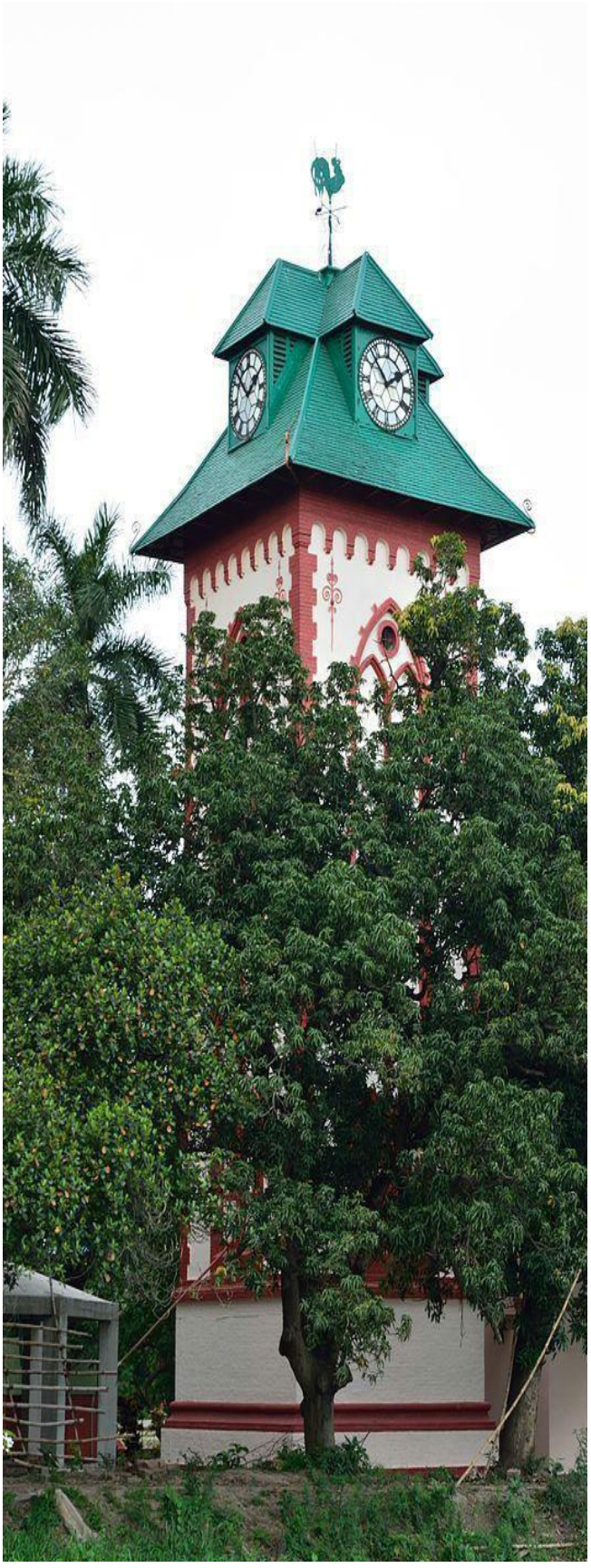

Department of Mathematics

Undergraduate Programme

Course Structure and Syllabus

(Effective from 2025-26 admitting batch onwards)

Indian Institute of Engineering Science and Technology (IIEST), Shibpur

Botanic Garden, Howrah

Course Code	MA1101N	Course Name	Mathematics-I	Course Category	PC B.Tech.(1st Sem.)	L	T	P
						3	1	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	The objective is to impart knowledge of mathematics necessary for B.Tech. education in general for all branches of engineering students.

Module	Syllabus	Duration (class-hour)
I.	**Functions of Single Real Variable:** *n*-th order derivative, Leibnitz's theorem for successive differentiation, Rolle's theorem, M.V.T's of differential calculus, Taylor's theorem with Lagrange's and Cauchy's forms of remainders, Taylor's and Maclaurin's series, expansion of functions, curvature, asymptotes.	10
II.	**Functions of Several Real Variables:** Partial derivatives, chain rule, differential and small error, Euler's theorem for homogeneous functions, Taylor's theorem(statement only), expansion of functions of two real variables, maxima and minima, Lagrange's method of undetermined multipliers.	8
III.	**Infinite Series:** Concept of convergence, Geometric series and p-series, Comparison test, D'Alembert's ratio test, Cauchy's root test, Raabe's test, Gauss' test, Power series, radius of convergence.	5
IV.	**Multiple Integrals:** Double integral, change of order of integration, Jacobian, change of variables, applications.	4
V.	**Improper Integrals:**Definition, Convergence, Cauchy's principal value, Comparison test, μ-test, Beta and Gamma functions and their properties, relation between Gamma function and Beta function.	5
VI.	**Ordinary Differential Equations:**Higher order ordinary differential equations with constant coefficients, Euler's equation, method of variation of parameters, series solutionin the neighborhoodofan ordinary point, Legendre differential equation, Legendre polynomials, Orthogonality property, recurrence relations, Bessel differential equation, Bessel functions, recurrence relations.	10

Course Outcome	The outcome is the development of fundamental understanding and working knowledge of mathematics in the topics taught in the course for the purpose of engineering education in all branches as well as in relevant interdisciplinary studies.

Learning Resources	(1) Advanced Engineering Mathematics - E. Kryszig,10th edition, Wiley India Edition (2010). (2) Engineering Mathematics- S.S.Sastry, 4th edition, PHI learning private Ltd. (2008). (3) Introductory Course in Differential Equations- Daniel A. Murray, Fb & c Limited, (2018). (4) Differential Calculus – B.C. Das & B.N.Mukherjee, 16th edition, U. N. Dhur& sons private Ltd., (1970). (5) Integral Calculus – B.C. Das &B.N.Mukherjee, 44th edition, U. N. Dhur& sons private Ltd., (1996). (6) Advanced Calculus- D.V. Widder. 3rd edition, Prentice-Hall, Inc. (1947).

Course Code	MA1102N	Course Name	Mathematics-IA	Course Category	PC B.Arch.(1st Sem.)	L	T	P
						2	1	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	The objective is to equip the students with the knowledge of mathematics necessary for B.Arch. education.

Module	Syllabus	Duration (class-hour)
I.	**Functions of a Single Real Variable:** *n*-th order derivative, Leibnitz's theorem for successive differentiation, Taylor's theorem with Lagrange's and Cauchy's forms of remainders, Taylor's and Maclaurin's series, expansion of functions, curvature, asymptotes, curve tracing.	15
II.	**Functions of Several Real Variables:** Partial derivatives, chain rule, differential and small error, Euler's theorem for homogeneous functions, Taylor's theorem (statement only), expansion of functions of two real variables, maxima and minima, Lagrange's method of multipliers.	15
III.	**Infinite Series:** Concept of convergence, Geometric series and p series, Comparison test, D'Alembert's Ratio Test, Cauchy's Root Test, Raabe's Test, Gauss test, Power series, Radius of convergence.	6
IV.	**Multiple Integral:** Double integral, change of order of integration, Jacobian, change of variables, applications.	6

Course Outcome	The outcome is the development in the students of basic understanding and working knowledge of mathematics in the topics taught in the course for the purpose of their use in core B. Arch. Education and also in relevant interdisciplinary studies.

Learning Resources	(1) Advanced Engineering Mathematics - E. Kryszig, 10th edition, Wiley India Edition (2010). (2) Engineering Mathematics - B. S. Grewal, 45th edition, Khanna Publishers, (2020). (3) Introductory Course in Differential Equations- Daniel A. Murray, Fb & c Limited, (2018). (4) Differential Calculus – B.C. Das & B.N.Mukherjee, 16th edition, U. N. Dhur& sons private Ltd., (1970). (5) Integral Calculus – B.C. Das &B.N.Mukherjee, 44th edition, U. N. Dhur& sons private Ltd., (1996). (6) Advanced Calculus- D.V. Widder. 3rd edition, Prentice-Hall, Inc. (1947).

Course Code	MA1201N	Course Name	Mathematics-II	Course Category	PC B.Tech.(2nd Sem.)	L	T	P
						3	1	0

Pre-requisite Courses	MA1101N	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	The objective of the course is to impart necessary mathematical knowledge to all branches of B.Tech. students for utilization in higher semesters.

Module	Syllabus	Duration (class-hour)
I.	**Vector Space and Linear Transformation:** Definition, subspace, linear combination, linear dependence and independence of vectors, span, basis, dimension of a vector space, linear transformation and some elementary properties.	7
II.	**Matrices:** Concept of Rank of matrices, reduction to Normal and Echelon forms, consistency of a system of linear equations, Orthogonal matrix, Hermitian and Unitary matrices, eigenvalues and eigenvectors, similarity transformation, diagonalization.	8
III.	**Vector:** Brief review of vector algebra, Shortest distance between skew lines, work done by a force, moment of a force about a point and about an axis, motion of a rigid body about a fixed axis, Directional derivatives, Gradient, Divergence, Curl, Line integral, Surface integral, Volume integral, Irrotational vector field, Gauss' divergence theorem and Stokes' theorem (statements only), Green's theorem in the plane, illustrations.	9
IV.	**Fourier Series:** Fourier series, Dirichlet's conditions, Half range series as Fourier sine and cosine series.	5
V.	**Complex Variables :** Introduction to Complex variable, Function, concept of limit and continuity, Derivative of complex function, Analytic function, Cauchy- Riemann equations, Harmonic function, line integral, Cauchy Goursat theorem (statement only), Cauchy's Integral formula, Generalized Cauchy's Integral formula (Statement only), Taylor's and Laurent's series (statements only), Type of singular points, Residue, Cauchy's Residue theorem and its application to evaluate real integrals using unit circle and semi-circle (without indentation).	13

Course Outcome	A basic understanding of the concepts relating to the topics taught in the course and also working knowledge on these topics enabling the students in general of all branches of engineering to apply them in core and interdisciplinary engineering problems are the outcomes of the course.

Learning Resources	(1) Advanced Engineering Mathematics - E. Kryszig, 10th edition, Wiley India Edition (2010). (2) Engineering Mathematics - B. S. Grewal, 45th edition, Khanna Publishers, (2020). (3) Engineering Mathematics- S.S.Sastry, 4th edition, PHI Learning Private Ltd. (2008). (4) Higher Algebra Chakraborty & Ghosh, 14th edition, U. N. Dhur& Sons Private Ltd., (1972). (5) Vector Analysis – Ghosh &Maity, New Central Book Agency Ltd.(2011).

Course Code	MA1202N	Course Name	Mathematics-IIA	Course Category	PC B.Arch.(2nd Sem.)	L	T	P
						3	0	0

Pre-requisite Courses	MA1102N	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	The objective of the course is to provide the B. Arch students with relevant mathematical knowledge for being utilized in higher semesters of B.Arch. studies.

Module	Syllabus	Duration (class-hour)
I.	**Co-ordinate Geometry:** Two dimensions: Transformation of coordinates – Translation, Rotation, Reduction of general equation of second degree.	4
II.	**Co-ordinate Geometry:** Three dimensions: Coordinates, Direction Cosines, Planes, Straight lines, Spheres, Standard equations of simple surface e.g. cylinders, cones, ellipsoids, Hyperboloids etc.	9
III.	**Vector Algebra:** Sum and products of vectors, Application in Geometry.	4
IV.	**Linear Programming:** Geometrical ideas of convex sets, feasible solutions and domains etc. Fundamental theorem of LPP (statement only), Graphical methods, Simplex Algorithm.	7
V.	**Statistics:** Analysis of data (direct and grouped), Frequency Diagrams, Ogive, Histogram, Mean, Median, Mode, Measures of dispersion, Skewness, Kurtosis, Fitting of curves (Least square method), Correlation, Regression.	10
VI.	**Differential Equations:** Second order differential equations with constant coefficients, Cauchy-Euler differential equation and Variation of parameters.	8

Course Outcome	The outcomes of the course are basic understandings and also working knowledge of the concepts relating to the topics taught in the course with a view to enabling the students to apply them in core Architecture and related interdisciplinary problems.

Learning Resources	(1) Analytical Geometry of Two & Three Dimensions & Vector Analysis – R. M. Khan, New Central Book Agency (P) Ltd., (2012). (2) Vector Analysis: Schaum's Outline Series – M. Spiegel, 2nd edition, Schaum's Outline Series, MaGraw-Hill. (3) Linear Programming & Game Theory – J. G. Chakraborty & P.R. Ghosh, Moulik Library (2014). (4) Linear Programming & Theory of Games – P. M. Karak, 2nd edition, New Central Book Agency (2015). (5) Statistical Methods – N. G. Das, 1st edition, McGraw-Hill. (6) Fundamentals of Statistics – A. M. Gun, M. K. Gupta, B. Dasgupta, World Press Private Ltd. (2013). (7) An Introduction to Differential Equations – Ghosh & Maity, 9th edition, New Central Book Agency. (8) Ordinary and Partial Differential Equations – M.D Raisinghania, 20th edition, S. Chand Publishing.

						L	T	P
Course Code	MA2101N	**Course Name**	Mathematics-III/1	**Course Category**	PC B.Tech 3rd Sem (EE, ME,. CST, IT)	3	0	0

Pre-requisite Courses	MA1101N MA1201N	**Co-requisite Courses**	Nil	**Progressive Courses**	Nil
Course Offering Department		**Department of Mathematics**		**Data Book / Codes/Standards**	Nil

Course Objective	This course aims to develop a solid understanding of fundamental concepts in key areas of Applied Mathematics, focusing on their application to real-world data and practical problems.

Module	Syllabus	Duration (class-hour)
I.	**Probability:**Axiomatic approach to probability theory, Univariate probability distributions – discrete and continuous. Standard distribution: Binomial, Poisson, Geometric, Exponential, Normal, Uniform and Gamma. Bivariate distributions – concepts of joint and conditional distributions, Mathematical expectation, variance and covariance. Correlation coefficient. Tchebycheff's inequality.	15
II.	**Statistics:** Concepts of Statistics, Idea of sample, Correlation coefficients, Curve fitting: Method of Least Square, Simple Regression models.	6
III.	**Laplace Transform:** Definition, Laplace transform of elementary functions, Basic operational properties, Inverse Laplace transform, Convolution theorem, Applications to initial value problems involving Ordinary Differential Equations.	8
IV.	**Linear Programming Problem:**Basic solutions, Reduction of feasible solution to basic feasible solution, Convex combination, Convex set, Extreme points, Hyperplanes, Slack and surplus variables, Simplex method, Charnes' Big-M methods.	13
		42

Course Outcome	On completion of the course, students are expected to: • understand basic concepts of probability distributions, expectation, variance, correlation coefficient and their uses and also develop some basic idea in statistics. • develop a basic knowledge Laplace Transform and apply to solve the differential equations. • learn to handle the linear optimization problem.

Learning Resources	**References:** 1. A. Mood, F. Graybill & D. Boes: Introduction to the Theory of Statistics, McGraw Hill Education, 2017. 2. P. G. Hoel, S. Port & C. Stone: Introduction to Probability Theory, Houghton Mifflin, 1971. 3. S. M. Ross: A first course in probability, Pearson Education India, 9th edition, 2013. 4. Amritava Gupta: Groundwork of Mathematical Probability and Statistics, Academic Publishers 6th edition, 2012. 5. P.M. Karak: Linear programming, New Central Book Agency Pvt. Ltd 2011. 6. J.G. Chakraborty & P.R. Ghosh: Linear programming and Game Theory, Moulik Library. 7. R. V. Churchill: Operational Mathematics, McGraw-Hill 3rd edition. 1972. 8. Schaum'sOutline of Laplace Transforms, Murray R. Spiegel, McGraw-Hill, 1965.

Course Code	MA2102N	Course Name	Mathematics-III/2	Course Category	PC B.Tech 3rd Sem (ETCE, AE)	L	T	P
						3	0	0

Pre-requisite Courses	MA1101N MA1201N	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	This course provides a comprehensive foundation in applied mathematics, focusing on probability and statistics, Laplace transforms, linear programming, and numerical methods.Students will develop proficiency in probability theory, including discrete and continuous distributions, statistical measures, and regression analysis; apply Laplace transforms to solve ordinary differential equations; utilize the Simplex method for linear programming optimization; and implement numerical techniques for solving nonlinear equations and initial value problems.

Module	Syllabus	Duration (class-hour)
I	**Probability & Statistics:** Axiomatic approach to probability theory, Univariate probability distributions – discrete and continuous. Standard distributions: Binomial, Poisson, Exponential, Normal, Uniform. Mathematical expectation, variance and covariance. Correlation coefficient. Concept of Statistics, Idea of sample correlation coefficients, curve fitting: Method of Least Square, Simple Regression models.	16
II	**Laplace Transform:** Definition, Laplace transform of elementary functions, Basic operational properties, Inverse Laplace transform, convolution theorem, Applications to initial value problems involving Ordinary Differential Equations.	8
III	**Linear Programming Problem:** Basic solution, Reduction of feasible solution to basic feasible solution, convex combination,Convexcombination,Convex set, Extreme points, Hyperplanes, Slack and surplus variables, Simplex Method.	10

IV	**Introduction to numerical Methods:** Numerical solution of $f(x)=0$: Bisection Method, Secant Method, Regula Falsi Method, Newton-Raphson Method. Numerical solution of initial value problems involving Ordinary Differential Equations: Eular's Method, Runge-Kutta Methods.	8
		42

Course Outcome	Upon completing this course, students will be proficient in applying probability theory to analyze data, utilize Laplace transforms to solve differential equations, optimize linear systems using the Simplex method, and employ numerical techniques to approximate solutions to complex mathematical problems.

Learning Resources	**References:** 1. A. Mood, F. Graybill& D. Boes: Introduction to the Theory of Statistics, McGraw Hill Education, 2017. 2. P. G. Hoel, S. Port & C. Stone: Introduction to Probability Theory, Houghton Mifflin, 1971. 3. S. A. Mollah: Numerical Analysis and Computational Procedures, Books & Allied (P) PvtLtd, 2000. 4. Amritava Gupta: Groundwork of Mathematical Probability and Statistics, Academic Publishers 6th edition, 2012. 5. P.M. Karak: Linear programming, New Central Book Agency Pvt. Ltd 2011. 6. J.G. Chakraborty & P.R. Ghosh: Linear programming and Game Theory, Moulik Library, 2021. 7. GuruprasadSamanta: Engineering Mathematics-II A, Aryan Publishing House, 2024.

Course Code	MA- 2103N	Course Name	Mathematics -III/3	Course Category	PC B.Tech 3rd Sem (MET, MIN)	L	T	P
						3	0	0

Pre-requisite Courses	MA1101N MA1201N	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	To develop fundamental concepts in some important topics of Applied Mathematics with a view to applications involving real-life data.

Module	Syllabus	Duration (class-hour)
1	**Probability & Statistics:** Axiomatic approach to probability theory, Univariate probability distributions – discrete and continuous. Standard distributions: Binomial, Poisson, Exponential, Normal, Uniform. Mathematical expectation, variance and covariance. Correlation coefficient. Concept of Statistics, Idea of sample correlation coefficients, curve fitting: Method of Least Square, Simple Regression models.	16
2	**Introduction to graph theory:** Basic Concept of graph, Walk, Path, Circuit, Euler graph and Hamiltonian graph, Cut-sets and cut-vertices, Diagraph, Weighted graph, Bipartite graph.	6
3	**Linear Programming Problem:** Basic solution, reduction of feasible solution to basic feasible solution, convex combination, convex set, extreme points, hyperplanes, slack and surplus variables, Simplex Method.	10
4	**Introduction to numerical Methods:** Numerical solution of f(x)=0: Bisection Method, Secant Method, Regula Falsi Method,Newton-Raphson Method. Numerical solution of ODE: Eular's Method, Runge-Kutta Methods. Numerical integration: Trapezoidal Rule, Simpson's 1/3rule, Simpson's 3/8 rule.	10
		42

Course Outcome	On completion of the course, students are expected to: • understand basic concepts of probability distributions, expectation, variance, correlation coefficient and their uses and also develop some basic idea in statistics. • develop a basic knowledge in graph theory and apply this to some real-life problems. • learn to handle optimization problems. • learn to handle situations wherethe mathematical problems cannot be solved analytically.

Learning Resources	**References:** 1. A. Mood, F. Graybill& D. Boes: Introduction to the Theory of Statistics, McGraw Hill Education, 2017. 2. P. G. Hoel, S. Port & C. Stone: Introduction to Probability Theory, Houghton Mifflin, 1971. 3. S. A. Mollah: Numerical Analysis and Computational Procedures, Publisher: Books & Allied (P) Ltd. 4. Amritava Gupta: Groundwork of Mathematical Probability and Statistics, Academic Publishers 6th edition, 2012. 5. J.G. Chakraborty & P.R. Ghosh: Linear programming and Game Theory, Moulik Library. 6. GuruprasadSamanta: Engineering Mathematics-II A, Aryan Publishing House, Kolkata-700048. 7. GuruprasadSamanta: Engineering Mathematics-III A, Aryan Publishing House, Kolkata-700048.

Course Code	MA2104N	Course Name	Mathematics-III/4	Course Category	PC B.Tech 3rd Sem (CE)	L	T	P
						3	0	0

Pre-requisite Courses	MA1101N MA1201N	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department		Department of Mathematics		Data Book / Codes/Standards	Nil

Course Objective	The objective of this course is to equip students with a strong foundation in probability theory and statistical methods, enabling them to model, analyze, and interpret data and uncertainty in different systems, interpret data and gather knowledge about estimation of parameters. This course will provide them with a comprehensive understanding of linear programming theory, solution techniques, and applications. The third module introduces the fundamental concepts, classification, and solution techniques of partial differential equations (PDEs). The course is designed to develop students' analytical skills and provide a foundation for modeling and solving problems involving functions of several variables.

Module	Syllabus	Duration (class-hour)
1.	**Probability and Statistics:** Axiomatic approach to probability theory, Univariate probability distributions – discrete and continuous. Standard distributions: Binomial, Poisson, Geometric, Exponential, Normal, Uniform. Bivariate distributions – concepts of joint and conditional distributions, Mathematical expectation, variance and covariance. Concept of Statistics, Idea of sample correlation coefficients, curve fitting: Method of Least Square, Regression models, Concept of Estimation.	19
2.	**Linear Programming Problem:** Basic solution, convex combination, convex set, extreme points, hyperplanes, slack and surplus variables, Simplex Method.	09
3.	**Partial Differential Equation:** Introduction to first order PDE, Classification of 2nd order PDE, Solution of Heat, Wave & Laplace equation by variables separation techniquewith applications.	14
		42

Course Outcome	Upon successful completion of this course, students will be able to: Understand the basic concepts of probability and statistics and apply them to solve real-world problems. Formulate and solve linear programming problems using the simplex method and interpret the results for decision-making. Solve first-order and second-order PDEs and apply them to basic physical and engineering problems involving heat conduction, wave motion, and potential theory.

Learning Resources	**References:** 1. A. Mood, F. Graybill & D. Boes: Introduction to the theory of statistics, McGraw Hill Education, 2017. 2. P. G. Hoel, S. Port & C. Stone: Introduction to probability Theory, Houghton Mifflin, 1971. 3. S.M. Ross: A first course in probability, Pearson Education India; 9th edition, 2013. 4. Amritava Gupta: Groundwork of Mathematical Probability and Statistics, Academic Publishers 6th edition, 2012. 5. P.M. Karak: Linear programming, New Central Book Agency (P) Limited, 2011. 6. J.G. Chakraborty & P.R. Ghosh: Linear programming and Game theory, Moulik Library, 2012. 7. GuruprasadSamanta: Engineering Mathematics-II A, Aryan Publishing House, Kolkata-700048, 2024. 8. GuruprasadSamanta: A Textbook of Partial Differential Equations, New Age International Publishers, 2017. 9. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley, 8th Edition (International). 10. B V Ramana: Higher Engineering Mathematics, Tata McGraw Hill Education.