

University of Madras
B.Sc. Mathematics

Summary

University of Madras
B.Sc. Mathematics
Revised Scheme of Examinations

I SEMESTER

Course Components / Title of the paper	Credits	Marks		
		CIA	EXT	TOTAL
Part –I - Language Paper -I	3	25	75	100
Part –II - English Paper -I	3	25	75	100
Part-III Core Paper-I: Algebra	4	25	75	100
Core Paper-II: Trigonometry	4	25	75	100
Allied Paper- I	5	25	75	100
* Part-IV: Basic Tamil/Adv. Tamil/ Non Major Elective -I	2	25	75	100
Soft Skills -I	3	50	50	100

II SEMESTER

Course Components/Title of the paper	Credits	Marks		
		CIA	EXT	TOTAL
Part –I – Language Paper -II	3	25	75	100
Part –II - English Paper –II	3	25	75	100
Part-III Core Paper -III: Differential Calculus	4	25	75	100
Core Paper – IV: Analytical Geometry	4	25	75	100
Allied paper- II	5	25	75	100
* Part-IV: Basic Tamil/Adv. Tamil/ Non Major Elective -II	2	25	75	100
Part-IV Soft Skills -II	3	50	50	100

- * (a) Non-Tamil Students upto XII Std must studied Basic Tamil comprising of two course in degree level
- (b) Tamil Students upto XII Std, taken Non-Tamil Language under Part-I at degree level, shall take Advanced Tamil comprising of two courses.
- (c) Tamil Students upto XII Std and taken Tamil under Part-I Language at degree level, shall be chosen Non- major Electives at degree level

University of Madras
B.Sc. Mathematics

III SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Part –I – Language Paper -III	3	25	75	100
Part –II – English Paper -III	3	25	75	100
Part-III Core paper-V: Integral Calculus	4	25	75	100
Core Paper – VI: Differential Equations	4	25	75	100
Allied Paper- III	5	25	75	100
Part-IV Environmental Studies	2	Exam in IV Semester		
Soft Skills –III	3	50	50	100

IV SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Part –I - Language Paper –IV	3	25	75	100
Part –II - English Paper –IV	3	25	75	100
Part-III Core paper-VII: Transform Techniques	4	25	75	100
Core Paper VIII : Statics	4	25	75	100
Allied paper- IV	5	25	75	100
Part-IV Environmental Studies	2	25	75	100
Soft Skills-IV	3	50	50	100

V SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Part-III Core Paper-IX: Algebraic Structures	4	25	75	100
Core Paper -X: Real Analysis-I	4	25	75	100
Core Paper-XI: Dynamics	4	25	75	100
Core Paper – XII: Discrete Mathematics	4	25	75	100
Elective Paper -I: Choose any one from Group-A	5	25	75	100
Part-IV Value Education	2			

University of Madras
B.Sc. Mathematics

VI SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
Part-III Core Paper-XII: Linear Algebra	4	25	75	100
Core Paper -XIV:Real analysis-II	4	25	75	100
Core Paper XV: Complex Analysis	4	25	75	100
Elective Paper II : Choose any one from Group B	5	25	75	100
Elective Paper III: Choose any one from Group B	5	25	75	100
Part-V Extension Activity	1			

LIST OF ELECTIVE SUBJECTS

GROUP A

1. PROGRAMMING LANGUAGE 'C' WITH PRACTICALS
2. MATHEMATICAL MODELING
3. NUMERICAL METHODS

GROUP B

4. ELEMENTARY NUMBER THEORY
5. GRAPH THEORY
6. OPERATIONS RESEARCH
7. SPECIAL FUNCTIONS

University of Madras
B.Sc. Mathematics

Syllabus

(Core Papers)

University of Madras
B.Sc. Mathematics

CORE PAPER I - ALGEBRA

Unit- 1

Polynomial equations; Imaginary and irrational roots; Relation between roots and coefficients; Symmetric functions of roots in terms of coefficients; Transformations of equations; Reciprocal equations

Chapter 6 Section 9 to 12, 15, 15.1,15.2,15.3, 16, 16.1,16.2.

Unit-2

Increase or decrease the roots of the given equation: Removal of term: Descartes' rule of signs: Approximate solutions of roots of polynomials by Horner's method; Cardan's method of solution of a cubic polynomial. Summation of Series using Binomial, Exponential and Logarithmic series:

Chapter 6: Section 17, 19, 24, 30, 34, 34.1

Chapter 3: Section 10, Chapter 4: Section 3, 3.1, 7.

Unit-3

Symmetric; Skew Symmetric; Hermitian; Skew Hermitian; Orthogonal Matrices; Eigen values; Eigen Vectors; Cayley - Hamilton Theorem; Similar matrices; Diagonalization of a matrix.

Chapter 2, Section 6.1 to 6.3, 9.1, 9.2 , 16 , 16.1,16.2 16.3

Unit-4

Prime number; Composite number; decomposition of a composite number as a product of primes uniquely; divisors of a positive integer n ; Euler function.

Chapter 5, Section 1 to 11

Unit-5

Congruence modulo n ; highest power of a prime number p contained in $n!$; Fermat's and Wilson's theorems

.Chapter 5, Section 12 to 17

Contents and treatment as in

Unit – 1 and 2

Algebra Volume I by T. K. Manicavachagam Pillay,T.Natarajan, K.S.Ganapathy, Viswanathan Publication 2007

Unit – 3, 4 and 5

Algebra Volume II by T. K. Manicavachagam Pillay ,T.Natarajan ,K.S.Ganapathy, Viswanathan Publication 2008

Reference Books:-

1. Algebra: by S. Arumugam (New Gama publishing house, Palayamkottai)

University of Madras
B.Sc. Mathematics

CORE PAPER II-TRIGONOMETRY

Unit- 1

Expansions of powers of $\sin\theta$, $\cos\theta$ - Expansions of $\cos^n \theta$, $\sin^n \theta$, $\cos^m \theta \sin^n \theta$
Chapter 2, Section 2.1, 2.1.1, 2.1.2, 2.1.3

Unit-2

Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ - Expansions of $\tan(\theta_1+\theta_2+\dots+\theta_n)$ - Expansions of $\sin x$,
 $\cos x$, $\tan x$ in terms of x -Sum of roots of trigonometric equations – Formation of equation with trigonometric roots.
Chapter 3, Section 3.1 to 3.6

Unit-3

Hyperbolic functions-Relation between circular and hyperbolic functions - Formulas in hyperbolic functions – Inverse hyperbolic functions
Chapter 4, Section 4.1 to 4.7

Unit 4

Inverse function of exponential functions – Values of $\text{Log}(u+iv)$ - Complex index.
Chapter 5, Section 5.1 to 5.3

Unit-5

Sums of trigonometrical series – Applications of binomial, exponential, logarithmic and Gregory's series - Difference method.
Chapter 6, Section 6.1 to 6.6.3

Content and treatment as in Trigonometry by P. Duraipandian and Kayalal Pachaiyappa, Muhil Publishers.

Reference Books:-

1. Trigonometry by T.K. Manickavachagam Pillay

University of Madras
B.Sc. Mathematics

CORE PAPER III - DIFFERENTIAL CALCULUS

Unit- 1

Successive differentiation - n^{th} derivative- standard results – trigonometrical - transformation – formation of equations using derivatives - Leibnitz's theorem and its applications

Chapter 3 section 1.1 to 1.6, 2.1 and 2.2

Unit- 2

Total differential of a function – special cases – implicit functions - partial derivatives of a function of two functions - Maxima and Minima of functions of 2 variables- Lagrange's method of undetermined multipliers.

Chapter 8 section 1.3 to 1.5 and 1.7, Section 4, 4.1 and 5 .

Unit- 3

Envelopes – method of finding envelopes – Curvature- circle, radius and centre of curvature- Cartesian formula for radius of curvature – coordinates of the centre of curvature – evolute-and involute - radius of curvature and centre of curvature in polar coordinates – p-r equation

Chapter 10 Section 1.1 to 1.4 and Section 2.1 to 2.7

Unit- 4

P-r equations- angle between the radius vector and the tangent – slope of the tangent in the polar coordinates – the angle of intersection of two curves in polar coordinates- polar sub tangent and polar sub normal – the length of arc in polar coordinates.

Chapter 9 Section 4.1 to 4.6

Unit- 5

Asymptotes parallel to the axes – special cases – another method for finding asymptotes - asymptotes by inspection – intersection of a curve with an asymptote.

Chapter 11 - Section 1 to 4, Section 5.1 , 5.2,6 and 7

Content and treatment as in Calculus Vol- 1 by S. Narayanan and T.K.

Manicavachagom pillay -

S. Viswanathan publishers – 2006

Reference Books:-

1. Calculus by Thomas and Fenny ,Pearson Publication
2. Calculus by Stewart

University of Madras
B.Sc. Mathematics

CORE PAPER IV - ANALYTICAL GEOMETRY

Unit-1

Chord of contact – polar and pole,- conjugate points and conjugate lines – chord with (x_1, y_1) as its midpoint – diameters – conjugate diameters of an ellipse.- semi diameters- conjugate diameters of hyperbola

Chapter – 7 Sections 7.1 to 7.3 , Chapter – 8 Section 8.1 to 8.5

Unit- 2

Co-normal points, co-normal points as the intersection of the conic and a certain R.H. concyclic points – Polar coordinates, general polar equation of straight line – polar equation of a circle on A_1A_2 as diameter, equation of a straight line, circle, conic – equation of chord , tangent, normal. Equations of the asymptotes of a hyperbola.

Chapter – 9 Sec 9.1 to 9.3 , Chapter – 10 Sec 10.1 to 10.8

Unit- 3

Introduction – System of Planes - Length of the perpendicular – orthogonal projection.

Chapter 2 Sec 2.1 to 2.10

Unit- 4

Representation of line – angle between a line and a plane- co-planar lines- shortest distance 2 skew lines- Length of the perpendicular- intersection of three planes

Chapter 3 Sec 3.1 to 3.8

Unit- 5

Equation of a sphere ; general equation ; section of a sphere by a plane - equation of the circle ; tangent plane ; radical plane ; coaxial system of spheres; orthogonal spheres.

Chapter 6 Sec 6.1 to 6.9

Contents and treatment as in

1. Analytical Geometry of 2D by P.Durai Pandian- Muhil publishers for Unit – 1 and 2
2. Analytical Solid Geometry of 3D by Shanthi Narayan and Dr.P.K. Mittal for Unit – 3 to 5

Reference Books:-

1. Analytical Geometry of Two Dimension by T. K. Manikavachakam Pillai and S. Narayanan.
2. Analytical Geometry of Three Dimension by T. K. Manikavachakam Pillai and S. Narayanan

University of Madras
B.Sc. Mathematics

CORE PAPER V- INTEGRAL CALCULUS

Unit- 1

Reduction formulae –Types $\int x^n e^{ax} dx$, $\int x^n \cos ax dx$, $\int x^n \sin ax dx$
 $\int \cos^n x dx$, $\int \sin^n x dx$, $\int \sin^m x \cos^n x dx$, $\int \tan^n x dx$, $\int \cot^n x dx$, $\int \sec^n x dx$, $\int \operatorname{cosec}^n x dx$
 $\int x^n (\log x)^m dx$. Bernoulli's formula.

Chapter 1 Section 13, 13.1 to 13.10, 14, 15.1

Unit- 2

Multiple Integrals- definition of the double integrals- evaluation of the double integrals-
double integrals in polar coordinates – triple integrals – applications of multiple integrals
– volumes of solids of revolution – areas of curved surfaces – change of variables –
Jacobians

Chapter 5 Section 1, 2.1, 2.2, 3.1, 4, 6.1, 6.2, 6.3, 7

Chapter 6 Section 1.1, 1.2, 2.1 to 2.4

Unit- 3

Beta and Gamma functions- indefinite integral – definitions – convergence of $\Gamma (n)$ –
recurrence formula of Γ functions – properties of β -function- relation between β and Γ
functions

Chapter 7 Sections 1.1 to 1.4 , 2.1 to 2.3, 3, 4, 5.

Unit-4

Introduction, Gradient, divergence, curl, directional derivative, unit normal to a surface.
Solenoidal and irrotational. Laplacian Differential Operator.

Chapter 2 Sections 2.3 - 2.8

Unit-5

Line, surface and volume integrals; Theorems of Gauss, Stokes and Green. (Without
proof) – Problems.

Chapter 3 Sections 3.1-3.8 and Chapter 4 Sections 4.1- 4.8

Content and treatment as in

1. Calculus Vol- II by S. Narayanan and T.K. Manicavachagam pillay - S. Viswanathan publishers – 2007 for Unit 1 , Unit 2 , Unit 3
2. Content and treatment as in Vector Analysis by P.Duraipandian and Laxmi Duraipandian. Emerald Publishers. For Unit 4 , Unit 5

Reference Books:-

1. Integral Calculus and differential equations : Dipak Chatterjee (TATA McGraw Hill Publishing company Ltd.)
2. Vector Algebra and Analysis by Narayanan and T.K.Manickvachagam Pillay S .Viswanathan Publishers.
3. Vector Analysis: Murray Spiegel (Schaum Publishing Company, New York)

University of Madras
B.Sc. Mathematics

CORE PAPER- VI-DIFFERENTIAL EQUATIONS

Unit- 1

Homogenous equations. Exact equations. Integratic factor. Linear equations, Reduction of order.

Chapter 2 Sections 7-11

Unit- 2

Second order linear differential equations introduction .General solution of homogenous equations. The use of known solution to find another. Homogeneous equation with constant coefficients- Method of undetermined coefficients; Method of variation of parameters;

Chapter 3 Sections 14-19

Unit -3

System of first order equations-Linear systems. Homogeneous linear systems with constant coefficients.(Omit non-homogeneous system of equations)

Chapter 10 Sections 55 and 56

Unit-4

Formation of P.D.E by eliminating arbitrary constants and arbitrary functions; complete integral; Singular integral; general integral: Lagrange's equations $Pp + Qq=R$.

Chapter 0 Sections 0.4 and 0.5

Unit-5

Charpit's method and Special types of first order equations.

Chapter 0 Sections 0.11, 0.11.1

Contents and treatment as in

1. Differential equations with Applications and Historical Notes by George F. Simmons Second Edition, Tata Mcgraw Hill Publications. Unit 1, 2 and 3
2. Introduction to Partial Differential Equations Second Edition(2009) by K.Sankara Rao, PHI Learning Private Limited. Unit 4 and 5

Reference Books:-

1. Differential equations by Simmons.
2. Partial Differential Equations by Sneddon.
3. Ordinary and partial differential equations by Dr.M.D.Raisinghania S.Chand

University of Madras
B.Sc. Mathematics

CORE PAPER VII TRANSFORM TECHNIQUES

Unit- 1

Introduction – Properties of Laplace transform- Laplace transform of elementary functions-Problems using properties-Laplace transform of special function, unit step function and Dirac delta function - Laplace transform of derivatives and Integrals – Evaluation of integral using Laplace Transform - Initial Value Theorem – Final Value Theorem and problems –Laplace Transform of periodic function

Chapter 2 : Section 2.1 to 2.20

Unit-2

Introduction, Properties of inverse Laplace transform, Problems (usual types); Convolution Theorem - Inverse Laplace Transform using Convolution theorem

Chapter 3, Section 3.1 to 3.11

Unit-3

Introduction, Expansions of periodic function of period 2π ; expansion of even and odd functions; half range cosine and sine series – Fourier series of change of interval.

Chapter 1, Section 1.1 to 1.11

Unit- 4

Introduction of Fourier transform - Properties of Fourier Transforms - Inverse Fourier transform – Problems, Fourier sine and cosine transforms and their inverse Fourier transform – Problems, Convolution theorem, Parseval's identity and problems using Parseval's identity.

Chapter 4, Section 4.1 to 4.12

Unit- 5

Applications of Laplace transform to solution of first and second order linear differential equations (constant coefficients) and simultaneous linear ordinary differential equations – Application of Laplace transform to partial differential equations. Application of Laplace Transform and Fourier transform to Initial and Boundary Value Problems.

Chapter 5, Section 5.1, 5.3, 5.7 to 5.11

Contents and treatment as in “Fourier Series and Integral Transforms” – Dr. S. Sreenath, S.Ranganatham, Dr. M.V.S.S.N.Prasad and Dr. V. Ramesh Babu. S.Chand and Company Ltd

Reference Books:-

1. Engineering Mathematics volume 3 : M.K. Venkataraman(National Publishing Co.)
2. Engineering Mathematics volume 3 : P.Kandasamy and others(S.Chand and Co.)
3. Advanced Engineering Mathematics : Stanley Grossman and William R.Devit (Harper and Row publishers)

University of Madras
B.Sc. Mathematics

CORE PAPER- VIII -STATICS

Unit-1

Newton's laws of motion - resultant of two forces on a particle- Equilibrium of a particle- Limiting Equilibrium of a particle on an inclined plane
Chapter 2 - Section 2.1, 2.2, Chapter 3 - Section 3.1 and 3.2

Unit-2

Forces on a rigid body – moment of a force – general motion of a rigid body- equivalent systems of forces – parallel forces – forces along the sides of a triangle – couples
Chapter 4 - Section 4.1 to 4.6

Unit-3

Resultant of several coplanar forces- equation of the line of action of the resultant- Equilibrium of a rigid body under three coplanar forces – Reduction of coplanar forces into a force and a couple.- problems involving frictional forces
Chapter 4 - Section 4.7 to 4.9, Chapter 5 - Section 5.1, 5.2

Unit-4

Centre of mass – finding mass centre – a hanging body in equilibrium – stability of equilibrium – stability using differentiation
Chapter 6 - Section 6.1 to 6.3, Chapter 7 - Section 7.1, 7.2

Unit-5

Virtual work – hanging strings- equilibrium of a uniform homogeneous string – suspension bridge
Chapter 8 - Section 8.1, Chapter 9 - Section 9.1, 9.2

Contents and treatment as in “Mechanics – P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

Reference Books:

1. Dynamics – K. Viswanatha Naik and M. S. Kasi, Emerald Publishers.
2. Dynamics – A. V. Dharmapadam, S. Viswanathan Publishers.
3. Mechanics – Walter Grenier

University of Madras
B.Sc. Mathematics

CORE PAPER- IX : ALGEBRAIC STRUCTURES

Unit -1

Introduction to groups. Subgroups, cyclic groups and properties of cyclic groups; Lagrange's Theorem; A counting principle
Chapter 2 Section 2.4 and 2.5

Unit -2

Normal subgroups and Quotient group; Homomorphism; Automorphism.
Chapter 2 Section 2.6 to 2.8

Unit – 3

Cayley's Theorem; Permutation groups.
Chapter 2 Section 2.9 and 2.10

Unit -4

Definition and examples of ring- Some special classes of rings; homomorphism of rings; Ideals and quotient rings; More ideals and quotient rings.
Chapter 3 Section 3.1 to 3.5

Unit – 5

The field of quotients of an integral domain; Euclidean Rings; The particular Euclidean ring.
Section 3.6 to 3.8

Contents and treatment as in "Topics in Algebra" – I. N. Herstein, Wiley Eastern Ltd.

Reference Book :-

1. Modern Algebra by M.L.Santiago
2. Modern Algebra by S. Arumugam and others, New Gamma publishing House, Palayamkottai.
3. Modern Algebra by Visvanathan Nayak

University of Madras
B.Sc. Mathematics

CORE PAPER-X- REAL ANALYSIS -I

Unit – 1

Sets and elements; Operations on sets; functions; real valued functions; equivalence; countability ; real numbers; least upper bounds.

Chapter 1 Section 1. 1 to 1.7

Unit – 2

Definition of a sequence and subsequence; limit of a sequence; convergent sequences; divergent sequences; bounded sequences; monotone sequences;

Chapter 2 Section 2.1 to 2.6

Unit – 3

Operations on convergent sequences; operations on divergent sequences; limit superior and limit inferior; Cauchy sequences.

Chapter 2 Section 2.7 to 2.10

Unit- 4

Convergence and divergence; series with non-negative numbers; alternating series; conditional convergence and absolute convergence; tests for absolute convergence; series whose terms form a non-increasing sequence; the class l^2

Chapter 3 Section 3.1 to 3.4, 3.6, 3.7 and 3.10

Unit – 5

Limit of a function on a real line;. Metric spaces; Limits in metric spaces.Function continuous at a point on the real line, reformulation, Function continuous on a metric space.

Chapter 4 Section 4.1 to 4.3 Chapter 5 Section 5.1-5.3

Contents and Treatment as in “Methods of Real Analysis” : Richard R. Goldberg (Oxford and IBH Publishing Co.)

Reference Books :-

1. Principles of Mathematical Analysis by Walter Rudin
2. Mathematical Analysis Tom M Apostol

University of Madras
B.Sc. Mathematics

CORE PAPER- XI- DYNAMICS

Unit -1

Basic units – velocity – acceleration- coplanar motion – rectilinear motion under constant forces – acceleration and retardation – thrust on a plane – motion along a vertical line under gravity – line of quickest descent - motion along an inclined plane – motion of connected particles.

Chapter 1 - Section 1.1 to 1.4, Chapter 10 - Section 10.1 to 10.6

Unit – 2

Work, Energy and power – work – conservative field of force – power – Rectilinear motion under varying Force simple harmonic motion (S.H.M.) – S.H.M. along a horizontal line- S.H.M. along a vertical line – motion under gravity in a resisting medium.

Chapter 11 - Section 11.1to 11.3 , Chapter 12 - Section 12.1 to 12.4

Unit – 3

Forces on a projectile- projectile projected on an inclined plane- Enveloping parabola or bounding parabola – impact – impulse force - impact of sphere - impact of two smooth spheres – impact of a smooth sphere on a plane – oblique impact of two smooth spheres

Chapter 13 - Section 13.1 to 13.3, Chapter 14 - Section 14.1, 14.5

Unit – 4

Circular motion – Conical pendulum – motion of a cyclist on a circular path – circular motion on a vertical plane – relative rest in a revolving cone – simple pendulum – central orbits -general orbits - central orbits- conic as centered orbit.

Chapter 15 - Section 15.1 to 15.6, Chapter 16 - Section 16.1 to 16.3

Unit – 5

Moment of inertia. Two dimensional motion of a rigid body –equations of motion for two dimensional motion – theory of dimensions- definition of dimensions.

Chapter 17 -Section 17.1, Chapter 18 - Section 18.1, 18.2, Chapter 19 - Section 19.1

Contents and treatment as in “Mechanics” – P. Duraipandian , Laxmi Duraipandian , Muthamizh Jayapragasham, S. Chand and Co limited 2008 .

Reference Books:

1. Dynamics – K. Viswanatha Naik and M. S. Kasi, Emerald Publishers.
2. Dynamics – A. V. Dharmapadam, S. Viswanathan Publishers.
3. Mechanics – Walter Grenier

University of Madras
B.Sc. Mathematics

CORE PAPER- XII- DISCRETE MATHEMATICS

Unit- 1

Set, some basic properties of integers, Mathematical induction, divisibility of integers, representation of positive integers

Chapter 1 - Sections 1.1 to 1.5

Unit – 2

Boolean algebra, two element Boolean algebra, Disjunctive normal form, Conjunctive normal form

Chapter 5 - Sections 5.1 to 5.4

Unit – 3

Application, Simplification of circuits, Designing of switching circuits, Logical Gates and Combinatorial circuits.

Chapter 5 - Section 5.5, 5.6

Unit – 4

Sequence and recurrence relation, Solving recurrence relations by iteration method, Modeling of counting problems by recurrence relations, Linear (difference equations) recurrence relations with constant coefficients, Generating functions, Sum and product of two generating functions, Useful generating functions, Combinatorial problems.

Chapter 6 - Section 6.1 to 6.6

Unit – 5

Introduction, Walk, Path and cycles, Euler circuit

Chapter 7 - Sections 7.1 to 7.3

Contents and treatment as in introduction to Discrete Mathematics, 2nd edition, 2002 by M. K. Sen and B. C. Chakraborty, Books and Allied Private Ltd., Kolkata.

Reference Books:

1. Discrete mathematics for computer scientists and mathematicians by J. L. Mertz, Abraham Kendel and T. P. Baker prentice-hall, India.
2. Discrete mathematics for computer scientists by John Truss-Addison Wesley.
3. Elements of Discrete Mathematics, C. L. Liu, New York Mcgraw-Hill, 1977.

University of Madras
B.Sc. Mathematics

CORE PAPER-XIII - LINEAR ALGEBRA

Unit – 1

Vector spaces. Elementary basic concepts; linear independence and bases
Chapter 4 Section 4.1 and 4.2

Unit – 2

Dual spaces
Chapter 4 Section 4.3

Unit – 3

Inner product spaces.
Chapter 4 Section 4.4

Unit – 4

Algebra of linear transformations; characteristic roots.
Chapter 6 Section 6.1 and 6.2

Unit – 5

Matrices; canonical forms; triangular forms.
Chapter 6 Section 6.3 and 6.4

Treatment and content as in “Topics in Algebra” – I. N. Herstein-Wiley Eastern Ltd.

Reference Books:

1. University Algebra – N. S. Gopalakrishnan – New Age International Publications, Wiley Eastern Ltd.
2. First course in Algebra – John B. Fraleigh, Addison Wesley.
3. Text Book of Algebra – R. Balakrishna and N. Ramabadrana, Vikas publishing Co.
4. Algebra – S. Arumugam, New Gamma publishing house, Palayamkottai.

University of Madras
B.Sc. Mathematics

CORE PAPER – XIV- REAL ANALYSIS -II

Unit – 1

Open sets; closed sets; Discontinuous function on \mathbb{R}^1 . More about open sets; Connected sets :
Chapter 5 Section 5.4 to 5.6
Chapter 6 Section 6.1 and 6.2

Unit – 2

Bounded sets and totally bounded sets: Complete metric spaces; compact metric spaces, continuous functions on a compact metric space, continuity of inverse functions, uniform continuity.
Chapter 6 Section 6.3 to 6.8

Unit – 3

Sets of measure zero, definition of the Riemann integral, existence of the Riemann integral; properties of Riemann integral.
Chapter 7 Section 7.1 to 7.4

Unit – 4

Derivatives; Rolle's theorem, Law of mean, Fundamental theorems of calculus.
Chapter 7 Section 7.5 to 7.8

Unit – 5

Taylor's theorem; Pointwise convergence of sequences of functions, uniform convergence of sequences of functions.
Chapter 8 Section 8.5 Chapter 9 Section 9.1 and 9.2

Content and Treatment as in "Methods of Real Analysis"- Richard R. Goldberg (Oxford and IBH Publishing Co)

Reference Books:

1. Principles of Mathematical Analysis by Walter Rudin
2. Mathematical Analysis Tom M Apostol

University of Madras
B.Sc. Mathematics

CORE PAPER – XV- COMPLEX ANALYSIS

Unit – 1

Functions of a complex variable - mappings, limits - theorems on limits, continuity, derivatives, differentiation formulae - Cauchy-Riemann equations - sufficient conditions for differentiability- Cauchy-Riemann equations in polar form - Analytic functions - Harmonic functions.

Chapter 2 Section 2.9 to 2.12, 2.14 to 2.20 and 2.22

Unit – 2

Linear functions - The transformation $w = 1/z$ - linear fractional transformations - an implicit form - exponential and logarithmic transformations – transformation $w = \sin z$ - Preservation of angles.

Chapter 8 Section 8.68 to 8.71 and 8.73, 8.74 Chapter 9 : 9.79

Unit – 3

Complex Valued functions- contours - contour integrals - Anti derivatives - Cauchy-Goursat theorem. Cauchy integral formula - derivatives of analytic function - Liouville's theorem and fundamental theorem of algebra -maximum moduli of functions.

Chapter 4 Section 4.30 to 4.42

Unit – 4

Convergence of sequences and series - Taylor's series -Laurent's series - zeros of analytic functions.

Chapter 5 Section 5.43 to 5.47

Unit – 5

Residues - Residue theorems- Three types of isolated singular points- Residues at poles- Zeros and poles of order 'm' - Evaluation of improper integrals – Improper integrals involving sines and cosines - Definite integrals involving sines and cosines – Argument principle and Rouché's theorem.

Chapter 6 Section 6.53 to 6.57 and Chapter 7 Section 7.60 to 7.65.

Content and treatment as in

Complex variables and Applications (Sixth Edition) by James Ward Brown and Ruel V.Churchill, Mc.Grawhill Inc.

Reference Books:

1. Theory and problems of Complex Variables – Murray R.Spiegel, Schaum outline series
2. Complex Analysis – P. Duraipandian
3. Introduction to Complex Analysis S. Ponnuswamy , Narosa Publishers 1993

University of Madras
B.Sc. Mathematics

Syllabus

(Allied Papers)

University of Madras
B.Sc. Mathematics

**ALLIED PAPER I :
CALCULUS OF FINITE DIFFERENCES AND NUMERICAL ANALYSIS – I**

Solutions of algebraic and transcendental equations, Bisection method, Iteration method, Regula-falsi method, Newton-Raphson method.

Solution of simultaneous linear equations :

Guass-elimination method, Guass – Jordan method, Guass – Siedel method, Crout's method.

Finite differences:

E operators and relation between them, Differences of a polynomial, Factorial polynomials, differences of zero, summation series.

Interpolation with equal intervals:

Newton's forward and backward interpolation formulae. Central differences formulae- Gauss forward and backward formulae, Sterling's formula and Bessel's formula.

Interpolation with unequal intervals:

Divided differences and Newton's divided differences formula for interpolation and Lagrange's formula for interpolation.

Inverse Interpolation – Lagrange's method, Reversion of series method.

Reference Books:

1. Calculus of finite differences and Numerical analysis by Gupta-Malik, Krishna Prakastan Mandir, Meerut.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
3. Numerical Analysis by B.D. Gupta, Konark publishing.
4. Calculus of finite differences and Numerical Analysis by Saxena, S. Chand & Co.

University of Madras
B.Sc. Mathematics

ALLIED PAPER II :
CALCULUS OF FINITE DIFFERENCES AND NUMERICAL ANALYSIS- II

Numerical differentiation :

Derivatives using Newton's forward and backward difference formulae, Derivatives using Sterling's formula, Derivative using divided difference formula, Maxima and Minima using the above formulae.

Numerical integration :

General quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule, Euler-Maclaurin Summation formula, Sterling's formula for $n!$.

Difference equations :

Linear homogenous and nonhomogenous difference equation with constant coefficients, particular integrals for $a^u x^m$, x^m , $\sin kx$, $\cos kx$.

Numerical solution of ordinary difference equations (1 order only)

Taylor's series method, Picard's method, Euler's method, Modified Euler's method, Runge-kutta method fourth order only, Predictor-corrector method-Milne's method and Adams-Bashforth method.

Reference Books:

1. Calculus of finite differences and Numerical Analysis by Gupta-Malik, Krishna prakastan Mandir, Meerut.
2. Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
3. Numerical Analysis by B.D. Gupta, Konark publishing.
4. Calculus of finite differences and Numerical Analysis by Saxena, Chand & Co.

University of Madras
B.Sc. Mathematics

ALLIED PAPER III :
MATHEMATICAL STATISTICS – I (Theory)
(Theory and Practicals)

UNIT – 1 : Statistics – Definition – functions – applications – complete enumeration – sampling methods – measures of central tendency – measures of dispersion – skewness-kurtosis.

UNIT – 2 : Sample space – Events, Definition of probability (Classical, Statistical & Axiomatic) – Addition and multiplication laws of probability – Independence – Conditional probability – Bayes theorem – simple problems.

UNIT – 3 : Random Variables (Discrete and continuous), Distribution function – Expected values & moments – Moment generating function – probability generating function – Examples. Characteristic function – Uniqueness and inversion theorems (Statements and applications only) – Cumulants, Chebychev's inequality – Simple problems.

UNIT – 4 : Concepts of bivariate distribution – Correlation : Rank correlation coefficient – Concepts of partial and multiple correlation coefficients – Regression : Method of Least squares for fitting Linear, Quadratic and exponential curves - simple problems.

UNIT – 5 : Standard distributions – Binomial, Hyper geometric, Poisson, Normal and Uniform distributions – Geometric, Exponential, Gamma and Beta distributions, Inter-relationship among distributions.

Books for study and reference:

1. Hogg R. V. & Craig A. T. 1988) : Introduction to Mathematical Statistics, Mcmillan.
2. Mood A. M & Graybill F. A & Boes D. G (1974) : Introduction to theory of Statistics, Mcgraw Hill.
3. Snedecor G. W. & Cochran W. G (1967) : Statistical Methods, Oxford and IBH.

University of Madras
B.Sc. Mathematics

ALLIED PAPER IV :
MATHEMATICAL STATISTICS – II (Theory)
(Theory and Practicals)

UNIT – 1 : Sampling Theory – sampling distributions – concept of standard error-sampling distribution based on Normal distribution : t, chi-square and F distribution.

UNIT – 2 : Point estimation-concepts of unbiasedness, consistency, efficiency and sufficiency-Cramer Rao inequality-methods of estimation : Maximum likelihood, moments and minimum chi-square and their properties. (Statement only)

UNIT – 3 : Test of Significance-standard error-large sample tests. Exact tests based on Normal, t, chi-square and F distributions with respect to population mean/means, proportion/proportions variances and correlation co-efficient. Theory of attributes – tests of independence of attributes based on contingency tables – goodness of fit tests based on Chi-square.

UNIT – 4 : Analysis of variance : One way, two-way classification – Concepts and problems, interval estimation – confidence intervals for population mean/means, proportion/proportions and variances based on Normal, t, chi-square and F.

UNIT – 5 : Tests of hypothesis : Type I and Type II errors – power of test-Neyman Pearson Lemma – Likelihood ratio tests – concepts of most powerful test – (statements and results only) simple problems

Books for study and reference:

1. Hogg R. V. & Craig A. T (1998) : Introduction to Mathematical Statistics, Mcmillan.
2. Mood A. M & Graybill F. A & Boes D. G (1974) : Introduction to theory of Statistics.
3. Snedecor G. W & Cochran W. G : Statistical Methods, Oxford and IBH.
4. Hoel P. G. (1971) : Introduction to Mathematical Statistics, Wiley.
5. Wilks S. S : Elementary Statistical Analysis, Oxford and IBH.

University of Madras
B.Sc. Mathematics

PRACTICALS BASED ON
ALLIED PAPER III & IV :
MATHEMATICAL STATISTICS I AND II

1. Construction of univariate and bivariate frequency distributions with samples of size not exceeding 200.
2. Diagrammatic and Graphical Representation of data and frequency distribution.
3. Cumulative frequency distribution-Ogives-Lorenz curve.
4. Measure of location and dispersion(absolute and relative), Skewness and Kurtosis.
5. Numerical Problem involving derivation of marginal and conditional distributions and related measures of Moments.
6. Fitting of Binomial, Poisson and Normal distributions and tests of goodness of fit.
7. Curve fitting by the method of least squares.
(i) $y=ax+b$;(ii) $y=ax^2 +bx+c$;(iii) $y=ae^{bx}$;(iv) $y=ax^b$
8. Computation of correlation coefficients and regression lines for raw and grouped data. Rank correlation coefficient.
9. Asymptotic and exact test of significance with regard to population mean, proportion, variance and coefficient of correlation.
10. Test for independence of attributes based on contingency table.
11. Confidence Interval based on Normal,t,Chi-square statistics.

NOTE:

Use of scientific calculator may be permitted for Mathematical Statistics Practical Examination.

Statistical and Mathematical tables are to be provided to students at the examination hall.

University of Madras
B.Sc. Mathematics

Syllabus

(Elective Papers)

University of Madras
B.Sc. Mathematics

ELECTIVE I :
PROGRAMMING LANGUAGE 'C' WITH PRACTICALS
THEORY

Unit - 1

Introduction. Constants-Variables-Data-types (Fundamental and user defined)
Operators-Precedence of operators – Library functions –Input ,Output statements-
Escape sequences-Formatted outputs – Storage classes -Compiler directives.
Chapter 2 Sections 2.1 - 2.8 , Chapter 3 Sections 3.1 – 3.7, 3.12 ,Chapter 4 Sections
4.2 – 4.5

Unit – 2

Decision making and branching: Simple if, if e
lse, nested if, else if ladder and switch statement –conditional operator – go to
statement.

Decision making and looping : while, do while and for statement – nested for loops –
continue and break statements.

Chapter 5 Sections 5.1 – 5.9 ,Chapter 6 Sections 6.1 – 6.5

Unit - 3

Arrays : One dimensional and 2 dimensional arrays – declarations – initialization of
arrays– Operation on strings-String handling functions.

Chapter 7 Sections 7.1 – 7.4 ,Chapter 8 Sections 8.1 – 8.8

Unit – 4

Functions : Function definition and declaration – Categories of functions – recursion –
Concept of pointers. Function call by reference - call by value.

Chapter 9 Sections 9.1 – 9.13

Chapter 11 Sections11.1-11.5

Unit – 5

Files : Definition, operations on files- file operation functions.

Chapter 12, Sections 12.1 – 12.

Content and Treatment as in

Programming in ANSI C 2nd edition by E.Balagurusamy, Tata-Mcgraw Hill Publishing
Company.

Reference Books:

1. Venugopal, programming in C
2. Gottfried, B.S : programming with C , Schaum's outline series, TMH 2001
3. Yashvant Kanitkar, Let us 'C' BPB Publications

ELECTIVE I :

PROGRAMMING LANGUAGE 'C' WITH PRACTICALS
PRACTICALS

Writing 'C' programs for the following:

1. To convert centigrade to Fahrenheit
2. To find the area, circumference of a circle
3. To convert days into months and days
4. To solve a quadratic equation
5. To find sum of n numbers
6. To find the largest and smallest numbers
7. To generate Pascal's triangle, Floyd's triangle
8. To find the trace of a matrix
9. To add and subtract two matrices
10. To multiply two matrices
11. To generate Fibonacci series using functions
12. To compute factorial of a given number, using functions
13. To add complex numbers using functions
14. To concatenate two strings using string handling functions
15. To check whether the given string is a palindrome or not using string handling functions

University of Madras
B.Sc. Mathematics

**ELECTIVE II :
GRAPH THEORY**

Unit – 1

Graphs, sub graphs, degree of a vertex, isomorphism of graphs, independent sets and coverings, intersection graphs and line graphs, adjacency and incidence matrices, operations on graphs,
Chapter 2 Sections 2.0 – 2.9

Unit – 2

Degree sequences and graphic sequences – simple problems. Connectedness, walks, trails, paths, components, bridge, block, connectivity – simple problems.
Chapter 3 Sections 3.0 – 3.2 , Chapter 4 Sections 4.0 – 4.4

Unit – 3

Eulerian and Hamiltonian graphs
Chapter 5 Sections 5.0 – 5.2

Unit – 4

Trees – simple problems.
Planarity : Definition and properties, characterization of planar graphs.
Chapter 6 Sections 6.0 – 6.2 ,Chapter 8 Sections 8.0 – 8.2

Unit - 5

Digraphs and matrices, tournaments, some application connector problem
Chapter 10 Sections 10.0 – 10.4 ,Chapter 11 Sections 11.0 – 11.1

Content and treatment as in

Invitation to Graph Theory by S.Arumugam and S.Ramachandran, New Gamma Publishing House, Palayamkottai

Reference Books

1. A first book at graph theory by John Clark and Derek Allan Holton, Allied publishers
2. Graph Theory by S.Kumaravelu and Susheela Kumaravelu, Publishers authors C/o 182 Chidambara Nagar, Nagarkoil

University of Madras
B.Sc. Mathematics

**ELECTIVE III :
OPERATIONS RESEARCH**

Unit-1

Linear programming: Formulation – graphical solution. Simplex method. Big-M method. Duality- primal-dual relation.

Chapter 6 Sections 6.1 – 6.13, 6.20 – 6.31

Unit – 2

Transportation problem: Mathematical Formulation. Basic Feasible solution. North West Corner rule, Least Cost Method, Vogel's approximation. Optimal Solution. Unbalanced Transportation Problems. Degeneracy in Transportation problems.

Assignment problem: Mathematical Formulation. Comparison with Transportation Model. Hungarian Method. Unbalanced Assignment problems

Chapter 9 Sections 9.1 – 9.12 ,Chapter 8 Sections 8.1 – 8.5

Unit – 3

Sequencing problem: n jobs on 2 machines – n jobs on 3 machines – two jobs on m machines – n jobs on m machines.

Game theory : Two-person Zero-sum game with saddle point – without saddle point – dominance – solving $2 \times n$ or $m \times 2$ game by graphical method.

Chapter 10 Sections 10.1 – 10.6 ,Chapter 12 Sections 12.1 – 12.15

Unit – 4

Queuing theory: Basic concepts. Steady state analysis of $M / M / 1$ and $M / M / S$ models with finite and infinite capacities.

Chapter 5 Sections 5.1 – 5.18

Unit – 5

Network: : Project Network diagram – CPM and PERT computations. (Crashing excluded)

Chapter 13 Sections 13.1 – 13.10

Content and treatment as in

Operations Research, by R.K.Gupta , Krishna Prakashan India (p),Meerut Publications

Reference Books :

Gauss S.I. Linear programming , McGraw-Hill Book Company.

Gupta P.K. and Hira D.S., Problems in Operations Research , S.Chand & Co.

Kanti Swaroop, Gupta P.K and Manmohan , Problems in Operations Research,Sultan Chand & Sons

Ravindran A., Phillips D.T. and Solberg J.J., Operations Research, John wiley & Sons.

Taha H.A. Operation Research, Macmillan pub. Company, New York.

Linear Programming, Transporation, Assignment Game by Dr.Paria, Books and Allied(p) Ltd.,1999.

V.Sundaresan,K.S. Ganapathy Subramaian and K.Ganesan,Resource Management Techniques..A.R Publications.

University of Madras
B.Sc. Mathematics

Syllabus

(Non-Major Elective Papers)

University of Madras
B.Sc. Mathematics

Non-Major Elective I
Functional Mathematics I

Unit – I

Ratio and Proportions

Unit – II

Percentages

Unit – III

Profit and Loss, Discounts

Unit – IV

Simple Interest and Compound Interest

Unit – V

Solutions of simultaneous equations problems on ages and two digit number

Book for Reference:

Quantitative Aptitude – R.S. Agarwal

University of Madras
B.Sc. Mathematics

Non-Major Elective II
Functional Mathematics II

Unit – I

Time and Work – Pipes and Cisterns - Problem

Unit – II

Time and Distance, Relative Speeds – Problems on Races, Boats and Streams, and Trains

Unit – III

Mensuration - Problems

Unit – IV

Polygons – Interior Angles – Numbers of Diagonals – Regular Polygons - Problem

Unit – V

Stocks and Shares - Problems

Book for Reference:

Quantitative Aptitude – R.S. Agarwal