

Course and Programme Outcomes of Mathematics Honours Under NEP

Semester-1

Paper: DS1

Algebra

Learning Outcomes: On completion of this course, the student will have a clear-cut understanding of some important concepts of Classical Algebra, Abstract Algebra & Linear Algebra as follows:

- Understand the nature of Hyperbolic functions.
- Polar representation of complex numbers, n -th roots of unity, De Moivre's theorem for rational indices and its applications. Exponential, logarithmic, trigonometric and hyperbolic functions of the complex variable.
- Theory of equations: Relation between roots and coefficients, transformation of the equation, Descartes rule of signs, Sturm's theorem, cubic equation (solution by Cardan's method) and biquadratic equation (solution by Ferrari's method).
- Inequality: The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.
- Relation: equivalence relation, equivalence classes & partition, partial order relation, poset, linear order relation.
- Mapping: injective, surjective, one to one correspondence, invertible mapping, composition of mappings, relation between the composition of mappings and various set theoretic operations. \
- Well-ordering property of positive integers, Principles of Mathematical induction, division algorithm, divisibility and Euclidean algorithm. Prime numbers and their properties, Euclid's theorem. Congruence relation between integers. Fundamental Theorem of Arithmetic. Chinese remainder theorem. Arithmetic functions, some arithmetic functions such as φ , τ , σ and their properties.
- Rank of a matrix, inverse of a matrix, characterizations of invertible matrices.
- Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation $AX = B$, solution sets of linear systems, applications of linear systems.

Paper: DS2

Calculus

Learning Outcomes: After completion of this course, the students will be able to understand the concept of real-valued functions, limit, continuity, and differentiability in detail. They can find expansions of real functions in series forms. The students will become conversant with many of the important theorems of Differential Calculus after the completion of this Major Course which has been covered in the following topics:

- Rolle's Theorem, Mean value theorems of Lagrange and Cauchy — as an application of Rolle's theorem. Taylor's theorem on closed and bounded interval with Lagrange's and Cauchy's form of remainder deduced from Lagrange's and Cauchy's mean value theorem respectively. Expansion of e^x , $\log(1+x)$, $(1+x)^m$, $\sin x$, $\cos x$ with their range of validity (assuming relevant theorems). Application of Taylor's theorem to inequalities.
- Statement of L'Hospital's rule and its consequences. Point of local extremum (maximum, minimum) of a function in an interval. Sufficient condition for the existence of a local maximum/minimum of a function at a point (statement only). Determination of local extremum using first order derivative. Application of the principle of maximum/minimum in geometrical problems.
- Develop an idea of convergence and working knowledge of Beta and Gamma and their interrelation.
- Compute different integrals when they exist (using Beta and Gamma function).
- Find higher order derivatives and apply the Leibnitz rule to solve problems related to such derivatives.
- Plot the graphs of polynomials of degree 4 and 5, the derivative graph, the second derivative graph and compare them.
- Apply the concept and principles of differential calculus to find the curvature, concavity and points of inflection, envelopes, rectilinear asymptotes (Cartesian & parametric form only) of different curves.
- Apply the concept and principles of differential calculus to solve different geometric and physical problems that may arise in business, economics and life sciences.
- Derive Reduction formulae for some complex integrations and hence Integrate functions of a much higher degree which are applicable in real life situations.
- Apply the integral calculus to find arc length of a curve, arc length of parametric curves, area under a curve, surface area.

Graphical Demonstration

- Visualize and graphically demonstrate geometric figures and classify different geometric solids using teaching aid - preferably free software's :
 - ✓ Tracing of conics in Cartesian coordinates/ polar coordinates.
 - ✓ Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic paraboloid, and hyperbolic paraboloid using Cartesian coordinates.
- Understand the basic applications of the analytical plane and solid geometry.

Programme Outcome

The Certificate Degree in B.Sc. Mathematics is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements sought to be acquired by learners at the end of this program. Hence, the learning outcomes of Mathematics for this course are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge of mathematics. Mathematics is the study of quantity, structure, space and change. It has very broad scope in science, engineering and social sciences. The key areas of study in Mathematics are Calculus, Algebra.

Programme Specific Outcome of Certificate course in B.Sc. Mathematics

- Think in a critical manner.
- Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of mathematics and statistics.
- 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.

Certificate Course in Mathematics is the culmination of in-depth knowledge of algebra and calculus. This also leads to study of related areas like computer science, Financial Mathematics, statistics and many more. Thus, this programme helps learners in building a solid foundation for higher studies in mathematics. The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This can be utilized in modelling and solving real life problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society. Students completing this programme will be able to present mathematics clearly and precisely, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians. This programme will also help students to enhance their employability for government jobs, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.