Class M.Sc.II Sem

Advanced Discrete Mathematics

(H-2051) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of formal logic system.

PO2 Aims to understand the lattices.

PO3 Perform different types of trees.

PO4 Develop the ability to read and learn Boolean algebra.

PO5 Develop the concept of graph and circuits.

PO6 Find the degree of vertex.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in Discrete Mathematics through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of tautologies and contradictions.

2. Distinguish between lattice and sublattice.

3.Perform the concept of undirected trees.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.III Sem

Complex Analysis

(H-3050) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of complex integration.

PO2 Aims to understand the solution of different integrals.

PO3 Perform maximum modulus principle.

PO4 Develop the ability to read and learn transformations.

PO5 Develop the concept of Bilinear transformations.

PO6 Find out the Laurent series.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in complex analysis through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of different integrals.

2. Develop the concept of analytic continuation.

3.Recognize isolated singularities.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment Marks = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.III Sem

Mathematical Methods

(H-3051) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of integral equations.

PO2 Aims to understand the solution of different types of integral equations.

PO3 Perform integration of Fourier series.

PO4 Develop the ability to read and learn integral equations.

PO5 Develop competitive strength for job in different sectors of education.

PO6 Find the integral equations and their classification.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in Mathematical method through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of integral equations.

2. Distinguish between integral and differential equations.

3.Recognize Volterra's integral equation.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.III Sem

Mathematical Statistics

(H-3055) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of set theoretic approach of probability.

PO2 Aims to understand the distribution functions.

PO3 Perform moment generating functions.

PO4 Develop the ability to read and learn Statistics.

PO5 Develop Central limit theorem.

PO6 Find theoretical distributions.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in statistics through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of related to probability density function.

2. Distinguish between mgf and cgf.

3.Recognize null hypothesis and errors.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.IV Sem

Fluid Dynamics

(H-4051) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of fluids and its physical properties.

PO2 Aims to understand the concept of continuum hypothesis.

PO3 Perform the equation of continuity.

PO4 Develop fundamental knowledge and understanding of mechanics fluids at rest/ motion.

PO5 Develop general theory of stress and rate of strain.

PO6 Find the constitutive equations for Newtonian fluid.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in Fluid dynamics through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of principle stress and principle directions.

2. Distinguish between Newtonian and non-newtonian fluid.

3.Recognize vortex motion and its properties.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.IV Sem

Functional Analysis

(H-4052) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding ideas of analysis and topology.

PO2 Aims to understand the application in approximation theory.

PO3 Perform operators theory in the field of Mathematics.

PO4 Develop the ability to read and learn analysis.

PO5 Develop the concept of normed linear space.

PO6 Find the equivalent norms.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in functional analysis through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of subspaces of Banach spaces.

2. Distinguish between inner product space and Hilbert space.

3.Recognize Dual spaces.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment Marks = 10 Marks

Total = 40 +10 = 50 Marks

Class B.Sc. I Year

Calculus

(B-127) M.M. - 65

I. PROGRAM OUTCOME (PO):

PO1 Develop an understanding of underlying unifying structure of Mathematics.

PO2 Aims to understand the value of proof and distinguishes Mathematics from all other disciplines.

PO3 Able to transmit Mathematics ideas.

PO4 Develop the ability to read and learn Mathematics.

PO5 Develop competitive strength for job in different sectors of education.

PO6 Develop self employability.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in calculus through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get familiar with basic concepts , techniques and applications of Mathematics.

2. Identify the various Mathematical ideas.

3. Became able to carry out the applications of Mathematics.

The Assessments/Evaluation Methods:

For Annual System

Theory Exam : 65 Marks

Class B.Sc. I Year

Geometry and Vectors

(B-128) M.M. - 70

I. PROGRAM OUTCOME (PO):

PO1 Communicate Mathematical ideas..

PO2 Develop the demonstrate proficiency in writing and understanding proofs.

PO3 Able to transmit geometrical concept of Mathematics.

PO4 Develop the ability to read and learn vector calculus.

PO5 Develop competitive strength for job in different sectors of education.

PO6 Develop figures in coordinate planes.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in geometry and vectors through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get familiar knowledge of vector fields.

2. Identify the various Mathematical equations in polar form.

3. Derivation of different types of conics.

The Assessments/Evaluation Methods:

For Annual System

Theory Exam : 70 Marks

Class B.Sc. II Year

Linear Algebra and Matrices

(B-226) M.M. - 65

I. PROGRAM OUTCOME (PO):

PO1 Develop an understanding of geometric representation of vectors.

PO2 Aims to understand the solution system of linear equations.

PO3 Perform row operations on a matrix.

PO4 Develop the ability to read and learn pure Mathematics.

PO5 Develop different types of matrices.

PO6 Find the transpose of a matrix.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in linear algebra and matrices through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of subspaces of a vector space.

2. Distinguish between homogeneous and non homogeneous systems.

3.Recognize echelon forms.

The Assessments/Evaluation Methods:

For Annual System

Theory Exam : 65 Marks

Class B.Sc. II Year

Differential Equations and Integral Transforms

(B-227) M.M. - 65

I. PROGRAM OUTCOME (PO):

PO1 Develop a variety of differential equations and their solutions.

PO2 Aims to understand the value of integral transform.

PO3 Able to transmit Mathematics ideas about integrals.

PO4 Introduction to ordinary differential equations with applications.

PO5 Develop Laplace and inverse Laplace transform to return familiar functions.

PO6 Develop context specific skills.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in differential equations and integral transform through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get meaning of solution of differential equations.

2. Identify the origins and applications of differential equations.

3. Identify the various types of integral transforms.

The Assessments/Evaluation Methods:

For Annual System

Theory Exam : 65 Marks

Class B.Sc. III Year

Real Analysis

(B 326) M.M. - 75

I. PROGRAM OUTCOME (PO):

PO1 Develop an understanding of real numbers.

PO2 Aims to understand the basic material in systematic manner in context of real valued functions.

PO3 Able to understand the topic of basic set theorey.

PO4 Develop the ability to read and learn Real Analysis.

PO5 Develop competitive strength for job in different sectors of education.

PO6 Develop axiomatic study of real number system.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in real analysis through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get familiar with basic concepts and applications of Real Numbers.

2. Identify the fundamental theorem on calculus.

3. Knowledge of different types of numbers.

The Assessments/Evaluation Methods:

For Annual System

Theory Exam : 75 Marks

Class B.Sc. III Year

Complex Analysis

(B-327) M.M. - 75

I. PROGRAM OUTCOME (PO):

PO1 Develop an understanding of basic algebraic manipulation with complex numbers.

PO2 Aims to understand the geometric interpretation of complex numbers.

PO3 Able to find roots of complex numbers.

PO4 Develop the ability to read and learn complex plane.

PO5 Develop the solutions of simple polynomial equations.

PO6 Develop the concept of De Moivre's theorem.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in complex analysis through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get familiar with basic concepts and applications of complex numbers .

2. Identify the calculating of nth roots of a complex number.

3. Became able to find out the subset of complex plane.

The Assessments/Evaluation Methods:

For Annual System

Theorey Exam : 75 Marks

Class M.Sc.I Sem

Real Analysis

(H-1050) M.M. - 50 **I.**

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of Riemann Integrals.

PO2 Aims to understand the solution of integration and differentation.

PO3 Perform different types of sequences.

PO4 Develop the ability of severable variables.

PO5 Develop competitive strength for job in different sectors of education.

PO6 Find the implicit and explicit functions.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in real analysis through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of integral valued functions.

2. Distinguish between Riemann integral and Riemann Stieltjes integrals.

3.Recognize Weierasstrass approximation theorem.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.I Sem

Differential Equations

(H-1051) M.M. - 50 **I.**

I.PROGRAM OUTCOME (PO):

PO1 Develop an idea of ordinary differential equation.

PO2 Aims to understand the solution system of differential equations equations.

PO3 Perform partial differential equation.

PO4 Develop the ability to read and learn differential equation.

PO5 Develop problems based on differential equations.

PO6 Develop nonlinear differential equation.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in differential equation through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1. Distinguish between ordinary differential equation and partial differential equation.

2. Get the solutions of diffusion equations

3.Recognize partial differential equation into canonical form.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.I Sem

Metric Spaces

(H-1052) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of basic set theory and metric spaces.

PO2 Aims to understand the concept of equivalent metric spaces.

PO3 Perform sequence and subsequences.

PO4 Develop the ability to read and learn pure Mathematics.

PO5 Develop the concept of continuity.

PO6 Find concept of compactness.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in metric spaces through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of different types of metric spaces.

2. Distinguish between metric space and pseudo metric spaces.

3.Recognize some aspects of Cantor's intersection theorem.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.II Sem

Topology

(H-2049) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of topological spaces.

PO2 Aims to understand the concept of topology.

PO3 Perform examples on topology.

PO4 Develop the ability to read the concept of set theorey.

PO5 Develop competitive strength for job in different sectors.

PO6 Find the countability axioms.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in topology through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of topological spaces.

2. Distinguish between connectes and disconnected sets.

3. Perform compact spaces.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva-voce = 100 marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

Class M.Sc.II Sem

Measure and Integration

(H-2050) M.M. - 50

I.PROGRAM OUTCOME (PO):

PO1 Develop an understanding of countable and uncountable sets.

PO2 Aims to understand the concept of sets and functions.

PO3 Perform the concept of measurable functions.

PO4 Develop the ability to read and learn Mathematics.

PO5 Develop Lebesgue integral.

PO6 Find theorems on convergences.

II. PROGRAM SPECIFIC OUTCOME (PSO):

The program offers divers knowledge and learning in measure and integration through teaching , discussions and aims to develop the communicate ideas effectively.

III. COURSE OUTCOME :

After the completion of the course , the student will able to understand following aspects

1.Get list examples of countable and uncountable sets.

2. Distinguish between different types of sets.

3.Recognize convex function.

The Assessments/Evaluation Methods:

For Semester System

Theory Exam : 50 Marks Viva- voce = 100 Marks

Internal- Test – 20 (15+5) + (15+5) = 40 Marks

Assignment/Seminar = 10 Marks

Total = 40 +10 = 50 Marks

RECOMMENDED UNIFIED SYLLABUS OF MATHEMATICS
For B.A./B.Sc. Classes
(From 2011-12 onwards)

B.A./B.Sc. I

Paper I : ALGEBRA and TRIGONOMETRY M.M. : 33/65

Algebra

Unit 1. Sequence and its convergence (basic idea), Convergence of infinite series, Comparison test, ratio test, root test, Raabe's test, Logarithmic ratio test, Cauchy's condensation test, DeMorgan and Bertrand test and higher logarithmic ratio test. Alternating series, Leibnitz test, Absolute and conditional convergence, Congruence modulo *m* relation, Equivalence relations and partitions.

Unit 2. Definition of a group with examples and simple properties, Permutation groups, Subgroups, Centre and normalizer, Cyclic groups, Coset decomposition, Lagrange's theorem and its consequences.

Unit 3. Homomorphism and isomorphism, Cayley's theorem, Normal subgroups, Quotient group, Fundamental theorem of homomorphism, Conjugacy relation, Class equation, Direct product.

Unit 4. Introduction to rings, subrings, integral domains and fields, Characteristic of a ring, Homomorphism of rings, Ideals, Quotient rings.

Trigonometry

Unit 5. Complex functions and separation into real and imaginary parts, Exponential, direct and inverse trigonometric and hyperbolic functions, logarithmic function, Gregory's series, Summation of series.

Paper II : CALCULUS M.M. : 33/65

Differential Calculus

Unit 1. ε–δ definition of the limit of a function, Continuous functions and classification of discontinuities, Differentiability, Chain rule of differentiability, Rolle's theorem, First and second mean value theorems, Taylor's theorems with Lagrange's and Cauchy's forms of remainder, Successive differentiation and Leibnitz's theorem.

Unit 2. Expansion of functions (in Taylor's and Maclaurin's series), Indeterminate forms, Partial differentiation and Euler's theorem, Jacobians.

Unit 3. Maxima and Minima (for functions of two variables), Tangents and normals (polar form only), Curvature, Envelopes and evolutes.

Unit 4(*a*). Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian and polar co-ordinates.

Integral Calculus

Unit 4(*b*). Reduction formulae, Beta and Gamma functions.

Unit 5. Qudrature, Rectification, Volumes and surfaces of solids of revolution, Pappus

theorem, Double and triple integrals, Change of order of integration, Dirichlet's and Liouville's integral formulae.

Paper III : GEOMETRY and VECTOR CALCULUS M.M. : 34/70

Geometry

Unit 1. General equation of second degree, Tracing of conics, System of conics, Confocal conics, Polar equation of a conic and its properties.

Unit 2. Three dimensional system of co-ordinates, Projection and direction cosines, Plane, Straight line.

Unit 3. Sphere, cone and cylinder.

Unit 4. Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar, Conjugate diameters, Generating lines, Plane sections.

Vector Calculus

Unit 5. Vector differentiation and integration, Gradient, divergence and curl and their properties, Line integrals, Theorems of Gauss, Green and Stokes and problems based on these.

B.A./B.Sc. II

(From 2012-13 onwards)

Paper I : LINEAR ALGEBRA and MATRICES M.M. : 33/65

Linear Algebra

Unit 1. Vector spaces and their elementary properties, Subspaces, Linear dependence and independence, Basis and dimension, Direct sum, Quotient space.

Unit 2. Linear transformations and their algebra, Range and null space, Rank and nullity, Matrix representation of linear transformations, Change of basis.

Unit 3. Linear functionals, Dual space, Bi-dual space, Natural isomorphism, Annihilators, Bilinear and quadratic forms, Inner product spaces, Cauchy-Schwarz's inequality, Bessel's inequality and orthogonality.

Matrices

Unit 4. Symmetric and skew-symmetric matrices, Hermitian and skew-Hermitian matrices, Orthogonal and unitary matrices, Triangular and diagonal matrices, Rank of a matrix, Elementary transformations, Echelon and normal forms, Inverse of a matrix by elementary transformations.

Unit 5. Characteristic equation, Eigen values and eigen vectors of a matrix, Cayley-Hamilton's theorem and its use in finding inverse of a matrix, Application of matrices to solve a system of linear (both homogeneous and non-homogeneous) equations, Consistency and general solution, Diagonalization of square matrices with distinct eigen values, Quadratic forms.

Paper II : DIFFERENTIAL EQUATIONS and INTEGRAL TRANSFORMS

M.M. : 33/65

Differential Equations

Unit 1. Formation of a differential equation (D.E.), Degree, order and solution of a D.E., Equations of first order and first degree : Separation of variables method, Solution of homogeneous equations, linear equations and exact equations, Linear differential equations with constant coefficients, Homogeneous linear differential equations,

Unit 2. Differential equations of the first order but not of the first degree, Clairaut's equations and singular solutions, Orthogonal trajectories, Simultaneous linear differential equations with constant coefficients, Linear differential equations of the second order (including the method of variation of parameters),

Unit 3. Series solutions of second order differential equations, Legendre and Bessel functions (P_n and J_n only) and their properties.

Order, degree and formation of partial differential equations, Partial differential equations of the first order, Lagrange's equations, Charpit's general method, Linear partial differential equations with constant coefficients.

Unit 4(*i*). Partial differential equations of the second order, Monge's method.

Integral Transforms

Unit 4(*ii*). The concept of transform, Integral transforms and kernel, Linearity property of transforms, Laplace transform, Inverse Laplace transform, Convolution theorem, Applications of Laplace transform to solve ordinary differential equations.

Unit 5. Fourier transforms (finite and infinite), Fourier integral, Applications of Fourier transform to boundary value problems, Fourier series.

Paper III : MECHANICS

Dynamics M.M. : 34/70

Unit 1. Velocity and acceleration along radial and transverse directions, and along tangential and normal directions, Simple harmonic motion, Motion under other laws of forces, Earth attraction, Elastic strings.

Unit 2. Motion in resisting medium, Constrained motion (circular and cycloidal only).

Unit 3. Motion on smooth and rough plane curves, Rocket motion, Central orbits and Kepler's law, Motion of a particle in three dimensions.

Statics

Unit 4. Common catenary, Centre of gravity, Stable and unstable equilibrium, Virtual work.

Unit 5. Forces in three dimensions, Poinsot's central axis, Wrenches, Null line and null plane.

B.A./B.Sc. III

(From 2013-14 onwards)

Paper I : REAL ANALYSIS M.M. : 36/75

Unit 1. Axiomatic study of real numbers, Completeness property in R, Archimedean property, Countable and uncountable sets, Neighbourhood, Interior points, Limit points, Open and closed sets, Derived sets, Dense sets, Perfect sets, Bolzano-Weierstrass theorem.

Unit 2. Sequences of real numbers, Subsequences, Bounded and monotonic sequences, Convergent sequences, Cauchy's theorems on limit, Cauchy sequence, Cauchy's general principle of convergence, Uniform convergence of sequences and series of functions, Weierstrass M-test, Abel's and Dirichlet's tests.

Unit 3. Sequential continuity, Boundeness and intermediate value properties of continuous functions, Uniform continuity, Meaning of sign of derivative, Darboux theorem.

Limit and continuity of functions of two variables, Taylor's theorem for functions of two variables, Maxima and minima of functions of three variables, Lagrange's method of undetermined multipliers.

Unit 4. Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Improper integrals and their convergence, Comparison test, μ-test, Abel's test, Dirichlet's test, Integral as a function of a parameter and its differentiability and integrability.

Unit 5. Definition and examples of metric spaces, Neighbourhoods, Interior points, Limit points, Open and closed sets, Subspaces, Convergent and Cauchy sequences, Completeness, Cantor's intersection theorem.

Paper II : COMPLEX ANALYSIS M.M. : 36/75

Unit 1. Functions of a complex variable, Concepts of limit, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations (Cartesian and polar form), Harmonic functions, Orthogonal system, Power series as an analytic function.

Unit 2. Elementary functions, Mapping by elementary functions, Linear and bilinear transformations, Fixed points, Cross ratio, Inverse points and critical points, Conformal transformations.

Unit 3. Complex Integration, Line integral, Cauchy's fundamental theorem, Cauchy's integral formula, Morera's theorem, Liouville theorem, Maximum Modulus theorem, Taylor and Laurent series.

Unit 4. Singularities and zeros of an analytic function, Rouche's theorem, Fundamental theorem of algebra, Analytic continuation.

Unit 5. Residue theorem and its applications to the evaluation of definite integrals, Argument principle.

Paper III : NUMERICAL ANALYSIS and PROGRAMMING IN *C*

Numerical Analysis M.M. : 36/75

Unit 1. Shift operator, Forward and backward difference operators and their relationships, Fundamental theorem of difference calculus, Interpolation, Newton-Gregory's forward and backward interpolation formulae.

Unit 2. Divided differences, Newton's divided difference formula, Lagrange's interpolation formula, Central differences, Formulae based on central differences : Gauss, Striling's, Bessel's and Everett's interpolation formulae, Numerical differentiation.

Unit 3. Numerical integration, General quadrature formula, Trapezoidal and Simpson's rules, Weddle's rule, Cote's formula, Numerical solution of first order differential equations : Euler's method, Picard's method, Runge-Kutta method and Milne's method, Numerical solution of linear, homogeneous and simultaneous difference equations, Generating function method.

Unit 4. Solution of transcendental and polynomial equations by iteration, bisection, Regula-Falsi and Newton-Raphson methods, Algebraic eigen value problems : Power method, Jacobi's method, Given's method, Householder's method and *Q-R* method, Approximation : Different types of approximations, Least square polynomial approximation, Polynomial approximation using orthogonal polynomials, Legendre approximation, Approximation with trigonometric functions, exponential functions, rational functions, Chebyshev polynomials.

Programming in C

Unit 5. Programmer's model of computer, Algorithms, Data type, Arithmetic and input/out instruction, Decisions, Control structures, Decision statements, Logical and

conditional operators, Loop case control structures, Functions, Recursion, Preprocessors, Arrays, Puppetting of strings Structures, Pointers, File formatting.

OPTIONAL PAPER

Any one of the following papers : M.M. : 42/75

Paper IV(*a*) : NUMBER THEORY and CRYPTOGRAPHY

Unit 1. Divisibility : gcd, lcm, prime numbers, fundamental theorem of arithmetic, perfect numbers, floor and ceiling functions, Congruence : properties, complete and reduced residue systems, Fermat's theorem, Euler functions, Chinese remaineder theorem.

Unit 2. Primality testing and factorization algorithms, Pseudo-primes, Fermat's pseudo-primes, Pollard's rho method for factorization.

Unit 3. Introduction to cryptography : Attacks, services and mechanisms, Security services, Conventional encryption - Classical techniques : Model, Stegnanography, Classical encryption technique, Modern techniques : DES, cryptanalysis, block cipher principles and design, Key distribution problem, Random number generation.

Unit 4. Hash functions, Public key cryptography, Diffie-Hellmann key exchange, Discrete logarithm-based crypto-systems, RSA crypto-system, Signature schemes, Digital signature standard (DSA), RSA signature schemes, Knapsack problem.

Unit 5. Elliptic curve cryptography : Introduction to elliptic curves, Group structure, Rational points on elliptic curves, Elliptic curve cryptography, Applications in cryptography and factorization, Known attacks.

Paper IV(*b*) : LINEAR PROGRAMMING

Unit 1. Linear programming problems, Statement and formation of general linear programming problems, Graphical method, Slack, and surplus variables, Standard and matrix forms of linear programming problem, Basic feasible solution.

Unit 2. Convex sets, Fundamental theorem of linear programming, Simplex method, Artificial variables, Big-*M* method, Two phase method.

Unit 3. Resolution of degeneracy, Revised simplex method, Sensitivity Analysis.

Unit 4. Duality in linear programming problems, Dual simplex method, Primal-dual method Integer programming.

Unit 5. Transportation problems, Assignment problems.

Paper IV(*c*) : DIFFERENTIAL GEOMETRY and TENSOR ANALYSIS

Differential Geometry

Unit 1. Local theory of curves- Space curves, Examples, Plane curves, tangent and normal and binormal, Osculating plane, normal plane and rectifying plane, Helices, Serret-Frenet apparatus, contact between curve and surfaces, tangent surfaces, involutes and evolutes of curves, Intrinsic equations, fundamental existence theorem for space curves, Local theory of surfaces- Parametric patches on surface curve of a surface, surfaces of revolutions, Helicoids, metric-first fundamental form and arc length.

Unit 2. Local theory of surfaces (Contd.), Direction coefficients, families of curves, intrinsic properties, geodesics, canonical geodesic equations, normal properties of geodesics, geodesics curvature, geodesics polars, Gauss-Bonnet theorem, Gaussian curvature, normal curvature, Meusneir's theorem, mean curvature, Gaussian curvature, umbilic points, lines of curvature, Rodrigue's formula, Euler's theorem.

Unit 3. The fundamental equation of surface theory – The equation of Gauss, the

equation of Weingarten, the Mainardi-Codazzi equation, Tensor algebra : Vector spaces, the dual spaces, tensor product of vector spaces, transformation formulae, contraction, special tensor, inner product, associated tensor.

Unit 4. Differential Manifold-examples, tangent vectors, connexions, covariant differentiation. Elements of general Riemannian geometry-Riemannian metric, the fundamental theorem of local Riemannian Geometry, Differential parameters, curvature tensor, Geodesics, geodesics curvature, geometrical interpretation of the curvature tensor and special Riemannian spaces.

Tensor Analysis

Unit 5. Contravariant and covariant vectors and tensors, Mixed tensors, Symmetric and skew-symmetric tensors, Algebra of tensors, Contraction and inner product, Quotient theorem, Reciprocal tensors, Christoffel's symbols, Covariant differentiation, Gradient, divergence and curl in tensor notation.

Paper IV(*d*) : PRINCIPLES OF COMPUTER SCIENCE

Unit 1. Data Storage - Storage of bits, main memory, mass storage, Information of storage, The binary system, Storing integers, stroring fractions, communication errors.

Data Manipulations - The central processing unit, The stored program concept, Programme execution, Other Architectures, arithmetic/logic instructions, Computer – peripheral communication.

Unit 2. Operating System and Network – The evolution of operating system, Operating system architecture, Coordinating the machine's activates, Handling competition among process, networks, network protocol.

Unit 3. Algorithms - The concept of an algorithm, Algorithm representation, Algorithm, Discovery, Iterative structure, Recursive structures, Efficiency and correctness, (algorithm to be implemented in C++).

Unit 4. Programming Languages - Historical perspective, Traditional programming Concepts, Program units, Languages implementation, Parallel computing, Declarative computing.

Unit 5. Software Engineering - The software engineering discipline, The software life cycle, Modularity, Development, Tools and techniques, Documentation, Software ownership and liability. **Data Structures** - Array, Lists, Stack, Queues, Trees, Customised data types, Object-oriented.

Paper IV(*e*) : DISCRETE MATHEMATICS

Unit 1. Propositional Logic - Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Method of Proof - Mathematical induction, proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof by using truth table, proof by counter example.

Unit 2. Relation - Definition, types of relation, composition of relations, domain and range of a relation, pictorial representation of relation, properties of relation, partial ordering relation.

Posets, Hasse Diagram and Lattices - Introduction, ordered set, Hasse diagram of partially ordered set, isomorphic ordered set, well ordered set, properties of lattices, and complemented lattices.

Boolean Algebra - Basic definitions, Sum of products and product of sums, Logic gates and Karnaugh maps.

Unit 3. Graphs - Simple graph, multi graph, graph terminology, representation of graphs, Bipartite, regular, planar and connected graphs, connected components in a graph, Euler graphs, Hamiltonian path and circuits, Graph colouring, chromatic number, isomorphism and homomorphism of graphs.

Tree - Definition, Rooted tree, properties of trees, binary search tree, tree traversal.

Unit 4. Combinatorics - Basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (n^{th} order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relations), generating function (closed form expression, properties of G.F., solution of recurrence relation using, G.F, solution of combinatorial problem using G.F.).

Unit 5. Finite Automata - Basic concepts of automation theory, Deterministic finite automation (DFA), transition function, transition table, Non deterministic finite automata (NDFA), Mealy and Moore machine, Minimization of finite automation.

Paper IV(*b*) : MATHEMATICAL STATISTICS

Probability Theory

Unit 1. Three definitions of probability (Mathematical, Empirical & axiomatic). Dependent, independent and compound events.

Addition and multiplication theorems of probability, conditional probability. Bionomial and multinomial theorems of probability, Baye's theorem, Mathematical expectation and its properties, Moment generating functions (m.g.f.) and cumulants.

Distributions

Unit 2. Discrete distributions – Binomial & Poisson distributions and their properties.

Continuous distributions – Distribution function, Probability density function (Pdf), Cauchy's distribution, rectangular distribution, exponential distribution, Beta, Gamma Normal distributions and their properties.

Fitting of the Curves by method of least square – Straight line, parabola and exponential curves.

Correlation and Regression

Unit 3. Bivariate population, Meaning of correlation & regression. Coefficient of Correlation, rank correlation, lines of regression. Properties of regression coefficients, Partial and multiple correlation and their simple Properties.

Sampling Theory

Unit 4. Types of population, Parameters & Statistics, Null Hypothesis, Level of Significance, critical region. Procedure for testing Hypothesis. Type I & Type II error, χ^2 - distribution and its properties.

Unit 5. Simple and random sampling. Test of significance for large samples. Sampling distribution of Mean. Standard error, Test of significance based on χ^2. Test of significance based on t,F & Z distribution, ANOVA.

CH. CHARAN SINGH UNIVERSITY, MEERUT
M.Sc. (Mathematics) SYLLABI (2016 Onwards)

M.Sc. Semester I		hrs/week	L:T:P	Max. marks
1. M – 101	AbstractAlgebra	6	6:0:0	100
2. M – 102	Real Analysis	6	6:0:0	100
3. M – 103	Differential Equations	6	6:0:0	100
4. M – 104	Metric Spaces	6	6:0:0	100
5. OE – 105	Open Elective	4	4:0:0	100
M.Sc. Semester II				
1. M – 201	Topology	6	6:0:0	100
2. M – 202	Measure and Integration	6	6:0:0	100
3. M – 203	Advanced Discrete Mathematics	6	6:0:0	100
4. M – 204	Operations Research	6	6:0:0	100
5. OE– 205	**Open Elective**	4	4 : 0:0	100
M.Sc. Semester III				
1. M – 301	Complex Analysis	6	6:0:0	100
2. M – 302	Mathematical Methods	6	6:0:0	100
3. M – 303	Core- Elective (Any one of the following)			
(I)	Algebraic Coding Theory	6	6:0:0	100
(II)	Numerical Analysis	6	6:0:0	100
(III)	Lattice Theory	6	6:0:0	100
(IV)	Object Oriented Programming in C^{++}	6	4:0:2	100
4. M – 304	Core- Elective (Any one of the following)	6	6:0:0	100
(I)	Mathematical Statistics			
(II)	Partial Differential Equations	6	6:0:0	100
(III)	Mechanics			
(IV)	Mathematical Programming			
5. OE – 305	**Open Elective**	4	4 :0:0	100

M.Sc. Semester IV

1. M – 401	Number Theory	6	6:0:0	100
2. M – 402	Fluid Dynamics	6	6:0:0	100
***3.* M -403**	**Core- Elective (Any one of the following)**	**6**	**6:0:0**	**100**

(I) Functional Analysis
(II) Information Theory
(III) Mathematical Cryptography
(IV) Algebraic Topology

4. M-	**Core- Elective (Any one of the following)**	**6**	**6:0:0**	**100**

(I) Differential Geomentry
(II) Plasma Dynamics
(III) File Structure And Database Management System
(IV) Fuzzy Sets and its Applications

5. OE– 405	**Open Elective**	4	4:0:0	100

Syllabi of Courses/ Papers under CBCS Programme for Students of other Departments

Open Elective- MA01	**Basic Cryptography**	4	4:0:0	100
Open Elective- MA02	**Optimization Techniques**	4	4:0:0	100