.	Introduction to Computation and Programming Using Python by John V Guttag, Prentice Hal
3.	Python: The Complete Reference, by Martin C. Brown , McGraw Hill Education
On-line resources to be used as reference material	

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (5)

Course Code	US05MIMTH01	Title of the Course	Numerical Analysis-1
Total Credits of the Course	2	Hours per Week	2 hours

Course Objectives:	1. To introduce students Numerical Analysis and to apply where it can be useful. 2. To teach students various Numerical Methods for solving equations. 3. To teach students how to use Numerical Methods for solving certain problems in Calculus.

Course Content		
Unit	Description	Weightage* (%)
1.	Errors and Their Computations, A General Error Formula, Errors in a Series Approximation, Solution of Algebraic and Transcendental Equations: Bisection Method, Iteration Method, Aitken's Δ^2 process, Method of False Position, Newton – Raphson Method.	50%
2.	Interpolation: Finite Differences, Forward, Backward and Central Differences, Symbolic Relations of Operators, Detection of Errors by Using Difference Tables, Differences of Polynomials, Newton's Forward and Backward Formulae, Gauss Forward and Backward Formulae, Stirling's, Bessel's and Everett's Formulae.	50%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand various methods for approximating roots of equations.
2.	interpolate through a given set of data and to find an approximating value of the function.

Suggested References:	
Sr. No.	References
1.	S. S. Sastry, Introductory Methods of Numerical Analysis, 4th Ed., Prentice Hall of India, 2010. Chapter : 1(1.3,1.4,1.5), 2(2.1 to 2.6), 3(3.3.1, 3.3.2, 3.3.3, 3.6, 3.7)
2.	G. Sankar Rao, Numerical Analysis
3.	B. S. Grewal, Numerical Analysis, Khanna Publiication.
4.	M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age Int. Publisher, India 2007

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MIMTH02	Title of the Course	Problems and Exercises in Numerical Analysis-1
Total Credits of the Course	2	Hours per Week	4 hours

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Numerical Analysis.

Course Content

(NUMERICAL ANALYSIS)

Unit	Description	Weightage* (%)
1.	Inherent Errors and truncated errors; Errors in a series approximation. Solution of algebraic and transcendental equations: Bisection method,	10%
2.	Solution of algebraic and transcendental equations: Iteration method, Aitken's Δ^2 process, method of false position, Newton Raphson's method	10%
3.	Interpolation: Finite Differences, Forward, Backward and Central Differences, Symbolic Relations of Operators, Detection of Errors by Use of Difference Tables, Differences of a Polynomial.	10%
4.	Newton's Forward and Backward Formulae, Gauss Forward and Backward Formulae	10%
5.	Stirling's, Bessel's and Everett's Formula.	10%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Practical Examination	50%

NOTE:

1. There shall be a batch of problem solving session of four hours per week and they will be conducted in batches of students of size 15 to 20 per batch.
2. The candidate shall have to produce at the time practical Examination the record of their prescribed Laboratory work, certified by the Head of the Department.

Course Outcomes: Having completed this course, the learner will be able to	
1.	Find error in function and series.
2.	Numerically approximate root of an equation.
3.	Interpolate a given set of data to find an interpolating function.

Suggested References:	
Sr. No.	References
1.	S. S. Sastry, Introductory methods of Numerical analysis,4th Ed., Prentice hall of India,2010.
2.	G. Sankar Rao, Numerical analysis.
3.	B. S. Grewal, Numerical Analysis, Khanna Publication.
4.	M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International Publisher, India 2007.

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MIMTH03	Title of the Course	Ordinary Differential Equations-1
Total Credits of the Course	2	Hours per Week	2 hours

Course Objectives:	1. To teach Ordinary Differential Equations in more depth. 2. To make practice of solving Ordinary Differential Equations.

Course Content		
Unit	Description	Weightage* (%)
1.	Differential Equations. Exact Differential Equations, Integrating Factors, Differential Equations of the First Order and of Higher Degree, Differential Equation Solvable for p, for y and for x, Clairaut's Equation	50%
2.	Linear Differential Equations with Constant Coefficients, Complimentary Function and Particular Integral, Operators, Products of Operators, Determination of Complimentary Function, Inverse Operators, Determination of Particular Integral and Working rules for f(D)y=X where, $X = e^{mx}, \sin mx, \cos mx, x^m, e^{ax}V, xV$ (V is a function of x only). Homogeneous Linear Differential Equations.	50%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use ofICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	realize the importance of Ordinary Differential Equations
2.	solve the problems of Ordinary Differential Equations.

Suggested References:	
Sr. No.	References
1.	Shanti Narayan, Integral Calculus, 14th Edition, S. Chand & Company Ltd., New Delhi, 1996 Chapter: 11(11.8,11.9 Only), 12,14
2.	Zafar Ahsan, Differential Equations and Their Applications, 2nd Ed., Prentice – Hall of India Pvt. Ltd., New Delhi
3.	B. S. Grewal, Higher Engineering Mathematics, 35th Edition, Khanna Publications
4.	D J Karia, N Y Patel, B P Patel, M L Patel, Introduction to calculus and differential equations, Roopal Prakashan.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MIMTH04	Title of the Course	Problems and Exercises in Ordinary Differential Equations-1
Total Credits of the Course	2	Hours per Week	4 hours

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Ordinary Differential Equations.

Course Content		
ORDINARY DIFFERENTIAL EQUATIONS		
Unit	Description	Weightage* (%)
1.	Differential Equations, Exact Differential Equations; Integrating Factors.	10%
2.	Differential Equations of the First Order and of Higher Degree Differential Equation Solvable for p, for x and for y.	10%
3.	Clairaut's Equation, Linear Differential Equations with Constant Coefficients, Complimentary Function and Particular Integral,	10%
4.	Determination of Particular Integral and Working rules for f(D)y = X where X = e^{mx} , sinmx, cosmx, x^m	10%
5.	Determination of Particular Integral and Working rules for f(D)y = X, where X = $e^{ax}V$, xV (where V is a function of x only). Homogeneous Linear Differential Equations	10%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Practical Examination	50%

NOTE:

1. There shall be a batch of problem solving session of four hours per week and they will be conducted in batches of students of size 15 to 20 per batch.
2. The candidate shall have to produce at the time practical Examination the record of their prescribed Laboratory work, certified by the Head of the Department.

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize an Ordinary Differential Equation.
2.	solve Ordinary Differential Equations.
3.	apply knowledge of Ordinary Differential Equation to solve certain problems.

Suggested References:	
Sr. No.	References
1.	Shanti Narayan, Integral Calculus, 14th Edition, S. Chand & Company Ltd., New Delhi, 1996
2.	Zafar Ahsan, Differential Equations and Their Applications, 2nd Ed., Prentice – Hall of India Pvt. Ltd., New Delhi
3.	B. S. Grewal, Higher Engineering Mathematics, 35th Edition, Khanna Publications
4.	D J Karia, N Y Patel, B P Patel, M L Patel, Introduction to calculus and differential equations, Roopal Prakashan.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MIMTH05	Title of the Course	Partial Differential Equations-1
Total Credits of the Course	2	Hours per Week	2 hours

Course Objectives:	1. To teach Partial Differential Equations in more depth. 2. To make practice of solving Partial Differential Equations.

Course Content		
Unit	Description	Weightage* (%)
1.	Surfaces and Curves in Three Dimensions, Methods of solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$, Orthogonal Trajectories of a System of Curves on Surface, Pfaffian Forms and Equations, Solution of Pfaffian Differential Equations in Three Variables.	50%
2.	Partial Differential Equations, Origin of First Order Partial Differential Equations, Linear Equations of First Order, Integral Surfaces Through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces.	50%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand Different Methods of Solving Partial Differential Equations.
2.	understand the concepts so that they can be applied to the applications of the Partial Differential Equations.

Suggested References:

I.Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, International Student Edition. Chapter 1 (1.1, 1.3, 1.4, 1.5(excluding Thm.6), 1.6), Chapter 2 (2.1, 2.2, 2.4(Thm.3 without proof), 2.5, 2.6)

Sr. No.	References
1.	Shanti Narayan, Integral Calculus, 14th Edition, S. Chand & Company Ltd., New Delhi, 1996
2.	Nita Shah, Ordinary and Partial Differential Equations – Theory and Applications, PHI Learning Pvt. Ltd., New Delhi.
3.	Zafar Ahsan, Differential Equations and Their Applications, 2nd Ed., Prentice – Hall of India Pvt. Ltd., New Delhi
4.	M. D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Ltd., New Delhi.

On-line resources to be used if available as reference material

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics)Semester (5)

Course Code	US05MIMTH06	Title of the Course	Problems and Exercises in Partial Differential Equation-1
Total Credits of the Course	2	Hours per Week	4 hours

Course Objectives:	1. To develop problem solving skills of students through interactive teaching and supervised practice. 2. To teach students various methods of solving and applying results of Partial Differential Equations.

Course Content

PARTIAL DIFFERENTIAL EQUATIONS

Unit	Description	Weightage* (%)
1.	Surfaces and Curves in Three Dimensions, Methods of solving $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.	10%
2.	Orthogonal Trajectories of a system of curves on Surface	10%
3.	Pfaffian Forms and Equations , Solution of Pfaffian Differential Equations in Three Variables.	10%
4.	Partial Differential Equations , Origin of First Order Partial Differential Equations , Linear Equations of the First Order	10%
5.	Integral Surfaces Through a Given Curve ,Surfaces Orthogonal to a Given System of Surfaces.	10%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%

2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Practical Examination	50%

NOTE:

1. There would be a batch of problem solving session will be of eight hours per week and they will be conducted in batches of students of size 15 to 20 per batch.
2. The candidate shall have to produce at the time practical Examination the record of their prescribed Laboratory work, certified by the Head of the Department.

Course Outcomes: Having completed this course, the learner will be able to	
1.	identify and categorize Partial Differential Equations.
2.	solve Partial Differential Equations.
3.	apply knowledge of Partial Differential Equations to solve certain problems.

Sr. No.	Suggested References:
1.	I. Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, International Student Edition .
2.	Shanti Narayan, Integral Calculus, Fourteenth Edition, S. Chand & Company Ltd., New Delhi, 1996
3.	M. D. Raisinghania, Ordinary and Partial differential equations, S. Chand & Company Ltd., New Delhi.
4.	Nita Shah, Ordinary and Partial Differential Equations - Theory and Applications , PHI Learning Pvt. Ltd. , New Delhi
5.	Zafar Ahsan, Differential Equations and Their Applications, Prentice - Hall of India Pvt. Ltd., New Delhi.

On-line resources to be used if available as reference material

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SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.11)
Syllabus with effect from the Academic Year 2024-2025

(Bachelor of Science)
B. Sc. Semester – V (Mathematics)

Course Code	US05SEMTH01	Title of the Course	Numerical Methods (Practical)
Total Credits of the Course	2	Hours per Week	4 hours

Course Objectives:	• To understand and implement numerical methods for finding the roots of equations. • To learn interpolation and extrapolation techniques for estimating values at points within and outside a data range. • To introduce methods for approximating definite integrals of complex functions using numerical techniques.

Sr. No.	Description
1.	Method of successive bisection.
2.	Method of false position
3.	Method of Newton Raphson
4.	Interpolation and Extrapolation with equal intervals: The Gregory-Newton formula for forward and backward interpolation.
5.	Interpolation for unequal intervals using Lagrange's interpolation and Newton's divided differences formula.
6.	Numerical Integration: Trapezoid Rule, Simpson's $\left(\frac{1}{3}\right)^{rd}$ and $\left(\frac{3}{8}\right)^{th}$ Rule.

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Exam Pattern		
Sr. No	Details of the Evaluation	Weightage
1	Internal Written / Practical Examination (As per CBCS R.6.8.3)	----
2	Internal Continuous Assessment in the form of Practical, Viva-voce, Practical Journal, Attendance (As per CBCS R.6.8.3)	----
3	University Examination	100 %

Course Outcomes: Upon completion of the course, the student will be able to....

1.	find roots of linear and non-linear system (algebraic and transcendental) equations.
2.	apply interpolation and extrapolation methods for both equal and unequal in real-world problems such as estimating missing values in data sets.
3.	apply, analyze, and implement various numerical integration methods to solve real-world problems with high accuracy and efficiency.

Suggested References:

Sr. No.	References
1.	S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd, fifth edition, 2012.
2.	B. S. Grewal, Higher Engineering Mathematics, Khanna Publiication, 45th edition, 2024.
3.	G. Sankar Rao, Numerical Analysis, 5th Edition, New Age International Pubishers, 2018.
4.	E. Kreyszig, Advanced Engineering Mathematics, Wiley, 10th edition, 2017.

On-line resources to be used if available as reference material
On-line Resources: https://nptel.ac.in/courses/111107105 - Unit-4-7.

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(Bachelor of Science) (Mathematics)
(B.Sc.) (Mathematics) Semester (V)

Course Code	US05SEMTH02	Title of the Course	Basics of Cryptography
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	- Introduce the fundamental principles of classical and modern cryptography. - Develop an understanding of symmetric key cryptographic techniques and their cryptanalysis. - Provide mathematical foundations such as modular arithmetic and integer rings essential for cryptography. - Explain the working of stream ciphers, including their structure, generation techniques, and security.

Course Content		
Unit	Description	Weightage (%)
1.	Overview of Cryptography, Symmetric cryptography, Cryptanalysis, Modular Arithmetic, Integer rings, Substitution cipher, Shift cipher, Affine cipher, Hill cipher, Permutation cipher.	50%
2.	Stream Ciphers: Stream Ciphers vs Block Ciphers, Encryption and Decryption with Stream ciphers, True Random number generators, Pseudorandom number generators, The one-time pad.	50%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Use of ICT whenever required.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage

1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	25%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	25%
3.	University Examination	50%

Course Outcomes: Upon successful completion of the course, students will be able to:	
1.	Explain the principles and importance of cryptography in securing information.
2.	Apply symmetric key encryption methods such as shift, affine, Hill, and permutation ciphers.
3.	Analyse the security of classical ciphers using cryptanalytic techniques.

Suggested References:	
Sr. No.	References
1.	Paar, C., & Pelzl, J. (2009). *Understanding cryptography: a textbook for students and practitioners*. Springer Science & Business Media.
2.	William Stallings (2017). *Cryptography and Network Security: Principles and Practice*. 7th Edition, Pearson Education Publication.
3.	Shyamala, C. K., Harini, N., & Padmanabhan, T. R. (2013). *Cryptography and security*. Wiley.
3.	Menezes, A. J., Van Oorschot, P. C., & Vanstone, S. A. (2018). *Handbook of applied cryptography*. CRC press.
4.	Katz, J., & Lindell, Y. (2020). *Introduction to modern cryptography*. CRC press.

On-line resources to be used if available as reference material
On-line Resources

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