SUBSIDIARY COURSES BEING TAUGHT TO THE STUDENTS OF OTHER DEPARTMENTS

I. SCIENCE DEPARTMENTS

Course Title: Matrices and Infinite series
Paper Code: MTH 155 A

L	T	P	Credits
4	0	0	4

Course Objective:
The aim of this course is to familiarize the students with the theory of matrices which are used in solving equations in mechanics and the other streams. This course also provides a comprehensive understanding of some basic concepts of linear algebra.

UNIT-A   **12HOURS**
Determinants and their properties, special matrices-hermitian, skew hermitian, orthogonal, unitary, rank of matrix, elementary transformations, vector spaces, linear span, linear dependence and independence, bases and dimension.

UNIT-B   **15HOURS**
Linear transformations, properties of linear transformations, Rank and Nullity of a linear transformation, Rank-Nullity theorem (without proof), matrix of a linear transformation with respect to a given basis.

UNIT-C   **13HOURS**
Eigen values and eigenvectors, characteristic polynomials, minimal polynomials, Cayley-Hamilton Theorem, diagonalization, Eigen values of special type of matrices.

UNIT-D   **14HOURS**
Sequence, Infinite series, convergence , divergence and oscillation of a series, Geometric series, Convergence tests (Comparison test, integral test, D'Alembert's ratio test, Logarithmic test, Cauchy's root test), Alternating series, Absolute convergence of a series, convergence of exponential series.

Reference Books:
1. Narayan, S. and P. K. Mittal. *A textbook of Matrices*. New Delhi: S. Chand and Co., 2010.
2. Grewal, B.S. *Higher Engineering Mathematics, 42ⁿᵈ edition*. New Delhi: Khanna Publication, Reprint 2012.
3. Lipschutz, S., and M. Lipson. *Schaum's Outline of Linear Algebra,* 4ᵗʰ edition. New Delhi: Tata McGraw-Hill, 2008.
4. Hoffman K., and R. Kunze, *Linear Algebra,* 2ⁿᵈ edition. New Delhi: PHI Learning Pvt. Ltd., Reprint 2014.

Course Title: Calculus & Geometry
Paper Code: MTH-156 A

L	T	P	Credits
4	0	0	4

Course Objective:
The objective of the course is to equip the students with the knowledge of basic concepts of partial derivatives, multiple integration and their applications in geometry.

UNIT-A   **12 HOURS**

Equations of parabola, ellipse, hyperbola and their properties, Cartesian equation and vector equation of a line, shortest distance between two lines, Cartesian and vector equation of a plane, Angle between (i) two lines, (ii) two planes, (iii) a line and a plane, Distance of a point from a plane.

UNIT-B   **14 HOURS**
Solid Geometry: Sphere, Cone, Cylinder, Equation of Paraboloid, ellipsoid and hyperboloid in standard forms. Simple properties of these surfaces. Equation of tangent planes to the above surfaces.

UNIT-C   **13 HOURS**
Functions of two and more variables: Vector-valued function and space curves. Arc length and unit tangent vector. Limit and continuity of multivariable function. Partial derivatives. Directional derivatives, gradient vectors and tangent planes.

UNIT-D   **14 HOURS**
Multiple Integrals and Integral in vector fields: Double and triple integrals. Fubini's Theorem Without proof, Change of order of integration in double integrals, volume of a region in space, Triple integrals in spherical and cylindrical coordinates, substitution in multiple integrals. Line integrals vector fields. Path independence and surface integrals. Divergence and Stoke's theorem (Applications only).

Reference Books:

1. Thomas, G.B. and R.L. Finney. *Calculus and Analytic Geometry*. New-Delhi: Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2012.
2. Loney, S.L. *The Elements of Coordinate Geometry*, London: McMillan and Company, 1895, Print.
3. Grewal, B.S. *Higher Engineering Mathematics, 42nd edition*. New-Delhi: Khanna Publication, Reprint 2012.
4. Narayan, S. and P.K. Mittal, *Analytical Solid Geometry*. Delhi: S. Chand & Company Pvt. Ltd., 2008. Print.

Course Title: Differential Equations and Fourier series
Paper Code: MTH-255 A

L	T	P	Credits
4	0	0	4

Objective:
The objective of the course is to enable the students to understand the basic concepts related to ordinary differential, partial differential equations and Fourier series and their applications.

UNIT-A   **14 HOURS**
Ordinary Differential Equations: Exact Differential Equations of First Order, Homogeneous and Non-homogeneous Linear Differential equations of Second Order with constant coefficients. Method of variation of parameters. Simultaneous linear equations.

UNIT-B   **14 HOURS**
Solution in series of second order linear differential equations with variable coefficients (in particular, solutions of Legendre's and Bessel's equations.) Bessel functions, Legendre functions, their recurrence and orthogonal relations, Gamma and Beta functions.

UNIT-C   **15 HOURS**
Periodic functions, Euler's formula. Dirichlet's conditions. Fourier series of discontinuous functions. Fourier series of Even and Odd functions, half range expansions, Fourier series of different wave forms, Complex form of Fourier series

UNIT-D   **13 HOURS**
Formulation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients.
Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation and their applications, solution by the method of separation of variables.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R., *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995

Course Title: Integral Transforms and Complex Analysis
Paper Code: MTH-351A

L	T	P	Credits
4	0	0	4

Objective:
To acquaint the students with the application of Laplace transforms to solve ordinary differential equations. Moreover, basics of Complex Analysis are also included in this course.

UNIT-A   **15 HOURS**
Laplace Transforms: Laplace transforms: definition, elementary transforms. Transforms of derivatives and integrals. Transforms of periodic functions. Convolution theorem. Inverse Laplace transforms. Application to ordinary differential equations.

UNIT-B   **15 HOURS**
Complex Analysis: Complex numbers, absolute value, argument. Functions e^z, sin z, cos z, log z and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Harmonic functions and their conjugates.

UNIT-C   **14 HOURS**
Integration of complex functions, Cauchy's theorem (statement only), Cauchy's theorem for multiply connected domains (statement only). Cauchy's integral formula (statement only) and simple consequences.

UNIT-D   **12 HOURS**
Expansion into Laurent series, singularities, Residues, Cauchy residue theorem (statement only). Evaluation of definite integrals using contour integration

Reference Books:
1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995
5. Churchill, R. V, and Brown J. W. *Complex Variables and Application*. New Delhi: McGraw-Hill, 2008.

	L	**T**	**P**	**Credits**
Course Title: Mathematics for Chemists-I	4	0	0	4
Paper Code: MTH 160 A				

Course Objective: This course familiarizes the students with trigonometry, permutations and combinations, the theory of matrices which are used in solving equations in mechanics and other streams used in Mathematics, Physics etc. The objective is to provide basic understanding of the geometry of two and three dimensions.

UNIT-A   **14 HOURS**
Trigonometry:
T- Ratios, addition and subtraction formulae, multiple angles, sub-multiple angles, trigonometric equations, inverse trigonometrically functions (proofs of articles are not required).

UNIT-B   **14 HOURS**
Algebra: Fundamental principle of counting, Permutation and Combination with simple applications. Principle of mathematical induction, statement of Binomial Theorem and its applications.

UNIT-C   **12 HOURS**
Determinants and Matrices:
Introduction to matrix, Different kinds of matrices, Addition, Multiplication, Symmetric and Skew symmetric matrix, Transpose of matrix. Determinant of matrix, properties of determinant, product of two determinant of third order. Adjoint and Inverse of matrix, Rank of matrices, Condition of Consistency of system of linear equations, Eigen vectors and Eigen values using matrices, Cayley's Hamilton Theorem (without proof).

UNIT-D   **16 HOURS**
Co-ordinate Geometry:
Polar & Cartesian co-ordinates in plane, different forms of straight lines. Angle between two Straight lines. Conditions of parallelism and perpendicularity. Standard equations of circle, Parabola, ellipse and Hyperbola (without proof) and simple problems.
Solid Geometry: Sphere, Cone, Cylinder

Reference Books:

1. Mathematics, *A Text book for Class XI and XII (Parts I & II)*. New Delhi: NCERT 2003.
2. Jain, R K, and S.R.K. Iyengar *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
3. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995
4. Narayan, Shanti. *A text book of Matrices*. New Delhi: S Chand & co Ltd, 2004.

Course Title: Mathematics for Chemists-II	**L**	**T**	**P**	**Credits**
Paper Code: MTH 260 A	**4**	**0**	**0**	**4**

Course Objective: This course is designed to introduce the fundamental concepts of continuity, differentiation and integration of functions of one variable. Its objective is to acquaint students with various applications of these topics relating to extreme value problems, problems of finding areas and distance travelled, moreover to describe connection between integral and differential calculus through Fundamental Theorem of Calculus.

UNIT-A   **11 HOURS**
Function, Limit and Continuity:
 Functions and graphs, Domain and Co-Domain, range, Inverse Functions, Exponential and Logarithmic Functions, limit of Functions, Algebraic Computations of limits, Continuity of Functions at a point, Continuity of Functions in interval.

UNIT-B   **13 HOURS**
Differential of Explicit and Implicit functions:
An Introduction to the Derivative, Differentiation of standard Functions, Formulae on derivative of sum, difference, product and quotient of functions, chain rule, derivative of Trigonometric functions, Inverse Trigonometric functions, Exponential and Logarithmic Functions.

Differentiation of implicit functions, Derivative of functions expressed in parametric form, derivative of higher order**.**

UNIT-C   **11 HOURS**
Applications of derivatives:
Increasing and decreasing functions, Sign of derivative, Maxima and Minima of a function of single variable. Rolle's, Lagrange and Cauchy mean values theorems and their applications, Taylor theorem and Maclaurian's theorem with Lagrange's form of remainder and applications of formal expansions of functions. (Proofs of theorems are not required).

UNIT-D   **11 HOURS**
Integral Calculus:
Integration as inverse of differentiation, Indefinite Integral of standard forms, Methods of Substitution, Methods of fractions, Integration by parts, Definite Integral.

Reference Books:

1. Narayan, Shanti and Mittal P K .*Differential Calculus*. New Delhi: S Chand & Co Ltd, 2005.
2. Narayan, Shanti and Mittal P K. *Integral Calculus*, New Delhi: S Chand & Co Ltd, 2004.
3. Mathematics, *A Text book for Class XI and XII (Parts I & II)*. New Delhi: NCERT 2003.

Course Title: Mathematics for Chemists-III
Paper Code: MTH 261A

L	T	P	Credits
4	0	0	4

Course Objective: This course provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques of solving ordinary and partial differential equations.

UNIT-A   **14 HOURS**
Partial Differentiation and Multiple Integrals:
Introduction to Partial differentiation.
Integral calculus: Double Integral, Change of Order, Triple integrals, Determination of C.G. using double and triple integrals. Integration by trapezoidal and Simpson's rule.

UNIT-B   **15 HOURS**
Differential Equations:
Ordinary differential equations. Formation of differential equation, solution of linear differential equation of the first order and first degree. Solution of homogeneous and non-homogeneous differential equations with constant coefficient. The chemical application of the first differential equations.

UNIT-C   **12 HOURS**
Partial differential equations:
Formation of partial differential equations. Linear PDE- Solution by Lagrange's Method. Non-linear PDE- Solution by Charpit's Method. Solution of homogeneous partial differential equations with constant coefficients.

UNIT-D
Complex Analysis: **15 HOURS**
De-Moivre's theorem and its applications: Functions of complex variables. Analytic functions. C-R equations, Complex line integral. Cauchy's integral theorem & Cauchy's integral formula. Singularities.

Reference Books:

1 Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2 Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3 Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4 Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.
5 Dence, Joseph B. *Mathematical Techniques in Chemistry*. New Delhi: Wiley, 1975.

Course Title: Mathematics for Chemists-IV
Paper Code: MTH 360 A

L	T	P	Credits
4	0	0	4

Course Objective: The aim of this course is to make the students acquire facility and confidence in the use of vectors and vector calculus so that they may employ the same in an effective manner to various applications.

UNIT-A   **13 HOURS**
Vectors Algebra:
Definition of vector and scalar. Scalar & Vector product of two vectors. Scalars triple product and vector triple product and their applications. Work done by a force, moment of a force about a point

UNIT-B   **14 HOURS**
Vectors Calculus:
Vector differentiation and integration of vectors. Vectors operators, Gradient, Divergence and Curl. Gauss, Stoke and Green's Theorem (Statement only) and their applications.

UNIT-C   **15 HOURS**
Laplace Transform:
Definition of elementary transforms, transforms of integrals and derivatives. Laplace transforms of periodic functions, inverse Laplace transforms of periodic functions. Solutions of ordinary differential equations and simultaneous differential equations using Laplace transforms.

UNIT-D   **14 HOURS**
Fourier series:
Periodic Functions, Dirichlet Conditions, Fourier Series & Fourier coefficient, functions having arbitrary period, Sin and Cosine Series, half range expansions, Fourier integral (definitions), Harmonic Analysis.

Reference Books:

1 Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2 Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3 Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4 Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.
5 Dence, Joseph B. *Mathematical Techniques in Chemistry*. New Delhi: Wiley, 1975.

Course Title: Engineering Mathematics-I
Paper Code: MTH 151 A

L	T	P	Credits
4	0	0	4

Objective: The aim of this course is to familiarize the students with the theory of matrices which are used in solving equations in mechanics and the other streams. This course also provides a comprehensive understanding of the origin and development of ideas to exhibit the techniques origin and development of ideas to exhibit the techniques of solving ordinary differential equations.

UNIT-A   **15 HOURS**
Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method, Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermition and unitary matrices.

UNIT-B   **14 HOURS**
Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem, Total Derivative, Differentiation of an implicit function, chain rule, Change of variables,Jacobian, Taylor's and McLaurin's series. Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.

UNIT-C   **14 HOURS**
Formation of ordinary differential equations, solution of first order differential equations by separation of variables, Homogeneous equations, Reduce to Homogenous, exact differential equations, equations reducible to exact form by integrating factors, equations of the first order and higher degree, clairaut's equation.

UNIT-D   **13 HOURS**
Solution of differential equations with constant coefficients: method of differential operators. Non – homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters, Simultaneously Linear differential equation.

Reference Books :

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995.

Course Title: Engineering Mathematics-II
Course Code: MTH 152 A

L	T	P	Credits
4	0	0	4

Objective:
The objective of the course is to equip the students with the knowledge of concepts of vectors and geometry and their applications.

Unit-A   **13 HOURS**
Functions of Complex Variables: Complex Numbers and elementary functions of complex variables, De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables. Summation of trigonometric series (C+iS method).

Unit-B   **15 HOURS**
Integral Calculus: Rectification of standard curves, Areas bounded by standard curves,Volumes and surfaces of revolution of curves.
Multiple Integrals: Double and triple integral and their evaluation, change of order of integration, change of variables, application of double and triple integration to find areas and volumes. Centre of gravity and Moment of inertia.

Unit-C   **15 HOURS**
Vector Calculus: Scalar and vector fields, differentiation of vectors, velocity and acceleration.
Vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Line, surface and volume integrals.
Application of Vector Calculus: Flux, Solenoidal and Irrotational vectors, Gauss Divergence theorem, Green's theorem in plane, Stoke's theorem (without proofs) and their applications.

Unit-D   **14 HOURS**
Infinite Series: Convergence and divergence of series, tests of convergence (without proofs): comparison test, Integral test, ratio test, Raabe's test, logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series, uniform Convergence and power Series.

Reference Books:

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R. K., and S.R.K. Iyengar. *Advanced Engineering Mathematics*. New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B., and Finney Ross L. *Calculus*. Pearson Education, 9th Ed, 2010. Print.

Course Title: Engineering Mathematics-III	L	T	P	Credits
Course Code: MTH 252 A	4	0	0	4

Objective:
The objective of the course is to enable the students to understand the basic concepts related to Laplace transforms, Fourier series, ordinary differential and partial differential equations and their applications.

Unit-A   **14 HOURS**
Fourier series: Periodic functions, Euler's formula. Dirichlet's conditions. Fourier series of discontinuous functions. Fourier series of Even and Odd functions, half range expansions, Fourier series of different wave forms, Complex form of Fourier series. Fourier Transformation.

Unit-B   **14 HOURS**
Laplace Transforms: Laplace transforms of various standard functions, Linear property of Laplace transforms, Shifting property and change of scale, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Unit-C   **14 HOURS**
Partial Differential Equations: Formulation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation and their applications, solution by the method of separation of variables.

Unit-D   **15 HOURS**
Analytic Function: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; **Complex Integration:** Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Reference Books :

1. Grewal, B.S. *Higher Engineering Mathematics*. New Delhi: Khanna Publication, 2009
2. Kreyszig, Erwin. *Advanced Engineering Mathematics*. New Delhi: Wiley Eastern Ltd., 2003.
3. Jain, R K, and K Iyengar S R. *Advanced Engineering Mathematics*, New Delhi: Narosa Publishing House, 2003.
4. Thomas, George B. and Finney Ross L. *Calculus and Analytic Geometry*. New Delhi Addison Wesley, 1995

L	T	P	Credits
4	0	0	4

Course Title: Discrete Mathematics
Course Code: MTH 254 A

Objective:
The objective of this course is to acquaint the students with the basic concepts in Discrete Mathematics and Graph Theory. It includes the topic like Set Theory, Functions, Relations, Graph and Trees.

Unit-A   **14 HOURS**
Set Theory, Relation and Functions: Sets, Subsets, Set Operations and the Laws of Set Theory and Venn Diagram, Cartesian Product, Relations, Introduction to Binary relations, Equivalence relation, partition, Partial order relation, Hasse diagram, Permutation, Combination, Pigeonhole Principle, Inclusion-exclusion Principle, Mathematical Induction.

Unit-B   **13 HOURS**
Mathematical Logic and Recurrence Relations: Propositions, Basic logical operators, Logic equivalence involving Tautologies and Contradiction, Conditional Propositions, Quantifiers, Recursively Defined Sequences, Solving Recurrence Relations, Characteristic Polynomial and Equations, Homogeneous and non-homogeneous linear recurrence relations with constant coefficients, Generating Functions for some standard sequences.

Unit-C   **14 HOURS**
Graphs: Basic Terminology, Special Graphs, The Handshaking Theorem, Isomorphism of Graphs, Walks, Paths, Circuits, Eulerian and Hamiltonian Paths, Planar and Non Planar Graphs, Coloring of Graph, Directed graphs, Travelling Salesman Problem.

Unit-D   **14 HOURS**
Trees: Basic Terminology, Binary Trees, Tree Traversing: Preorder, Post-order and In-order Traversals, Minimum Spanning Trees, Prim's and Kruskal's Algorithm, Introduction to Boolean algebra, laws of Boolean algebra, Boolean function, Sum of product form.

Reference Books:
1. Rosen, K. H., *Discrete Mathematics and its Applications*, 6th Edition, McGraw Hill, 2007.
2. Malik, D.S. and Sen, M.K., *Discrete Mathematical Structures: Theory and Applications*, Thomson Cengagae Learning, New Delhi, 2004.
3. Lipschutz, S. and Lipson M., *Schaum's Outline of Discrete Mathematics*, Schaum's Outlines, New Delhi, 2007
4. Ram, B., *Discrete Mathematics*, Pearson Publications, 2011.
5. Trembley, J.P. and R.P. Manohar., *Discrete Mathematical Structures with Applications to Computer Science*. McGraw Hill, 1975.

Course Title: Numerical Methods

Paper Code: MTH 256 A

L	T	P	Credits
3	0	0	3

Course Objective:
The aim of this course is to teach the applications of various numerical techniques for a variety of problems occurring in daily life. At the end of the course, the students will be able to understand the basic concepts in Numerical Analysis of differential equations.

UNIT-A   **15 HOURS**
Approximate numbers, Significant figures, rounding off numbers, Inherent errors, Rounding errors, Truncation errors, Absolute, Relative and Percentage error.
Non-Linear Equations: Bisection, Regula-Falsi, Secant, Newton-Raphson, General Iteration Method. Rate of convergence.

UNIT-B   **14 HOURS**
Systems of Simultaneous Linear Equations: Direct methods: Gauss elimination method, Gauss Jordon method, Matrix inversion method; Iterative methods: Jacobi method and Gauss-Seidal method, Power method for finding largest/smallest Eigen value.

UNIT-C   **13 HOURS**
Operators: Forward, Backward and Shift (Definitions and some relations among them).
Newton forward and backward, Gauss backward and forward interpolation, Stirling formula, Bessel formula, Lagrange's interpolation, Hermite Interpolation, Newton divided difference Interpolation. Numerical Differentiation, Maximum and Minimum values of a tabulated function.

UNIT-D   **14 HOURS**
Numerical Integration: General Quadrature formula, Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Boole's rule, Weddle's Rule.
Numerical solutions to first order ordinary differential equations: Taylor Series method, Picard's Method, Euler's and modified Euler's methods, Runge-Kutta methods

Reference Books:

1. Grewal B.S. *Numerical Methods in Engineering and Science.* New Delhi: Khanna Publishers, 2014. Print.
2. Shastry, S.S. *Introductory Methods of Numerical Analysis.* New Delhi: PHI Learning Private Limited, 2005. Print.
3. Iyenger, S.R.K., R.K. Jain, and Mahinder Kumar. *Numerical Methods for Scientific and Engineering Computation.* Delhi: New Age International Publishers, 2012. Print.
4. Mathews, John H., and D. Fink Kurtis. *Numerical Methods using Matlab*, 4th Ed. New Delhi: PHI Learning Private Limited, 2012. Print.

Course Title: Numerical Methods with C/C++
Course Code: MTH 257

L	T	P	Credits
0	0	2	1

List of Programs:

1. Write a program to solve a polynomial equation.
2. Write a program to find C (n, r).
3. Write a program to for matrix addition, subtraction and muliplication.
4. Write a program to find the roots of a quadratic equation.
5. Write a program to solve the system of linear equations using Gauss Elimination method
6. Write a program to find the characteristic roots of a matrix.
7. WAP on Bisection and False Position Method.
8. WAP on Newton interpolation.
9. WAP on Lagrange's Interpolation.
10. WAP on Hermite Interpolation.
11. WAP on Trapezoidal rule.
12. WAP on Simpson's rules.
13. WAP on Taylor Series method.
14. WAP on Euler's Method.
15. WAP on Runge-Kutta Methods.

Reference Books:

1. Gottfried, S. Byron. *Programming with C*. Delhi: Tata McGraw Hill, 2010. Print.
2. Balagurusamy, E. *Programming in ANSI C*. Delhi: McGrawHill, 2012. Print.
3. Hanly R. Jeri, and Elliot B. Koffman. *Problem Solving and Program Design in C*. USA: Addison Wesley, 2013. Print.
4. Kanetker, Yashwant. *Let us C*. Delhi: BPB Publications, 2005. Print.
5. Balagurusamy, E. *Object oriented programming with C++*. Delhi: McGrawHill, 2008. Print.

III COMPUTER APPLICATION

Course Title: Mathematical Foundation of Computer Science
Course Code: MTH 190 A

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: The syllabus of this course is specially designed for the beginners in computer science with the first exposure to mathematical topics essential to their study of computer science or digital logic.

UNIT-A   **14 HOURS**

Set Theory, Relation and Functions: Sets, Subsets, Set Operations and the Laws of Set Theory and Venn Diagrams, Cartesian Products, Relations, Introduction to Binary relations, Equivalence relations and partitions, Partial order relations, Hasse diagram.

UNIT-B   **15 HOURS**

Matrix Algebra: Matrix Algebra Matrices, Types of Matrices, Operations on Matrices, and Properties of Determinants (Statement Only). Minors, Cofactors, Adjoint and Inverse of a Matrix, Elementary Transformations in a Matrix Rank of a Matrix. Solution of Simultaneous Equations using Crammer's Rule and Matrix Inversion Method. Characteristics of Polynomial. Eigen Values, Nature of Eigen values, Certain Types of Matrices, Cayley – Hamilton Theorem.

UNIT-C   **14 HOURS**

Differentiation and Integration: Laws of Derivative, Chain Rule Differentiation Using Log, Repeated Derivatives, Derivatives of Implicit Functions Integration of Algebraic, Logarithmic and Exponential Function, Integration of Functions Using Partial Fraction (Simple Form Using Properties) Integration of Functions by Parts, Definite Integral.

UNIT-D   **14 HOURS**

Statistics: Introduction to Statistics, Measures of Central Tendency Mean, Median and Modes. Measures of Dispersion, Mean Deviation, Standard Deviation and Coefficient of Variation. Applications of Logarithms: Problems Related To Compound Interest, Depreciation and Annuities.

Reference Books:

1. Grewal, B.S., *Advanced Engineering Mathematics*. New Delhi: Khanna Publisher, 2007.
2. Grimaldi, Ralph P., *Discrete and Combinational Mathematics* (5th edition.). New Delhi: Pearson Education, 2006.
3. Tremblay, J. P. and Manohar, R. P., *Discrete Mathematical Structures with Applications to Computer Science* (9th edition). New Delhi: MGH Publications

Course Title: Numerical Analysis

Paper Code: MTH 551 A

L	T	P	Credits
4	0	0	4

Objective:

The aim of this course is to teach the applications of various numerical techniques for a variety of problems occurring in daily life. At the end of the course, the students will be able to understand the basic concepts in Numerical Analysis of differential equations.

UNIT-A   **15 HOURS**

Approximate numbers, Significant figures, rounding off numbers, Inherent errors, Rounding errors, Truncation errors, Absolute, Relative and Percentage error.
 Algebraic and transcendental equations: Review of some concepts, Solution of algebraic and transcendental equations: Bisection method, Secant method, Regula Falsi method, Newton-Raphson method, General iteration method.
Systems of simultaneous Linear Equations: Matrix inversion method, Gauss elimination, Gauss Jordon method, Iterative methods: Jacobi method and Gauss-Seidel method, Eigenvalues and Eigen vectors, Power method for finding largest/smallest Eigen value.

UNIT –B   **13 HOURS**

Operators: Forward, Backward and Shift (Definitions and relations among them).
Finite Difference Methods: Forward, Backward, Central differences, Newton's forward, backward and divided difference formulae, Gauss, Stirling and Bessel's central difference formulae, Lagrange and Hermite interpolation.

UNIT –C   **14 HOURS**

Numerical Differentiation and Numerical Integration: Numerical Differentiation, Trapezoidal, Simpson's one third, Simpson's three eight, Boole and Weddle's rule for numerical integration, Taylor's series method, Euler, modified Euler's method, Runge-Kutta methods.

UNIT –D   **14 HOURS**

Classification of second order partial differential equation, Finite difference approximations to partial derivatives, Solution to elliptic and parabolic equations.

Reference Books:
1. Grewal B.S. *Numerical Methods in Engineering and Science.* New Delhi: Khanna Publishers, 2014. Print.
2. Shastry, S.S. *Introductory Methods of Numerical Analysis.* New Delhi: PHI Learning Private Limited, 2005. Print.
3. Iyenger, S.R.K., R.K. Jain, and Mahinder Kumar. *Numerical Methods for Scientific and Engineering Computation.* Delhi: New Age International Publishers, 2012. Print.
4. Mathews, John H., and D. Fink Kurtis. *Numerical Methods using Matlab*, 4th Ed. New Delhi: PHI Learning Private Limited, 2012. Print.

Course Title: Business Mathematics

Course Code: MTH153A

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: This course builds the foundation of students for other quantitative courses and also prepares them for competitive exams.

Learning Outcomes: The students will be able to handle the quantitative aptitude part in competitive examinations. They will also better understand the quantitative portions in the functional areas of management.

UNIT-A (14)

Concepts of basic algebra, Set theory, Types of Matrices, Algebra of Matrices, Determinants, Adjoint of a Matrix, Inverse of a Matrix via adjoint Matrix, Homogeneous System of Linear equations, Condition for Uniqueness for the homogeneous system, Solution of Non-homogeneous System of Linear equations (not more than three variables), Condition for existence and uniqueness of solution, Solution using inverse of the coefficient matrix.

UNIT-B (10)

Ratio and Proportion, Percentage-Meaning and Computations of Percentages, time, speed, distance, Simple Interest, Compound interest (reducing balance & Flat Interest rate of interest), Equated Monthly Installments(EMI), Problems.

UNIT-C (13)

Profit and Loss: terms and formulae, Trade discount, Cash discount, Problems involving cost price, selling Price, Trade discount and Cash Discount. Introduction to commission and brokerage, Problems on Commission and brokerage, Partnership, Stock and Shares.

UNIT-D (12)

Concept of LCM,GCD,HCF, Progression: Arithmetic, Geometric, Harmonic, Mean, Median, Mode, Remainder theorem, even odd functions, Binomial theorem, Quadratic equations, Properties of Logarithm, Permutation and Combination.

Reference Books:

1. Hazarika, P. *Business Mathematics*. New Delhi: Sultan Chand & Sons, 2013.
2. Kapoor, V.K. *Business Mathematics*. New Delhi: Sultan Chand & Sons.2014.
3. Bari. *Business Mathematics*. Mumbai : New Literature Publishing Company.2013

	L	T	P	Credits
Course Title: Basic Mathematics	2	0	0	0
Course Code: MTH 170 A				

Course Objective: This course is designed to introduce the fundamental concepts of continuity, differentiation and integration of functions of one variable. Its objective is to acquaint students with various applications of these topics relating to extreme value problems, problems of finding areas and distance travelled, moreover to describe connection between integral and differential calculus through Fundamental Theorem of Calculus and This course familiarizes the students with the theory of matrices.

UNIT-A   **15 HOURS**
Review of trigonometric functions, sum and product formulae for trigonometric functions, Trigonometric Equations.
Complex Numbers and Quadratic Equations, Permutations and combinations, Binomial Theorem, Sequences and series.

UNIT-B   **14 HOURS**
Matrices, Operations on Matrices, Determinants, singular and non-singular matrices, Adjoint and Inverse of a matrix.
Co-ordinate Geometry: Rectangular Coordinate system, Straight lines, Circles and family of Circles, Parabola, Ellipse and Hyperbola-their equations in standard form.

UNIT-C   **14 HOURS**
Introduction: Limits, Continuity, Differentiability. Exponential and Logarithmic Differentiation. Derivative of a function in parametric form, second order derivative. Integral as anti-derivative. Integration by substitution, by partial fractions and by parts. Definite integral and its properties. Areas of bounded regions.

UNIT-D   **13 HOURS**
Vector valued functions. Limit and continuity of vector functions. Differentiation of vector Functions. Arc length. Line, Surface and Volume integrals. The gradient, divergence and curl. The Del operator. Green's, Gauss' and Stokes' theorems (statements only). Applications to Physical problems.

Reference Books:

1. Mathematics, *A Text book for Class XI and XII (Parts I & II)*. New Delhi: NCERT 2003.
2. Narayan, Shanti and Mittal P. K., *A Text Book of Matrices*. New Delhi: S. Chand & Co. Ltd., 2002.
3. Thomas, George B, and Rose L. Finney. Calculus and Analytic Geometry (9th Edition). New Delhi: Addison Wesley, 1998.