

M.Sc. Mathematics (2018-19)

PO:

- Students are able to conduct research independently and pursue higher studies towards the Ph.D. degree in mathematics and computing.
- Students have been developed with the attitude to read, have deep knowledge of concepts of various fields in Mathematics.
- Students are prepared to carry out development work as well as to take up challenges in the emerging areas of Industry.

PSO 1:

- Cultivation of mathematical attitude and rising of the interest towards mathematics.
- Disciplines such as Analysis, Algebra, Number Theory, and Geometry explained with strong background.
- Communication of mathematical thoughts efficiently, in script as well as verbal.

CO 1: Mathematical analysis

- Construction of the framework for understanding the concept of real numbers.
- Understanding the concepts of mean value theorem, fundamental theorem of calculus in the experimental way using several specific examples.
- Awareness of concepts of Metric Spaces, Riemann's Integral and its applications.

CO 2: Number Theory

- Description and interpretation of concepts of prime numbers, divisibility, congruence, g.c.d., prime factorizations.
- Description of some open problems in number theory.
- Improvement in ability of mathematical thinking.
- Learning of intriguing findings related to properties of prime numbers.

CO 3: Algebra:

- Establishment of interest in structures of groups and rings.

- Creation of interest towards the fundamental results and to solve algebraic problems using appropriate techniques.
- Understanding of the structure of a permutation group and its applications in real life.
- Learning of commutative ring with unity that helps in developing basic foundation in other areas of mathematics.

CO 4: Complex Analysis:

- Representation of complex numbers algebraically and geometrically.
- Study of how to use concepts and consequences of analytic and meromorphic functions.
- Classification of singularities and poles of functions and representation of them as Taylor, power and Laurent series.
- Development of the techniques of finding residues and evaluate complex integrals.

CO 5: Ordinary Differential Equations:

- Detailed study of existence, uniqueness and continuity of solutions of first order ODE's.
- Understanding of the concepts like eigen values and eigen functions of Sturm–Liouville systems and the solutions of initial and boundary value problems.
- Investigation of qualitative behavior of solutions of system of differential equations.
- Development of interest in solving a number of problems related to model natural phenomena, engineering systems and many other situations.

CO 6: Functional analysis:

- Description of properties of Banach Space and Hilbert Space.
- Basic study of the concepts, properties of operators and their classification.

- Investigation of best approximation of a given vector by vectors in a given subspace.

CO 7: Rings and Modules:

- Understanding of basic proficiency of rings and fields and the structure theory of modules over Euclidean Domain along with its implications.
- Understanding of the importance of a ring as a fundamental object in algebra and the concept of a module as a generalization of a vector space.
- Development of capability to transact with module theory which is requisite in broad arrays of mathematical areas.

CO 8: Topology:

- Introduction with topological spaces and a grasp on basic results on set theory.
- Demonstration of interior, closure, boundary points, limit points of subsets and basis, sub basis of topological spaces.
- Knowledge of continuity of functions in general way, concepts of homeomorphism and to distinguish the spaces up to homeomorphisms.
- Study of connectedness and path connectedness of spaces.
- Basics of several separation axioms of spaces.

CO 9: Differential Geometry:

- Introduction of line integrals, dealing with differential forms and calculation of arc length and curvature of surfaces.
- Deep understanding of the solutions of smooth real valued functions, vector fields and tangent spaces.
- Learning of curvature of a plane curve with applications in geometry and physics.

CO 10: Measure Theory:

- Verification of measurability of various sets and functions.
- Interpretation of basic definitions, concepts of inner and outer measure of sets.

- Understanding of the fundamental integral convergence theorems and its applications.
- Understanding the requirement of Lebesgue integral and its difference from Riemann integral along with its properties.
- Learning how to apply the Holder and Minkowski inequalities in L^p spaces and understanding of the completeness of L^p spaces.

PSO 2:

- Sound knowledge of mathematical modeling, programming and computational techniques.
- More specification in communicating the mathematical concepts.
- Nurturing the interest towards applications of mathematics in real life.
- Development of the ability to think critically, logically and analytically and hence using mathematical reasoning in daily life.

CO 11: Field Theory:

- Identification and construction of the examples of finite as well as infinite fields.
- Construction of the algebraic, normal, separable, Galois, cyclic extensions of fields.
- Description about the structures and extensions of given fields.
- Classification of finite fields using roots of unity.

CO 12: Computer fundamentals and programming in C:

- Understanding of the basic concepts, terminology of IT and familiarize with the use of IT tools.
- Understanding of the basic terminology used in computer programming, writing, compiling and debugging involving decision structures, loops and functions, arrays, strings and pointers.
- Enabled to take up systems programming or Advanced C programming course.

CO 13: Mathematical Methods:

- Performing integration and other operations by approximation techniques.
- Knowledge of how to test the convergence of methods and to interpret the results.
- Translation of a practical problem into mathematical problem and solving it by means of calculus.

CO 14: Optimization Techniques:

- Learning about the convex sets, their properties and the formulation of real life problem into mathematical problem.
- Understanding the importance of optimization of industrial process management and applying the basic concepts of mathematics to formulate an optimization problem.
- Applications of Linear Programming to transportation, assignment and game problem.

CO 15: Mathematical Statistics-I:

- Inculcation of the skills for problem solving, data modeling and analysis.
- Learning how to frame problems using numerous mathematical and statistical depictions of appropriate structures and relationships and to find the solutions using standard techniques.
- Clear communication of quantitative ideas both orally and in writing.
- Description and application of certain frequently used discrete and continuous probability distributions.

CO 16: Category Theory- I:

- Understanding the basics concepts and methods of category theory.
- Learning the techniques to work with commutative diagrams, naturality and universality properties.
- Application of categorical ideas and methods in wide range of area of mathematics.

CO 17: Fuzzy Sets and applications:

- Understanding the difference between crisp set theory and fuzzy set theory
- Recognition of the basic knowledge of fuzzy sets and fuzzy membership function.
- Handling the problems having uncertain and imprecise data.
- Description of Plausibility and Possibility.

CO 18: Advanced Topology:

- Learning of the concepts of net and filters in topological spaces.
- Study and understanding of the separation axioms more specifically.
- Familiarize with the Urysohn's Lemma and Tietze extension theorem to characterize metrizable spaces.
- Detailed knowledge of the concepts of compactness and learning about Bolzano- Weierstrass property of a space and Tychonoff theorem.
- Proving a selection of theorems concerning product topologies and quotient topologies.

CO 19: Differentiable manifolds:

- Identification of the structure of a manifold and its examples.
- Learning about various concepts such as contraction, Exterior product, and Lie- derivative.
- Easy manipulation of the basic operation on tangent vectors, tangent space, and vector fields in local coordinate description.
- Gaining the basics of tensors and its forms.
- Study and understanding of the Riemannian geometry in a detailed manner.

CO 20: Fluid Mechanics:

- Understanding of the concepts of fluid and their classification, models and approaches to study the fluid flow.
- Familiarize with three dimensional motions, Kelvin's Theorem.
- Learning of the concepts of stress and strain in viscous flow.

CO 21: Complex Analysis-II:

- Understanding of deeper aspects of complex analysis such as Riemann Mapping Theorem.
- Knowledge about harmonic function theory on a disk.
- Enrichment of the students with concepts of convex and starlike functions, and close to convex functions.

CO 22: Partial Differential Equations:

- Techniques of finding the solutions of one dimensional Wave and Heat equations employing the methods in Partial Differential equations.
- Implementation of Laplace's equation in two dimensions and proving a selection of theorems.

CO 23: Classic Mechanics:

- Development of Mathematical skills with applications to physics.
- Understanding the basic principles of mechanics such as mechanics of a particle, Holonomic and Non- Holonomic constraints.
- Study and understanding of the Kepler's law in detail.
- Description and understanding of the motion of a mechanical system using Lagrange- Hamilton formalism.

CO 24: Geometry of Differentiable Manifolds:

- Elaboration of the concepts of differentiable manifolds geometrically
- Knowledge about the basic proficiency of Topological groups and Lie-groups.
- Application of the concepts of fibers and fiber bundles geometrically.
- Study of the complex form of Manifolds along with the properties.

CO 25: Mathematical Statistics –II:

- Deep study of the concepts of statistics those are more helpful in conducting research.
- Recognition and computation of the sampling distributions of means and variances and the t- and F- distributions.

- Understanding, applying and computing in one and two sample test of Hypothesis problems.
- Recognition of the concept of ANNOVA techniques.

CO 26: Category theory- II:

- Understanding of the basics concepts and methods of category theory.
- Deep knowledge of the Yoneda lemma and its applications.
- Application of categorical ideas and methods in wide range of area of mathematics.

CO 27: Numerical Analysis:

- Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.
- Study of the basic techniques for the efficient numerical solution of problems in science and engineering.
- Technical proficiency to solve the system of Elliptic and Hyperbolic equations.

CO 28: Commutative algebra:

- Localization of rings at prime ideal.
- Close observation of the polynomial rings in one or more variables over a commutative ring and their prime spectrum.
- Constructions of the concepts like tensor product and basic theory of it.
- Understanding the basic theory for support and associated prime ideals of modules and know primary decomposition of ideals.

CO 29: Operations Research:

- Identification and development of operation research models from the real system and understanding the mathematical tools that are needed to solve optimization problems.
- Demonstration of the network models and learning the various algorithms for their solution.
- Deep insights in the queuing and replacement problems.

CO 30: Non Linear Programming:

- Classification of the non-linear programming problems.
- Recognition of the unconstrained and constrained optimization methods, convex analysis, Lagrangian relaxation, non differentiable optimization, and applications in integer programming.
- Enhancement of the applications drawn from control, communications, power systems, and resource allocation problems.

CO 31: Analytic Number Theory:

- Deep insights in study of the various arithmetic functions, their properties and identification of the multiplicative and completely multiplicative arithmetic functions.
- Enrichment of the students to prove elementary result on sum over primes and use these to calculate averages of additive arithmetic functions.
- Description of the Dirichlet's characters and their applications.

CO 32: Theory of linear operator:

- Formal introduction of the notion of operators and linearity.
- Discussion of basic operator terminology and the linear operators.
- Basic proficiency of Null Spaces and Range Spaces in spectral theory.
- Deep insights into spectral properties of compact linear operators.

CO 33: Algebraic Coding Theory:

- Insight into matrix representation of a code as well as encoding and decoding.
- Understanding Hamming codes, BCH codes.
- Learning about cyclic codes and their generator polynomial.
- Construction of binary codes in different ways and error detection and correction by various methods.

CO 34: Algebraic Topology:

- Grasping the basics of Algebraic Topology covering spaces along with homotopy.
- Determining the fundamental groups of some standard spaces like Euclidean spaces and spheres.
- Understanding the theorems like Fundamental theorem of Algebra, Brower's fixed point theorem, Borsuk-Ulam theorem.

CO 35: Solid Mechanics:

- Recognition of stresses and deflection of beams on elastic foundation.
- Application of various failure criteria for general stress states at points.
- Analysis of solid mechanics problems using classical methods and energy methods.
- Analysis of the behavior of structural and machine components subject to various loading and support condition based on principle of equilibrium.

M.Sc. Statistics (2018-19)

PO:

- Students are able to conduct research independently and pursue higher studies towards the Ph.D. degree in statistics.
- Students have been developed with the attitude to read, have deep knowledge of concepts of various fields in Statistics.
- Development of knowledge of identifying and applying major statistical tools.
- Learning of the designs and development to give solutions to real life problems.

PSO 2:

- Provided with theoretical foundations that will motivate and prepare the students to take up theoretical and applied research in the field of Statistics.
- Covering of the design side of statistics including subjects like sampling and Design of Experiment.
- Students have learnt to use Mathematical tools, statistical computing tools.

CO 1: Statistical Inference –I:

- Familiarize with drawing the valid conclusions point estimation, minimum variance unbiased estimator.
- Learnt to apply a selection of theorems to practical problems.
- Students are able to estimate the parameters of the population and perform the testing for them.

CO 2: Design of Experiments:

- Learnt the fundamental concepts of design of experiments.
- Introduction to planning valid and economical experiments within given resources.
- Applications of Completely randomized design, Randomized block design, Latin square design, BIB designs, Youden squares.

CO 3: Industrial Statistics:

- Establishment of interest in statistical parameters in industries.
- Awareness of Time series analysis, trend measurement.
- Learnt the various Concepts like Acceptance quality level (A.Q.L), Lot tolerance proportion defective (LTPD) and indifference quality.

CO 4: Stochastic Processes:

- Introduction and classification of stochastic processes according to state, space and time domain.
- Learnt the Notions of Markov processes in continuous time and Chapman-Kolmogorov equations.
- Applications of Queuing in real life with single and multiple servers.

CO 5: Computer Oriented Statistical Practicals-III:

- Application of statistical software packages for statistical problems based on theory papers.
- Learnt the use of Statistical Software packages such as MS- Excel, SPSS, STATISTICA, Minitab etc.

CO 6: Statistical Inference-II:

- Learnt the Sequential testing procedure and various performance functions.
- Learnt the applications of a number of goodness of fit tests like chi-square test and Kolmogorov test and distribution-free nature of these tests.
- Learnt the Concept of nonparametric and distribution-free method.

CO 7: Operational Research (Programming):

- Learnt the formulation of real life problem into mathematical problem.
- Understanding of the importance of optimization of industrial process management and application of the basic concepts of mathematics to formulate an optimization problem.
- Applications of Linear Programming to transportation, assignment and game problem.

CO 8: Reliability theory:

- Learnt about the Reliability concepts and measures, components and systems.
- Learnt the Reliability estimation based on failure times in various censored life tests and tests with replacement of failed items.
- Knowledge of various reliability models and their applications.

CO 9: Multivariate Analysis:

- Introduction of various multivariate distributions.
- Conceptual study of simple, partial and multiple correlation and their sampling distributions.
- Description of Principal components and Canonical correlations in the population

CO 10: Computer Oriented Statistical Practicals-IV:

- Applying statistical software packages for problems based on Theory papers.
- Learnt the use of Statistical Software packages such as MS- Excel, SPSS, STATISTICA, Minitab more specifically.

P.O: The overall aims of B.Sc. (Hons) Mathematics (2018-2019)

- Create deep interest in learning mathematics.
- Develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.
- Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- Enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.
- Provide students/learners sufficient knowledge and skills enabling them to undertake Further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
- Encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

PSO-I

- First year subjects clear the basic manipulative skills of algebra, trigonometry and beginning level of calculus.
- Creates the interest in theory and application of the subjects.

CO 1: Differential Calculus

- Understand the concept of $(\epsilon-\delta)$ method
- Understand the concept of the n th order derivative using Leibnitz's theorem
- Familiarize with concavity convexity and Asymptotes
- Understand the concept of two or more variables for differential calculus.

CO 2: Algebra and Trigonometry

- Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots.
- Familiarize with relations, equivalence relations and partitions.
- Employ De Moivre's theorem in a number of applications to solve numerical problems.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank.
- Find eigen values and corresponding eigenvectors for a square matrix.

CO 3: Computer Fundamentals

- Understand the basic concepts, terminology of IT and familiar with the use of IT tools.
- Learn and explore new IT techniques in various applications and to identify the issues

related to security.

- Learn the working knowledge of hardware and software of computer.
- Learn the various features of MS-Office.

CO 4: Mathematical Foundation of Statistics

- Familiarize with definitions, aims, scope and significance of statistics.
- Know about A.M ,G.M ,H.M , Median , Mode, Quartiles, Deciles etc.
- Understand the concept of Correlation and regression.
- Familiarize with details of random variables .

CO 5:Sequence and Series

- Assimilate the notions of limit of a sequence and convergence of a sequence of real numbers.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers
- Gaining Knowledge of Different kinds of convergence criterion for series
- Gaining Knowledge of Different kinds of Tests for convergence/ Divergence.

CO 6: Differential Equation-I

- Understand the genesis of ordinary differential equations.
- Learn various techniques of getting exact solutions of solvable first order differential equations and linear differential equations of higher order.
- Grasp the concept of a general solution of a linear differential equation of an arbitrary order and also learn a few methods to obtain the general solution of such equations.

CO 7: Database Management System

- Gain a good understanding of the architecture and functioning of database management systems as well as associated tools and techniques, principles of data modelling using entity relationship and develop a good database design and normalization techniques to normalize a database.
- Understand the use of structured query language and its syntax, transactions, database recovery and techniques for query optimization.
- Acquire a good understanding of database systems concepts and to be in a position to use and design databases for different applications.

CO 8: Linear Programming

- Analyze and solve linear programming models of real life situations.
- Provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points.
- Understand the theory of the simple method.

- Know about the relationships between the primal and dual problems, and to understand sensitivity analysis.
- Learn about the applications to transportation, assignment and two-person zero-sum game problems.

PSO-II

- In second year abstract concepts and techniques in analysis, algebra and Geometry develops the ability to read and learn mathematics on their own.
- Students gain exposure in the field of computer science and related field.
- Developing keen interest toward higher mathematics

CO 9: Integral Calculus

- Analyze and find integral of Hyperbolic function, rational function , trigonometric function and logarithmic function .
- Understand the concept of Improper integral.
- Understand the concept of partition and fundamental concept Riemann Integrability.
- Understand the concept of multiple integral and Improper Integral.

CO 10: Linear Algebra

- Understand the concepts of vector spaces, subspaces, bases, dimension and their properties.
- Relate matrices and linear transformations, compute eigen values and eigen vectors of linear transformations.
- Learn properties of Rank and Kernel.
- Realise importance of adjoint of a linear transformation and its canonical form.

CO 11: Differential Equation –II

- Know Picard’s method of obtaining successive approximations of solutions of first order differential equations, passing through a given point in the plane and Power series method for higher order linear equations, especially in cases when there is no method available to solve such equations.

CO 12: Programming Using C

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

- Understand the basic terminology used in computer programming, Writing, Compiling and Debugging involving decision structures, loops and functions, arrays, strings and pointers.
- A student will be able to take up Systems programming or Advanced C programming course.

CO 13: Co-ordinate Geometry

- Understand the concept of eccentricity, pole, Polar and pair of tangents of conics.
- Understand the concept of chord, midpoint form and geometric properties of conics.
- Analyze the condition of tangency and normality of different conic sections.
- Understand the concept of shifting and rotation of the axis.

CO 14: Group theory

- Recognize the mathematical objects called groups.
- Link the fundamental concepts of groups and symmetries of geometrical objects.
- Explain the significance of the notions of cosets, normal subgroups, and factor groups.
- Analyze consequences of Lagrange's theorem.

CO 15: Numerical Method

- Obtain numerical solutions of algebraic and transcendental equations.
- Find numerical solutions of system of linear equations and check the accuracy of the solutions.
- Learn about various interpolating and extrapolating methods.
- Solve initial and boundary value problems in differential equations using numerical methods.
- Apply various numerical methods in real life problems

CO 16: Real Analysis

- Understand the concept of Bounded Variation and its properties.
- Solve Riemann-Stieltjes integral using Riemann integral.
- Understand the concept of series of function their convergence and uniform convergence.
- Solution of power series using different techniques

CO 17: Computer Networks and Internet Technologies

- Independently understand basic computer network technology and data communication systems.
- Identify the different types of network topologies.
- Understand the functions of the layers of the OSI and TCP/IP models.
- Identify the different types of network devices and their functions within a network
- Familiarity with the basic protocols of computer networks.
- Describe how communication works in computer networks and to understand the basic terminology of computer networks
- Design and create a media-rich dynamic websites to meet the specifications of clients using text, fonts, colors, images, tables, hyperlinks and other elements using technologies like HTML, CSS etc

CO 18: Solid Geometry & Vector Analysis

- Understand the concept of three dimensions
- Understand the different forms of plane using vector and Cartesian form
- Understand the concept of cone, sphere and cylinder and application to the daily life.
- Realize importance of vector in geometry using curl divergence and gradient .

PSO-III

- Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics and describe mathematical ideas from multiple perspectives.
- Students can explain fundamental concepts of mathematics to non-mathematicians.
- This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various public and private enterprises.

CO 19: Ring theory

- Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields.
- Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.

CO 20:Mathematical Method

- Know about piece wise continuous functions, Dirac delta function, Laplace transforms and its properties.
- Solve ordinary differential equations using Laplace transforms.
- Familiarize with Fourier transforms of functions belonging to L class, relation between Laplace and Fourier transforms.
- Learn Fourier series, Bessel's inequality, term by term differentiation and integration of Fourier series.
- Apply the concepts of the course in real life problems.

CO 21: Statics

- Familiarize with subject matter, which has been the single centre, to which were drawn mathematicians, physicists, astronomers, and engineers together.
- Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system of coplanar forces acting on a rigid body.
- Determine the centre of gravity of some materialistic systems and discuss the equilibrium of a uniform cable hanging freely under its own weight.

CO 22: Discrete Mathematics-I

- Learn about partially ordered sets, lattices and their types.
- Understand Boolean algebra and Boolean functions, logic gates, switching circuits and their applications.
- Solve real-life problems using finite-state and Turing machines.
- Assimilate various graph theoretic concepts and familiarize with their applications.

CO 23 : Object Oriented Programming Using C++

- Understand the difference between object oriented programming and procedural oriented language and data types in C++.
- Program using C++ features such as composition of objects, Operator overloading, inheritance, Polymorphism etc.
- Simulate the problem in the subjects like Operating system, Computer networks and real world problems.

- Implement various concepts related to language

CO 24: Complex Analysis

- Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy Riemann equations.
- Learn the role of Cauchy Goursat theorem and Cauchy integral formula in evaluation of contour integrals.
- Apply Liouville's theorem in fundamental theorem of algebra.
- Understand the convergence, term by term integration and differentiation of a power series.
- Learn Taylor and Laurent series expansions of analytic functions, classify the nature of singularity, poles and residues and application of Cauchy Residue theorem

CO 25: Linear Integral Equation

- Familiarize with linear integral equation of first and second kind
- Learn to obtain differential equation and Volterra equation from each other.
- Understand Fredholm's solution of integral equation for different values of determinants
- Know about symmetric kernel, Schwarz's Inequality and its applications.

CO 26: Dynamics

- Familiarize the concept of motion with constant acceleration and freely falling body.
- Know about the inclined motion and variable acceleration.
- Understand the concept of S.H.M and curvilinear motion.
- Familiarize the concept of Linear momentum, angular momentum, conservation of angular momentum, impulsive forces, principle of impulse and momentum.

CO 27: Discrete Mathematics-II

- Description of various discrete numeric functions.
- Familiarize with homogenous and non homogenous recurrence relations and their solution using generating functions.
- Observation of the complexity of the algorithms
- Basic study of Boolean Algebra, Boolean addition and multiplication with their application to switching theory.

CO 28 : Advanced Database Management System

- Gain a good understanding of the architecture and functioning of database management systems as well as associated tools and techniques, principles of data modelling using entity relationship and develop a good database design and normalization techniques to normalize a database.
- Understand the use of structured query language and its syntax, transactions, database recovery and techniques for query optimization.
- Acquire a good understanding of database systems concepts and to be in a position to use and design databases for different applications.

B.Sc. CSM Session 2018-19

PO:

B.Sc. CSM is 3 year degree program in Computer Science, Statistics and Mathematics. The well designed program provides an in-depth knowledge of Computer Science and its application which prepares the students to pursue higher study courses in computers like MCA. This program gives an insight to Statistics and its applications and enables students to go for higher studies in Statistics and crack competitive exams like Indian Statistical Service Examination (UPSC). Students learn Mathematics in-depth during this program and after completion they can also opt for higher studies in Mathematics. As a whole students get wide choices at the completion of this program.

PSO 1:

After completion of first year of program students are able to solve problems of Algebra, Trigonometry, calculus, differential equation, Geometry, Basic Statistics, Probability Theory and Fundamentals of Computer.

C O 1: Algebra:

After completing the course students have

- Learn methods to solve the equations
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigenvalues and corresponding eigenvectors for a square matrix.

CO 2: Trigonometry and Differential Calculus:

After completing the course students have completely

- Understand the importance of roots of real and complex polynomials
- Learn various methods of obtaining roots.
- Application of De Moivre's Theorem to solve numerical problems.
- Sketch curves in a plane using its mathematical properties in the cartesian coordinate system.

CO3: Descriptive Statistics and Introductory Probability

- Learn various techniques to represent data, variance in data and enable students to do analysis of variance by different techniques.
- Understand the concept of correlation and regression of data index numbers and time series.
- Introduction to probability and various theorems on probability.

CO4: Statistics Lab I

Enable students to solve problem based on

- Measures of Central Tendency
- Measures of Dispersion.
- Measures of Skewness
- Measures of Kurtosis.

CO5: Integral Calculus and differential equations

After completing this course, students have developed a clear understanding to:

- Compute area under the curve and length of curve
- Solve the exact, linear and Bernoulli equations and find orthogonal trajectories.
- Apply the method of variation of parameters to solve linear differential equations.
- Formulate and solve various types of first and second order partial differential equation.

CO6: Geometry

- Properties of ellipse, parabola and hyperbola.
- Be well-versed with sphere, cone and cylinder
- Able to relate the shape of real-life objects with the curves/conics.

CO7: Probability Theory

- Basic probability axioms and familiar with discrete and continuous random variables.
- To measure the scale of association between two variables and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
- Central limit theorem, which helps to understand the remarkable fact that the empirical frequencies of so many natural populations.

CO8: Statistics Lab II

Enable the students to solve problem based on Discrete Distribution:

- Fitting of Binomial Distribution
- Fitting of Poisson Distribution
- Fitting of Geometric Distribution
- Fitting of Negative-Binomial Distribution

PSO2:

After completion of second year of program, students understand the concepts of calculus and real analysis, Statistical Inference, applied Statistics and Computer language C++, Operating Systems and Web Technologies.

CO1: Advanced Calculus

- Be familiar with the concept of sequences, series .
- Recognize convergent, divergent, bounded, Cauchy and monotone sequences.
- Test the convergence and divergence of series using ratio test, root test and Leibnitz test.
- Understand the concept of Uniform continuity and differentiability of functions.

CO2:Differential Equation

- Origin of Partial Differential Equation and learnt methods to solve P.d.e.
- Laplace Transforms and its applications to solve system of differential equations.

CO3:Statistical Inference I

- Familiar of drawing the valid conclusions about the population from the sample when nature of the population is known.
- After completion of this course, students are able to estimate the parameters of the population and perform the testing for them.

CO4: Applied Statistics

- Understand the concept of data index numbers and its applications.
- Understand the concept of time series and its uses.

CO5: Statistics Lab III

Prepare the students to solve problems based on

- Unbiasedness
- Consistency
- Sufficiency
- Maximum likelihood method of estimation
- Method of moments

Enable the students for Tests of significance- Applications of following:

- Z-test
- Student's t-test
- Chi-square Test
- F-test

Tests of Independence of attributes- Contingency Tables.

CO6:Real Analysis

After completing this course, students should have developed a clear understanding of:

- Integrability of continuous and monotone functions.
- Recognition of the concept of Riemann Integration
- Convergence of improper Integrals
- The concept of limit, continuity and differentiability in two variables

CO7:Topics in Analysis

- Able to calculate the volume and surface area using Green, Gauss and Stoke Theorem.
- Introduction to the concept of Beta and Gamma functions.
- Representation of complex numbers geometrically.
- Introduction and application the concept of analytic function.

CO8:Statistical Inference II

- Familiar with Sampling Distributions
- Uses of Large Sample Tests

CO9: Industrial Statistics

- Quality Control, Process Control
- Understand Inventory Problem

CO10: Statistics Lab IV

Exercises based on Statistical Inference II and Industrial statistics.

PSO3:

At the completion of third year of program, students get an idea of abstract algebraic structures, graphs, algorithms, Mechanics, Numerical Methods, Design of Experiments, Java Programming and Software Engineering.

CO1: Abstract Algebra

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups etc.
- Explain the significance of cosets, normal subgroups, and quotient groups.
- Understand the fundamental concepts of rings, fields and integral domains.

CO2: Discrete Mathematics

- Know about various types of graphs such as complete and bipartite graphs.
- Understand graphs, their types and its applications in study of shortest path algorithms
- Understand Boolean Algebra and its applications.

CO3: Computer Oriented Numerical Methods

- Find the consequences of finite precision and the inherent limits of numerical methods.
- Appropriate numerical methods to solve algebraic and transcendental equations.
- Solve first order initial value problems of ODE's

CO4: Sample Surveys

- After completion of this course, students are able to differentiate between non-probabilistic and probabilistic sample surveys.
- They are aware about various errors in a survey and able to perform statistical analysis of a real sample surveys.

CO5: Statistical Lab V

- Draw a random sample from a normal population.
- SRS without replacement variance is less than the variance obtained from sampling with replacement.
- Verify- sample mean is an unbiased estimator of population mean.
- Using proportional allocation technique draw the sample.

CO6: Linear Algebra

- Recognize the algebraic structure vector spaces, subspaces and quotient spaces.
- Understand the fundamental concepts of Linear Transformation
- Identification of square matrix as operator.
- Matrix representation of linear operator.

CO7: Mechanics

- Learn about friction, centre of gravity, work and potential energy in statics.
- Know about various topics in dynamics such as simple harmonic motion, simple pendulum and projectile motion.

CO8: Linear Programming

- Analyze and solve linear programming models in real life situations.
- Provide graphical solutions to linear programming problems in two variables
- Illustration of concept of convex set and extreme points.
- Learn the applications to Transportation, Assignment and game problems

CO9: Design and Analysis of Experiments

After completing this course, students have developed a clear understanding of:

- The fundamental concepts of design of experiments.
- Introduction to planning valid and economical experiments within given resources.
- Completely randomized design, Randomized block design, Latin square design.

CO10: Statistical Lab VI

Examples based on

- Analysis of variance: One way classification, two way classification with m observations per cell.
- Design: CRD, RBD, LSD, BIBD, PBIBD
- 2^2 and 2^3 factorial experiment