

M.Sc MATHEMATICS

ALGEBRA

M.Sc(Mathematics)

Semester - I

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP



Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP-517 502


DIRECTOR
Centre for Distance and
Online Education (CDCO)
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TIRUPATI - 517 502.




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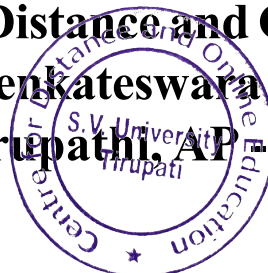
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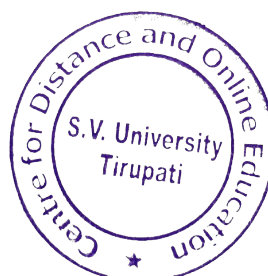
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Syllabus for I - MSc(Mathematics)

Paper I : Algebra

I.GROUP THEORY

Homomorphisms, Automorphisms, Cayleys theorem, Permutation groups, Another counting principle. Sylow's theorem, Direct products, Finite abelian groups.
(3 Questions to be set).

II. RING THEORY

Rings, Some special classes of rings, Homomorphisms, Ideals and quotients of an integral domain, Euclidean rings. The field of quotients of an integral domain, Euclidean rings, a particular Euclidean ring, polynomial rings, polynomial over the rational field, polynomial rings over the commutative rings.
(2 Questions to be set).

III.FIELDS

Extension fields, Roots of polynomials, Construction with straight edge and compass, More about roots, the elements of Galois theory, Solvability by radicals, Galois groups over the rationals. (3 Questions to be set).

IV. LATTICES

Partially ordered sets, Lattices, Modular Lattices, Schreier's theorem. The Chain conditions decomposition theory for Lattices with ascending chain condition, Independence, complemented modular lattices, Boolean algebras.
(2 Questions to be set).

Text Books:

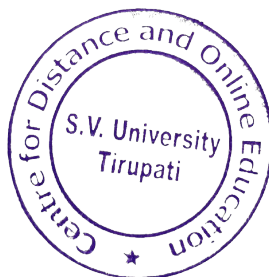
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1. Topics in Algebra by I.N. Herstein (2nd Edition), Vikas Publishing House Pvt. Ltd.
2. Lectures in Abstract Algebra by Nathan Jacobson, D. Van Nostrand Co. Inc.



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Analysis

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Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP



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Sri Venkateswara University

Tirupathi, AP - 517 502


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Centre for Distance and
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- 5.8 The Lebeggue theory- set function
- 5.9 Construction of lebesgue measure
- 5.10 Measure spaces and functions
- 5.11 Simple functions
- 5.12 Lebesgue Integration
- 5.13 Comparison with Riemann integral
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- 5.15 Functions of class
- 5.16 Exercise

Syllabus for I - M.Sc(Mathematics)

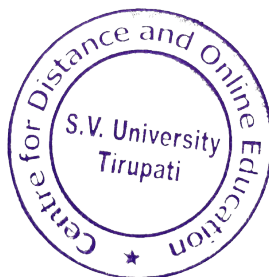
Paper – II : Analysis

- I. Finite, countable and uncountable sets - Metric spaces - Compact sets - Perfect sets
Connected sets. (2 questions to be set)
- II. Sequences in metric spaces Subsequences - Cauchy sequences - Upper and lower
limits - Some special sequences. Absolute convergence - Addition and multiplication
of series Rearrangements. (1 question to be set).
- III. Continuity - Limits of functions Continuous functions Continuity and compactness
Continuity and connectedness Discontinuities Monotonic functions Infinite and limits
at infinity. (1 question to be set).
- IV. Riemann Stieltjes integral Definition and existences of integral - Properties of integral
- Integration and differentiation. (2 questions to be set).
- V. Sequences and series of functions Uniform convergence - Uniform convergence and
continuity - Uniform convergence and integration - Uniform convergence and
differentiation - Equicontinuous family of functions - Weierstrass approximation
theorem. (2 questions to be set).
- The Lebesgue theory - Set functions A construction of the Lebesgue measure -
measure spaces - Measurable functions - Simple function - Integration - Comparison
with Riemann integral - Integration of complex function - Functions of class L^2 . (2
questions to be set).

Text Books:

Walter Rudin: Principle of Mathematical Analysis (Third Edition) Mc. Graw Hill
International Edition.


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DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

M.Sc(Mathematics)

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP

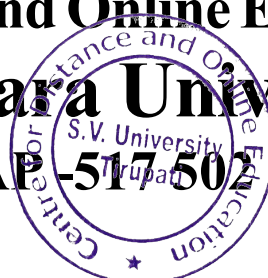


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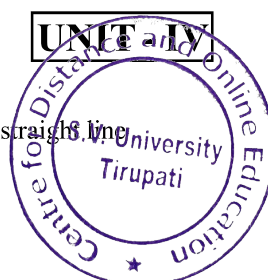
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Syllabus for I -MSc (Mathematics)

Paper III : Differential Equations & Numerical Methods

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Differential Equation: Differential equation -order of differential equation-degree of differential equation -Solution of differential equation-General Solution-Particular Solution-Differential equation of first order and first degree-Solution of differential equation of first order and first degree, Variable - separable form, Equation reducible to variable – separable form , Linear differential equation, Bernoul’s Equation, Homogeneous Differential Equations, Homogeneous Differential Equation can be Reduced in the homogeneous form, Exact differential equation- Formation of a differential equation-Finding equation of a curve whose geometrical properties are given -Orthogonal trajectory.

Unit-2

Linear Differential equations (nth order with constant coefficients) : Linear differential equation with constant coefficients-The Operator D- Complementary Functions (C.F)- Auxiliary equation (A.E)- Rules for finding complementary function, If all the roots of A.E are distinct and real , when the roots of auxiliary equation are equal , when roots of A.E are imaginary, When roots of A. E equation are repeated imaginary, When roots of A. E equation are repeated imaginary, When roots of A.E equations are

irrational -The Inverse Operator $\frac{1}{f(D)}$ -Rules for finding the particular integral (P.I) -

When $Q = e^{a.x}$ or a^{x+b} , Case of failure, When $Q = \sin(ax + b)$ or $\cos(ax + b)$, Case of failure, When $Q = x^m$, m being a positive integer, When $Q = e^{ax} \cdot v$, where v is the function of x only, When $Q = x.v$

Unit-3

Solution of Algebraic and Transcendental Equations : Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method. Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward Differences-Backward differences –Central differences –Symbolic relations and separation of symbols-Differences of a polynomial-Newton’s formulae for interpolation – Central difference interpolation Formulae – Gauss’ Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange’s Interpolation formula.

Unit-4

Fitting a straight line –Nonlinear curve fitting –Curve fitting by a sum of exponentials-Weighted least squares approximation-Linear weighted least squares approximation-Nonlinear weighted least squares. Numerical Differentiation and Integration: The Cubic Spline Method – Trapezoidal rule – Simpson’s 1/3 Rule –Simpson’s 3/8 Rule- Boole’s and Weddle’s Rules.

Unit-5

Numerical solution of Ordinary Differential equations: Solution by Taylor’s series-Picard’s Method of successive Approximations- Euler’s Method-Runge-Kutta Methods– Predictor-Corrector Methods- Adams-Moulton Method –Milne’s Method.

COMPLEX ANALYSIS AND SPECIAL FUNCTIONS

M.Sc(Mathematics)

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP

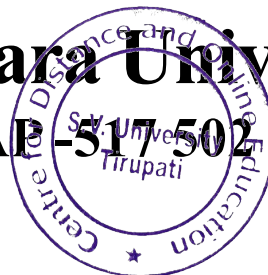


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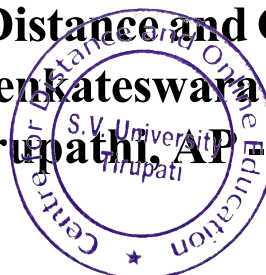
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- 5.2 Transformation by e^z , $\ln z$, z^n (n positive integer), $\text{Sin}z$, $\text{Cos}z$, $z + a/z$
- 5.3 Bilinear Transformations
- 5.4 Exercise

Syllabus for I - MSc (Mathematics)

Paper IV - Complex Analysis and Special Functions

UNIT – I

Special functions: Gamma and Beta Functions – Their properties – evaluation of improper integrals. Bessel functions – properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue’s formula – Recurrence relations – Orthogonality.

UNIT-II

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.

Elementary functions: Exponential, trigonometric, hyperbolic functions and their properties – General power Z^c (c is complex), principal value.

UNIT-III

Complex integration: Line integral – evaluation along a path and by indefinite integration – Cauchy’s integral theorem – Cauchy’s integral formula – Generalized integral formula.

Complex power series: Radius of convergence – Expansion in Taylor’s series, Maclaurin’s series and Laurent series. Singular point – Isolated singular point – pole of order m – essential singularity.

UNIT-IV

Residue – Evaluation of residue by formula and by Laurent series - Residue theorem. Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$

(b) $\int_c^{c+2\pi} f(\cos \theta, \sin \theta)d\theta$

(c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

(d) Integrals by indentation.

Argument principle – Rouche’s theorem – determination of number of zeros of complex polynomials - Maximum Modulus principle - Fundamental theorem of Algebra, Liouville’s Theorem.

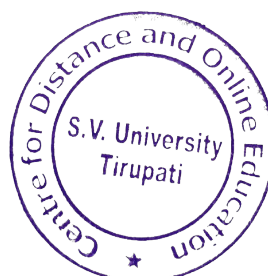
UNIT-V

Conformal mapping: Transformation by e^z , $\ln z, z^2, z^n$ (n positive integer), Sinz , cosz , $z + a/z$. Translation, rotation, inversion and bilinear transformation – fixed point – cross ratio – properties – invariance of circles and cross ratio – determination of bilinear transformation mapping 3 given points.

Text Books

1. A text Book of Mathematical Methods, S M Naidu, StudentsHelpline Books
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley India Pvt. Ltd.
3. A text Book of Engineering Mathematics, Thamson Book Collection.
4. A text Book of Engineering Mathematics, Shahnaz Bathul, Prentice Hall of India.


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M.Sc MATHEMATICS

OPERATION RESEARCH

M.Sc(Mathematics)

Semester - I

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics


S.V. University, Tirupati - 517502 AP



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Tirupathi, AP - 517 502


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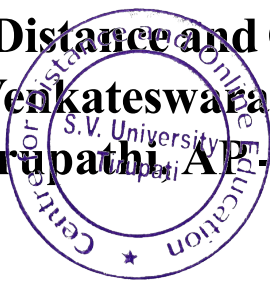
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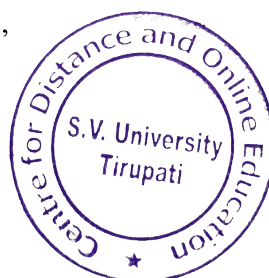
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Syllabus for I - MSc (Mathematics)

Paper V : OPERATION RESEARCH

UNIT- 1

Linear Programming problem Mathematical formulation, assumptions in linear programming, graphical method of solution, simplex method, Big-M method and Two phase method, Dual simplex method.

Unit-2

Integer Programming Introduction, Gomory's cutting plane method, Fractional cut method-Mixed integer and branch and bound techniques.

Transportation Problem-General transportation problem, Finding an initial basic feasible solution, Loops in transportation tables, Degeneracy, Optimality method-MODI method.

Assignment Problem- Hungarian Method, Traveling salesman problem.

Unit-3

Game theory Introduction, two-person zero-sum games, some basic terms, the maxmini-minimax principle, games without saddle points-Mixed Strategies, graphic solution of $2 \times n$ and $m \times 2$ games, dominance property.

Simulation Introduction, Definition of Monte-Carlo Simulation.

Unit-4

Dynamic Programming Introduction, The Recursive equation approach, Algorithm, Solution of a L.P.P by Dynamic Programming.

Sequencing Models-Processing n jobs through 2 machines, n jobs through 3 machines, two jobs through m machines.

Networking Analysis CPM & PERT – Network minimization, shortest route problem, maximal-flow problem, Project scheduling, critical path calculations, PERT calculation.

Unit-5

Queuing Theory Introduction, Queuing system, Elements of Queuing system, Characteristics of Queuing system, Classification of Queuing Models, Poisson Queuing systems-Model I (M/M/1): (∞ :FIFO)-Characteristics of Model I and waiting time characteristics. Characteristics of (M/M/1):(N/FIFO), (M/M/C):(∞ /FIFO), (M/M/C):(N/FIFO)-all without derivation

Suggested Readings:

1. Operation Research by Kanti Swarup, P.KGuptha , Man Mohan 11th edition Sultan Chand & Sons Publication.
2. Operation Research , Jaico Publishing House
3. Operation Research-An introduction by Hamdy A Taha. Prentice Hall.
4. Introduction To Management Science, Anderson, Thomson Learning, 11Edn.
5. Operation Research Applications and Algorithms, Winston, Thomson Learning, 4Edn.
6. Introduction to Operation Research by Hillier/Lieberman. McGraw Hill

**TOPOLOGY AND
FUNCTIONAL ANALYSIS**
M.Sc(Mathematics)

Authors

Dr. K Rama Krishna
Dr. T Mahesh Kumar
Dept. of Mathematics
S.V. University, Tirupati - 517502 AP



Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP - 517 502

DIRECTOR
Centre for Distance and
Online Education (CDCO)
Sri Venkateswara University
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II M.Sc(Mathematics)

Topology and Functional Analysis

Unit - 1

Topological Space definition of a Topological space, Elementary Concepts, open bases and open sub-bases, weak topologies. The function algebras (X, \mathbb{R}) and (X, \mathbb{C}) (1 Question).

Unit - 2

Compactness, product of spaces, Technoff's theorem and locally compact spaces, compactness for the metric spaces, Ascolis theorem. (2 questions).

Unit - 3

Separation, T-spaces and Hausdorff spaces completely regular and normal spaces, Urysohn's Lemma and Tietz extension theorem. The Urysohn's embedding theorem. Connectedness, connected spaces, components of a space. (2 questions)

Unit - 4

Banach Spaces, definition of Banach spaces, continuous linear transformation, The Hahn –Banach theorem, the natural imbedding of \mathbb{N} in \mathbb{N}^{**} , the open mapping theorem, the conjugate of an operator. (2 questions)

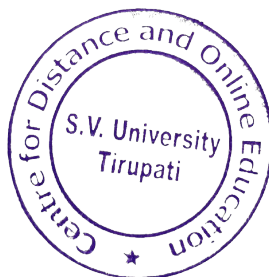
Unit - 5

Hilbert spaces, definition and example, orthogonal complements, orthonormal set, the conjugate space H^* , the adjoint of an operator, self-adjoint operators, normal and unitary operators, projections. (3 questions)

Books recommended:

1. Topology and Modern Analysis by G.F.Simmons, Mc.Graw Hill Chapters


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TIRUPATI - 517 502.




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TIRUPATI

DISCRETE MATHEMATICS

M.Sc(Mathematics)

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP



Centre for Distance and Online Education

Sri Venkateswara University

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DIRECTOR
Centre for Distance and
Online Education (CDC)
Sri Venkateswara University
TIRUPATI - 517 502.

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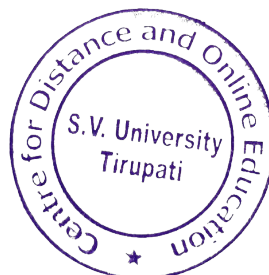



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II - M.Sc(Mathematics)

Discrete Mathematics

UNIT-I

Mathematical Logic: Statements and notation, connectives, Normal Forms, Disjunctive Normal Forms [DNF], Conjunctive Normal Forms (CNF), Principal DNF, Principal CNF.

Set Theory : Basic Concepts of Set Theory, Relations and Ordering, Functions and Recursion.

UNIT-II

Lattices, Boolean Algebra, Representation and minimization of Boolean functions. Semi-groups, Product and Quotients of Semi-group, Groups, Product and Quotients of Groups, Coding of Binary Information and Error Detection, Decoding and Error Correction.

UNIT-III

Combinatorics: Basics, Permutations and Combinations with repetitions and Constrained Repetitions, Binomial and Multinomial Theorems, Principle of Inclusion and Exclusion.

UNIT-IV

Graph Theory -I : Basic Concepts, Isomorphism, sub - graphs, trees and their Properties., Spanning Tree, Directed Trees, Binary Trees.

UNIT-V

Graph Theory - II : Planar Graphs, Eule Formula, Multi-graphs and Euler Circuit Hamiltonian Circuit; Chromatic Numbers, Four Colour Problem.

Books recommended:

1. Jr. P.Trembley and R. Manohar, "Discrete Mathematical structures with applications to computer science", Mc Graw Hill 1987.
2. S M Naidu & R Madan Mohan, "Discrete Mathematics for Computer Scientists" StudentsHelpline Publishing House 2007.
3. Bernard Kolman, Nadeem Ur Rehaman "Discrete Mathematical Structures" Pearson Education, 2005.
4. J.L.Moth, Abraham Kandel, and T.P.Parker, "Discrete Mathematics for Computer Scientists and Mathematicians", PHI, 1976.

COMPUTER ALGORITHM AND PROBLEM SOLVING

M.Sc(Mathematics)

Authors

Dr. K Rama Krishna

Dr. T Mahesh Kumar

Dept. of Mathematics

S.V. University, Tirupati - 517502 AP



Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP - 517 502

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Sri Venkateswara University
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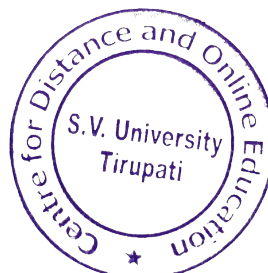
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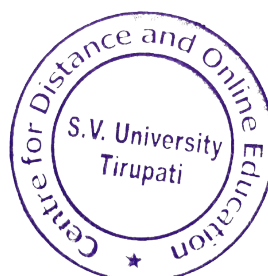
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II - M.Sc(Mathematics)

Computer Algorithm and Problem Solving

Unit - 1

Introduction to Algorithms: Algorithms representations through Flowcharts, Mathematical Flowcharts, finding highest and lowest of given quantities, finding sum of 100 odd numbers, commerce related flowcharts like laying customs duty, finding Gross Sales and discount, Calculations for salary of employees.

Unit 2

Array Algorithms: Concept of Array, Flowcharts and their Algorithms for manipulation of arrays to transfer contents of one memory array to another, assigning Constant value to the contents of an array, addition, subtraction, multiplication of arrays, sorting and printing techniques through Algorithm.

Unit 3

Decision Tables: Introduction to Decision making. Structure of Decision Tables Algorithms for selection criteria's - Drafting entries in the decision tables for the same.

Unit 4

Introduction to Problem Solving: Components of Program, Constants, Variables, Input and Output in Progress, Operators, Decision Making, Iteration, the concept of Loop.

Unit 5

Arrays Revisited: Types of Arrays, Subroutine calls, top-down design, subroutines and structured problem solving.

Books Recommended:

1. Solving it by Computers - R.G. Dromey
2. Let us C : Yashwant Kanetkar
3. How to Solve it by Computer – S M Naidu