

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

**Scheme of Examinations :**

**I SEMESTER**

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part –I</b> - Language Paper -I	3	25	75	100
<b>Part –II</b> - English Paper -I	3	25	75	100
<b>Part-III</b> - Core Paper-I:Algebra	4	25	75	100
Core Paper-II: Trigonometry	4	25	75	100
Allied Paper- I	5	25	75	100
<b>Part-IV</b> - 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
<b>Part –I</b> – Language Paper -II	3	25	75	100
<b>Part –II</b> - English Paper –II	3	25	75	100
<b>Part-III</b> - 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
<b>Part-IV</b> - 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
<b>Part –I</b> – Language Paper -III	3	25	75	100
<b>Part –II</b> – English Paper -III	3	25	75	100
<b>Part-III</b> - 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
<b>Part-IV</b> - 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
<b>Part –I</b> - Language Paper -IV	3	25	75	100
<b>Part –II</b> - English Paper -IV	3	25	75	100
<b>Part-III</b> - Core paper-VII: Transform Techniques	4	25	75	100
Core Paper VIII : Statics	4	25	75	100
Allied paper- IV	5	25	75	100
<b>Part-IV</b> - 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
<b>Part-III</b> 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
<b>Part-IV</b> - Value Education	2	25	75	100

VI SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part-III</b> 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
<b>Part-V</b> - 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

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**UNIVERSITY OF MADRAS**  
**B.Sc. DEGREE COURSE IN MATHEMATICS**  
**(Effective from the academic year 2015-16)**

**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. ManicavachagamPillay,T.Natarajan, K.S.Ganapathy, ViswanathanPublication 2007

Unit – 3, 4 and 5

Algebra Volume II by T. K. ManicavachagomPillay ,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

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**II SEMSTER**  
**CORE PAPER III - DIFFERENTIAL CALCULUS**

**Unit- 1**

Successive differentiation -  $n^{\text{th}}$  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. Manicavachagompillay - S. Viswanathan publishers – 2006

**Reference Books:-**

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

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## 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.DuraiPandian- 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

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**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  $\Gamma$  functions – properties of  $\beta$ -function- relation between  $\beta$  and  $\Gamma$  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. Manicavachagampillay - S. Viswanathan publishers – 2007 for Unit 1, Unit 2, Unit 3
2. Content and treatment as in Vector Analysis by P.Duraipandian and LaxmiDuraipandian. Emerald Publishers. For Unit 4, Unit 5

**Reference Books:-**

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

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## 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,TataMcgraw Hill Publications.Unit 1, 2 and 3
2. Introduction to Partial Differential Equations Second Edition(2009) by K.SankaraRao,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.RaisinghaniaS.Chand

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**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  $2\pi$  ; 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)

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## 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, LaxmiDuraipandian, MuthamizhJayapragasham, S. Chand and Co limited 2008 .

### Reference Books:

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

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**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 VisvanathanNayak

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## 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

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## 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 - Section16.1 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 ,LaxmiDuraipandian , MuthamizhJayapragasham, S. Chand and Co limited 2008 .

### Reference Books:

1. Dynamics – K. ViswanathaNaik 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, 2<sup>nd</sup> 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 RuelV.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 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 2<sup>nd</sup> 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. YashvantKanitkar, 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 Bimalk . Mishra and DipakK.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 DrP.Kandasamy, Dr. K. Thilagavathy and Dr. K. Gunavathi.S.Chand and Company Ltd

#### Reference Books

1. Numerical Methods With Programming in C by T. Veerarajanand 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 SusheelaKumaravelu, 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  $2 \times n$  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 :

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, Transportation, 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.



## 8. 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. ScPhysics, 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**

**UNIT – I**

**ALGEBRA and NUMERICAL METHODS:**

**Algebra:** Summation of series - simple problems.

**Numerical Methods:** Operators  $E, \Delta, \nabla$ , 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 " $\theta$ " - Expansions of  $\sin\theta$ ,  $\cos\theta$  and  $\tan\theta$  in a series of powers of " $\theta$ " – Hyperbolic and inverse hyperbolic functions - Logarithms of complex numbers.

Chapter 6, Section 6.1 to 6.5

## UNIT V

### DIFFERENTIAL CALCULUS:

Successive differentiation,  $n^{\text{th}}$  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.

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## 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 2<sup>nd</sup> 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  $\nabla$ , 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.

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