B. A. \ B.Sc (Mathematics) III semester
(Sessions 2021-22. 2022-23, 2023-24)

Paper-I: Analysis-I

For Regular Students	**Maximum Time: 3 Hrs.**
Maximum Marks: 50 Marks	Teaching Hours : 50
University Exam: 40	Internal Assessment: 10

For Distance Education Students /Private Students
Maximum Marks: 50 Marks (No Internal Assessment)

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Sequence: Definition of a sequence, Bounded and Monotonic sequences, Convergent sequence, Cauchy sequences, Cauchy's Convergence Criterion, Theorems on limits of sequences. Sub-sequence, Sequential continuity.

Infinite Series: Definition of a series, Tests of convergence, Comparison test. Cauchy's integral Ratio test, condensation test, Raabe's test, Logarithmic test, Gauss test, Cauchy's root test, Alternating series. Leibnitz's test. Absolute convergence and conditional convergence. Weierstrass M-Test for Uniform convergence of sequence of functions and series of functions. Simple applications. Determination of Radius of convergence of power series. (All Test without proofs only applications)
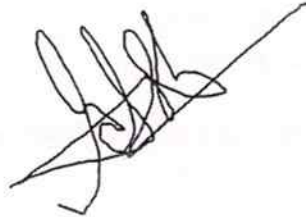
SECTION-B

Improper integrals: Definition, statements of their conditions of existence. Test of the convergence of improper integral, beta and gamma functions and their convergence. Abel's and Dirichlet's tests.

BOOKS RECOMMENDED:

1. Tom.M. Apostol: *Mathematical Analysis*, Second Edition, Addsion-Wesley Publishing Company, 1974.
2. W. Rudin: *Principles of Mathematical Analysis*, third edition. McGraw Hill, 2013.
3. S.C Malik, S. Arora: *Mathematical Analysis*, New Age International Publishers, 1992.

PAPER-II: Linear Programming

For Regular Students

Maximum Marks: 50 Marks

University Exam: 40

Maximum Time: 3 Hrs.

Teaching Hours : 50

Internal Assessment: 10

For Distance Education Students /Private Students

Maximum Marks: 50 Marks (No Internal Assessment)

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Linear Programming: Formation of LPP, Graphical Method. Theory of the Simplex Method, Standard form of LPP, Feasible solution to basic feasible solution, Improving BFS, Optimality Condition, Unbounded solution, Alternative optimal solution, Correspondence between BFS and extreme points. Simplex Method, Simplex Algorithm, Simplex Tableau. Simplex Method Case of Degeneracy, Big-M Method, Infeasible solution, Alternate solution, Solution of LPP for unrestricted variable.

SECTION-A

Transportation Problem: Formation of TP, Concepts of solution, feasible solution, Finding Initial Basic Feasible Solution by North West Corner Method, Matrix Minima Method, Vogel's Approximation Method. Optimal Solution by MODI method, Unbalanced and maximization type of TP.

Assignment Problem: Maximization, Minimization, Unbalances, With restriction Assignment problems, Algorithm, Hungarian method.

BOOKS RECOMMENDED:

Paper-III: MECHANICS

For Regular Students
Maximum Marks: 50 Marks
University Exam: 40

Maximum Time: 3 Hrs.
Teaching Hours : 50
Internal Assessment: 10

For Distance Education Students /Private Students
Maximum Marks: 50 Marks (No Internal Assessment)

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Statics: Basic notation, Newton Laws of motion, system of two forces, parallelogram law of forces, resultant of two collinear forces, resolution of forces, moment of a force, couple, theorem on moments of a couple, coplanar forces, resultant of three coplanar concurrent forces, theorem of resolved parts, resultant of two forces acting on a rigid body, Varignon's theorem, generalized theorem of moments.

Equilibrium of two concurrent forces, equilibrium condition for any number of coplanar concurrent forces, Lami's theorem. λ - μ theorem, theorems of moments, resultant of a force and a couple. Equilibrium conditions for coplanar non-concurrent forces.

SECTION-B

Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upward, motion of a two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Variable acceleration, Simple harmonic motion, Projectile.

BOOKS RECOMMENDED:

1. S.L. Loney: *The Elements of Statics and Dynamics*, 5th edition, Cambridge University Press, 1947.
2. John L. Synge, Byron A. Griffith: *Principles of Mechanics*, 3rd Edition, McGraw-Hill

B. A. \ B.Sc (Mathematics) IV semester

PAPER-IV: Analysis-II

For Regular Students
Maximum Marks: 50 Marks
University Exam: 40
For Distance Education Students /Private Students
Maximum Marks: 50 Marks (No Internal Assessment)

Maximum Time: 3 Hrs.
Teaching Hours : 50
Internal Assessment: 10

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

Objective: This course continues the study of Analysis started in Paper II (Analysis I) and will students will study Uniform Convergence, Power Series and Vector Calculus.

SECTION-A

Functions of bounded Variation and Rectifiable Curves: Properties of Monotonic Functions, Functions of Bounded Variation, Total variation, Additive property of total variation, Total Variation on [a, x] as a function of x, functions of bounded variation expressed as the difference of increasing functions, continuous functions of bounded variation, rectifiable curves and arc length. Additive and continuity Property of Arc Length, Equivalence of Paths and Change of Parameter.

SECTION-B

The Riemann-Stieltjes integrals: Definition, elementary properties, integration by parts, change of variable, reduction to Riemann integral, step functions as integrators. Reduction of

Riemann's Condition, Comparison Theorems, Integrators of bounded variation, Mean value theorems for Riemann-Stieltjes integrals, Fundamental theorem of integral calculus, Mean value theorems for Riemann Integrals.

BOOKS RECOMMENDED:

1. T. M. Apostol: *Mathematical Analysis*, Norosa Publishing House, New Delhi, 1985.
2. S. Kumaresan: Topology of Metric Space, Alpha Science International Ltd.2005
3. S. C. Malik, Savita Arora: *Mathematical Analysis,* Wiley, 1984.

Paper-V: Numerical Methods

For Regular Students   **Maximum Time: 3 Hrs.**
Maximum Marks: 50 Marks   Teaching Hours : 50
University Exam: 40   Internal Assessment: 10
For Distance Education Students /Private Students
Maximum Marks: 50 Marks (No Internal Assessment)

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Measures of Errors: Relative, absolute and percentage errors. Types of errors: Inherent error, Round-off error and Truncation error.
Bisection method, Regula-Falsi method, Secant method, Fixed-point iteration, Intermediate value theorem. Iteration methods based on first degree equation: Newton-Raphson method, Birge-Vieta method, Bairstrow method.

SECTION-B

Linear System of Equations: Gauss-Elimination method, Pivot element, Pivoting strategies, Partial and complete Pivoting, Gauss Jordan and Triangularization method, Jacobi Method, Gauss Seidel Method, Eigen value problem.
Interpolation: Finite differences, Divided differences, Newton Gregory Forward and Backward formula, Lagrange's Formula, Newton's Formulae, Central Differences, Stirling, Bessel's and Everett's formulae, Error in linear and quadratic interpolation.

BOOKS RECOMMENDED:

3. S.S. Sastry: *Introductory Methods Of Numerical Analysis*, Fifth Edition, Eastern Economy edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
4. Kendall E. Atkinson: *An Introduction to Numerical Analysis,* Wiley, 1978.

Paper-VI: Number Theory

For Regular Students   **Maximum Time: 3 Hrs.**
Maximum Marks: 50 Marks   Teaching Hours : 50
 University Exam: 40   Internal Assessment: 10
For Distance Education Students /Private Students
Maximum Marks: 50 Marks (No Internal Assessment)

INSTRUCTIONS FOR THE PAPER-SETTER(Regular Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 06 marks and Section C will be of 16 marks.

INSTRUCTIONS FOR THE PAPER-SETTER(Distance Education/ Private Students)

The question paper will consist of three sections A, B and C. Sections A and B will have four questions each from the respective sections of the syllabus and Section C will consist of one compulsory question having eight short answer type questions covering the entire syllabus uniformly. Each question in Sections A and B will be of 7.5 marks and Section C will be of 20 marks.

INSTRUCTIONS FOR THE CANDIDATES

Candidates are required to attempt five questions in all selecting two questions from each of the Sections A and B and compulsory question of Section C.

SECTION-A

Divisibility, Greatest common divisor, Fundamental Theorem of arithmetic, congruence, residue classes and reduced residue classes, Euler-Fermat theorem, Wilsons's theorem, Linear congruence, Chinese Remainder theorem.

SECTION-B

An Application to cryptography, primitive roots, indices, quadratic residues, Legendre Symbol, Euler's criterion, Gauss Lemma., Quadratic reciprocity Law, Jacobi Symbol. Arithmetic functions $\mu(n)$, $d(n)$, $\varphi(n)$, $\sigma_a(n)$, Mobius inversion Formula.

BOOKS RECOMMENDED:

1. David M. Burton: *Elementary Number Theory*, 3rd Edition, McGraw-Hill Higher Education, (scope as in Chapters I-II), 2007.
2. I. Niven, Herbert S. Zuckerman: *An Introduction to the Theory of Numbers*, Wiley Eastern (Scope as in Chapters 1-7), 1976.
3. G.H. Hardy, E.M. Wright: *Number Theory*, Oxford Univ. Press (Scope as in Chapter 19), 2008.