

# ***ALGEBRA***

*I - M.Sc(Mathematics) / I - Semester  
Choice Based Credit System(CBCS)*



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**Tirupathi, AP -517 502**

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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:**

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

# *Analysis*

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# Syllabus for I - M.Sc(Mathematics)

## Paper – II : Analysis

---

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- II. Sequences in metric spaces Subsequences - Cauchy sequences - Upper and lower  
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- III. Continuity - Limits of functions Continuous functions Continuity and compactness  
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- IV. Riemann Stieltjes integral Definition and existence of integral - Properties of integral  
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- V. Sequences and series of functions Uniform convergence - Uniform convergence and  
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- 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.

# ***DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS***

***I - M.Sc(Mathematics) / I - Semester  
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## Syllabus for I -MSc (Mathematics )

### Paper-III: *Differential Equations & Numerical Methods*

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#### UNIT- 1

**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 (n<sup>th</sup> 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  $Q = e^{a \cdot x}$  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  $Q = x \cdot v$

#### 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***

*I - M.Sc(Mathematics) / I - Semester  
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- 5.3 Bilinear Transformations
- 5.4 Exercise

## Syllabus for I - MSc (Mathematics)

### *Paper IV - Complex Analysis and Special Functions*

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#### 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),  $\text{Sin}z, \text{cos}z, z + a/z$ . 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.

# ***OPERATION RESEARCH***

***I - M.Sc(Mathematics) / I - Semester  
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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 max-mini-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): ( $\infty$  :FIFO)-Characteristics of Model I and waiting time characteristics. Characteristics of (M/M/1):(N/FIFO), (M/M/C):(  $\infty$  /FIFO), (M/M/C):(N/FIFO)-all without derivation

#### Suggested Readings:

1. Operation Research by Kanti Swarup, P.KGuptha , Man Mohan 11<sup>th</sup> 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 Hiller/Lieberman. McGraw Hill.

# ***TOPOLOGY AND FUNCTIONAL ANALYSIS***

***I - M.Sc(Mathematics) / II - Semester  
Choice Based Credit System(CBCS)***

**Authors**

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# **I 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, Tychonoff's theorem and locally compact spaces, compactness for the metric spaces, Ascoli 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  $N$  in  $N^{**}$ , 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

# ***DISCRETE MATHEMATICS***

***I - M.Sc(Mathematics) / II - Semester  
Choice Based Credit System(CBCS)***



## **Authors**

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# I - 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, Euler 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***

***I - M.Sc(Mathematics) / II - Semester  
Choice Based Credit System(CBCS)***



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# I - 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

# ***PROBABILITY AND STATISTICS***

***I - M.Sc(Mathematics) / II - Semester  
Choice Based Credit System(CBCS)***

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## II - M.Sc(Mathematics)

### *Probability and Statistics*

---

#### UNIT I

**Probability:** Sample space and events – Probability – The axioms of probability - Some elementary theorems - Conditional probability – Baye’s theorem.

#### UNIT II

**Random variables** – Discrete and continuous – Distribution – Distribution function.

Distribution - Binomial, Poisson and normal distribution – related properties.

#### UNIT III

**Sampling distribution:** Populations and samples - Sampling distributions of mean (known and unknown) proportions, sums and differences.

Estimation: Point estimation – interval estimation - Bayesian estimation.

#### UNIT IV

**Test of Hypothesis** – Means and proportions – Hypothesis concerning one and two means – Type I and Type II errors. One tail, two-tail tests. Tests of significance – Student’s t-test, F-test,  $\chi^2$  test. Estimation of proportions.

#### UNIT V

**Curve fitting:** The method of least squares – Inferences based on the least squares estimations - Curvilinear regression – multiple regressions – correlation for univariate and bivariate distributions.

#### **Books recommended:**

1. Probability and statistics for engineers (Erwin Miller And John E.Freund), R A Johnson And C.B.Gupta.. 7th edition, Pearson Education / PHI.
2. S M Naidu, “Probability and statistics for Computer Scientists” StudentsHelpline Publishing House 2007.
3. Introduction to Probability and Statistics, 12th edition, W.Mendenhall, R.J.Beaver and B.M.Beaver, Thomson. (Indian edition).
4. Probability and Statistics in Engineering, 4th Edition, William W.Hines, Douglas C.Montgomery, David M.Goldsman, Connie M.Borrer, Wiley Student Edition.
5. Probability, Statistics and Queuing Theory, 2nd Edition, Trivedi, John Wiley and Sons
6. Introduction to Probability and Statistics, J.S.Milton, Jesse C.Arnold, 4th edition, TMH.