BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

Office of the Secretary

Faculty Council for Undergraduate Studies

Ref: BKU/FCUG/213/2025 Date: 25/08/2025

NOTIFICATION

As directed, the undersigned is pleased to inform all concerned that Bankura University has initiated the process to implement New Curriculum and Credit Framework for Undergraduate Programme, UGC 2022 (as per NEP 2020) for 4-years Undergraduate programme with Mathematics as Major, Minor etc. from the academic session 2023-2024. The syllabus as framed / drafted and partially implemented deserves to be analysed after receiving feedback from different stakeholders. As an important corollary to the process, a workshop will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme/course are requested for their kind participation in the workshop and to present their views/ observations, etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on ugsecretaryoffice@bankurauniv.ac.in within three days from the date of publication of this notice.

Date: 28th August, 2025

Time: 2:30 PM

Venue : Academic Building Seminar Room (Room No-301) Bankura University.

Sd/-
Dr. Arindam Chakraborty
Secretary
Faculty Council for Undergraduate Studies

Semester - V

MJC – 9 – Ring Theory

Ring and Field Theory	
	4 Credits

Unit 1

Definition and examples of rings, properties of rings, subrings, polynomial rings, integral domains and fields, subfield, necessary and sufficient condition for a nonempty subset of a field to be a subfield, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Unit 2

Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, Correspondence theorem, congruence on rings, one-one correspondence between the set of ideals and the set of all congruences on a ring.

Unit 3

Divisibility in integral domains, irreducible, primes, unique factorization domains, Principal ideal domain, principal ideal ring, Euclidean domain, relation between Euclidean domain and principal ideal domain, division algorithm, irreducible elements (specially of degree 2 and 3) in polynomial rings, Polynomial rings being a PID and its factor by maximal ideals (examples).

Greatest common divisor (gcd), least common multiple (lcm), expression of gcd, examples of a ring R and a pair of elements $a, b \in R$ such that gcd(a, b) does not exist.

References

- John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
- M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
- Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
- I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975.
- D. S. Malik, John M. Mordeson and M. K. Sen, Fundamentals of abstract algebra, Tata McGraw-Hill, New York.
- D. S. Dummit, R. M. Foote, Abstract Algebra, John Wiley and Sons Incs. 2004.
- S. K. Mapa, Higher Algebra: Abstract and Linear, Levant Books, Kolkata, 2019.
- V. K. Khanna, S. K. Bhambri, A Course in Abstract Algebra, 2nd Ed., Vikas Publishing House Pvt.

Ltd., New Delhi, 2006.

- U. M. Swamy and A.V.S.N. Murthy, Algebra: Abstract and Modern, Pearson (India), New Delhi, 2012.
- M. Pal, Advanced Algebra, PHI Learning, New Delhi, 2013.

MJC – 10 – Linear Algebra

Linear Algebra	
	4 Credits

Unit1

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit2

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation. Algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms.

Inner product spaces, matrix of an inner product, Cauchy-Schwarz inequality. orthogonal/orthonormal set, Orthonormal basis, Gram-Schmidt orthogonalization process.

Unit3

Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, Project on operator and its relation with the eigenvalues of a linear operator, the minimal polynomial for a linear operator, primary decomposition theorem, invariant factors, elementary divisors, working procedure to find possible Rational and Jordan canonical forms of a linear operator.

Unit4

The adjoint of a linear operator. Normal and self-adjoint operators. Bessel's inequality, Orthogonal complement, Orthogonal projections, Best approximation and its application to Least Squares approximation, minimal solutions to systems of linear equations.

Bilinear and quadratic forms, Diagonalisation of symmetric matrices, Second derivative test for critical point of a function of several variables, Hessian matrix, Sylvester's law of inertia. Index, signature.

References

- Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
- S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

- Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
- S. Kumaresan, Linear Algebra – A Geometric Approach, Prentice Hall of India, 1999.
- S. K. Mapa, Higher Algebra: Abstract and Linear, Levant Books, Kolkata, 2019.
- P. B. Bhattacharya, S.K. Jain, S. R. Nagpaul, First Course in Linear Algebra, 2nd Ed., New Age International Publishers, New Delhi, 2015.
- K. Hoffman, R. Kunze, Linear Algebra, 2nd Ed., Pearson, New Delhi, 2016.
- P. K. Nayak, Linear Algebra: Concepts and Applications, 3rd Ed., Books and Allied Pvt. Ltd., Kolkata, 2022.
- G. Paria, Linear Algebra, New Central Book Agency, Kolkata, 2011.
- M. Pal, Advanced Algebra, PHI Learning, New Delhi, 2013.

MJC – 11 – Partial Differential Equations (PDE)

Partial Differential Equations (PDE)

4 Credits

Unit1

Introduction to Partial differential equations: Definitions. Solutions, Classifications, Formation of PDE, Equations of the first order, Lagrange's solution, The characteristic Cauchy Problem: General Solution, Integral surface, Method of Separation of variables for first order equations.

Nonlinear first order partial differential equations, Monge strip and Charpit's general method of solution, some special types of equations which can be solved easily by methods other than the general method.

Unit2

Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic, Canonical forms, Reduction of second order linear equations to canonical forms.
The Cauchy problem, Cauchy problem of finite and infinite string. Initial boundary value problems, De Alembert's solutions: One dimensional homogeneous and non-homogeneous wave equations, Semi-infinite string with fixed end; string of finite length.

Unit3

Method of separation of variables: initial and boundary value problems, solving the vibrating string problem, Solving the heat conduction problem for finite rod, Maximum-Minimum Principle, Solution of Laplace equations: Dirichlet's and Neumann Problems.

References

- Ian Sneddon, Elements of Partial Differential equations, Mcgraw-Hill International Edition, 1957.
- M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Higher Academic, 19th Edition, 2017.
- K. Sankara Rao, Introduction to Partial Differential Equations, PHI, Third Edition, 2015.
- P. Prasad, R. Ravindran, Partial Differential Equations, 2nd Ed., New Age International Publishers,

New Delhi, 2011.

- Tyn Myint-U, Lokenath Debnath, Linear Partial Differential Equations for Scientists and Engineers, 4th Ed., Birkhauser, Boston, 2007.
- P. Duchateau, D. W. Zachmann, Theory and Problems of Partial Differential Equations, Schaum's Outline Series, McGraw-Hill, Singapore, 1986.
- T. Amaranath, An Elementary Course in Partial Differential Equations, Alpha Science International, 2003.
- B. K. Dutta, Introduction to Partial Differential Equations, New Central Book Agency (P) Limited, Kolkata, 2008.

MJC-12-Numerical Analysis (Theory & Practical)

Numerical Analysis (Theory)	
	3 Credits
Unit1	
Computational Error: Round-off error, Local and global truncation errors, Inerrant errors, Algorithms and convergence, Relative and Percentage error. Propagation of Error. Solution of Algebraic and Transcendental equations: Bisection method, False position method, Fixed point iteration method, Newton's method and secant method for solving equations. Convergency conditions of these methods.	
Unit2	
Solution of System of Linear equations: Partial and scaled partial pivoting, Gaussian Elimination Method; Jacobi and Gauss-Seidel methods, Convergency conditions. Greatest and least eigen values and the corresponding eigen vectors by power method.	
Unit3	
Interpolation: Finite difference operators, shift operator, Gregory-Newton forward and backward difference interpolations. Lagrange's interpolation, Newton's divided difference method. Extrapolation methods.	
Unit4	
First order and higher order approximation for first derivative, Approximation for second Derivative. Numerical integration: Newton-Cotes formula, Trapezoidal rule, Simpson's one third rule, Error analysis, Geometry.	
Unit 5	

Solution of IVP: Euler's method, Modified Euler's method, Taylor series method, Runge-Kutta methods,

Reference Books

- Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
- M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007.
- C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson Education, India, 2008.
- Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
- John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.
- Scarborough, James B., Numerical Mathematical Analysis, Oxford and IBH publishing co.
- Atkinson, K.E., An Introduction to Numerical Analysis, John Wiley and Sons, 1978.
- F. B. Hildebrand (2013). *Introduction to Numerical Analysis*: (2nd edition). Dover Publications.
- P. K. Nayek, A Textbook of Advanced Numerical Analysis (Theory, Problems and MATLAB Programming), SpellBound, Kolkata, 2024.
- S. A. Mollah, Numerical Analysis and Computational Procedures, Books & Allied Pvt. Ltd., Kolkata, 2022.
- D. C. Sanyal, K. Das, A Text Book of Numerical Analysis, U. N. Dhur & Sons, Kolkata, 2015.

Numerical Analysis (Practical)

1 Credits

List of Practical (Using C programming)

1. Solution of transcendental and algebraic equations by
    a. Newton Raphson method.
    b. Fixed Point iteration
2 Solution of system of linear equations
    c. Gaussian elimination method
    d. Jacobi Method
3. Interpolation
    a. Lagrange Interpolation
4. Numerical Integration
    a. Trapezoidal Rule
    b. Simpson's one third rule
5. Method of finding Eigenvalue by Power method
6. Solution of ordinary differential equations
    a. Modified Euler method
    b. Runge-Kutta method (4^{th} order)

Note: Practical note book (3 marks), Problem Solving using C-language (8 marks), Viva-Voce (4 marks)

MN – 5 – Algebra-2

Algebra -2	
	4 Credits
Unit 1	
Binary Composition; Definition of Group; Examples of Groups; Semi-groups, Monoids, Elementary properties of groups, Commutative groups, Examples of Commutative and non-commutative groups, Finite groups, Order of an element of a group, Order of a group, Permutation groups, Klain-4 group, Symmetric groups, Dihedral groups, Quaternion groups, Subgroups, Properties of subgroups, Cyclic groups, Statement of Lagrange's theorem.	
Unit 2	
Definition and examples of rings, properties of rings, subrings, zero divisor, Integral domains and fields, Examples, subfield, necessary and sufficient condition for a nonempty subset of a field to be a subfield.	
Unit 3	
Boolean algebra: definition and examples, Huntington postulates, Subalgebra, Basic properties of Boolean algebra, Duality property, Uniqueness of identity and complements, Truth tables, DNF and CNF, Boolean functions, Switching algebra.	
Unit 4	
Vector Space, Internal and External operations, Definitions and Examples, Properties of vector space, Subspaces, properties of subspaces, Linearly dependent and independent vectors, Basic theorems, Linear Span, Basis and Dimension of vector spaces, Linear transformation on vector spaces, Properties.	
References	
► R. M. Khan, New Central Book Agency, Kolkata, 2024. ► John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002. ► J. G. Chakravorty, P.R. Ghosh, Advanced Higher Algebra, U. N. Dhur & Sons, Kolkata, 2018. ► I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, India, 1975. ► D. S. Malik, John M. Mordeson and M. K. Sen, Fundamentals of abstract algebra, Tata McGraw-Hill, New York. ► M. K. Sen, S. Ghosh, P. Mukhopadhyay, S. K. Maity, Topics in Abstract Algebra, University Press, Hyderabad, 2019. ► S. K. Mapa, Higher Algebra: Abstract and Linear, Levant Books, Kolkata, 2019. ► V. K. Khanna, S. K. Bhambri, A Course in Abstract Algebra, 2nd Ed., Vikas Publishing House Pvt. Ltd., New Delhi, 2006.	

- P. K. Nayak, Linear Algebra: Concepts and Applications, 3rd Ed., Books and Allied Pvt. Ltd., Kolkata, 2022.
- G. Paria, Linear Algebra, New Central Book Agency, Kolkata, 2011.
- M. Pal, Advanced Algebra, PHI Learning, New Delhi, 2013.
- S. Kumaresan, Linear Algebra – A Geometric Approach, Prentice Hall of India, 1999.
- P. B. Bhattacharya, S.K. Jain, S. R. Nagpaul, First Course in Linear Algebra, 2nd Ed., New Age International Publishers, New Delhi, 2015.
- K. Hoffman, R. Kunze, Linear Algebra, 2nd Ed., Pearson, New Delhi, 2016.

Semester – VI

MJC – 13 – Operations Research

Operations Research

4 Credits

Unit1

Introduction to linear programming problem, Feasible Solution, Basic Feasible solution, Convex Set, Extreme points, Related theorems, Theory of simplex method, Fundamental theorem of LPP, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction of artificial variables, two- phase method. Big- M method and their comparison. Revised Simplex Method.

Unit2

Duality, formulation of the dual problem, primal- dual relationships, Duality theorems, Fundamental theorem of duality, Duality and Simplex method, Dual-simplex method.

Transportation problem and its mathematical formulation, north west- corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problems, Unbalanced Transportation Problems. Assignment problem and its mathematical formulation, Hungarian method for solving assignment problems.

Unit3

Game theory: formulation of two-person zero sum games, solving two-person zero sum games, games with mixed strategies, Dominance Property, graphical solution procedure, linear programming solution of games.

Reference Books

- Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, Linear Programming and Network Flows, 2nd Ed., John Wiley and Sons, India, 2004.
- Hamdy A. Taha, Operations Research, An Introduction, 8th Ed., Prentice- Hall, India, 2006.

- G. Hadley, Linear Programming, Narosa Publishing House, New Delhi, 2002.
- Kanti Swarup, Gupta, P. K., Mon Mohan, Operations Research, S Chand and Sons, New Delhi, 2010.
- Sharma J.K., Operations Research: Theory and Applications, Trinity Press, New Delhi, 2017.
- J.G. Chakraborty & P. R. Ghosh, Linear Programming & Game Theory, Moullik Library, Kolkata.

MJC – 14 – Metric Spaces and Functional Analysis

Metric Spaces and Functional Analysis	
	4 Credits
Unit1	
Metrics paces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, closed set as a complement of an open set, diameter of a set, distance of a set from a point, distance between two sets, subspaces, dense sets, separable spaces. Sequences in metric spaces, Cauchy sequences. Complete Metric Spaces with examples, Examples of incomplete metric spaces, every convergent sequence is Cauchy and bounded but converse need not be true, Cantor's intersection theorem.	
Unit2	
Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness, connected subsets of R. Compactness: Concept of compactness, Sequential compactness, Heine Borel property, Totally bounded spaces, finite intersection property, and continuous functions on compact spaces. Homeomorphism. Contraction mappings. Banach Fixed point Theorem and its application to ordinary differential equation.	
Unit3	
Normed Space, Banach Space, Properties of Normed space, Finite dimensional spaces and subspaces, Compactness and finite dimension, Linear operators, Bounded and Continuous Linear operators, Linear Functionals, Linear operators and Functionals on Finite dimensional spaces, Normed spaces of Operators, Dual space.	
Unit 4	
Inner product space, Hilbert Space, Properties of Inner product space, Orthogonal complements and Direct sums, Orthonormal sets and sequences, Series related to Orthonormal sequences and sets, Total orthonormal sets and sequences, Functionals on Hilbert space, Hilbert-Adjoint operators, Self-adjoint, Unitary and Normed operators. Zorn's Lemma, Hahn-Banach Theorem.	
References	
- Satish Shirali and Harikishan L. Vasudeva, Metric Spaces, Springer Verlag, London, 2006.	

- S. Kumaresan, Topology of Metric Spaces, 2nd Ed., Narosa Publishing House, 2011.
- P.K.Jain, K. Ahmad, Metric Spaces, Narosa, New Delhi.
- G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 2004.
- C.G.C. Pitts, Introduction to Metric Spaces, Oliver & Boyd, Edinburgh, 1972.
- K. Yosida, Functional Analysis, 6th Ed., Springer-Verlag, Berlin, 1980.
- E. Kreyszig, Introductory Functional Analysis with Applications, John Wiley & Sons, New York, 1978.

MJC-15- Probability and Statistics

Probability and Statistics	
	4 Credits
Unit 1	
Probability axioms, real random variables (discrete and continuous), cumulative distribution functions and its properties, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, Mean, Variance and moments, discrete distributions: uniform, binomial, Poisson, Poisson distribution as approximation to Binomial distribution, geometric, continuous distributions: uniform, normal, exponential, Gamma, Beta and Cauchy distributions. Transformation of random variables.	
Unit 2	
Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of functions of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.	
Unit 3	
Statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central Limit theorem for independent and identically distributed random variables with finite variance, Asymptotic distributions.	
Unit 4	

Random Samples, Population, Standard error, Sampling Distributions of sample mean and sample variance. Sampling from the normal distributions, Chi-square, *t* and *F*-distributions, Estimation of parameters, Point and Interval estimations, Unbiased and consistent estimator, Minimum variance unbiased estimator, Maximum Likelihood Estimation method, Confidence interval and degree of confidence, Confidence interval for mean, proportion, variance etc. Testing of hypothesis, Null and Alternative hypothesis, Power of a test, Level of significance.

Reference Books

- Robert V. Hogg, Joseph W. Mc Kean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson Education, Asia, 2007.
- Irwin Miller and Marylees Miller, John E. Freund, Mathematical Statistics with Applications, 7thEd., Pearson Education, Asia, 2006.
- Sheldon Ross, Introduction to Probability Models, 9thEd., Academic Press, Indian Reprint, 2007.
- Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, Introduction to the Theory of Statistics,3rd Ed., Tata McGraw-Hill, Reprint, 2007.
- A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers.
- A. Banerjee, S.K. De, S. Sen, Mathematical Probability, U. N. Dhur & Sons Pvt. Ltd., Kolkata, 2018.
- S.K. De, S. Sen, Mathematical Statistics, U. N. Dhur & Sons Pvt. Ltd., Kolkata, 2018.
- J. Sarkhel, S. K. Dutta, An Insight into Statistics, Book Syndicate (P) Ltd., Kolkata, 2007.
- A. Mukherjee, Fundamental Treatise on Probability and Statistics, Sreetara Prakashani, Kolkata, 2015.

MJC – 16 – Complex Analysis

Complex Analysis	
	4 Credits

Unit1

Complex field, Geometric representation: Argand plane, Properties of complex numbers, regions in the complex plane, Points at infinity: Stereographic Projection.

Functions of complex variables, Limits, Limits involving the point at infinity, Continuity, Theorems on limits and continuity.

Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for

differentiability, Analytic functions, examples of analytic functions, Harmonic conjugates, exponential function, Logarithmic function, trigonometric function.

Unit2

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem (without proof), Simply and Multiply connected domains; Cauchy integral formula (without proof) and its consequences, Liouville's theorem.

Unit 3

Convergence of sequences and series, Taylor's series (statement only) and its applications. Laurent's series (statement only) and its applications in Singularities and their classification: Isolated singularity, removable singularity, essential singularity, Poles, Zeros of an analytic function of order *n*.

Unit 4

Residues, Cauchy's Residue theorem (statement only), Residues at poles, Applications of Residues in contour integration. Conformal mapping and its basic concept, Basic concept of Mobius Transformation, Cross ratios.

References

- James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw–Hill International Edition, 2009.
- Joseph Bak and Donald J. Newman, Complex Analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
- S. Ponnusamy, Foundations of complex analysis, Narosa Publishing House, New Delhi, 2005.
- E. M. Stein and R.Shakrachi, Complex Analysis, Princeton University Press.
- P. K. Nayek, M. R. Seikh, A Textbook of Complex Analysis, University Press, 2018.
- B. Choudhury, The Elements of Complex Analysis, New Age International Publishers, New Delhi, 1992.
- A. Gupta, Principles of Complex Analysis, Academic Publishers, Kolkata.
- S. Ganguly, D. Mandal, Lecture Course on Complex Analysis, Academic Publishers, Kolkata.

MN-6- Probability and Statistics

Probability and Statistics	
	4 Credits

Unit 1

Probability axioms, Real random variables (discrete and continuous), Cumulative distribution functions and its properties, Probability mass/density functions, Mathematical expectation, moments, Mean, Variance, Discrete distributions: uniform, binomial, Poisson, Continuous distributions: uniform, normal.

Unit 2

Joint cumulative distribution function and its properties, joint probability mass and density functions, marginal and conditional distributions, expectation of functions of two random variables, conditional expectations, independent random variables, Covariance, Correlation coefficient, linear regression for two variables.

Unit 3

Random Samples, Population, Standard error, Sampling Distributions of sample mean and sample variance. Central Limit theorem for independent and identically distributed random variables with finite variance, Sampling from the normal distributions, Chi-square, Estimation of parameters, Point and Interval estimations, Unbiased and consistent estimator, Maximum Likelihood Estimation method, Confidence interval and degree of confidence, Confidence interval for mean, Variance etc.

Reference Books

- A. Banerjee, S.K. De, S. Sen, Mathematical Probability, U. N. Dhur & Sons Pvt. Ltd., Kolkata, 2018.
- S.K. De, S. Sen, Mathematical Statistics, U. N. Dhur & Sons Pvt. Ltd., Kolkata, 2018.
- J. Sarkhel, S. K. Dutta, An Insight into Statistics, Book Syndicate (P) Ltd., Kolkata, 2007.
- A. Mukherjee, Fundamental Treatise on Probability and Statistics, Sreetara Prakashani, Kolkata, 2015.
- A. Gupta, Ground work of Mathematical Probability and Statistics, Academic publishers.