St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Courses of Self-Financed B.Sc. Mathematics

MT 1551 : Matrix Algebra and Co-ordinate Geometry (Theory) **2**

MT 1552L : Matrix Algebra and Co-ordinate Geometry (Practical) **4**

EG 1314 : Logic (Elective) **5**

MT 2551 : Calculus and Differential Equations (Theory) **6**

MT 2552L : Calculus and Differential Equations (Practical) **8**

MT 3551 : Differential Calculus of Several Variables (Theory) **9**

MT 3552 : Introduction to Linear Algebra (Theory) **11**

MT 3553L : Computer Oriented Numerical Methods - I (CONM - I)(Practicals) **13**

EG xxxx : Elementary Combinatorics (Theory-Elective) **15**

MT 4551 : Integral Calculus of Several Variables (Theory) **16**

MT 4552 : Linear Algebra (Theory) **18**

MT 4553L : Computer Oriented Numerical Methods - II (CONM - II)(Practicals) **20**

EG xxxx : Latex for Mathematics & Science (Elective) **22**

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: I
Matrix Algebra and Co-ordinate Geometry (Theory) **Course Code: MT 1551**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to perform matrix operations and employ fundamental concepts of matrix theory.

CO2 Student will be able to use fundamental concepts of matrices in some applicable concepts like system of simultaneous linear equations, eigenvalues and eigenvectors.

CO3 Students will be able to use mathematical concepts studied in coordinate Geometry in three dimensional space like Sphere, Cone & Cylinder.

CO4 Students will be able to establish the connection and transition between previously studied mathematics and more advanced mathematics.

Unit 1: Introduction to matrices, different types of matrices, operations on matrices, theorems on matrices, elementary operations on matrices, symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, orthogonal matrices, unitary matrices, normal matrices. Linear dependence and independence of row and column of matrix, row rank, column rank and rank of a matrix, row reduced echelon (RRE) form of a matrix and matrix inversion using row reduced echelon (RRE) form.

Unit 2: Application of matrices in solving a system of simultaneous linear equations, Cramer's rule, theorems on consistency of a system of simultaneous linear equations, eigenvalues, eigenvectors and the characteristic equation of a matrix. Cayley-Hamilton theorem and its use to find the inverse of a matrix.

Unit 3: Sphere: Definition of a sphere in $\mathbb{R}^3$, Cartesian equation of a sphere, general equation of a sphere, equation of a sphere with diametrically opposite end points, intersection of a sphere with line/ plane/ sphere (no theory but only problems), equation of a tangent plane to a sphere. The tangency of a plane and normality of a line to a sphere, orthogonal spheres.
Conicoids: Introduction to conicoid, types of central and non central conicoids in $\mathbb{R}^3$, figures of conicoids.

Unit 4: Polar coordinates in $\mathbb{R}^2$ and its relationships with Cartesian coordinates, polar equation of line/ circle/ conic and properties of conics. Spherical, cylindrical, conical coordinates in $\mathbb{R}^3$.
Cone & Cylinder: Introduction to different types of cone and cylinder, equation of enveloping cone and cylinder, right circular cone and cylinder (without proof), problems on cone and cylinder.

Reference books:

1. H. Anton, Elementary linear algebra with applications (8th Edition), John Wiley 1995).
2. Linear Algebra Theory and Applications - Ward Cheney, David Kincaid. Jones and Bartlet India Pvt. Ltd.
3. Introduction to Linear Algebra - Serge Lang. Springer (India).
4. Gilbert Strang, Linear Algebra and its Applications (English) 4th edition, Academic press, Indian edition.
5. Matrix and Linear Algebra - K. B. Dutta, Prentice Hall.
6. A Textbook of Matrices - Shanti Narayan, P. K. Mittal, S. Chand Group.
7. Analytical Solid Geometry- Shanti Narayan
8. Co-ordinate Geometry By : R.J.T. Bell.
9. Solid Geometry(three dimension) - H. K. Das, S. C. Saxena and Raisinghania, S. Chand.
10. Coordinate Geometry, Polar Coordinate approach, M. M. Tripathi, Alpha Science International.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: I
Matrix Algebra and Co-ordinate Geometry (Practical) **Course Code: MT 1552L**
No. of Credits: 03 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to perform matrix operations to determine invertible matrices and its RRE forms.

CO2 Student will be able to apply matrix operations to solve system of simultaneous linear equations, eigenvalues and eigenvectors.

CO3 Students will be able to use mathematical concepts in coordinate Geometry in three dimensional space like Sphere, Cone & Cylinder.

CO4 Students will be able to establish the connection and transition between previously studied mathematics and more advanced mathematics.

List of practicals (problems on):

(1) Matrix algebra.

(2) Different methods of finding Inverse of a matrix.

(3) RRE form and rank of a matrix.

(4) Solution of system of linear equations using row operations and Cramer's rule.

(5) Linearly independent and dependent vectors.

(6) The Cayley-Hamilton theorem and its applications.

(7) Eigen values and eigen vectors of matrices.

(8) Various coordinate systems in $\mathbb{R}^2$ and polar equation of line.

(9) Various coordinate systems in $\mathbb{R}^3$. Transformation equations from one system to another system.

(10) Polar equations of Circle.

(11) Polar equations of Conic.

(12) Sphere-I.

(13) Sphere-II.

(14) Cone.

(15) Cylinder.

(16) Project on identification of curves/surfaces.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: II
Logic (Elective) **Course Code: EG 1314**
No. of Credits: 02 **Learning Hours: 30 Hours**

Course Outcomes:

CO1 Students will be able to apply the concepts of different connectives in logic.

CO2 Students will be able to convert a logical statement into different normal forms.

CO3 Students will be able to use the rule of inference in verifying the consistency of premises using direct and indirect method of proof.

CO4 Students will be able to employ different quantifiers and concepts of bound and free variables in inference calculus.

Unit 1: Mathematical Logic

Statement, negation, conjunction, disjunction, statement formulas and truth table, conditional and bi-conditional, well-formed formula, tautology, equivalence of formulas, duality law, tautological implications, functionally complete set of connectives, other connectives, D.N.F, C.N.F, P.D.N.F, P.C.N.F.

Unit 2: Theory of Inference and the Predicate Calculus

Rules of inference, consistency of premises, the indirect method of proof, automatic theorem proving, Predicates, the statement function, variables, Quantifiers, predicate formulas, free and bound variables, the universe of discourse, the theory of inference for predicate calculus

Reference books:

1. Discrete Mathematical Structure with application to computer science – J. P. Trembly & R. Manohar, McGraw Hill.
2. Logic for computer science – Uwe Schoning, Birkhauser, Boston.
3. Elements of Discrete Mathematics – A computer oriented approach – C. L. Liu, D. P. Mohapatra, TMT.
4. Discrete Mathematics – N. Chandrasekaran, M. Umaparvathi, PHI.
5. Discrete Mathematics & Combinatorics – T. Sengadir, Pearson.
6. Discrete Mathematics – Schaum series.
7. Discrete Mathematics Kenneth Rosen.
8. Logic and Discrete Mathematics, A concise Introduction- Willem Conradie and Valentin Goranko, Wiley.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: II
Calculus and Differential Equations (Theory) **Course Code: MT 2551**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Students will be able to employ concepts of differential calculus like higher order derivative of several real valued functions.

CO2 Students will be able to test the convergence of infinite series.

CO3 Students will be able to obtain series expansion of several real valued functions of one variable.

CO4 Students will be able to formulate real-life problems in form of ordinary differential equations.

CO5 Students will be able to solve ordinary differential equations.

Prerequisites: Introduction of differential equations, its order and degree. Family of curves leading to differential equation and its solution in family of curves, different types of solutions (viz. General, particular and singular solutions). Constant of integration, boundary/initial conditions, differential equations of first order and first degree.

Unit 1: Successive Differentiation: Introduction to successive derivatives, nth derivatives of some standard functions, Leibnitz theorem.
Mean Value theorems: Rolle's mean value theorem, Lagrange's mean value theorem.
Different forms of Lagrange's mean value theorem, Cauchy's mean value theorem, Applications of mean value theorems.

Unit 2: Convergence and divergence of infinite series: Definition of series, Convergent and divergent series of real numbers, sum of series, different test of convergence of infinite series-convergence of geometric series, comparison test, practical comparison test, D'Alembert's ratio test, Cauchy's root test, alternating series, power series.
Taylor's and Maclaurin's Theorems (without proof), expansions of some standard functions as infinite power series without validity of the expansions.

Unit 3: Methods of solving differential equations of first order and degree one: Variable separable, Homogeneous and non- homogeneous differential equations, exact differential equations (without proof), Integrating factors, linear differential equation, Bernoulli's differential equation and Differential Equations reducible to them.
Method of solving differential equations of first order and higher degree solvable for y, solvable for x, solvable for p $\left(\text{where } p = \dfrac{dy}{dx}\right)$, Clairaut's differential equation, Lagrange's differential equation.

Unit 4: Linear differential equations of higher order and degree one: Differential operators. Linear differential equations of higher order and degree one with constant coefficients, Complementary and particular integrals. Inverse operator, operational methods for its solutions, Euler form of homogeneous linear differential equations with variable coefficients.

Reference books:

1. Differential Caculus, Shanti Narayan, S. K. Mittal, S. Chand and Co. Publication.
2. Anton, Biven and Davis, Calculus, 10th edition, Willey Publication.
3. Thomas, Calculus early transcendental, Addison-Wesley person publication.
4. Integral calculus, Shanti Narayan, S. Chand Limited, 2005.
5. Elementary Differential Equations, Rainville and Bedient, Macmillan Publication.
6. Ordinary and Partial Differential Equations, M. D. Raisingania, S. Chand, 2009.
7. Differential Equations- D.A. Murray, Tata McGraw Hills.
8. Ordinary Differential Equations and Partial Differential Equations, Nita shah, PHI Ltd.
9. Theory and problems on Differential Equations- Frank Ayres, McGraw Hill Book Co., New York.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: II

Calculus and Differential Equations (Practical)	**Course Code: MT 2552L**
No. of Credits: 03	**Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to plot the curves give in different forms.

CO2 Student will be able to identify the behaviour of curve in given interval and at infinity.

CO3 Student will be able to obtain series expansion of several real valued functions of one variable.

CO4 Students will be able to solve ordinary differential equations.

List of practicals (problems on):

(1) Graphs of some Cartesian curves $\mathbb{R}^2$. (Trigonometric function, conic, polynomial)

(2) Graphs of some parametric and polar curves in $\mathbb{R}^2$. (Cycloid, conic, asteroid, cardioids)

(3) Discuss concavity and point of inflexion of the curve in $\mathbb{R}^2$.

(4) To find asymptotes of curves including Cauchy's method.

(5) Method of Integration: Partial fraction, Limit of sum using definite integral, Substitution method, Integration by parts.

(6) Reduction formula only for definite integrals.

(7) Application of Integration-I (Arc length and Area)

(8) Application of Integration-II (Volume and surface Area)

(9) Application of Leibniz theorem.

(10) Discuss convergence of the infinite series.

(11) Problems on Mean value theorem.

(12) Expansion of function in infinite power series using Taylor's and Maclaurin's formula.

(13) Evaluate limits using L'Höspital's Rule.

(14) The differential equations of order 1 and degree 1.

(15) The differential equations of order 1 and higher degree.

(16) The differential equations of higher order and degree 1.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: III
Differential Calculus of Several Variables (Theory) **Course Code: MT 3551**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to understand the concepts of several variables in terms of their limits, continuity and differentiability.

CO2 Student will be able to understand the conditions on differentiability of functions of several variables.

CO3 Students will be able to obtain the partial derivatives of functions of several variables and use them to optimize the function.

CO4 Students will be able to apply the concept of partial differentiation in obtaining series expansion and different concepts in geometry.

Unit 1: Limit-Continuity of function of several variables and partial derivatives
Introduction to function of several variables, rectangular and spherical neighborhood of a point in $\mathbb{R}^n$, Limit of function of several variables, concept of iterated limits, limit and path, continuity of function of several variables.

Unit 2: Differentiability of function of several variables-I
Directional derivatives, Introduction to partial derivatives and their geometric interpretation, higher order partial derivatives and problems. Differentiability of function of two variables, theorems on differentiability conditions and their converses, Schwartz's theorem and Young's theorem on mixed partial derivatives.

Unit 3: Differentiability of function of several variables-II
Differential of function of two variables, Chain rules for differentiability, derivatives of implicit functions. Homogeneous functions, Euler's theorem for homogeneous functions of n-variables, Extreme values of functions of two variables and its converse, Lagrange's method of undetermined multipliers (only problems to be asked).

Unit 4: Applications of partial derivatives
Taylor's Theorem for function of two variables (proof of two variables only), Maclaurin's theorem, problems on Taylor's and Maclaurin's theorems, multiple points, different types of double points and examples, radius of curvature for Cartesian-parametric-polar equations of a curve in Application to geometry.

Reference books:

1. Mathematical Analysis - S. C. Malik and Savita Arrora, Second Edition, New Age Int. (P) Ltd.
2. Differential Calculus - Shanti Narayan.
3. Calculus - David V. Widder- PHI-second edition.
4. Calculus & Analytic Geometry - G. B. Thomas & R. L. Finney Addison- Wesley pub. India.

5. Calculus with Early Transcendental functions - James Stewart, Indian Edition, Engage Learning India Pvt Ltd.

6. Advanced Calculus Volume I & II - T. M. Apostol.

7. Howard Anton, Stephen Davis and Irl Bivens. Calculus: a new horizon. New York: Wiley, 1999.

8. The calculus with analytic geometry, Louis Leithold, Harper & Row, 5th edition, 1986.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: III
Introduction to Linear Algebra (Theory) **Course Code: MT 3552**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to understand the concept of vector space and its subspace and its properties.

CO2 Student will be able to use the concept of linear combination and obtain the basis and dimension of vector spaces and subspaces.

CO3 Students will be able to understand the concept of linear transformation and obtain their range and kernel.

CO4 Student will be able to associate a matrix to the linear transformation and apply in related examples.

Prerequisites: Relation, Equivalence Relation, Binary Operation.

Unit 1: Vector space: definition, examples, properties, subspaces, span of a set, operations of subspaces, sum and direct sum of subspaces, linear variety.

Unit 2: Finite linear combination, linear dependence/independence, basis and dimension of a vector space, dimension theorem.

Unit 3: Linear transformations, range and kernel of a linear map, rank and nullity of a linear map, rank - nullity theorem, inverse of a linear map, consequences of rank - nullity theorem, isomorphism, operation equation.

Unit 4: Matrix associated with a linear map, linear map associated with a matrix, linear operations in $\mu_{(m,n)}$, dimension theorems for $\mu_{(m,n)}$ and $L(U, V)$. Rank - Nullity of matrices and verification of the rank-nullity theorem for matrices.

Text book:

An Introduction to Linear Algebra - V. Krishnamurthy & others. (Affiliated East-West press, New Delhi)

Reference books:

1. Linear Algebra: a Geometric Approach - S. Kumaresan, PHI.
2. Linear Algebra with Applications - Otto Bretscher, 3rd edition, Pearson Education.
3. An Introduction to Linear Algebra - I. K. Rana, Ane Books Pvt. Ltd., New Delhi.
4. Matrix and Linear Algebra - K. B. Datta, Prentice Hall, New Delhi.
5. Linear Algebra: Theory & Appl. - Ward Cheney & David Kincaid Viva Books, Jones & Bartlett.
6. Vector Calculus, Linear Algebra & Differential Forms: A unified approach - Hubbard J. & Hubbard B. Prentice Hall 1999.
7. Introduction to Linear Algebra - Serge Lang, Springer, India.

8. Finite Dimension Vector Spaces - P. R. Halmos.

9. Linear Algebra Problem Book - P. R. Halmos.

10. Linear Algebra with Applications - Jeanne, L. Agnew & Robert C. Knapp Brooks / Col publishing Co, California.

11. A First Course in Linear Algebra - Dr. Aloknath Chakrabarti, Tata McGraw-Hill Edu. Pvt. Ltd

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: III

Computer Oriented Numerical Methods - I (CONM - I)(Practicals)	**Course Code:**	**MT 3553L**
No. of Credits: 2.5	**Learning Hours:**	**60 Hours**

Course Outcomes:

CO1 Student will be able to find different least squares and implement them using programming language.

CO2 Student will be able to find differentiation using various numerical methods and implement them using programming language.

CO3 Student will be able to solve system of linear equations using different numerical methods and implement them using programming language.

CO4 Student will be able to find the value of the function at a given point using different numerical methods and implement them using programming language.

Note: The following is a list of practicals to be implemented using C++ or Python programming language. Each practical should be written in general form as far as possible and output must be in the tabular form wherever is needed. Students should be given the fundamental mathematical knowledge of each practical topic for better understanding and are encouraged to do practical in C++ or python of their choice.

List of practicals (problems on):

(1) Linear and quadratic least squares.

(2) Exponential and power least squares.

(3) Differentiation based on $n + 1$ points.

(4) Newton's divided formula for differentiation.

(5) Back substitution for solving system of linear equations in upper triangle form.

(6) Gauss elimination method for solving system of linear equations.

(7) Guass-Jacobi method for solving system of linear equations.

(8) Gauss-Seidel method for solving system of linear equations.

(9) Newton's forward interpolation formula.

(10) Newton's backward interpolation formula.

(11) Lagrange's interpolation formula.

(12) Newton's divided interpolation.

(13) Newton's divided inverse interpolation.

(14) Lagrange's inverse interpolation.

(15) Project preparation.

(16) Project presentation.

Reference books:

1. Numerical methods for mathematics, science and engineering by John H Mathews (2nd edition) Prentice Hall of India. (For Algorithms).
2. Numerical analysis and computational procedure by Dr. S.A. Mollah, Books and Allied(P) Ltd. (For Mathematical concepts of Numerical Analysis)
3. Computer Oriented Numerical Methods- V. Rajaraman, Prentice Hall of India.
4. Introductory Methods of Numerical Analysis S S Sastry, Prentice Hall of India.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: III
Elementary Combinatorics (Theory-Elective) **Course Code: EG xxxx**
No. of Credits: 02 **Learning Hours: 30 Hours**

Course Outcomes:

CO1 Student will be able to apply various elementary counting techniques for counting problems.

CO2 Student will be able to apply binomial theorem and Pascal's triangle.

CO3 Student will be able to pigeon hole principle and Ramsey theory for various problems.

CO4 Student will be able to Principle of Inclusion and Exclusion in various counting problems.

Unit 1: Permutations and Combinations: Basic Counting Principles, Permutations, Circular Permutations, Combinations, The injection and Bijection Principles, Arrangements and selection with Repetitions, Distribution Problems.

Unit 2: Binomial Coefficients and Multinomial Coefficients: The Binomial Theorem, Combinatorial Identities, The Pascal's Triangles, Chu Shin-Chie's Identity, Shortest Routes in a Rectangular Grid, Some properties of Binomial Coefficients, Multinomial Coefficients and the Multinomial Theorem.

Text book:

Principles and Techniques in Combinatorics - Chen Chuan Chong and Koh Khee Meng, World Scientific Chapters 1 and 2.

Reference books:

1. Combinatorial Techniques, Sharad Sane, Hindustan Book Agency
2. Combinatorics including concepts of Graph Theory - V. K. Balakrishnan, Schaum's Outline Series, McGraw-Hill, INC.
3. A Path to Combinatorics for Undergraduates Counting Strategies - Titu Andreescu and Zuming Feng, Birkhauser.
4. Introduction to Combinatorial Mathematics - C. L. Liu, McGraw Hill Book Company.
5. Introduction to Combinatorics - 4th edition, Richard A. Brualdi, Pearson Education.
6. An Excursion in Mathematics, M. R. Modak, S. A. Katre, V. V. Acharya and V. M. Sholapurkar, BhaskaracharyaPratishthana, Pune.
7. A First Course in Graph Theory and Combinatorics, Sebastian M. Cioaba and M. Ram Murty, Hindustan Book Agency.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: IV
Integral Calculus of Several Variables (Theory) **Course Code: MT 4551**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Students will be able to understand the concept of multiple integral and solve examples using various methods.

CO2 Students will be able to evaluate various definite integral using Beta and Gamma functions and their properties.

CO3 Students will be able to understand the concept of vector calculus and use them to verify Green's theorem, Gauss's Divergence theorem and Stoke's theorem.

CO4 Student will be able to understand the concept of partial differential equations and solve them using various methods.

Unit 1: Multiple integrals

Introduction to double integral, repeated or iterated integral, double integral over a closed region, evaluation of double integral, changing the order of double integral, triple integrals, Iterated triple integrals, Geometrical interpretation of double and triple integrals and problems based on it, Introduction to Jacobian (only definition), transformation of double and triple integrals.

Unit 2: Beta and Gamma functions and Vector Calculus

Definition of beta and gamma functions, properties of beta and gamma functions, relation between beta and gamma functions, duplication formula, evaluation of definite integrals using beta-gamma functions.
Definition of gradient, divergence and curl, properties of theses operators.

Unit 3: Line surface and volume integrals

Definition of line integral, Green's theorem, surface and volume integral, Gauss's divergence theorem, Stoke's theorem, verification of the three theorems and problems based on the theorems.

Unit 4: Partial Differential Equations

Formation of Partial differential equations by the elimination of arbitrary constants and arbitrary functions, Partial differential equations of the first order, the complete and particular integrals, Lagrange's solution of the linear equation, Some special types of equations which can be solved easily by the methods other than Charpit's method.

Reference books:

1. Mathematical Analysis - S. C. Malik and Savita Arrora, Second Edition, New Age Int.(P) Ltd.
2. Integral calculus - Shanti Narayan.
3. Calculus - David V. Widder, Second Edition, PHI.
4. Calculus: Early Transcendentals, James Stewart, Indian Edition, Cengage Learning India Pvt Ltd.

5. Partial Differential Equations - T. Amarnath.
6. Ordinary and Partial Differential Equations - Nita H Shah, PHI Learning.
7. Calculus & Analytic Geometry - G. B. Thomas & R. L. Finney, Addison - Wesley pub. India.
8. Elements of Partial Differential Equations- Ian N. Sneddon, McGraw Hill co.
9. Advanced Calculus Volume I & II - T. M. Apostol.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: IV
Linear Algebra (Theory) **Course Code: MT 4552**
No. of Credits: 04 **Learning Hours: 60 Hours**

Course Outcomes:

CO1 Student will be able to do the transformation of regions in vector space by using various methods.

CO2 Student will be able to understand the concept of inner product space and orthonormalize the basis.

CO3 Student will be able to identify quadratic curves as well as quadratic surfaces using diagonalization of a square matrix.

CO4 Students will be able to use the concept of linear algebra and solve some related problems.

CO5 Student will be able to apply the knowledge of Eigen values and Eigen vectors of square matrices in linear operators and solve related examples.

Unit 1: Composition of Linear Maps, The Space $L(U, V)$, Operator Equation, Linear Functional, Dual Spaces, Dual of Dual, Dual Basis Existence Theorem, Annihilators, Bilinear Forms.

Unit 2: Inner Product Space, Norm, Cauchy-Schwarz Inequality, Orthogonalization and Orthonormalization of Basis, Gram-Schmidt Orthogonalization Process. Orthogonal Complement and its properties. Orthogonal Transformations.

Unit 3: Determinants and their properties. Value of determinant, Basic results, Laplace expansion, Cramer's rule.

Unit 4: Eigenvalues and Eigenvectors of linear operators and square matrices, Caley-Hamilton's Theorem and its verification. Application to reduction of Quadrics, Classification of Quadrics, Diagonalization of real and symmetric Matrices, Spectral Theorem.

Text books:

1. An Introduction to Linear Algebra - V. Krishnamurthy and others, Affiliated East- West press, New Delhi.
2. Linear Algebra a Geometric Approach - S. Kumaresan, PHI.
3. Linear Algebra -I H Sheth, Nirav Prakashan.

Reference books:

1. Linear Algebra with Applications - Otto Bretscher, 3rd edition, Pearson Education.
2. An Introduction to Linear Algebra - I. K. Rana, Ane Books Pvt. Ltd., New Delhi.
3. Matrix and Linear Algebra by - K. B. Datta, Prentice Hall, New Delhi.
4. Linear Algebra: Theory & Applications - Ward Cheney & David Kincaid Viva Books, Jones & Bartlett.

5. Vector Calculus, Linear Algebra & Differential Forms: A unified approach - Hubbard J & Hubbard B., Prentice Hall 1999.

6. Linear Algebra with Applications -Jeanne, L. Agnew & Robert C. Knapp Brooks / Col publishing Co, California.

7. A First Course in Linear Algebra - Dr. Aloknath Chakrabarti, Tata McGraw-Hill Edu. Pvt. Ltd.

8. Elementary linear algebra with applications- H. Anton, 9th edition, Wiley-India.(2008)

9. Linear Algebra and its applications- G. Strang,4th eEdition, Thomson.(2006)

10. Linear algebra- Kenneth M Hoffman and Ray Kunze, 2nd edition, Prentice Hall Inc.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: IV

Computer Oriented Numerical Methods - II (CONM - II)(Practicals)	**Course Code:**	**MT 4553L**
No. of Credits: 2.5	**Learning Hours:**	**60 Hours**

Course Outcomes:

CO1 Student will be able to find the value of the function at a given point using different numerical methods and implement them using programming language.

CO2 Student will be able to find the value of a polynomial of degree n, its derivative and integral at a given point using synthetic division method and implement them using programming language.

CO3 Student will be able to find the integration of a given function using different numerical methods and implement them using programming language.

CO4 Student will be able to solve initial value problems using various numerical methods and implement them using programming language.

Note: The following is a list of practicals to be implemented using C++ or Python programming language. Each practical should be written in general form as far as possible and output must be in the tabular form wherever is needed. Students should be given the fundamental mathematical knowledge of each practical topic for better understanding and are encouraged to do practical in C++ or python of their choice.

List of practicals (problems on):

(1) Bisection Method

(2) False Position Method

(3) Secant Method and Newton-Raphson Method

(4) Fixed point Iteration method

(5) To find value of a polynomial of degree n and its derivative and integral at a given point using synthetic division method.

(6) Numerical integration using composite trapezoidal rule

(7) Numerical integration using composite Simpsons 1/3 rule and composite Simpsons 3/8 rule.

(8) Numerical integration using composite Weddles Rule

(9) Numerical integration using recursive trapezoidal rule.

(10) Romberg Integration

(11) Solution of I.V.P using Eulers method

(12) Solution of I.V.P using Modified Eulers method

(13) Solution of I.V.P using Runge-Kuttas method of order 2

(14) Solution of I.V.P using Runge-Kutas method of order 4

(15) Project preparation.

(16) Project presentation.

Reference books:

1. Numerical methods for mathematics, science and engineering by John H Mathews (2nd edition) Prentice Hall of India. (For Algorithms).
2. Numerical analysis and computational procedure by Dr. S.A. Mollah, Books and Allied(P) Ltd. (For Mathematical concepts of Numerical Analysis)
3. Computer Oriented Numerical Methods- V. Rajaraman, Prentice Hall of India.
4. Introductory Methods of Numerical Analysis S S Sastry, Prentice Hall of India.

St. Xavier's College (Autonomous)
Ahmedabad-09
Self-Financed B. Sc. Mathematics

Semester: IV
Latex for Mathematics & Science (Elective) **Course Code: EG xxxx**
No. of Credits: 02 **Learning Hours: 30 Hours**

Course Outcomes:

CO1 Student will be able to learn the installation of the software and create documents using basics of LaTeX.

CO2 Student will be able to create mathematical documents in LaTeX.

CO3 Student will be able to create presentations using beamer in LaTeX.

CO4 Students will be able to customize their documents by creating their own package, enviroment, command and class in LaTex.

Unit 1:
(a) Software installation
(b) LATEX typesetting basics
(c) LATEX math typesetting
(d) Tables and matrices

Unit 2:
(a) Graphics
(b) Packages
(c) User-definable
(d) Document classes

Unit 3:
(a) Introductory notions. Handling errors.
(b) Bibliographies and indices
(c) beamer
(d) Creating your own packages

Reference books:

1. http://www.dickimaw-books.com/latex/novices/novices-report.pdf
2. http://www.stats.ox.ac.uk/pub/susan/oucs latex/Further LaTeXHandbook:pdf

General information

1. The TEXUsers Group Web Site
2. Getting started with TEX, LATEX, and Friends
3. TEXResources on the Web
4. LATEX- A document preparation system
5. The TEXShowcase

6. What the heck is LATEX?
7. What is TEX?
8. LATEXentry from Wikipedia
9. TEXblog - Typography with TEX and LATEX
10. TeXample.net