Course Description

Course Name: Mathematics-I **Course Code: 18B11MA111**
L-T-P scheme: 3-1-0 **Credits: 4**

Prerequisite: Students should have basic knowledge of Algebra and calculus.

Objective: This course is aimed:

- To introduce the calculus of functions of two variables and applicability of derivatives and integrals of vector functions to Analytical geometry and physical problems.
- To make students aware of the basic mathematical concepts and methods which will help them in learning courses in engineering and Technology.

Learning Outcomes:

Course Outcome	This course will enable the students to:
CO1	Understand the rank, eigen values, eigen vectors, diagonalization of matrix; compute inverse of matrix by Caley-Hamilton theorem.
CO2	Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, and solve it by Gauss elimination method.
CO3	Interpret derivatives and integrals of multivariable functions geometrically and physically; implement multivariable calculus tools in engineering, science, optimization, and understand the architecture of surfaces in plane and space etc.
CO4	Know about piecewise continuous functions, Laplace transforms and its properties; use of Laplace transform and inverse transform for solving initial value problems.
CO5	Realize importance of line, surface and volume integrals, Gauss and Stokes theorems and apply the concepts of vector calculus in real life problems.
CO6	Formulate mathematical models in the form of ordinary differential equations and learn various techniques of getting solutions of linear differential equations of second order.

Teaching Plan:

Unit 1: Algebra of matrices, Determinants, Rank, Gauss elimination method, Eigen values and vectors. Quadratic forms.

Unit 2: Partial differentiation. Taylor's series. Maxima and minima. Jacobians**,** Double integrals,

Unit 3: Differential Equations with constants coefficients.

Unit 4: Gradient, divergence and curl. Line and surface integrals, Normal and tangent to a surface. Gauss and Stokes theorems, Equations to a line, plane, curve and surfaces.

Unit 5: Laplace transforms.

Methodology:

The course will be covered through lectures supported by tutorials. There shall be 3 Lectures per week where the teacher will explain the theory, give some examples supporting the theory and its applications. About 12 Tutorial Sheets covering whole of the syllabus shall be given. Difficulties and doubts shall be cleared in tutorials. Apart from the discussions on the topics covered in the lectures, assignments/ quizzes in the form of questions will also be given.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials, lecture slides and books on mathematics-1 will be available on the JUET server.

Books

1. Thomas, G.B., Finney, R.L.: Calculus and Analytical Geometry, 9th Ed., Addison Wesley,1996
2. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley Publishers.
3. Lipshuts, S., Lipsom M. : Linear Algebra, 3rd Ed, Schaum series 2001.
4. B. V. Raman : Higher Engineering Mathematics, McGraw-Hill Publishers.
5. R.K. Jain, S.R.K. Iyenger: Advanced Engineering Mathematics, Narosa Publishing House, New Delhi
6. Grewal, B.S. : Higher Engineering Mathematics, Khanna Publishers Delhi.

Course Title: Mathematics-2 **Code: 18B11MA201**

L-T-P scheme: 3-1-0 **Credits: 4**

Prerequisite: Students should have basic knowledge of differential equations and calculus.

Objective: This course is aimed

- To introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of fundamental concepts of Complex Analysis.
- To equip students with the concepts of ordinary and partial differential equations and how to solve them with different methods.

Learning Outcomes:

Course Outcome	This course will enable the students to:
CO1	Understand the concepts of limit, continuity, differentiability, analyticity, singularities, contour integration, Taylor and Laurent's series expansion of function complex variable.
CO2	Learn various techniques of getting solutions of linear ordinary and partial differential equations of second order,
CO3	Visualize complex numbers as points of $\mathbb{R}^2$, two path test for non-existence of limit, orthogonal trajectories, connected domain, conformal mapping.
CO4	Use Laurent series to evaluate complex integrals and classify the singularities of a function, conformal mapping in modeling and solving boundary value problems, power series method to solve linear differential equations.
CO5	Apply Cauchy residue theorem in evaluation of real integrals and separation of variables method in the solution of heat, wave and Laplace equation
CO6	Formulate mathematical models in the form of ordinary and partial differential equations to problems arising in mechanical, chemical and physical disciplines.

Course Content:

Unit-1: Functions of complex variable, analytical functions and Cauchy-Riemann equations, Conformal mapping, Poles and singularities, complex integration, Taylor's and Laurent's series, Cauchy residue theorem, contour integration and their application.

Unit-2: Second order linear differential equations, Convergence of series, convergence tests, solution of D.E. in series, Bessel functions; Legendre and Chebyshev polynomials, Orthogonality.

Unit-3: Second order partial differential equations and classification, one dimensional wave and diffusion equations with their applications. Laplace and Poisson equations. Use of Green's function.

Methodology:

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures, assignments and quizzes in the form of questions will also be given for practice.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials, lecture slides and books on mathematics-2 will be available on the JUET server.

Books

1. Kreyszig, Erwin : Advanced Engineering Mathematics, John Wiley & Sons, Inc.
2. Simmons, G.F. : Differential Equations with Applications, 2nd Ed., McGrawHill, 1991.
3. Brown, J.W., Churchill, R.V. : Complex Variables and Applications, 6th Ed., McGrawHill, 1996.
4. Prasad, C : a) Mathematics for Engineers
   b) Advanced Mathematics for Engineers, Prasad Mudranalaya, 1982.
5. Grewal, B. S. : Higher Engineering Mathematics, Khanna Publishers Delhi.

Course Title: Discrete Mathematics **Course Code: 18B11MA211**
L-T-P scheme: 3-1-0 **Credits: 4**

Objectives:

The aim of the course is to cover the basic principles sets relations functions partially ordered set, lattice, Boolean algebra and its applications. The main objective of the course is to develop in student, an intuitive understanding of graphs by emphasizing on the real world problems.

Course Outcomes:

At the end of the course, the student is able to:

CO1 Employ De Moivre's theorem in a number of applications to solve numerical problems.

CO2 Appreciate the definition and basics of graphs along with types and their examples.

CO3 Visualize the applications of graph theory to network flows. Understand the notion of planarity and coloring of a graph. Relate the graph theory to the real-world problems.

CO4 Understand the definition of a tree and learn its applications to fundamental circuits.

CO5 Solve real-life problems using finite-state and Turing machines

CO6 Learn about partially ordered sets, lattices and their types, Boolean algebra and Boolean functions, logic gates, switching circuits and their applications.

Course Contents:

Unit 1: Basics of set theory, Mathematical induction. Relations, Equivalence relation, partial- ordered relation algorithms and functions.

Unit 2: Big O notation, Proposition, Basic logical operators, Propositional functions and Quantifiers.

Unit 3: Graphs and related definitions, Eulerian and Hamiltonian graphs, Graph colorings. Trees, Algebraic expressions and Polish notation, shortest path.

Unit 4: Algebraic Systems. Lattice and Boolean Algebra.

Unit 5: Language, Finite State Automata and Machines. Grammars.

Methodology:
The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

Evaluation plan:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

References:

1. B. A, Davey & H. A. Priestley (2002). "Introduction to Lattices and Order" (2nd edition) Cambridge University, Press.
2. Edgar, G. Goodaire & Michael M. Parmenter (2018). "Discrete Mathematics with Graph Theory" (3rd edition). Pearson Education.
3. Rudolf Lidl & Günter Pilz (1998). "Applied Abstract Algebra" (2nd edition). Springer.
4. Kenneth H. Rosen (2012). "Discrete Mathematics and its Applications: With Combinatorics and Graph Theory" (7th edition), McGraw-Hill.
5. C. L. Liu (1985). "Elements of Discrete Mathematics" (2nd edition). McGraw-Hill.

Numerical methods

Course Title: Numerical methods **Code: 18B11MA411**

L-T-P scheme: 3-1-0 **Credits: 4**

Prerequisite: Students should have basic knowledge of calculus, differential equations and matrix algebra.

Objectives:

To make students aware of the concepts of numerical methods necessary for solving complicated mathematical problems numerically.

Learning Outcomes:

Course Outcome	This course will enable the students to:
CO1	Understand the concepts of finite differences, interpolation, extrapolation and approximation.
CO2	Learn various techniques of getting numerical solutions of system of linear equations and check the accuracy of the solutions.
CO3	Obtain numerical solutions of algebraic and transcendental equations.
CO4	Solve initial and boundary value problems in differential equations using numerical methods.
CO5	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO6	Apply numerical methods to diverse situations in physics, engineering and in other mathematical contexts.

Course Content:

Unit-1: Solution of linear system of equations- Direct and iterative methods. Eigen values and Eigen vectors, Jacobi and Householder methods. Solution of a single and a system of non-linear equations

Unit-2: Interpolation and Approximation

Unit-3: Numerical differentiation, Numerical Integration, Gauss quadrature

Unit-4: Initial and boundary value problems in ODE, Numerical solution of PDE by finite difference method, Method of weighted residuals (MWR).

Methodology:

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures, assignments and quizzes in the form of questions will also be given for practice.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials, lecture slides and books on numerical methods will be available on the JUET server.

Text Books

1. "Applied Numerical Analysis", Gerald C.F., Wheatley P.O., Pearson Education India; 7e, 2007.
2. "Numerical Methods", Jain, Iyengar &Jain, New age Int. Publication (P) Ltd, 6e.
3. "Numerical Methods", Grewal, B. S., Khanna Publisher; Eleventh edition, 2013.
4. "Advanced Engineering Math.", Erwin Kreyszig, John Wiley & Sons, INC.
5. "Introductory Methods of Numerical Analysis", S.S. Sastry, Prentice Hall India Ltd.

Title: Probability Theory and Random Processes **Code: 18B11MA511**

L-T-P scheme: 3-1-0 **Credit: 4**

Prerequisite: Students must have already studied course, "Mathematics-I" and should have the Knowledge of Differential & Integral Calculus.

Objective: Objective of this course is to provide a foundation in the theory and applications of probability and stochastic processes and an understanding of the mathematical techniques relating to random processes in the areas of signal processing, detection, estimation, and communication. Topics include the axioms of probability, random variables, and distribution functions; functions and sequences of random variables; stochastic processes; and representations of random processes.

Learning Outcomes:

Course Outcome	**Description**
CO1	Construct sample spaces of random experiments; identify and specify events, and perform set operations on events; compute probabilities by counting; evaluate conditional probability, and apply Bayes' theorem to simple situations.
CO2	Express random variables by using CDFs, PMFs; calculate moments related to random variables; understand the concept of inequalities and probabilistic limits. Understand the axiomatic approach of probability theory and intrinsic need of (functions of) random variables for the analysis of random phenomena.
CO3	Compute probability distributions and correlation measures of bivariate random variables; obtain marginal and conditional distributions of random variables; find probabilities for outcomes of various events related to an uncertain phenomenon using appropriate probability distributions as models.
CO4	Conduct hypotheses tests concerning population parameters based on sample data; perform and interpret chi-square test of goodness-of-fit and test of independence; find the equation of regression line and second degree curve, and to predict the value of one variable based on the value of the other variable.
CO5	Identify and classify random processes and determine covariance and spectral density of stationary and ergodic random processes; demonstrate specific applications to Gaussian process.
CO6	Students are able to provide the theories associated with the random variable and random process. The course particularly provides the student with an ability to apply to real-world problems in the communication and physical systems.

Course Contents:

Unit-1: Random experiments, sample space and events. Three basic approaches to probability, conditional probability, total probability theorem, Bayes' theorem of Probability of causes, Bayes' theorem of future events, total independence, mutual independence and pair wise independence.

Unit-2: One dimensional random variables(discrete and continuous) and their distributions, bivariate distributions, joint, marginal and conditional distributions, characteristic function.

Unit-3: Covariance and correlation of random variables. Some special probability distributions: Binomial, Poisson, probability distributions. Negative Binomial,Geometric and Normal probability distributions. Fitting of probability distributions.

Unit-4: Concept of reliability: Reliability function, Hazard rate function, Mean time to failure, cumulative and average failure rate, Conditional reliability and failure rates, residual MTTF, some special failure rate distributions- exponential distribution and the Weibull distribution, reliability of systems- series configuration and some deductions, parallel-series configuration, series -parallel configuration.

Unit-5: Introduction and description of random processes, average values of random processes, stationary processes and computation of their averages, autocorrelation function and its properties, Cross correlation and its properties. Power spectral density function and its properties. Ergodicity of a random process, Poisson processes.

Teaching Methodology:

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	

Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Probability Theory and Random Processes (will be added from time to time): Digital copy will be available on the JUET server.

Text books:

[1] T. Veerarajan ,Probability, Statistics and Random Processes, Tata McGraw Hill.
[2] J.J. Aunon & V. Chandrasekhar, Introduction to Probability and Random Processes, Mc-
Graw Hill International Ed.
[3] A. Papoulis & S.U. Pillai, Probability, Random Varibles and Stochastic Processes, Mc-
Graw Hill.
[4] H. Stark, and J.M. Woods, Probability and Random Processes with Applications to Signal Processing, Pearson Education.

Title: Optimization Techniques **Code: 14B14MA743**

L-T-P scheme: 3-1-0 C**redit: 3**

Prerequisite: Students must have already studied course, “Linear Algebra”.

Objective:

The objective of this course is to understand the theory of optimization methods and algorithms developed for solving various types of optimization problems. To familiar students with the basic mathematical concepts of optimization. To provide students with the modeling skills necessary to describe and formulate optimization problems to solve and interpret optimization problems in engineering. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Learning Outcomes:

Course Outcome	This course will enable the students to:
CO1	Solve linear programming problems by different methods.
CO2	Understand duality and dual simplex method.
CO3	Understand assignment problem and method for solving it.
CO4	Understand transportation model and finding solution of transportation problem.
CO5	Solve Integer programming problems by different methods. Solve nonlinear programming problem by Lagrangian multiplier method.
CO6	Learn about the applications to transportation, assignment in real world.

Course Contents:

Unit-1: Definition of Linear Programming Problems, Formulation of Linear Programming Problems and their Graphical Solutions.,

Unit-2: Simplex Method, Artificial Variable Method, Two Phase Method, Big-M Method, Revised Simplex Method, Duality

Unit-3: Dual Simplex Method, Integer Linear Programming Problems, Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method

Unit-4: Introduction to Transportation Model, Matrix Form of TP, Applications of TP Models, Basic Feasible Solution of a TP, Degeneracy in TP, Formation of Loops in TP, Solution Techniques of TP, Different Methods for Obtaining Initial Basic Feasible Basic Feasible Solutions viz. Matrix Minima Method, Row Minima Method, Column

Minima Methods, Vogel's Approximation Method. Techniques for Obtaining Optimal Basic Feasible Solution. Definition, Hungarian Method for Assignment Problems.

Unit-5: Introduction to Non- Linear Programming Problems, Formulation of Non- Linear Programming Problems and their Graphical Solutions. Kuhn- Tucker Conditions.

Teaching Methodology:

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2 & Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:

Tutorials and lecture slides on Optimization Techniques (will be added from time to time): Digital copy will be available on the JUET server.

Text books:

1. Taha, H.A.: Operations Research- An Introduction, New York, Macmillan, 1992.
2. Harvey M. Wagner: Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd 1975.
3. Hadley, G.: Linear Programming, Massachusetts: Addison- Wesley, 1962.
4. Hiller, F.S.and Lieberman G.J.: Introduction to Operations Research, San Francisco: Holden-Day, 1995.

Title: Numerical Techniques **Code: 14B14MA841**

L-T-P scheme: 3-0-0 C**redit: 3**

Prerequisite: Students must have already studied calculus, differential equations and linear algebra

Objective:

The main emphasis of this course is to equip the student with necessary analytic and technical skills to handle problems of mathematical nature as well as practical problems. More precisely, main target of this course is to explore the different tools for higher order derivatives, to plot the various curves and to solve the problems associated with differentiation and integration of vector functions.

Learning Outcomes:

Course Outcome	Description
CO-1	Ability to solve the system of linear equations and finding eigenvalues of the matrices.
CO-2	Perform polynomial interpolations using various techniques.
CO-3	Perform Cubic-spline interpolation and approximations. To understand numerical errors and obtain roots of system of nonlinear equations.
CO-4	Perform Numerical Differentiation, Numerical Integration.
CO-5	Solve IVP, BVP and numerical solutions of parabolic, elliptic and hyperbolic partial differential equations.
CO-6	Apply various numerical techniques in real life problems.

Course Contents:

Unit 1: System of linear equations, Direct methods, Gauss elimination method, Gauss Jordan method, LU decomposition, Crout's method, Doolittle method, Cholesky's method, Iterative methods, Gauss-Jacobi method, Gauss-Seidel method. Eigenvalues and eigenvectors, Power method, Jacobi Method, Householder's method.

Unit 2: Interpolation, Lagrange's interpolation, Newton's divided difference method, Hermite Interpolation, Newton's forward/backward difference method, Newton's

forward/backward difference method, Stirling's interpolation, Least squares approximation, Fitting linear equations, Fitting nonlinear equations.

Unit 3: Nonlinear equations, Bisection method**,** Newton-Raphson method for one variable**,** Newton-Raphson method for more than one variable. Forward difference formula, Derivatives using Lagrange's Formula, Three-point formula, Second three-point formula.

Unit 4:, Derivatives using Newton's forward/ backward difference formula, Derivatives using central difference formula (Stirling formula), Maxima and Minima of a tabulated function. Newton-Cotes integration formula, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Gauss-Legendre quadrature formula.

Unit 5: Numerical solution of initial value problems: Picard's Method of successive approximations, Euler's method, Modified Euler's method, Runge-Kutta method, Predictor-corrector methods: Euler's method, Milne's method, Adams-Bashforth-Moulton method, Numerical solution of boundary value problems: Finite difference method for ordinary differential equations.

Finite difference method for partial differential equations, Solution of Laplace equation and Poisson's equation, Solution of heat equation, Solution of wave equation, Method of weighted residuals (MWR).

Teaching Methodology:

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	

Total	**100 Marks**

Learning Resources:

Tutorials and lecture slides on Numerical Techniques (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:

1. B. S. Grewal, Numerical Methods in Engineering & Science with Programs in C & C ++, Khanna Publishers.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Publishers.
3. G. Shanker Rao, Numerical Analysis, New Age International Publishers.
4. M. K. Jain, S. R. K. Iyengar & R. K. Jain, Numerical Methods for Scientific and Engineering Computations, New Age International Publishers.

Title of Course: Applied Linear Algebra **Course code:** 14B14MA741

L-T-P Scheme: 3 -0 - 0 **Course Credit: 3**

Prerequisite: Students should have basic knowledge of group and field theory.

Objectives: The course is intended to prepare the students for mathematical theory and methods of linear algebra, in particular vector spaces over the real or complex numbers, linear transformation, diagonalization and orthogonality.

Learning Outcomes:

Course Outcome	At the end of the course, the student is able to:
CO1	Understand the concepts of Subspaces, linear dependence and independence, span of a set, bases and dimension. Direct sum and complement. Definition, Algebra of linear transformations, isomorphism, representation by matrices.
CO2	Determine linear independence for vectors in R^n, rank and nullity of linear transformation.
CO3	Derive the matrix representing a linear under a given basis, and determine how the matrix changes if the basis is changed.
CO4	Use characteristic polynomials to compute eigenvalues and eigenvectors,
CO5	Recognize definite integral as an inner product, orthogonality of vectors and its use in projecting vectors into subspaces and decomposing vectors into components.
CO6	Apply the theory, methods and techniques of the course to solve mathematical problems.

Course Contents:

Unit 1: Subspaces, linear dependence and independence, span of a set, bases and dimension. Direct sum and complement. Definition, Algebra of linear transformations, isomorphism, representation by matrices.

Unit 2: Rank and nullity theorem and its consequences. Change of basis, Inverse of linear transformation, linear function, Transpose. Application to system of linear equations.

Unit 3: Metric and normed spaces. Inner product and Inner product spaces. Orthoganility. Orthonormal basis. Gram-Schmidt orthogonalization. Expansion. Orthogonal and unitary matrices.

Unit 4: Modal matrix and diagonalization. Similarity Transformation, Power and function of matrices. Eigen systems of real symmetric, orthogonal, Hermitian and unitary matrices.

Unit 5: Quadratic forms. Positive definite matrices. Computation of eigen values. Norm of matrix. Condition number. Application to solving ordinary differential equations.

Methodology

The course will be covered through lectures supported by tutorials. Apart from the discussions on the topics covered in the lectures assignments/ quizzes in the form of questions will also be given.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15 Marks	Syllabus covered upto Test-1
Test-2	25 Marks	Syllabus covered upto Test-2
Test-3	35 Marks	Full Syllabus
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	

Learning Resources:

Tutorials and lecture slides on linear algebra (will be added from time to time): Digital copy will be available on the JUET server.

Books:

1. N. Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. K. Hoffman and R. Kunze, Linear Algebra, Prentice-Hall of India, New Delhi, 1971.
3. N. Jacobson, Basic Algebra, Vols I & II, W.H. Freeman, 1980
4. K.B. Dutta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd, New Delhi, 2000.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I - Groups, Narosa Publishing House, Vol. I 1996.