

ALGEBRA

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



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CONTENTS

	Page No.
Unit - I	1 - 102
1.1 Homomorphism	
1.2 Automorphism	
1.3 Cayley's theorem	
1.4 Permutation groups	
1.5 Another Counting principle	
1.6 Sylow's theorem	
1.7 Direct products	
1.8 Finite abelian groups.	
Unit - II	103 - 174
2.0 Aims and objects	
2.1 Rings	
2.2 Some special classes of Rings	
2.3 Homomorphism	
2.4 Ideals and quoties of an integral domain	
2.5 Euclidean rings(Domain)	
2.6 Polynomial Rings	
2.7 Polynomial Over the rational fields	
2.8 Polynomial rings over commutative Rings	
2.9 Exercise	
Unit - III	175 - 212
3.0 Aims and objects	
3.1 Extension fields	
3.2 Roots of polynomials	
3.3 Construction with straightedge and compass	

- 3.4 More about roots
- 3.5 The elements of Galois theory
- 3.6 Solvability of radicles
- 3.7 Galois group over the Rationals
- 3.8 Exercise

Unit - IV

213 - 260

- 4.0 Aims and objects
- 4.1 Partially ordered sets
- 4.2 Lattices
- 4.3 Modular lattices
- 4.4 Schreier's theorem
- 4.5 The chain conditions decomposition theory for lattices with ascending chain condition
- 4.6 Independence
- 4.7 Complemented modular lattices
- 4.8 Boolean algebras
- 4.9 Exercise

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

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CONTENTS

	Page No.
Unit - I	1 - 54
1.1 Finite, countable and uncountable sets	
1.2 Metric spaces	
1.3 Compact sets	
1.4 Perfect sets	
1.5 Connected sets	
1.6 Exercise	
Unit - II	55 - 94
2.1 Sequences in metric spaces	
2.1.1 Subsequences	
2.2 Cauchy sequences	
2.3 Upper and lower limits	
2.4 Some special sequences	
2.5 Absolute convergence	
2.6 Addition and Multiplication of series	
2.7 Rearrangements	
2.8 Exercise	
Unit - III	95 - 138
3.1 Continuity	
3.2 Limits of functions	
3.3 Continuous functions	
3.4 Continuity and compactness	
3.5 Continuity and Connectedness	

- 3.6 Discontinuities
- 3.7 Monotonic functions
- 3.8 Infinite limits and limits at infinity
- 3.9 Exercise

Unit - IV

139 - 186

- 4.1 Riemann stieltjes integral
- 4.2 Definition and existences of integral
- 4.3 Properties of integral
- 4.4 Integration and differentiation
- 4.5 Exercise

Unit - V

187 - 292

- 5.1 Sequences and series of functions
- 5.2 Uniform Convergence
- 5.3 Uniform Convergence and continuity
- 5.4 Uniform convergence and integration
- 5.5 Uniform convergence and differentiation
- 5.6 Equicontinuous family of functions
- 5.7 Weiestrass approximation theorem
- 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
- 5.14 Integration of complex functions
- 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 existence 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.

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

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CONTENTS

UNIT - I

	Page No.
1.0 Aims and Objectives	3
1.1 Introduction	4
1.2 Order of differential equation	4
1.3 Degree of differential equation	4
1.4 Solution of differential equation	5
1.5 General Solution	5
1.6 Particular Solution	5
1.7 Differential equation of first order and first degree	7
1.8 Solution of differential equation of first order and first degree	7- 14
1.8.1 Variable-separable form	
1.8.2 Equation reducible to variable separable form	
1.8.3 Linear differential equation	
1.8.4 Bernoul's Equation	
1.8.5 Homogeneous Differential Equations	
1.8.6 Non – Homogeneous differential equation which can be reduced in the homogeneous form	
1.8.7 Exact differential equation	
1.9 Formation of a differential equation	14
1.10 Finding equation of a curve whose geometrical properties are given	15
1.11 Orthogonal trajectory	20
1.12 Let us Sum up	21
1.13 Answers to 'Check Your Progress'	21
1.14 Questions for Discussion	23
1.15 Suggested Readings	25

UNIT - II

2.0 Aims and Objectives	29
2.1 Introduction	30
2.2 The Operator D	30
2.3 Complementary Functions (C.F)	31
2.4 Auxiliary equation (A.E)	31
2.5 Rules for finding complementary function	31-35
2.5.1 If all the roots of the A.E. are distinct and real	
2.5.2 When the roots of auxiliary equation are equal	
2.5.3 When roots of A.E. are imaginary	
2.5.4 When roots of A.E. equation are repeated imaginary	
2.5.5 When roots of A.E. equation are irrational	
2.6 The Inverse Operator $\frac{1}{f(D)}$	35
2.7 Rules for finding the particular integral (P.I)	36-48
2.7.1 When $Q = e^{a \cdot x}$ or a^{x+b}	

2.7.2	Case of failure	
2.7.3	When $Q = \sin(ax + b)$ or $\cos(ax + b)$	
2.7.4	Case of failure	
2.7.5	When $Q = x^m$, m being a positive integer	
2.7.6	When $Q = e^{ax} \cdot v$, where v is the function of x only	
2.7.7	When $Q = x \cdot v$	
2.8	Let us Sum up	48
2.9	Answers to 'Check Your Progress'	48
2.10	Questions for Discussion	51
2.11	Suggested Readings	52

UNIT - III

3.0	Aims and Objectives	55
3.1	Introduction	56
3.2	Errors	56
3.3	Significant Digits & Numerical Instability	58
3.4	Transcendental & Polynomial equations	59
3.5	Numerical Solution of Algebraic & Transcendental Equations	60
3.6	The Bisection Method	62
3.7	The Method of False Position	67
3.8	The Iteration Method	71
3.9	Newton-Raphson Method	78
3.10	Introduction: Interpolation	88
3.11	Errors in Polynomial	90
3.12	Finite differences	91
3.13	Differences of polynomial	96
3.14	Effect of an Error in a difference table	97
3.15	Difference operators	99
3.16	Newton's interpolation formulae	109
3.17	Central Difference interpolation formulae	114
3.18	Interpolation with unequal intervals	138
3.19	Lagrange's Interpolation Formula for unequal intervals	145
3.20	Let us Sum up	152
3.21	Answers to 'Check Your Progress'	152
3.22	Questions for Discussion	153
3.23	Suggested Readings	156

UNIT - IV

4.0	Aims and Objectives	159
4.1	Introduction: Fitting a straight line	160-187

4.1.1	Fitting of A Straight Line (linear Regression)	
4.1.2	Fitting of A Parabola (polynomial regression)	
4.1.3	Fitting of other Curves (Trancendental regression)	
4.1.4	Curve Fitting by a Sum of Exponentials	
4.1.5	Linear Weighter Least Squares Approximation Straight Line	
4.1.6	Non linear Weighted Least Squares Approximation	
4.2	Numerical Differentiation	187-199
4.2.1	Derivative using Newton's forward difference formula	
4.2.2	Derivative using Newton's backward difference formula	
4.2.3	Derivatives using stirling's Formula	
4.2.4	Maxima and Minima of Tabulated Function	
4.3	Numerical integration	199-218
4.3.1	Trapezoidal rule	
4.3.2	Simpson's one-third rule	
4.3.3	Simpson's three -eighths rule	
4.3.4	Boole's Rule	
4.3.5	Weddle's Rule	
4.4	Cubic Spline Method	219- 229
4.5	Let us Sum up	229
4.6	Questions for Discussion	229
4.7	Suggested Readings	232

UNIT - V

5.0	Aims and Objectives	235
5.1	Introduction	235
5.2	Picard's Method	236
5.3	Taylor's series method	240
5.4	Euler's Method	242- 250
	5.4.1 Improved Euler's Method	
	5.4.2 Modified Euler's Method	
5.5	Runge-Kutta Method	250
5.6	Predictor-Corrector Method	266 -286
	5.6.1 Milne's Method	
	5.6.2 General approach to predictors and correctors	
5.7	Let us Sum up	286
5.8	Questions for Discussion	287
5.9	Suggested Readings	290

Syllabus for I -MSc (Mathematics)

Paper-III: *Differential Equations & Numerical Methods*

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 (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 $Q = e^{a \cdot x}$ 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

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CONTENTS

	Page No.
Unit - I	1 - 68
1.0 Aims and Objectives	
1.1 Introduction	
1.2 Gamma and Beta Functions - Evaluation of Improper Integrals	
1.3 Bessel Functions	
1.4 Legendre Polynomials	
1.5 Exercise	
Unit - II	69 - 106
2.0 Aims and Objectives	
2.1 Introduction	
2.2 Continuity, Differentiability, Analycity, Properties and Cauchy-Riemann equations in Cartesian and Polar Coordinates	
2.3 Harmonic and Conjugate Harmonic Functions and Milne-Thompson Method	
2.4 Elementary Functions	
2.6 Exercise	
Unit - III	107 - 162
3.0 Aims and Objectives	
3.1 Introduction	
3.2 Line Integral and Evaluation along a path by indefinite integration	
3.3 Cauchy's Integral Theorem, Cauchy's Integral Formula and Generalised integral formula	

- 3.4 Radius of convergence, Expansion in Taylor's Series, maclaurin's series and Laurent series
- 3.5 Singular point - Isolated singular point - pole of order m - essential singularity
- 3.6 Exercise

Unit - IV

163 - 246

- 4.0 Aims and Objectives
- 4.1 Introduction
- 4.2 Evaluation of Residue by formula and by Laurent series, residue theorem and evaluation of integrals of different types
- 4.3 Argument Principle
- 4.4 Exercise

Unit - V

247 - 292

- 5.0 Aims and Objectives
- 5.1 Introduction
- 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), $\text{Sin}z, \text{cos}z, z + a/z$. 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

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CONTENTS

UNIT - I

	Page No.
1.0 Aims and Objectives	3
1.1 Introduction	3
1.2 Assumptions of LPP	4
1.3 Mathematical formulation	5
1.4 Graphical method of solution	9
1.5 Simplex method	13
1.6 Big-M method and Two phase method	21
1.6.1 The Big-M-method (Penalty Method)	21
1.6.2 The Phase Method	27
1.7 Dual simplex method	35
1.8 Let us Sum up	42
1.9 Keywords	42
1.10 Answers to 'Check Your Progress'	43
1.11 Questions for Discussion	53
1.12 Suggested Readings	54

UNIT - II

2.0 Aims and Objectives	57
2.1 Introduction	57
2.2 Importance of Integer Programming	58
2.3 Applications of Integer Programming	58
2.3.1 Methods of integer programming	59
2.4 Gomory's Fractional Cut Algorithm	59
(Or) Cutting Plane Method For Pure (All) I.P.P	
2.5 Mixed integer programming problem	67
2.6 Branch and bound techniques	72
2.7 Let us Sum up	78
2.8 Keywords	78
2.9 Answers to 'Check Your Progress'	78
2.10 Questions for Discussion	81
2.11 Suggested Readings	82

Lesson 3

3.0	Aims and Objectives	83
3.1	Introduction	83
3.2	Mathematical Model of formulation of TP	84
3.2.1	Tabular form of transportation model	85
3.3	General transportation problem	85
3.4	Initial basic feasible solution	87
3.4.1	North West Corner Method (NWCM) procedure	87
3.4.2	Least Cost Method (LCM) procedure	89
3.4.3	Vogel's Approximation Method (VAM) Procedure	92
3.5	Optimal Solution	95
3.5.1	Loops	95
3.5.2	Stepping stone method procedure	96
3.5.3	MODI method Procedure	97
3.6	Degeneracy	106
3.7	Let us Sum up	113
3.8	Keywords	114
3.9	Answers to 'Check Your Progress'	114
3.10	Questions for Discussion	125
3.11	Suggested Readings	126

Lesson 4

4.0	Aims and Objectives	127
4.1	Introduction	127
4.2	Hungarian Method	128
4.2.1	Mathematical Representation of AP	128
4.2.2	Definition and Assumptions of AP	128
4.2.3	Assignment Model	129
4.2.4	Solution Methods of Assignment Problem	129
4.2.4	Alogorithm to find the Optimal Solution to AP	129
4.3	Traveling salesman problem	135
4.4	Let us Sum up	140
4.5	Keywords	140
4.6	Answers to 'Check Your Progress'	141
4.7	Questions for Discussion	145
4.8	Suggested Readings	146

UNIT - III

5.0	Aims and Objectives	149
5.1	Introduction	149
5.2	Some basic terms	150
5.2.1	Assumptions of Game theory	151
5.3	Two-person zero-sum games	152
5.4	The maxmini-minimax principle	152
5.5	Games without saddle points-Mixed Strategies	155
5.5.1	Algebraic method	155
5.6	Graphic solution of $2 \times n$ and $m \times 2$ games	158
5.7	Dominance property	161
5.8	Let us Sum up	169
5.9	Keywords	169
5.10	Answers to 'Check Your Progress'	169
5.11	Questions for Discussion	175
5.12	Suggested Readings	176
Lesson 6		
6.0	Aims and Objectives	177
6.1	Introduction	177
6.2	Meaning & Purpose of Simulation	178
6.2.1	Characteristics of the process of simulation	178
6.3	Simulation Procedures	178
6.3.1	Monte Carlo Simulation Technique	178
6.4	Simulation: Its Application	180
6.5	Simulation: Its Merits & Demerits (A) Merits	181
6.6	Let us Sum up	182
6.7	Keywords	182
6.8	Answers to 'Check Your Progress'	182
6.9	Questions for Discussion	183
6.10	Suggested Readings	183

UNIT - IV

7.0	Aims and Objectives	187
7.1	Introduction	187
7.2	Need for Dynamic Programming	188
7.3	Bellman's Principle of Optimality	187

7.3.1	Recursive Approach	189
7.3.2	Solution of L.P.P By Dynamic Programming	190
7.4	Algorithm of DP	191
7.5	Let us Sum up	201
7.6	Keywords	201
7.7	Answers to ‘Check Your Progress’	203
7.8	Questions for Discussion	205
7.9	Suggested Readings	206
Lesson 8		
8.0	Aims and Objectives	207
8.1	Introduction	207
8.2	Definition, Application and Assumptions	208
8.2.1	Definition	208
8.2.2	Application areas	208
8.2.3	General Sequencing Problem	208
8.2.4	Assumptions of Sequencing Problem	209
8.3	Types of sequencing problems	209
8.4	Processing n jobs through 2 machines	210
8.5	n jobs through 3 machines	214
8.5.1	CDS method	218
8.6	Two jobs through m machines	220
8.7	Let us Sum up	225
8.8	Keywords	225
8.9	Answers to ‘Check Your Progress’	225
8.10	Questions for Discussion	230
8.11	Suggested Readings	231
Lesson 9		
9.0	Aims and Objectives	233
9.1	Introduction	233
9.2	Network minimization	234
9.3	Shortest route problem	235
9.3.1	Minimal Spanning Tree Problem	236
9.4	Maximal-flow problem	237
9.5	PERT and CPM	238
9.6	PERT (Three Time Estimate Approach)	240
9.6.1	CPM Method of Time Cost Trade Off	241
9.7	Let us Sum up	250

9.8	Keywords	250
9.9	Answers to ‘Check Your Progress’	251
9.10	Questions for Discussion	259
9.11	Suggested Readings	260

UNIT - V

10.0	Aims and Objectives	263
10.1	Introduction	263
10.2	Terminology	264
10.3	When Does a Queue Result?	264
10.4	The Elements of Queuing System	265
10.5	Costs Associated with Waiting Lines	267
10.6	Queue System : Salient Features	268
10.7	Queuing Models	272
10.8	Axioms of Poisson Process	274
10.9	Operating Characteristics of Queue System	274
10.10	Model - I (M/M/1):(∞ /FIFO)	276
10.11	Model-II (M/M/1):(N/FIFO)	281
10.12	Model-III (M/M/C):(∞ / FIFO)	283
10.13	Model-IV (M/M/C):(N/ FIFO)	287
10.14	Let us Sum up	291
10.15	Keywords	292
10.16	Answers to ‘Check Your Progress’	292
10.17	Questions for Discussion	294
10.18	Suggested Readings	295

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): (∞ :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 Hiller/Lieberman. McGraw Hill.

TOPOLOGY AND FUNCTIONAL ANALYSIS

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

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CONTENTS

	Page No.
Unit - I	1 - 28
1.1 Topological spaces	
1.2 Elementary Concepts	
1.3 Open bases and open sub-bases	
1.4 Weak topologies	
1.5 The function algebras (X, R) and (X, C)	
1.6 Exercise	
Unit - II	29 - 76
2.1 Compactness	
2.2 Product of spaces	
2.3 Technoff's theorem and locally compact spaces	
2.4 Compactness of metric spaces	
2.5 Ascolis theorem	
2.6 Exercise	
Unit - III	77 - 132
3.1 Separation	
3.2 T-Spaces and Hausdorff spaces	
3.3 Completely regular and normal spaces	
3.4 Urysohn's Lemma and Tietz extension theorem	
3.5 The Urysohn's embedding theorem	
3.6 Connectedness	
3.7 Connected spaces	
3.8 Components of a space	
3.9 Exercise	

Unit - IV

133 - 184

- 4.1 Banach spaces
- 4.2 Definition of Banach spaces
- 4.3 Continuous linear transformation
- 4.4 The Hahn-Banach Theorem
- 4.5 The natural imbedding of N in N^{**}
- 4.6 The open mapping Theorem
- 4.7 The conjugate of an operator
- 4.8 Exercise

Unit - V

185 - 216

- 5.1 Hilbert spaces
- 5.2 Definition and example
- 5.3 Orthogonal complements
- 5.4 Orthonormal set
- 5.5 The conjugate space H^*
- 5.6 The Adjoint of an operator
- 5.7 Self-Adjoint Operators
- 5.8 Normal and Unitary Operators
- 5.9 Projections
- 5.10 Exercise

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)***



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CONTENTS

	Page No.
Unit - I	1 - 68
Unit - II	69 - 114
Unit - III	115 - 164
Unit - IV	165 - 216
Unit - V	217 - 260

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
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CONTENTS

Page No.

Unit - I

1 - 40

- 1.0 Introduction
 - 1.1 Unit Objectives
 - 1.2 Algorithms representations through Flowcharts
 - 1.2.1 Algorithm
 - 1.2.1.1 Analysis
 - 1.2.1.2 The Key Features of an Algorithm
 - 1.2.1.3 A strategy for designing algorithms
 - 1.2.1.4 Simple example of the Algorithm
 - 1.2.2 Flowcharts
 - 1.2.2.1 Symbols
 - 1.2.2.2 Instructions
 - 1.2.2.3 Types of flow charts
 - 1.2.2.4 Interpretation
 - 1.2.2.5 Advantages of Flowcharts
 - 1.2.2.6 Limitations of Flowcharts
 - 1.2.2.7 Differences between Flowcharts and Algorithms
 - 1.3 Formalization of algorithms
 - 1.3.1 Expressing algorithms
 - 1.3.1.1 Implementation
 - 1.3.2 Example
 - 1.3.2.1 Algorithmic analysis
 - 1.3.2.2 Abstract versus empirical
 - 1.3.3 Classes
 - 1.3.3.1 Classification by implementation
 - 1.3.3.2 Classification by design paradigm
 - 1.3.3.3 Classification by field of study
 - 1.3.3.4 Classification by complexity
 - 1.3.3.5 Classification by computing power
 - 1.4 Example for Flowcharts with Algorithms
 - 1.5 Pseudo code
 - 1.5.1 Coding
 - 1.5.2 Program development steps
 - 1.6 Applications
 - 1.7 Summary
 - 1.8 Key Terms
 - 1.9 Answers to 'Check Your Progress'
 - 1.10 Questions and Exercises
 - 1.11 Further Reading

Unit - II

41 - 76

- 2.0 Introduction
- 2.1 Unit Objectives
- 2.2 Concept of Array
- 2.3 Memory map of an array
- 2.4 Assigning Constant value
- 2.5 Addition and subtraction
- 2.6 Multiplication of arrays
- 2.7 Sorting and printing techniques
- 2.8 Summary
- 2.9 Key Terms
- 2.10 Answers to 'Check Your Progress'
- 2.11 Questions and Exercises
- 2.12 Further Reading

Unit - III

77 - 112

- 3.0 Introduction**
- 3.1 Unit Objectives
- 3.2 Decision Tables**
 - 3.2.1 Applications of Decision Tables
 - 3.2.2 Designing Test Cases
 - 3.2.3 Decision Table to Test Program's Structure
 - 3.2.4 Expansion of Immaterial Entries
 - 3.2.5 Decision Table based Testing
- 3.3 Decision Structures/Decision making
 - 3.3.1 if-then-else
 - 3.3.2 Switch statement
- 3.4 Summary
- 3.5 Key Terms
- 3.6 Answers to 'Check Your Progress'
- 3.7 Questions and Exercises
- 3.8 Further Reading

Unit - IV

113 - 162

- 4.0 Introduction
- 4.1 Unit Objectives
- 4.2 Program Structure
- 4.3 Constants and Variable
 - 4.3.1 Constants
 - 4.3.2 Variable
 - 4.3.2.1 Naming conventions

- 4.3.2.2 Variables in source code
- 4.3.2.3 Variables in spreadsheets
- 4.3.2.4 Scope and extent
- 4.3.2.5 Typed and untyped variables
- 4.3.2.6 Parameters
- 4.3.2.7 Memory allocation
- 4.3.2.8 Constants
- 4.3.2.9 Variable interpolation
- 4.4 Input and Output
 - 4.4.1 Input-Output Operations
- 4.5 Operators
 - 4.5.1 Operators
 - 4.5.2 Relational Operators
 - 4.5.3 Logical operators
 - 4.5.4 Increment and decrement operators
 - 4.5.5 Bitwise operators
 - 4.5.6 Comma (,) operator
- 4.6 Control Structures
 - 4.6.1 Sequential structure
 - 4.6.2 Conditional or Decision or Selection structure
- 4.7 Loops /Interactive Statement
- 4.8 Summary
- 4.9 Key Terms
- 4.10 Answers to ‘Check Your Progress’
- 4.11 Questions and Exercises
- 4.12 Further Reading

Unit - V

163 - 196

- 5.0 Introduction
- 5.1 Unit Objectives
- 5.2 Types of Arrays
 - 5.2.1 Single Dimensional Array
 - 5.2.2 Multi Dimensional Arrays
 - 5.2.3 Characters Arrays (Strings)
 - 5.2.4 Passing Arrays to Functions
- 5.3 Subroutine calls
- 5.4 Top-down design
- 5.5 *Structured programming***
- 5.6 Summary
- 5.7 Key Terms
- 5.8 Answers to ‘Check Your Progress’
- 5.9 Questions and Exercises
- 5.10 Further Reading

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
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CONTENTS

	Page No.
Unit - I	1 - 50
1.0 Aims and Objectives	
1.1 Introduction	
1.2 Sample Space and Events	
1.3 Probability	
1.4 The axioms of probability and some elementary theorems	
1.5 Conditional Probability	
1.6 Bayes Theorem	
1.7 Exercise	
Unit - II	51 - 104
2.0 Aims and Objectives	
2.1 Introduction	
2.2 Discrete and continuous random variables - distribution - distribution function	
2.3 Binomial Distribution	
2.4 Poisson Distribution	
2.5 Normal Distribution	
2.6 Exercise	
Unit - III	105 - 150
3.0 Aims and Objectives	
3.1 Introduction	
3.2 Population and Samples, Sampling distribution of mean (known and unknown) proportions and Sampling distributions of sums and differences	
3.3 Estimation - Point estimation - interval estimation - Bayesian estimation	
3.4 Exercise	

Unit - IV**151 - 202**

- 4.0 Aims and Objectives
- 4.1 Introduction
- 4.2 Test of Hypothesis - Means and Proportions - Hypothesis concerning one or two means - Type I and Type II errors - One tail and two tailed tests
- 4.3 Test of significance - Student's t-test, F-test, χ^2 test. Estimation of proportion - Estimation of Proportions
- 4.4 Exercise

Unit - V**203 - 252**

- 5.0 Aims and Objectives
- 5.1 Introduction
- 5.2 The method of least squares - Inferences based on the least squares estimations
- 5.3 Curvilinear regression - multiple regressions
- 5.4 Correlation for univariate and bivariate distributions.
- 5.5 Exercise

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, χ^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.