VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in Mathematics

Programme: Master of Science (M.Sc.) in Mathematics

Duration: 2 Years (4 semesters)

Programme Overview:

M.Sc. Mathematics is a post graduate program where, candidates get a deeper knowledge of advanced mathematics through a vast preference of subjects such as geometry calculus, algebra, etc. the students become more skilled and specialized in a particular subject after the master degree program. Students learn about the problem-solving skills and reasoning skills which helps them to solve real-life problems. In this program, students learn to collect big data and analyze them with the help of different tools and methods

Programme Educational Objectives (PEOs):

After 3-4 years of completion of the programme:

1. Students are equipped with knowledge, skills and insight in Mathematics and related fields.
2. Students are able to work as a mathematical professional or as a scientific researcher.
3. Students develop the ability to utilize the mathematical problem solving methods such as analysis, modeling, programming and mathematical software applications in addressing the practical issues.
4. Students are able to recognize the need for and to develop the ability to engage in life-long learning.

Programme Outcomes (POs):

At the end of the programme the students will be able to:

1. Acquire in depth knowledge of topics in the area of mathematical sciences, such as mathematical analysis, algebra, numerical methods, Differential equations and Mathematical methods etc.
2. Evaluate his/her own capability/efficiency of finding and evaluating new sources to further mathematical science, renew and develop his/her academic skills, combine insight from multiple disciplines and contribute to multidisciplinary collaboration.

3. Develop logical reasoning techniques and techniques for analyzing the situation.
4. Read, analyze, and write logical arguments to prove mathematical concepts.
5. Communicate mathematical ideas with clarity and coherence, both written and verbally.
6. Acquire capability to evaluate hypothesis, methods and evidence within their proper contexts in any situation.
7. Demonstrate the ability to conduct research independently and pursue higher studies towards Doctoral Degree in Mathematics

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Distribution of Courses/Papers in Postgraduate Programme I Semester as per Choice Based Credit System (CBCS)

Department of Studies in Mathematics

M.Sc. I – SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem Exam	Total	L	T	P		
FIRST	DSC1	21MAT1C1L	Algebra	30	70	100	4	-	-	4	3
	DSC2	21MAT1C2L	Real Analysis	30	70	100	4	-	-	4	3
	DSC3	21MAT1C3L	Differential Equations	30	70	100	4	-	-	4	3
	DSC4	21MAT1C4L	Numerical Analysis	30	70	100	4	-	-	4	3
	DSC5	21MAT1C5L	Topology	30	70	100	4	-	-	4	3
	SEC1	21MAT1S1TP	Python Programming	20	30	50	-	1	2	2	2
	DSC4P1	21MAT1C4P	Numerical Analysis Using Python	20	30	50	-	-	4	2	4
Total Marks for I Semester						**600**				**24**	

M.Sc. II-SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC6	21MAT2C6L	Linear Algebra	30	70	100	4	-	-	4	3
	DSC7	21MAT2C7L	Measure theory and Integration	30	70	100	4	-	-	4	3
	DSC8	21MAT2C8L	Fluid Mechanics	30	70	100	4	-	-	4	3
	DSC9	21MAT2C9L	Graph Theory	30	70	100	4	-	-	4	3
	DSC10	21MAT2C10L	Complex Analysis	30	70	100	4	-	-	4	3
	SEC2	21MAT2S2TP	R-Programming	20	30	50	-	1	2	2	2
	DSC6P2	21MAT2C6P	Linear Algebra using MAT Lab	20	30	50	-	-	4	2	4
Total Marks for II Semester						**600**				**24**	

M.Sc. III-SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
THIRD	DSC10	21MAT3C10L	Mathematical Modeling	30	70	100	4	-	-	4	3
	DSC11	21MAT3C11L	Partial Differential Equations	30	70	100	4	-	-	4	3
	DSE1	21MAT3E1AL	A. Continuum Mechanics	30	70	100	4	-	-	4	3
		21MAT3E1BL	B. Matrix computation								
		21MAT3E1CL	C. Multi Variable Calculus								
	DSE2	21MAT3E2AL	A. Classical Mechanics	30	70	100	4	-	-	4	3
		21MAT3E2BL	B. Differential Geometry								
		21MAT3E2CL	C. Computational Techniques								
	GEC1	21MAT3G1AL	A. Mathematical Physics	20	30	50	2	-	-	2	2
		21MAT3G1BL	B. Mathematical Biology								
		21MAT3G1CL	C. Graph Theory								
	SEC3	21MAT3S3L P	Research Methodology	20	30	50	1	-	2	2	2
	DSC10P3	21MAT3C10P	Mathematical Modelling lab using R Programming	20	30	50	-	-	4	2	4
	DSC11P4	21MAT3C11P	Advanced Differential Equations lab using Mat Lab/ Python	20	30	50	-		4	2	4
Total Marks for III Semester						**600**				**24**	

M.Sc. IV-SEMESTER

Semester	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
FOURTH	DSC12	21MAT4C11L	Functional Analysis	30	70	100	4	-	-	4	3
	DSC13	21MAT4C12L	Mathematical Methods	30	70	100	4	-	-	4	3
	DSE3	21MAT4E3AL	A. Advanced Fluid Mechanics	30	70	100	4	-	-	4	3
		21MAT4E3BL	B. Applications of Numerical Linear Algebra								
		21MAT4E3CL	C. Operator Theory								
	DSE4	21MAT4E4AL	A. Fuzzy Structures	30	70	100	4	-	-	4	3
		21MAT4E4BL	B. Magnetohydrodynamics								
		21MAT4E4CL	C. Operation Research								
	GEC2	21MAT4G2AL	A. Commercial Mathematics	20	30	50	2	-	-	2	2
		21MAT4G2BL	B. Mathematical Statistics								
		21MAT4G2CL	C. Mathematics for Social Sciences								
	DSC13P5	21MAT4C13P	Mathematical Methods using PYTHON/MAT Lab	20	30	50	-	-	4	2	4
	Project	21MAT4C1R	Research Project	30	70	100		-	8	4	4
Total Marks for IV Semester						**600**				**24**	

(I-IV semester)- Total Marks: 2400 Total credits: 96

DSC – Department Specific Core, DSE – Discipline Specific Elective, SEC – Skill Enhancement Course, GEC – Generic Elective Course, IA – Internal Assessment, SEE – Semester End Examination, L – Lecture, T – Tutorial, P – Practical.

M.Sc. Mathematics First Semester

Course: Algebra	**Course Code:**21MAT1C1L
Teaching Hours/Week (L-T-P): 4-0-0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. To train the students in the present relationships between abstract algebraic structures with familiar number system.
2. To give sufficient knowledge of the subject, that can be used by student for further applications in their respective domains of interests.

Unit I:Groups:

Recompilation of Definitions, examples and elementary properties.Isomorphism theorems and the correspondence theorem.Center of a group and commutator subgroup of a group Symmetric group S_n. Structure theorem for symmetric groups.Action of a group on a set .Examples.Orbit and stabilizer of an element. **11 hours**

Unit II: Extension of Groups:

Class equation of a finite group.Cauchy's theorem for finite groups.Sylow theorems.Applications Wilson's theorem.Subnormal series of a group.Solvable group.Solvability of S_n. Composition Series of a group.Jordan-Holder theorem. **10 hours**

Unit III: Ring and Field Theory:

Recompilation of Definitions and examples. Polynomial ring R[X] over a ring in an indeterminate X. Principle ideal domain. Euclidean domain .The ring of Gaussian integers as an Euclidean domain. **11hours**

Unit IV: Polynomials over Rings and Fields:

Unique factorization domain. Primitive Polynomial. Gauss lemma. F[X] is a unique factorization domain for a field F. Eienstien's criterion of irreducibility for polynomials over a UFD.
09 hours

Unit V: Field extensions:

Characteristic of a field. Field extensions. Finite extensions. Algebraic extensions. Transitivity theorems. Simple extensions. Roots of polynomials. Splitting field of a polynomial. Existence and uniqueness theorems. Existence of a field with p^n element for a prime p and a positive integer n.
11hours

TEXT BOOKS:

1. I.N. Herstein, Topics in Algebra, 2nd Edition, John-Wiley & Sons, New York (2008).
2. M. Artin, Algebra, Prentice Hall of India (2004).

REFERENCES:

1. Surjeetsingh and QaziZameeruddin, Modern Algebra, Vikas Publishing House, 8th edition (2006)
2. S. K. Jain, P. B. Bhattacharya & S. R. Nagpaul, Basic Abstract Algebra, Cambridge University Press (2001).
3. S. Maclane& G. Birkhoff, Algebra, McMillan Co., New York (1999).
4. Hunger Ford, Abstract Algebra, Cengage Publication (2015)

Course Outcomes (CO): After completion of this course students will be able to

CO	**Statement**
CO1	Understand the importance of algebraic properties with regard to working within various number systems.
CO2	Explore the properties of groups and its actions. Understand Sylow's theorem, solvability of S_n and its applications.
CO3	Explore the properties of rings and field characteristics and extensions.
CO4	Established on Fields and Splitting field of polynomial

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Course: REAL ANALYSIS	**Course Code:** 21MAT1C2L
Teaching Hours/Week (L-T-P): 4-0-0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Define finite, countable and uncountable sets. Recognize convergent, divergent, bounded, Cauchy and monotone sequences.
2. To give exposure on basic topology on the real line. Recognize open, closed, connected and compact subsets of R.
3. Study the properties of continuous functions on the intervals of real line, uniform continuous.
4. Introduce the role of uniform convergence of sequence and series of functions.

Unit I: Properties of Subsets of R:

Finite and infinite sets. Denumerable and Non denumerable sets, Countable and Uncountable sets with examples, Equivalent sets and some results on cardinality. Real number system as a complete ordered field, Archimedean property, supremum, infimum. Completeness of R.Limsup, liminf of a sequence of real numbers with examples. **10 hours**

Unit-II: Topology of R:

Euclidean Topology on R: open, closed subsets of R. Computation of interior, exterior, boundary and closure for some subsets of R. Dense subsets of R. Bolzano-Weierstrass theorem, Heine- Borel theorem and connected subsets of R. **11hours**

Unit-III: Properties of Continuous functions:

Limits of a function and some results in terms of sequences, continuous function, properties of continuous functions on intervals, continuity and compactness, continuity and connectedness. Classification of discontinuities. Monotone functions. Uniform Continuity.

11hours

Unit-IV: Sequence and Series of functions:

Sequences and series of functions: Pointwise and uniform Convergence, Questions on Pintwise convergence in terms of limit, continuity, differentiability and integration. Cauchy's Criteria for uniform convergence, Criteria for uniform convergence of sequence of functions, Weierstrass M-Test.

11 hours

Unit-V:Properties of Uniform Convergence:

Uniform Convergence and continuity,Uniform convergence and Riemann Integration, Uniform convergence and Differentiation. **09 hours**

TEXTBOOKS:

1. Robert G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3rd edition, John-Wiley, 2005.

2. S. C. Malik and S. Arora, Mathematical Analysis, 4thedition, New Age International Publications, 2012.

REFERENCES:

1. W. Rudin, Principles of Mathematic Analysis, 3rd edition, McGraw Hill, 1986.
2. H. L. Royden, Real Analysis ,2ndedition,The McMillan Co. New York, 1968.
3. T. M. Apostol, Mathematical Analysis, 2nd edition, Narosa, 1996.
4. S. Abbott, Understanding Analysis, Springer, 2016.

Course Outcomes (CO): After completion of this course students will be able to

CO	**Statement**
CO1	Apply mathematical concepts involving of sets and their cardinalities.
CO2	Define and recognize the basic properties of field of real numbers.
CO3	Compute limit ofsequence of real functions.
CO4	Apply the theorem in a systematic way.
CO5	Use theorems to solve problems on continuity, convergence.

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Course: Differential Equations	**Course Code:**21MAT1C3L
Teaching Hours/Week (L-T-P): 4-0-0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Formulate Ordinary Differential Equations (ODEs) and seek understanding of their solutions, either obtained exactly or approximately by analytical or numerical methods.
2. Understand the concept of a solution to an initial value problem, and the guarantee of its existence and uniqueness under specific conditions.
3. Recognize basic types of differential equations which are solvable, and will understand the features of linear equations in particular.
4. Use different approaches to investigate equations which are not easily solvable. In particular, the student will be familiar with phase plane analysis.

Unit I: Higher Order Linear Differential Equations:

Introduction Differential equations and their classification. Homogeneous equations and general solution , Initial value problems. The Wronskian, Fundamental set, Adjoint equation, self- adjoint equation and their properties.Solutions of non homogeneous equations by Method of Variation of parameters, Method of Undetermined Coefficients, Existence and Uniqueness theorem.

12 hours

Unit II: Oscillations of Second Order Equations:

Introduction, Oscillatory and non-Oscillatory differential equations: The Strum theory, Abel's formula, Strum separation and comparison theorem, Conversion of standard form to normal form.

10 hours

Unit-III: **Orthogonality and Eigen Values:**

Orthogonality, orthogonal set of functions, orthonormal set of functions, Orthogonal and orthonormal set of function with respect to weight function. Working rule for getting orthonormal set, Boundary value problems; Sturm Liouville boundary value problem;Eigen functions and Eigen values, Green's function. **10 hours**

Unit IV: Power series solution of Differential Equations:

Power series, Radius of convergence and interval of convergence, examples and theorems. Ordinary and singular points,Power series solution about an ordianry point. The working rule of solution by Frobinius method . The series solution about regular singular pint at infinity, examples.

10 hours

Unit V: System of First Order Equations:

First order systems, Linear system of homogeneous and non-homogeneous equations (matrix method) Non-linear equations-Autonomous systems-Phase plane-Critical points–stability-Liapunov direct method-Bifurcation of plane autonomous systems.

10 hours

TEXT BOOKS:

1. Introduction to ordinary differential equations: Wiley publications IV edition, S L Ross, 1989.
2. Differential Equations ,Mcgraw Hill, Publications, 2005, Simmons, G.F. and Stevan G Krantz, 2015.

REFERENCES:

1. An Introduction to Ordinary Differential Equations, Dover publications, Eurl A. Coddington, 1989.
2. Ordinary and Partial differential equations , S Chand Publishers, M D Raisinghania, 2018
3. Differential Equations, Cambridge University Press, A C King, J Billingham and S R Otto, 2008.
4. Differential Equations with Applications and Historical Note Tata Mcgraw Hill, Publications, 2005, Simmons, G.F.

Course Outcomes (CO):After completion of this course students will be able to

CO	Statement
CO1	Apply the fundamental concepts of the basic numerical methods for their resolution.
CO2	Solve higher order and system of differential equations of different types.
CO3	Find the solutions of differential equation with initial and boundary conditions.
CO4	Solve higher order partial differential equations using various methods.
CO5	Understand concept of linear differential equation, Fundamental set Wronskian.
CO6	Understand the concept of Liouvilles theorem, Adjoint and Self Adjoint equation, Langrage's Identity, Green's formula, Eigen value and Eigen functions.
CO7	Identify ordinary and singular points and the capable of solving the solution by Frobenius Method.

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Course: Numerical Analysis	**Course Code:**21MAT1C4L
Teaching Hours/Week (L-T-P): 4-0-0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. Derive appropriate numerical methods to solve algebraic and transcendental equations.
2. Develop appropriate numerical methods to approximate a function.
3. Develop appropriate numerical methods to solve a differential equation.
4. Derive appropriate numerical methods to evaluate a derivative at a value.
5. Derive appropriate numerical methods to solve a linear system of equations.
6. Perform an error analysis for various numerical methods.
7. Derive appropriate numerical methods to calculate a definite integral.

Unit I:Solutions of Nonlinear/Transcendental Equations:

Fixed point iteration, Newton Rapshon Method, Regula-Falsi Method, Bairstow method, Brige-Vieta method, Muller's Method, Orders of convergence of each methods and applications on each method. **12 hours**

Unit II:System of Linear algebraic equations:

Direct methods with error analysis- Gauss elimination method, Gauss Jordan method, Triangularization method and Partition method. Iteration methods with convergence analysis- Jacobi method, Gauss seidal method, and SOR method. **12 hours**

Unit III: Eigen values and Eigen vectors of a matrix:

The characterstics of a polynomial, Bounds on Eigen values, Jacobi method for symmetric matrices, Givens method for symmetric matrices, Power method, Inverse power method. **10 hours**

Unit IV:Interpolation Theory:

Lagaranges and Bessel interpolations. Piecewise interpolation: linear piecewise, quadratic piecewise, cubic interpolation. spline interpolation: quadratic spline interpolation, cubic spline interpolation. **10 hours**

Unit V:Bivariate interpolation:

Lagaranges bivariate interpolation, Newtons Bivariate interpolation for equi spaced points, Approximations, least square approximation, Gram-Schmidt orthogonalising process. **10 hours**

TEXT BOOKS:

1. Introductory methods of Numerical Analysis, PHI Publisher, 2012, S SSastry,
2. Elementary Numerical Analysis, 3rd Edition, McGraw-Hill Book Company, S D Conte-Carle-de-Boor, 1980.

REFERENCES:

1. Elements of numerical Analysis, Cambridge University Press, R S Gupta, 2015.
2. Numerical Analysis, 9thedition,Cengage publisher, R L Burden, J D. Faires.2011.
3. Numerical Methods for Scientists and Engineers, PHI Publishers, KSankaraRao, 2007.
4. Numerical methods for scientific and Engineering Computation, New Age International Publishers, M K Jain, S R K Iyengar and R K Jain, 2014.
5. Numerical Mathematical Analysis 6th Edition, Oxford and IBH publisher, J B Scarborough, 1984.
6. Numerical methods in Engineering and Science, KhannaPublishers,B S Grewal, 2013.

Course Outcomes (CO):After completion of this course students will be able to

CO	Statement
CO1	Understand the theoretical and practical aspects of the use of numerical methods.
CO2	Implement numerical methods for a variety of multidisciplinary applications.
CO3	Establish the limitations, advantages, and disadvantages of numerical methods.
CO4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
CO5	Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
CO6	Code various numerical methods in a modern computer language.

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Course: Topology	**Course Code:**21MAT1C5L
Teaching Hours/Week (L-T-P): 4-0-0	**No. of Credits:** 04
Internal Assessment: 30 Marks	**Semester End Examination:** 70 Marks

Course Objectives:

1. To provide the basic concepts in metric spaces, including convergence and completeness.
2. To introduce the basic notion of a topological space,
3. To discuss the continuous mappings between topological spaces and introduce countable spaces.
4. To define the Separation axioms in the topological spaces and study its characteristics.
5. To explain the Compactness and connectedness properties in the topological space.

Unit I: Topology of Metric Space:

Distance functions, Definition of metric space, Examples, Some basic properties of metrics, Subspaces, Neighborhood, Open balls and closed balls, Definition of closed sets and open sets, their behavior under intersections and unions, accumulation point, derived sets, Dense sets, Sequences in metric space, subsequences, Cauchy sequences, Completeness, Bolzano-Weierstrass theorem, Continuity and uniform continuity in metric space. **13 hours**

Unit II: Topological Spaces:

Topological space: Definition and examples, open sets, closed sets, neighborhoods, closure, interior, exterior and boundary of a set, accumulation points, derived sets, dense sets. Bases, sub-bases, subspace, relative topology and product topology. **10 hours**

Unit III: Continuous Maps and Countability Axioms:

Continuous maps, open and closed maps, homeomorphisms, projection maps. First and second countable spaces, Lindelof space. **08 hours**

Unit IV: Separation Axioms:

T_0, T_1, T_2 ,T_3 and T_4 spaces, normal space: Examples and characterization, Urysohn's lemma, Tietze's, Extension theorem, Tychonoff spaces. **08 hours**

Unit V: Compactness and Connectedness:

Cover, sub-cover, compactness and their characterization, Compactness and finite intersection property.Invariance of compactness under maps and Tychonoff's theorem. Separated sets, Connected spaces and their basic properties.Connectedness of the real line,intermediate value theorem, components, local connectedness, path connectedness. **13 hours**

TEXT BOOKS:

1. K. D. Joshi, Introduction to General Topology, Wiley Eastern, (1983).
2. James R. Munkres, Topology, 2nd Edition, Pearson International, (2000).
3. J. Dugundji, Topology, Prentice-Hall of India, (1966).
4. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, (1963).

REFERENCE BOOKS:

1. J. L. Kelley, General Topology, Van Nostrand, (1995).
2. N. Bourbaki, General Topology, Part I, Addison-Wesley, (1966).
3. S.W. Davis, Topology, Tata McGraw Hill, (2006).
4. S. Shirali, Satish and H. L. Vasudeva, Metric Spaces, Springer-Verlag London, (2006).
5. S. Kumaresan, Topology of Metric Spaces, Narosa Publishing House, New Delhi, (2014).

Course Outcomes (CO):After completion of this course students will be able to

CO	Statement
CO1	Understand the basic concepts of metric spaces, convergence of sequences and able to find the limit in number of concrete and abstract spaces.
CO2	Analyze the basic characteristics to topological spaces, open bases and open sub bases, subspace, Continuity in the topological spaces and countable spaces.
CO3	Examine Separation axioms and its characteristics in the topological space.
CO4	Explain the compactness and connectedness properties in the topological space.

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Course: Python Programming	**Course Code:**21MAT1S1TP
Teaching Hours/Week (L-T-P): 0-1-2	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. Master the fundamentals of writing Python scripts.
2. Explore Python's object-oriented features.
3. To acquire programming skills in core Python.
4. To develop the skill of designing graphical user interfaces in Python.

Unit I:

Introduction to numPy and Matplotlib package: History of Python Identifiers, Key words, Statements & Expressions, Variables, Operators, Keywords, Input-Output, Control Flow statements, Functions , Numerical problems on numPy. **13 hours**

List of Programs:

1. Program to calculate factorial of a number, print Fibanacci number and convert binary number to decimal number and vice versa.
2. Program to find roots of quadratic equation.
3. Program to find real root of a polynomial using fixed point iterative method.
4. Program to find real root of a polynomial using Bisection method.
5. Program to find real root /multiple roots of a polynomial using Newton Raphson Method
6. Program to find real root of a polynomial using Secant Method.
7. Program to find real root of a polynomial using Muller Method
8. Program to find real root of a polynomial using RegulaFalsi method
9. Program to find sum and differences product of two matrices and hence find the row sum and column sum of a given matrix. Further to find the transpose, trace and norm of a matrix.
10. program to accept a matrix and determine whether it is a symmetric matrix/ skew-symmetric or not,
11. Program to solve system of equations using Matrix inversion method.
12. Program to solve system of equations using Cramers rule
13. Program to solve system of equations using Gauss Elimination Method.
14. Program to find inverse of the matrix using Gauss Jordan Method.
15. Program to find solution of system of equations using Jacobi Iterative Method.
16. Program to find solution of system of equations using Gauss Seidal Method.

TEXT BOOKS:

1. Gowrishankar S. Veena A -Introduction to Python Programming (2019).
2. Adam Stewart -Python Programming (2016).

REFERENCES:

1. Allen Downey, Jeff Elkner, and Chris Meyers -Learning with Python.(2015)
2. C.H. Swaroop -A Byte of Python.(2013)
3. Eric Matthews -Python Crash Course.(2016)
4. Kenneth A. Lambert, Cengage -Fundamentals of Python : First Programs (Introduction to Programming) (2011)
5. ReemaThareja-Python Programming: Using Problem Solving Approach. (2017).
6. Think Python, by Allen Downey, Green Tea Press.(2012).

Course Outcomes (CO):After completion of this course students will be able to

CO	Statement
CO1	Explain basic principles of Python programming language
CO2	Implement object oriented concepts.
CO3	Making Software easily right out of the box.
CO4	Experience with an interpreted Language.

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Course: Numerical Analysis Using Python	**Course Code:**21MAT1C4P
Teaching Hours/Week (L-T-P): 0-0-4	**No. of Credits:** 02
Internal Assessment: 20 Marks	**Semester End Examination:** 30 Marks

Course Objectives:

1. Master the Python scripts to solve system of equations.
2. To acquire programming skills in core Python to solve problems.
3. To develop the skill of designing graphical user interfaces in Python.

List of Programs:

1. Program to calculate factorial of a number, print Fibanacci number and convert binary number to decimal number and vice versa.
2. Program to find area of one of the geometric figures (circle, triangle, rectangle and square) using switch statements.
3. Program to read the coefficients of a polynomial, print the polynomial and evaluate the polynomial at given value.
4. Program to find roots of quadratic equation.
5. Program to find real root of a polynomial using fixed point iterative method.
6. Program to find real root of a polynomial using Bisection method.
7. Program to find real root /multiple roots of a polynomial using Newton Raphson Method
8. Program to find real root of a polynomial using Secant Method.
9. Program to find real root of a polynomial using Muller Method
10. Program to find real root of a polynomial using Ramanujans Method
11. Program to find real root of a polynomial using Bairstows Method
12. Program to find real root of a polynomial using RegulaFalsi method
13. Program to find sum and differences product of two matrices and hence find the row sum and column sum of a given matrix. Further to find the transpose, trace and norm of a matrix.
14. program to accept a matrix and determine whether it is a symmetric matrix/ skew-symmetric or not,
15. Program to solve system of equations using Matrix inversion method.
16. Program to solve system of equations using Cramers rule
17. Program to solve system of equations using Gauss Elimination Method.
18. Program to find inverse of the matrix using Gauss Jordan Method.
19. Program to find solution of system of equations using Jacobi Iterative Method.
20. Program to find solution of system of equations using GaussSeidal Method.
21. Program to find solution of system of equations using Cholesky’s method
22. Program to find solution of system of equations using Crout’s method
23. Program to find solution of system of equations using Do little method
24. Program to find solution of system of equations using LU decomposition method.

TEXT BOOKS:

1. Gowrishankar S. Veena A -Introduction to Python Programming (2019).
2. Introductory methods of Numerical Analysis, PHI Publisher, 2012, S SSastry,

REFERENCES:

1. Allen Downey, Jeff Elkner, and Chris Meyers -Learning with Python.(2015)
2. C.H. Swaroop -A Byte of Python.(2013)

3. Elementary Numerical Analysis, 3rd Edition, McGraw-Hill Book Company, S D Conte-Carle-de-Boor, 1980.
4. Elements of numerical Analysis, Cambridge University Press, R S Gupta, 2015.
5. Numerical Analysis, 9thedition,Cengage publisher, R L Burden, J D. Faires.2011.
6. Numerical Methods for Scientists and Engineers, PHI Publishers, KSankaraRao, 2007.

Course Outcomes (CO):After completion of this course students will be able to

CO	Statement
CO1	Program to find solution of system of equations using Crout's
CO2	Write Python scripts to find real root of a polynomial using Muller Method
CO3	Write Python scripts to find real root of a polynomial using Ramanujans Method
CO4	Find real root of a polynomial using fixed point iterative method in Python

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