DETAILED SYLLABUS - B. Sc. MATHEMATICS

Paper 1: ALGEBRA and TRIGONOMETRY – I

Unit 1: Binomial, Exponential and Logarithmic Series (proof of convergence to be assumed) - Summation of infinite series problems on above series.

Unit 2: Theory of Equations – symmetric functions of roots in terms of coefficients for polynomial functions – reciprocal equations.

Unit 3: Finding approximate roots of a polynomial by Newton – Raphson method - Descarte's rule of signs – and Horner's method – solving a cubic equation by Cardon's method.

Unit 4: Trigonometry: Expansions of sin nx, cos nx, tan nx, sinnx, cosnx.

Unit 5: Hyperbolic functions – logarithm of complex numbers.

Books for Reference and study:

1. Algebra: T. K. Manickavachagom Pillai and others (S.Viswanathan Publishers)
2. Trigonometry: T. K. Manickavachagom Pillai and others (S.Viswanathan Publishers)
3. Trigonometry: P.Duraipandian
4. Plane Trigonometry (Part 2) by S. L. Loney (Macmillan & Co., London)

PAPER 2: CALCULUS AND COORDINATE GEOMETRY OF 2 - DIMENSIONS

Unit 1: Differential Calculus: nth derivative of standard functions – Leibnitz Theorem and its applications – partial derivatives - total derivatives – Jacobian of a transformation – simple problems.

Unit 2: Maxima and minima of functions two and three independent variables – Lagrange's method for extrema problems (proof to be assumed).

Unit 3: Integration - reduction formulae for sinnx, cosnx, tannx, cosecnx, secnx, cotnx, xnsin nx, xncos nx.

Unit 4: Definite integrals, properties and simple problems.

Unit 5: Poles, polar, conjugate diameters for parabola, ellipse, hyperbola and simple problems.

Books for Reference and study:

Calculus - S. Narayanan and others (S. Viswanathan Publishers)

Analytical Geometry – T. K. Manickavachagom Pillai and others (S. Viswanathan Publishers)

Analytical Geometry of 2 dimensions – P. Duraipandian

Integral Calculus – Shanti Narayanan (S. Chand and Co.)

PAPER 3: ALGEBRA AND TRIGONOMETRY – II

Unit 1: Matrices – symmetric matrices – skew symmetric matrices – Hermitean matrices – skew Hermitean matrices – orthogonal matrices - unitary matrices – rank of a matrix – linear system of equations – consistency and solutions.

Unit 2: Cayley Hamilton Theorem (proof to be assumed) – eigen values – eigen vectors – similar matrices – diagonalization of a matrix.

Unit 3: Sum of sines and cosines of n angles in A.P – summation using telescopic method – C+i S method

Unit 4: Relations on a set – properties of relations – equivalence relations and equivalence classes – properties of equivalence classes - partition and equivalence classes – congruence relations on the integers.

Unit 5: Mappings – special types of mapping – composition of mapping – properties of composite mappings – inverse of mapping – permutations – composition of permutation – inverse of permutations.

Books for Reference and study:

Topics in Algebra – I.N.Herstein (Vikas Publications)

Algebra – T.K.Manickavachagom Pillai and others (S.Viswanathan Publishers)

Elementary Theory of Numbers – C.Y.Hsiung (Allied Publishers)

Trigonometry – P.Duraipandian (Emerald Publishers)

Trigonometry - T.K.Manickavachagom Pillai and others (S.Viswanathan Publishers)

Abstract Algebra – Palgrave Mathematical Guide

PAPER 4: CALCULUS AND DIFFERENTIAL GEOMETRY

Unit 1: Curvature – radius of curvature in Cartesian coordinates – polar coordinates – equation of a straight line, circle and a conic- radius of curvature in polar coordinates – angle of intersection of two curves – pedal equation – simple problems.

Unit 2: Evolutes – envelopes- asymptotes – methods of finding asymptotes of rational algebraic curves (without proof)

Unit 3: Integration – Beta and Gamma functions – simple problems

Unit 4: Double integral – change of order of integration - triple integrals

Unit 5: Application to area, surface area and volumes.

Books for Reference and study:

1. Calculus – S. Narayanan and others (S.Viswanathan Publishers}

2. Integral Calculus and Differential Equations – Deepak Chatterjee (Tata McGraw Hill Publishing Company).

PAPER 5: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Unit 1: Ordinary differential equations of first order but of higher degree – solvable for p – solvable for x – solvable for y – Clairaut's form – simple problems.

Unit 2: Second order ordinary differential equations with constant coefficients – particular integrals of $(aD^2+bD+c)y= X(x)$ when $X(x)= e^{ax}V$ where $V(x)= x^m$, cos mx, sin mx, m an integer – second order equations with variable coefficients – method of variation of parameters – total differential equations.

Unit 3: Partial Differential Equations – formation of partial differential equations by eliminating arbitrary constants and functions – complete integral – singular integral – general integral – solutions of equations of standard types – $f(p,q)=0$, $f(x,p,q)=0$, $f(z,p,q)=0$, $f(x,p)=f(y,q)$ – Lagrange's equation $P_p+Q_q=R$

Unit 4: Laplace Transform – standard results – inverse Laplace Transforms – properties of Laplace Transform.

Unit 5: Applications of Laplace Transform to Solution of first and second order differential equations with constant coefficients – simultaneous linear differential equations – simple problems.

Books for Reference and study:

1. Calculus – S.Narayanan and others (S.Viswanathan Publishers)

2. Engineering Mathematics Vol. 3 – M.K.Venkataraman (National Publishing Company).

PAPER 6: COORDINATE GEOMETRY OF 3 DIMENSIONS AND VECTOR CALCULUS

Unit 1: Planes and lines -Length and equations of the shortest distance between 2 skew lines - image of a point and a line with respect to a plane, bisector planes.

Unit 2: Equation of a sphere- general equation of a sphere – section of a sphere by a plane - tangent plane - radical plane - coaxial system of spheres - orthogonal spheres.

Unit 3: Vector Differentiation – gradient of a scalar point function - divergence – curl - directional derivative - unit normal to the surface – tangent and normal plane to a surface.

Unit 4: Vector Integration - line integrals - surface integrals – volume integrals – illustrative problems.

Unit 5: Vector integration - Theorems of Gauss, Stokes and Green (statements of the theorems and verification in illustrative examples – proofs of the theorems to be assumed) - simple problems.

Books for Reference and study:

1. Analytical Geometry - T.K.Manickavachagam Pillai (S.Viswanathan Publishers)
2. Vector Analysis - Murray Spiegel (Schaum series)
3. Vector Analysis - P.Duraipandian & Laxmi Duraipandian (Emerald Publishers)

PAPER 7: FOURIER SERIES, FOURIER INTEGRALS, FOURIER TRANSFORMS AND Z-TRANSFORMS

Unit 1: Fourier Series – Fourier series of even and odd functions – Convergence of Fourier series.

Unit 2: Fourier Half - range series – Complex form of Fourier series.

Unit 3: Fourier Integral.

Unit 4: Z-Transformation – Introduction – Basic theory of Z-Transforms – Inverse Z-Transforms (partial fraction method only) Solution of Difference equation using Z-Transforms – Applications of Z-Transforms to find the sum of the series.

Unit 5: Fourier transforms – Fourier transforms solution of some partial differential equations.

Books for Reference and study:

1. Advanced Engineering Mathematics – R.K. Jain and S.R.K. Iyengar (Narosa Publishers)
2. Engineering Mathematics - M.K. Venkataraman (National Publishing Co.)

PAPER 8: REAL ANALYSIS – I

Unit 1: Sets and elements - operations on sets - functions - real valued functions - countability - real numbers - least upper bounds.

Unit 2: Sequences of Real Numbers - definitions of a sequence and subsequences - limit of a sequence - convergent sequences - divergent sequences - bounded sequences - monotone sequences.

Unit 3: Sequences of Real Numbers - operations on convergent sequences - operations on divergent sequences - limit superior and limit inferior - Cauchy sequences.

Unit 4: Series of Real Numbers - convergence and divergence - series with non-negative terms - alternating series - conditional convergence and absolute convergence.

Unit 5: Series of Real Numbers - tests for absolute convergence - series whose terms form a non-increasing sequence - the class.

Books for Reference and study:

Treatment as in **"Methods of Real Analysis"**: **Richard. R. Goldberg** (Oxford and IBH Publishing Co.,)

Unit 1:	Chapter 1
Unit 2:	Chapter 2 – Sections 2.1 to 2.6
Unit 3:	Chapter 2 - Sections 2.7 to 2.10
Unit 4:	Chapter 3 - Sections 3.1 to 3.4
Unit 5:	Chapter 3 - Sections 3.6, 3.7 and 3.10.

PAPER 9: ALGEBRAIC STRUCTURES – I

Unit 1: Groups, Subgroups – Lagrange's theorem and corollaries - Normal subgroups – homomorphisms of groups

Unit 2: Cayley's theorem – permutation groups – conjugacy and class equation.

Unit 3: Rings – definition and examples – integral domain – homomorphism of rings

Unit 4: Ideals and quotient rings - maximum ideals – the field of quotients of an integral domain

Unit 5: Euclidean rings – Polynomial rings

Books for Reference and study:

Treatment as in **"Topics in Algebra" by I .N. Herstein.**

Unit 1: Chapter 2 – Sections 2.6, 2.7 and 2.8

Unit 2: Chapter 2 – Sections 2.9, 2.10 and 2.11

Unit 3: Chapter 3- Sections 3.1, 3.2 and 3.3

Unit 4: Chapter 3 - Sections 3.4, 3.5 and 3.6

Unit 5: Chapter 3 - Sections 3.7, 3.8 and 3.9.

PAPER 10: REAL ANALYSIS – II

Unit 1: Limits and metric spaces – limit of a function on a real line – metric spaces – limits in metric spaces – functions continuous at a point on the real line – reformulation – functions continuous on a metric space – open sets – closed sets – discontinuous functions on the real line.

Unit 2: More about open sets –connected sets – bounded sets and totally bounded sets – complete metric spaces.

Unit 3: Compact metric spaces – continuous functions on a compact metric space – continuity of inverse functions – uniform continuity

Unit 4: Sets of measure zero – Riemann integral – existence theorem (proof to be assumed) – properties of Riemann integral – derivatives – Rolle's theorem – law of mean – fundamental theorem of integral calculus.

Unit 5: Taylor's theorem - Sequences and series of functions – pointwise convergence of sequences of functions – uniform convergence of sequence of functions

Books for Reference and study:

Treatment as in **"Methods of Real Analysis"**: **Richard. R. Goldberg** (Oxford and IBH Publishing Co.,)

Unit 1: Chapter 4 and Chapter 5

Unit 2: Chapter 6 – Sections 6.1, 6.2, 6.3 and 6.4

Unit 3: Chapter 6 - Sections 6.5, 6.6, 6.7 and 6.8

Unit 4: Chapter 7 - Sections 7.1 to 7.8

Unit 5: Chapter 8 - Section 8.5

Chapter 9 - Sections 9.1 and 9.2

PAPER 11: MECHANICS

Unit 1: Types of forces – magnitude and direction of resultant of forces acting on a particle – Lami's theorem – equilibrium of a particle under three coplanar forces – parallel forces – moments – couples – simple problems

Unit 2: Kinematics of a particle – velocity and acceleration – relative velocity – angular velocity – Newton's laws of motion – equation of motion – rectilinear motion under constant acceleration

Unit 3: Simple harmonic motion – motion in a resisting medium under gravity with resistance proportional to the velocity and square of the velocvity.

Unit 4: Projectiles – range – motion on a inclined plane – circular motion – impulse and impulsive motion - direct and oblique impact – simple problems

Unit 5: Central forces – central orbits – p-r equations – law of force for a given central orbit – the orbit for a given law of force – moments of inertia – parallel axis theorem – perpendicular axis theorem.

Books for Reference and study:

1. Treatment as in "Mechanics" by P.Duraipandian (Chand and Co)
2. Dynamics – K. Viswanatha Naik and M. S. Kesi (Emerald Publishers)
3. Dynamics – A. V. Dharmapadam (S.Viswanathan Publishers)

PAPER 12: PROGRAMMING IN C WITH PRACTICALS

Unit I: Introduction: Importance of C – Programming Style Character Set – C Tokens – Keywords and Identifiers – Constants – Variables – Declaration of Storage Class – Assigning Values to Variables – Defining Symbolic Constants.

Unit II: Operators and expressions – arithmetic, relational, logical, assignment, increment and decrement, bitwise, conditional, special operators – arithmetic expressions – evaluation of expressions – precedence of arithmetic expressions

Unit III: Managing Input and Output Operations – Reading a character – writing a character – formatted input – formatted output – decision making with if – simple if, if else, nesting of if else, else if, switch, goto, while do while, for statements – jumps in loops.

Unit IV: Arrays – One dimensional arrays – declaration of one dimension arrays – initialization of one dimensional arrays – two dimensional arrays – initializing two dimensional arrays – multi dimensional arrays.

Unit V. User Defined Functions-Multi-Function -Return Values and their Types – Calling a Function-Category of Functions- Nesting of Function- Recursive Function –Function with arrays – Structures and Pointers.

Recommended Text

Programming in ANSI C, E. Balagurusamy, McGraw Hill Education India Pvt. Ltd.

Reference Books

1. Programming with C, Byron Gottried, Schaum's outline Fourth Edition, Tata Mcraw Hill, 2018
2. C Programming Language, Darrel L. Graham, Createspace Independent Publishing Company, 2016
3. Yashvant Kanetkar, Let us C, 18th Edition, BPB Publications, 2021.

PROGRAMMING IN C PRACTICAL LIST

1. Program to convert the given temperature in Fahrenheit to Celsius.
2. Program to generate the values of the functions sin x, cos x, e^x.
3. Program to find the roots of a quadratic equation.
4. Program to find the sum of squares of 1st N natural numbers using while, do-while &for loops.
5. Write a program to read a four-digit integer and print the sum of its digits
6. Write a program to determine and the print the sum of harmonic series
7. Program to print all prime number between two given positive integers.
8. Write a program to add and multiply matrices of order 3*3.
9. Program to calculate the standard deviation of n-values contained in an array.
10. Write a program to find the GCD and LCM of two numbers
11. Write a function to generate the Fibonacci series using recursion.
12. Write a recursive function that adds first 'n' natural numbers.
13. Write a recursive function that finds factorial of a number.
14. Implement a swap () function which exchanges the values of two integers. Call the function from the main to test the function with different values.
15. Develop code to create an unnamed structure 'student' to contain the following 1. Name 2. Test Scores 3. Final Grade Scores

PAPER 13: ELECTIVE – I (GRAPH THEORY)

Unit 1: Graphs - sub-graphs - degree of a vertex - isomorphism of graphs - independent sets and coverings- Simple problems. Intersection graphs- line graphs - adjacency matrix and incident matrix-simple problems- Operation on graphs - degree sequences and graphic sequences.

Unit 2: Connectedness - walks, trials, paths – simple problems - Components – bridge - block - connectivity.

Unit 3: Eulerian graph -simple problems - Hamiltonian graphs.

Unit 4: Trees and planarity.

Unit 5: Directed graphs – basic properties- paths and connectedness – digraphs and matrices.

Books for Reference and study:

Content and treatment as in **"Invitation to Graph Theory"** by S. Arumugam and S. Ramachandran, New Gamma Publishing House, Palayamkottai.

PAPER 14: ALGEBRAIC STRUCTURES – II

Unit 1: Vector spaces – definition and examples – dual spaces

Unit 2: Inner product spaces

Unit 3: Algebra of linear transformations

Unit 4: Characteristic roots

Unit 5: Matrices – canonical forms – triangular forms

Books for Reference and study:

Treatment as in **"Topics in Algebra" by** I**.N.Herstein**

Unit 1: Chapter 4 – Sections 4.1, 4.2 and 4.3

Unit 2: Chapter 4 – Section 4.4

Unit 3: Chapter 6- Section 6.1

Unit 4: Chapter 6 - Section 6.2

Unit 5: Chapter 6 - Sections 6.3 and 6.4

PAPER 15: COMPLEX ANALYSIS

Unit 1: Complex Numbers – Point at infinity – stereographic projection –analytic functions – functions of a complex variable – limits –continuity –derivatives – Cauchy Riemann equations in Cartesian and polar coordinates – necessary and sufficient condition for analytic functions – harmonic functions

Unit 2: Mappings by elementary functions – linear functions – the function 1/z, linear fractional transformations – w = zn, w = exp z, special linear fractional transformations.

Unit 3: Definite integrals – contours – line integrals – Cauchy-Goursat theorem (without proof) – Cauchy integral formula – derivatives of analytic functions – maximum modulus theorem.

Unit 4: Convergence of sequences and series – Taylor series – Laurent series – zeroes of analytic functions.

Unit 5: Residue - residue theorem – principal part of a function – poles – evaluation of real integrals – improper integrals – integrals involving trigonometric functions – definite integrals of trigonometric functions.

Books for Reference and study:

Treatment as in **"Complex Variable and Applications" by R. V. Churchill, James W.Brown and Roger F. Verhey (McGrawhill international student edition)**

PAPER 16: OPERATIONS RESEARCH

Unit 1: Linear Programming – formulation – graphical solution – simplex method

Unit 2: Big – M method – duality –primal –dual relation – dual simplex method

Unit 3: Transportation problem – assignment problem – traveling salesman problem.

Unit 4: Sequencing problem – n jobs through two machines – n jobs through three machines – n jobs through m machines

Unit 5: Game theory – two persons zero sum game with saddle point – without saddle point – dominance – solving 2 x n or m x 2 game by graphical method.

Books for Reference and study:

1. Problems in Operations Research by P. K. Gupta and D. S. Hira
2. Operations Research by Taha

PAPER 17: PROGRAMMING IN PYTHON PRACTICALS

Welcome to Python – What is Python? – Origins – Features – Downloading and Installing Python – Running Python – Python Documentation. Getting Started – Program Output Statement – Program Input function – Python Basics – Statements and Syntax – Variable Assignment – Identifiers – Numbers – Introduction – Integers – Double Precision Floating Point Numbers – Complex Numbers – Operators – Build-in-functions for all numeric types. (Chapter 1: Section1.1 to1.6, Chapter 2: Section 2.1 & 2.2, Chapter 3: 3.1 to 3.3, Chapter 5: 5.1 to 5.7)

Sequences: Strings, Lists and Tuples – Sequences – Strings – Strings and Operators – String-only Operators – Build-in Functions – String Build-in Methods – Lists – Operators – Build-in Functions – List Type Build-in Methods – Tuples – Tuple Operators and Build-in Functions – Mapping and Set Types: Dictionaries – Mapping Type Operators – Mapping Type Build-in Functions and Built-in Methods – Dictionary Keys. (Chapter 6: 6.1 to 6.6, 6.11 to 6.14, 6.16 & 6.17, Chapter 7: 7.1 to 7.5)

Conditionals and Loops – If statement – else statement – else if statement – Conditional expressions – while statement – for statement – break statement – continue statement – pass statement – Functions and Functional Programming – What are functions? – Calling Functions – Creating Funcitons – Passing Functions – Formal Arguments – Variable-Length Arguments- Recursion (Chapter 8: 8.1 to 8.9, Chapter 11: 11.1 to 11.6, 11.9).

Errors and Exceptions – What are Exception? – Exceptions in Python – Detecting and Handling Exceptions – Context Management – with statement – Raising Exceptions – Modules – What are Modules? – Modules and Files – Namespaces – Importing Modules – Features of Module Import – Module Build-in Functions – Packages – Other Features of Modules. (Chapter 10: 10.1 to 10.6, Chapter 12: 12.1 to 12.8)

Files and Input / Output: File Objects- File Built-in Functions – File Build-in Methods – File Built-in Attributes – Command- Line Arguments – File System. (Chapter 9: 9.1 to 9.6 (omit 9.5), 9.7.

Recommended Text

Wesley J. Chun, “Core Python Programming”, 2nd Edition, Pearson Education LPE, New Delhi, 2007.

Reference Books

1. Mark Summer Field, Programming in Python 3, Pearson Education LPE, New Delhi, 1996.
2. Python Programming, Ch Satyanarayana, M Radhika Mani, BN Jagadesh Cengage, New Delhi.
3. Introduction to Computer Science using Python – A computational Problem solving Focus,CharlesDierbach, WileyIndia Edition, 2015

Python Programming List

1. Write a Python program to calculate GCD of two numbers.
2. Write a Python program to calculate the exponentiation of a number.
3. Write a Python Program to calculate the maximum from the list of numbers.
4. Write a Python Program to perform insertion sort.
5. Write a Python Program to perform selection sort.
6. Write a Python program of function overloading with different function signatures.
7. Write a Python program to calculate the most frequent words in a text read from a file.
8. Write a Python program to find factorial of number
9. Write a Python program to add and multiply two matrices.
10. Write a Python program to print the Fibonacci Series using Recursion
11. Write a Python program to check a given number is an Armstrong number or not.
12. Write a Python program to find sum of series of n natural number
13. Write a Python program to implement Tower of Hanoi Problem

PAPER 18: ELECTIVE – I (NUMBER THEORY)

Unit 1: Divisibility.

Unit 2: Congruences – Solution of congruences – Chinese remainder theorem.

Unit 3: Quadratic residues – Quadratic reciprocity - The Jacobi Symbol.

Unit 4: Greatest integer function – Arithmetic function – The Mobius Inversion Fiormulae – Combinational Number Theory (Section 4.4 omitted).

Unit 5: The equation ax+by=c – Simultaneous Linear equations – Pythagorean Triples – Assorted examples (only simple problems should be asked)

Books for Reference and study:

1. Content and Treatment as in “An Introduction to theory of Numbers” (5th Edition) by Inan Niven, Hebert S. Zuckarman and L. Montgomery – John Wiley and sons Inc. 2001.
2. Elementary theory of numbers, Hsuing, Allied Publishers, 1995.
3. Elementary number theory, Allyn and Bacon Inc. Boston, 1980.
4. Introduction to Analytic Number Theory, Tom. M. Apostel, Narso Publishing House, New Delhi, 1989.

PAPER 18: ELECTIVE – II (GRAPH THEORY)

Unit 1: Graphs - sub-graphs - degree of a vertex - isomorphism of graphs - independent sets and coverings- Simple problems. Intersection graphs- line graphs - adjacency matrix and incident matrix-simple problems- Operation on graphs - degree sequences and graphic sequences

Unit 2: Connectedness - walks, trials, paths – simple problems -Components – bridge - block - connectivity

Unit 3: Eulerian graph -simple problems - Hamiltonian graphs

Unit 4: Trees and planarity

Unit 5: Directed graphs – basic properties- paths and connectedness – digraphs and matrices

Books for Reference and study:

Content and treatment as in **"Invitation to Graph Theory"** by S.Arumugam and S. Ramachandran, New Gamma Publishing House, Palayamkottai.

ALLIED SUBJECTS

CALCULUS OF FINITE DIFFERENCES AND NUMERIC ANALYSIS – I

Unit 1: Solutions of algebraic and Transcendental equations -Bisection method, iteration method, Regulafalsi method, Newton Rraphson method.

Unit 2: Solution of simultaneous linear equations -Gauss-elimination- Gauss-Jordan method- Gauss-Siedel method- Crout's method

Unit 3: Finite differences - E-operators and relation between them- Differences of a polynomial- Factorial polynomials- differences of zero- summation series.

Unit 4: 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.

Unit 5: 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.

Books for Reference and study:

1. Calculus of Finite Differences and Numeric Analysis by Venkatachalapathy
2. Calculus Of Finite Differences And Numeric Analysis by Kandaswamy, Thilagavathy & Others.
3. Numerical Methods by B. D. Gupta-Malik.
4. Numerical Methods by M. K. Venkataraman.

CALCULUS OF FINITE DIFFERENCES AND NUMERIC ANALYSIS - II

Unit 1: Numerical differentiation -Derivatives using Newton's forward and backward differences formula- derivatives using sterling's formula- derivatives using divided formula - Maxima and minima using the above formula.

Unit 2: Numerical integration - General quadrature formula – trapezoidal rule- Simpson 1/3 rule ,3/8 th rule, Weddle's rule Eeuler-Maclaurin's summation formula - Sterling formula for.

Unit 3: Difference equations - Linear homogeneous and Non-homogeneous difference Equation with constant coefficients, particular integrals for ax, xm, sin kx, cos kx.

Unit 4: Numerical solution of ordinary difference equations (1st order only) - Taylor's series method - Pichard's method - Euler's method- modified Euler's method.

Unit 5: Runge-Kutta method of 4th order only- predictor –corrector Method-Milne's method, Adams-Bashforth method.

Books for Reference and study:

1. Calculus of finite differences and numeric analysis by Venkatachalapathy
2. Calculus of finite differences and numeric analysis by Kandaswamy, Thilagavathy & others.
3. Numerical methods by B. D. Gupta-Malik.
4. Numerical methods by M. K. Venkataraman.

MATHEMATICAL STATISTICS – I

Unit 1: Concept of sample space - Events, Definition of probability (Classical, Statistical, Axiomatic) - Addition theorem of probability & its extension to 'n' events - Boole's inequality - Conditional Probability - Multiplication theorem of probability, Independent events - Multiplication theorem of independent events& its extension to 'n' events, Pairwise independent, Mutually independent events - Baye's theorem-(Simple problems)

Unit 2: Distribution Function - Properties of distribution function - Random Variable - Discrete random variable - Probability mass function - discrete distribution function - Continuous random variable-Probability density function, Continuous distribution function - Properties of distribution function – Expectation - Expected value of random variable - Expected value of function random variable, Properties of Expectation –Addition theorem, Multiplication theorem, Linear combination, Varience Covariance – Moments - Moment generating function - Properties of moment generating function.

Unit 3: Characteristic function - Properties of characteristic function, Uniqueness theorem & Inversion theorem (without Proof) - applications only - Cumulants: Properties of cumulants -Chebychev inequality - (Simple problems based on the above topics).

Unit 4: Concepts of Bivariate distribution - Probable error of correlation coefficient - Rank Correlation - Tied ranks - Limits for the rank correlation coefficient – Regression - Properties of regression coefficient - Concepts of partial & multiple correlation coefficient.

Unit 5: Standard Distributions - Binomial Distribution - Moments, Recurrance relation for the moments - Factorial Moments - Mean deviation about mean – Mode - Moments generating function - Characteristic function – Cummlants - Probability generating Function - Normal Distribution - Mode, Median, Cummulants - Moment generating function - Cummulants generating function - Point of inflexion of normal curve - Area property - Importance of normal distribution -Geometric distribution - Moments of geometric distribution - Exponential distribution - Moment generating function - Gamma distribution - Moment generating function, Cummulant generating function Limiting form of gamma distribution - Beta distribution - Constants of beta distribution of First kind & Second kind.

Books for Reference and study:

1. Hogg. R. V & Craig. A. T (1998): Introduction to Mathematical Statistics, Macmillian
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 &IBH
4. Hoel. P. G (1971): Introduction to Mathematical Statistics, Wiley.

MATHEMATICAL STATISTICS- II

Unit 1: Sampling Theory: Sampling distribution - Standard error - Sampling distribution based on Normal distribution - Student 't' distribution- Derivation of Student 't' distribution - Fishers 't' –Distribution of Fisher 't' - Constants of 't' distribution - t-test for difference of means - F-distribution – Derivation of Snedecor's F-distribution - Constants, Mode&Point of inflexion -F-test for equality of two-population varience - Chi-Square distribution - Derivation of Chi-Square - Moment generating function - Characteristic function – Mode – Skewness - Chi-square probability curve - Theorem on Chi-square distribution - Applications of Chi-Square distribution.

Unit 2: Theory of Estimation - Concepts of unbiasedness - Consistency, Efficiency & sufficiency, Cramer-Rao inequality - Methods of Estimation - Maximum likelihood, Moments & Chi-square &their properties (Statements Only)

Unit 3: Interval estimation - Confidence interval for Population mean - Proportions & Variance based on Normal, t - Chi-square & F-distribution - Test of Significance - Large Sample test based on t, Chi-square & F-distribution with respect to Population mean, proportion - Varience - Test of independence of attributes based on contingency tables- Goodness of fit tests based on chi-square.

Unit 4: Analysis of Variance - One-way classification - Two-way classification – Concepts & Problem - Test for Significance - Small Samples test based on 't 'with respect to test for specified mean - Chi-square & F-distribution with respect to difference between two sample means& two sample variances.

Unit 5: Test of hypothesis - Type I & II errors-Power of test –Neyman Pearson lemma-Likelihood ratio tests-Concepts of most powerful test (statements only)-Simple problems.

Books for Reference and study:

1. Hogg. R. V & Craig. A. T (1998): Introduction to Mathematical Statistics, Macmillian
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 &IBH
4. Hoel. P. G (1971): Introduction to Mathematical Statistics, Wiley.

Mathematical Statistics Practical using R Programming

1. Forming Univariate, Bivariate and Multivariate Frequency Distribution Tables.
2. Draw Bar plot, Pie Chart, Frequency Curve and Histogram.
3. Problems based on Probability and Baye's Theorem.
4. Computation of various measures of moments, skewness and kurtosis.
5. Computation of Karl Pearson Coefficient of Correlation-Spearman's Rank Correlation and Regression Lines.
6. Fitting of Binomial, Poisson and Normal distributions and Testing of Goodness of Fit.
7. Large Sample Tests.
8. Exact test base on t, Chi-square and F distributions.

ALLIED MATHEMATICS – PAPER I (FOR PHYSICS AND CHEMISTRY)

Unit 1: **ALGEBRA:** Binomial, exponential and logarithmic series (without proof) - summation and approximation-simple problems.

Unit 2: **THEORY OF EQUATIONS:** Polynomial equations with real coefficients-irrational roots, symmetric functions of roots- reciprocal equations- Newton's method to find a root approximately-simple problems.

Unit 3: **MATRICES:** Symmetric, skew-symmetric - orthogonal and unitary matrices - rank of a matrix - consistency of equations - eigen roots and eigen vectors - Cayley-Hamilton theorem (without proof) -verification and computation of inverse matrix.

Unit 4: **TRIGONOMETRY:** Expansions of in terms of - expansions of - Hyperbolic and inverse hyperbolic functions Logarithms of complex numbers.

Unit 5: **DIFFERENTIAL CALCULUS:** Nth derivatives - Leibnitz theorem (without proof) and applications – Jacobians- maxima and minima of functions of two variables - Lagrange's multipliers.

ALLIED MATHEMATICS – PAPER II (FOR PHYSICS AND CHEMISTRY)

Unit 1: **INTEGRAL CALCULUS:** Integration of irrational,trigonometric functions-Bernoulli's formula for integration by parts- reduction formulae - properties of definite integral and simple problems.

Unit 2: Evaluation of double, triple integrals - simple applications to area, volume and centroid - Fourier series for functions in (0,2p).

Unit 3: **ORDINARY DIFFERENTIAL EQUATIONS:** First order and higher degree equations solvable for p,y,x. Total differential equation Pdx+Qdy+Rdz=0. **PARTIAL DIFFERENTIAL EQUATIONS:** formation, complete integrals and general integrals, four standard types and Lagrange's equations.

Unit 4: **LAPLACE TRANSFORMS:** Laplace transformations of standard functions and simple properties, inverse laplace transforms Application to solution of linear differential equations of order 1 and 2 – simple problems.

Unit 5: **VECTOR ANALYSIS:** Scalar point functions, vector point functions, gradient, divergence, curl, directional derivatives, limit normal to a surface. Line and surface integrals; gauss,stoke's and green's theorems (without proofs). Simple problems on these.

Books for Reference and study:

1. Allied maths volumes 1 and 2 by Prof. P. Duraipandian and Dr. S. Udaybaskaran, Muhil publishers, Chennai.
2. Ancillary mathematics volume 1 and 2 by P. Balasubramanian & K. G. Subramanian.
3. Integral calculus and differential equations by Dipak Chatterjee, Tata Mcgraw Hill publishers co ltd.,
4. Ancillary mathematics by S. Narayanan and others, S. Viswanathan publishers.
5. Allied Mathematics by Dr. P. R. Vittal (Margham Publications)

NON-MAJOR ELECTIVE (NME) SUBJECTS

NME I – BASIC MATHEMATICS

Unit 1: Relations and functions – definition of equivalence relation – several examples – functions and its classifications – one-one, onto functions on finite and infinite sets – simple problems.

Unit 2: Linear programming problems – solution using graphical method.

Unit 3: Interest and annuities – simple and compound interest – effective and normal rate of interest - depreciation – annuities – profit and loss – simple problems involving cost price and selling price.

Unit 4: Concept of limit and continuity – differentiation of algebraic, exponential, trigonometric functions – product and quotient rule of differentiation – simple problems.

Unit 5: Maxima and minima of one variable – simple problems related to business.

NME II – BASIC STATISTICS

Unit 1: Collection of primary and secondary data – classification and tabulation – diagrammatic and graphical representation of data – frequency polygon and ogives.

Unit 2: Measures of central tendency – finding arithmetic mean, geometric mean and median, quartiles, deciles, percentile and mode for individual, discrete, and continuous cases.

Unit 3: Measures of dispersion – range, quartile deviation – mean deviation about mean and median, variance, standard deviation - coefficient of variation – simple problems.

Unit 4: Correlation analysis – definition and properties – finding correlation coefficient due to Karl Pearson – rank correlation – finding rank correlation coefficient due to Spearman– simple problems.

Unit 5: Regression – definition – finding regression coefficients and two lines of regression – curve fitting – fitting of lines using method of least squares.