

APPENDIX
UNIVERSITY OF MADRAS
B.Sc. Degree Course in Mathematics
(Effective from the academic year 2015-2016)
REGULATIONS

6. 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

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 IVSemester		
Soft Skills –III	3	50	50	100

SEMESTER – IV

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			

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

B.Sc. DEGREE COURSE IN MATHEMATICS

SYLLABUS

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)

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:-

2. Trigonometry by T.K. Manickavachagam Pillay

II SEMSTER
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

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

SEMESTER-III
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)

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.Raisinghanian S.Chand

SEMESTER-IV
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)

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

SEMESTER-V
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

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

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

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.

SEMESTER-VI
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. Ramabadran, Vikas publishing Co.
4. Algebra – S. Arumugam, New Gamma publishing house, Palayamkottai.

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

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

ELECTIVE SUBJECTS

GROUP A

1. 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 Sections 11.1-11.5

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

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

2. MATHEMATICAL MODELING

Unit-1

Mathematical Modeling : Simple situations requiring mathematical modeling, characteristics of mathematical model.

Chapter 1 Sections 1.1-1.5

Unit – 2

Mathematical Modeling through differential equations: Linear Growth and Decay Models. Non-Linear growth and decay models, Compartment models.

Chapter 2 Sections 2.1- 2.4

Unit – 3

Mathematical Modeling, through system of Ordinary differential equations of first order: Prey-predator models, Competition models, Model with removal and model with immigrations.

Epidemics: simple epidemic model, Susceptible-infected-susceptible(SIS) model, SIS model with constant number of carriers.

Medicine : Model for Diabetes Mellitus.

Chapter 3 Sections 3.11,3.12,3.2.and 3.51

Unit – 4

Introduction to difference equations.

Chapter 5 Sections 5.1 and 5.2

Unit - 5

Mathematical Modeling, through difference equations:Harrod Model, cobweb model application to Actuarial Science

Sections 5.3 (5.3.3 not included)

Content and treatment as in

J N Kapur, Mathematical Modeling, New Age International publishers.(2009)

Reference Books :-

1. Mathematical Modeling by Bimal k . Mishra and Dipak K.Satpathi

3. NUMERICAL METHODS

Unit 1

Interpolation and Approximation: First difference- Introduction; forward and backward difference; Newton's forward and backward difference formulas for equal intervals; Divided differences; Newton's divided difference formula; Lagrangian Polynomials for unequal intervals
Chapter 5, Section 5.1, Chapter 6, Section 6.1 to 6.3 and Chapter 8, Section 8.1 to 8.5 and 8.7

Unit 2

Numerical Differentiation and Integration :Differentiation using Newton's forward and backward interpolation formulae; Numerical integration by trapezoidal, Romberg's method; Simpson's 1/3 and 3/8 rules.

Chapter 9, Section 9.1 to 9.4, 9.6, 9.7 to 9.14

Unit 3

Taylor series method; Picard's method ; Euler method for first order equation; Modified Euler method; Fourth order Runge – Kutta method for solving first order equations;.

Chapter 11, Section 11.1, 11.5 to 11.9, 11.11 to 11.13.

Unit 4

Numerical solution of ordinary differential equation by finite difference method; Numerical solution of partial differential equations - Elliptic equation, Poisson equation.

Appendix E, Chapter 12, Section , 12.1, 12.4 and 12.5 to 12.7

Unit 5

Numerical solution of partial differential equations - Parabolic equations, Hyperbolic equations

Chapter 12, Section 12.8 to 12.10

Content and treatment as in Numerical Methods by Dr P.Kandasamy, Dr. K. Thilagavathy and Dr. K. Gunavathi. S.Chand and Company Ltd

Reference Books

1. Numerical Methods With Programming in C by T. Veerarajan and T. Ramachandran.
2. Introductory Methods of Numerical Analysis by S.S.Sastry.

GROUP B

4. ELEMENTARY NUMBER THEORY

Unit 1

Introduction – divisibility- primes- The Binomial theorem

Chapter 1 Sections - 1.1 to 1.4

Unit 2

Congruences, Solution of Congruences, Chinese Remainder Theorem- primitive roots and power Residues- Number Theory from an Algebraic view point - Groups, rings and fields.

Chapter – 2 Sections 2.1 to 2.3, 2.8 (cor 2.42, Th 2.43 and cor 2.44 are omitted) - 2.10.- 2.11

Unit 3

Quadratic Residues , Quadratic reciprocity , The Jacobi Symbol

Chapter – 3 Sections 3.1 to 3.3

Unit 4

Greatest Integer Function, Arithmetic function, The Mobius Inversion formula

Combinational Number Theory

Chapter – 4 Sections 4.1 to 4.3 and 4.5

Unit 5

The equation $ax+by=c$, Simultaneous Linear Equations, Pythagorean Triangle, Assorted examples.

Chapter – 5 Sections 5.1 to 5.4

Content and treatment as in - An introduction to the Theory of Numbers (Vth edition) by Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery John Wiley & Sons, Inc.2001.

Reference Books:

1. Elementary theory of numbers, cy. Hsiung, Allied publishers, 1995.
2. Elementary Number Theory, Allyn and Bacon Inc., Boston, 1980.
3. Introduction to Analytic Number Theory, Tom. M. Apostol, Narosa Publishing House, New Delhi, 1989.

5. 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

6. 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 x n or m x 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 :

1. Gauss S.I. Linear programming , McGraw-Hill Book Company.
- 2 .Gupta P.K. and Hira D.S., Problems in Operations Research , S.Chand & Co.
3. Kanti Swaroop, Gupta P.K and Manmohan , Problems in Operations Research,Sultan Chand & Sons
4. Ravindran A., Phillips D.T. and Solberg J.J., Operations Research, John wiley & Sons.
5. Taha H.A. Operation Research, Macmillan pub. Company, New York.
6. Linear Programming, Transporation, Assignment Game by Dr.Paria, Books and Allied(p) Ltd.,1999.
7. V.Sundaresan,K.S. Ganapathy Subramaian and K.Ganesan,Resource Management Techniques..A.R Publications.

7. SPECIAL FUNCTIONS

Unit – 1

Introduction and Review of power series – Series solution of first order differential equations
Chapter 5 Sections 26 and 27

Unit-2

Second order linear differential equations-Regular, singular points.
Chapter 5 Sections 28 and 29

Unit – 3

Regular singular points continued: Gauss's hyper geometric equations.
Chapter 5 Sections 30 and 31

Unit – 4

Legendre polynomials-Properties of Legendre polynomials
Chapter 8 Sections.44 and 45

Unit – 5

Bessel functions and Gamma functions-Properties of Bessel Functions.
Chapter 8 Sections 46 and 47

Contents and treatment as in Differential equations with Applications and Historical Notes by George F. Simmons Second Edition ,Tata Mcgraw Hill Publications.

Reference Books

1. Differential Equations by D. Raisinghania.
2. Differential Equations by Ganesh C.Gorian

**ALLIED MATHEMATICS PAPERS FOR OTHER BRANCHES OF B.Sc. DEGREE COURSES
(For B. Sc Physics, Physics with Computer Application, Chemistry, Bio-Chemistry, Electronic
Science, Geophysics and Computer Science, Bachelor of Computer Application (BCA) Major
only)**

SYLLABUS

**Semester I - Allied Paper –I - Mathematics -I
(Effective from the Academic Year 2015-16)**

UNIT – I

ALGEBRA and NUMERICAL METHODS:

Algebra: Summation of series - simple problems.

Numerical Methods: Operators E, Δ, ∇ , difference tables; Newton-Raphson method; Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.

Chapter 2, Section 2.1.3, 2.2, 2.2.1, 2.3, 2.3.3

Chapter 3, Section 3.4.1 and Chapter 5, Section 5.1 and 5.2.

UNIT- II

MATRICES:

Symmetric, Skew-Symmetric, Orthogonal, Hermetian, Skew-Hermetian and Unitary matrices. Eigen values and Eigen-vectors, Cayley-Hamilton theorem (without proof) – verification- Computation of inverse of matrix using Cayley - Hamilton theorem.

Chapter 4, Section 4.1.1 to 4.1.6, 4.5, 4.5.2, 4.5.3.

UNIT- III

THEORY OF EQUATIONS:

Polynomial equations with real coefficients, irrational roots, complex roots, symmetric functions of roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equation.

Newton's method to find a root approximately - simple problems.

Chapter 3, Section 3.1 to 3.4.1

UNIT IV

TRIGONOMETRY:

Expansions of $\sin(n\theta)$ and $\cos(n\theta)$ in a series of powers of $\sin\theta$ and $\cos\theta$ - Expansions of $\sin^n\theta$, $\cos^n\theta$, $\tan^n\theta$ in a series of sines, cosines and tangents of multiples of “ θ ” - Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in a series of powers of “ θ ” – Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers.

Chapter 6, Section 6.1 to 6.5

UNIT V

DIFFERENTIAL CALCULUS:

Successive differentiation, n^{th} derivatives, Leibnitz theorem (without proof) and applications, Jacobians, Curvature and radius of curvature in Cartesian co-ordinates, maxima and minima of functions of two variables, Lagrange's multipliers - Simple problems

Chapter 1, Section 1.1 to 1.3.2 and 1.4.3

Content and treatment as in

Allied Mathematics Volume I and II by P. Duraipandian and S. Udayabaskaran, S. Chand Publications

Book for Reference:

1. S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.
2. Allied Mathematics by Dr. A. Singaravelu.

Semester II - Allied Paper – II - Mathematics -II

Unit-I

INTEGRAL CALCULUS:

Bernoulli's formula. Reduction formulae - $\int_0^{\frac{\pi}{2}} \sin^n x dx$, $\int_0^{\frac{\pi}{2}} \cos^n x dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$ (m, n being positive integers), Fourier series for functions in $(\alpha, \alpha+2\pi)$, Half range sine and cosine series.

Chapter 2, Section 2.7 and 2.9

Chapter 4, Section 4.1 to 4.2

Unit-II

DIFFERENTIAL EQUATIONS

Ordinary Differential Equations: second order non- homogeneous differential equations with constant coefficients of the form $ay'' + by' + cy = X$ where X is of the form $e^{\alpha x} \cos \beta x$ and $e^{\alpha x} \sin \beta x$

Partial Differential Equations: Formation, complete integrals and general integrals, four standard types and solving Lagrange's linear equation $Pp + Qq = R$

Chapter 5, Section 5.2

Chapter 6, Section 6.1 to 6.4

Unit-III

LAPLACE TRANSFORMS:

Laplace transformations of standard functions and simple properties, inverse Laplace transforms, Application to solution of linear differential equations up to 2nd order- simple problems.

Chapter 7, Section 7.1.1 to 7.1.4 and 7.2 to 7.3

Unit – IV

VECTOR DIFFERENTIATION

Introduction, Scalar point functions, Vector point functions, Vector differential operator ∇ , Gradient, Divergence, Curl, Solenoidal, irrotational, identities.

Chapter 8, Section 8.1 to 8.4.4

Unit – V

VECTOR INTEGRATION

Line, surface and volume integrals, Gauss, Stoke's and Green's theorems (without proofs). Simple problems on these.

Chapter 8, Section 8.5 to 8.6.3

Content and treatment as in

Allied Mathematics Volume I and II by P. Duraipandian and S. Udayabaskaran, S. Chand Publications

Book for Reference:

1. S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.
2. Allied Mathematics by Dr. A. Singaravelu.

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN MATHEMATICS
SYLLABUS WITH EFFECT FROM 2020-2021

BMA-CSC01

CORE-I: ALGEBRA
(Common to B.Sc. Maths with Computer Applications)

Inst.Hrs : 5
Credits : 4

YEAR: I
SEMESTER: I

Learning Outcomes:
Students will acquire

- Basic ideas on Theory of Equations, Matrices and Theory of Numbers.
- Knowledge to solve theoretical and applied problems.

UNIT I

Theory of Equations :Polynomial equations with Imaginary and irrational roots- Relation between roots and coefficients- Symmetric functions of roots in terms of coefficients.
Chapter 6 : Section 9 to 12.

UNIT II

Reciprocal equations - Standard form-Increase or Decrease the roots of the given equation - Removal of terms Approximate solutions of roots of polynomials by Horner's method.
Chapter 6: section 16, 16.1, 16.2, 17, 30.

UNIT III

Summation of Series : Binomial- Exponential -Logarithmic series (Theorems without proof):
Chapter 3: Section 10, Chapter 4: Section 3, 3.1, 3.5, 3.6, 3.7 (omit 3.4)

UNIT IV

Symmetric- Skew Symmetric- Hermitian- Skew Hermitian- Orthogonal Matrices- Eigen values & Eigen Vectors- Similar matrices- Cayley - Hamilton Theorem.
Chapter 2: Section 6.1 to 6.3, 9.1, 9.2, 16, 16.1, 16.2, 16.3.

UNIT V

Prime number and Composite number - Divisors of a given number N- Euler's function (without proof) - Integral part of a real number - congruences.
Chapter 5: Section 1 to 13.

Contents and treatment as in

1. Algebra, Volume I by T. K. ManicavachagamPillay,T.Natarajan, K.S.Ganapathy, Viswanathan Publication 2007 - Unit – 1 and 2.
2. Algebra, Volume II by T. K. ManicavachagomPillay ,T.Natarajan ,K.S.Ganapathy, Viswanathan Publication 2008 - Unit – 3, 4 and 5.

Reference:-

1. Algebra by S. Arumugam (New Gama publishing house, Palayamkottai).
2. Algebra and Trigonometry, Volume I and II by P.R.Vittal, V.Malini (Margham Publishers).

e-Resources:

1. <http://mathworld.wolfram.com>
2. <http://www.themathpage.com/>

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN MATHEMATICS
SYLLABUS WITH EFFECT FROM 2020-2021

BMA-CSC02

CORE-II: DIFFERENTIAL CALCULUS
(Common to B.Sc. Maths with Computer Applications)

Inst.Hrs : 4

Credits : 4

YEAR: I

SEMESTER: I

Learning outcomes:

Students will acquire Knowledge about

- The basics of differentiation and its applications.
- The notion of curvature, evolutes, involutes and polar co-ordinates.

UNIT I

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 II

Total differential of a function – special cases – implicit functions - partial derivatives of a function of two functions - Maxima and Minima of functions of two 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 III

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 IV

Polar coordinates - 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 V

Definition-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 7.

Content and treatment as in

“Calculus”, Volume - 1 by S. Narayanan and T.K. Manicavachagompillay - S.Viswanathan publishers – 2006

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN MATHEMATICS
SYLLABUS WITH EFFECT FROM 2020-2021

Reference:-

1. Calculus , Dr. P.R. Vittal&Dr. V. Malini, Margham Publications, Chennai.
2. Calculus by Thomas and Fenny, Pearson Publication.
3. Calculus by Stewart
4. Calculus , Dr. P.R. Vittal&Dr. V. Malini, Margham Publications, Chennai.

e-Resources:

1. <http://www.themathpage.com/>
2. <http://mathworld.wolfram.com>
3. <http://www.univie.ac.at/future.media/moe/galerie.html>
4. <http://www.analyzemath.com/calculus>