

Department of Mathematics

Programme Outcome of Mathematics Honours under CBCS

PO-1. A Bachelor's degree in mathematics honours is the accumulation of depth knowledge of algebra, calculus, geometry, differential equations, partial differential equation, Laplace transform etc. and other branches of mathematics in this curriculum.

PO-2. The skills and knowledge gained by a student may be utilised in mathematical modelling, solving real life problems with proper explanation.

PO-3. After completing this programme, a student will be able to present mathematics clearly and precisely, by formulating a real-life problem. To explain a problem in micro and or macro level they can use several mathematical tools along with proper software.

PO-4. After successful completion of this program a student will place themselves in higher study in several premier institute like IIT, CMI, TIFR, IISER etc. as well as in several state and central universities.

PO-5. After completing this program students will also be able to join teaching professions in primary and secondary level.

PO-6. The students may take preparation for different job like Banking Service, WBCS, IAS, Insurance and Investment Sectors, Data Analyst jobs in various public and private sectors either in campusing procedure or by forced application.

PO-7 The student can build career as Operations Research Analyst, Data Analyst.

Programme Outcome of B. Sc. Generic Elective Courses

PO-1. The students after completion of Bachelor's Degree in a core course namely, Physics, Chemistry, Economics, Statistics, Micro-Biology with basic knowledge in mathematics (as a general subject) they can enrich their subjective skills. The combined knowledge of algebra, calculus, geometry, differential equations, linear programming and computer programming help them in higher study in respective discipline.

PO-2. After completing this program, a student will be able to present a topic (related to mathematics) clearly and precisely. They can formulate a real-life problem precisely in the language of mathematics and explain the result obtained after mathematical solution.

PO-3. After completing this programme students will also be able to join teaching professions in different level.

PO-4. This program will also help students to enhance their employability in Government jobs, jobs in Banking, Insurance, investment sectors and jobs in various other public and private sectors.

Course Outcome of Mathematics Honours under CBCS

Corse Code	Course Name	Course Outcome
CC1	Calculus, Geometry & Vector Analysis	<p>On completion of this course, the student will be able to</p> <ol style="list-style-type: none"> draw a curve with more accuracy by studying the nature of different point on this curve. Also validate the theoretical knowledge by plotting a plane curve with the help of computer. find the arc length of a plane curve, volume and surface area of a solid obtained by revolution of an arc/ plane area about an axis. solve problems on tangents, normal, chords of a conic in two-dimensional analytical geometry (both cartesian and polar curve). understand the concept of three-dimensional analytical geometry (cartesian system) and will be able to solve problems related to those topics within this course. solve various problems related to the course of vector analysis, which has useful applications in various branches of Mathematics and Physics.
CC2	Algebra	<p>On completion of this course, the student will go through</p> <ol style="list-style-type: none"> complex numbers, theory of equations, inequalities which will be foundation of complex analysis of the course CC-13 of Semester-6. relation, mapping, basic concepts of number theory which will foundation of Discrete Mathematics in DSE-B1.1 of Semester-5. basis of matrix theory and its application to linear system of equations which will be an introduction of linear algebra-I in CC-6 of Semester-3.
GE1	Mathematics GE-1	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> concept of complex number, polynomial and matrix theory and problem-solving skill related to these topics. concept of real number, limit continuity and differentiability of a real valued function. Also, the concept of partial derivatives and problem-solving skills. knowledge on ordinary differential equation and the existence and uniqueness of solution of ODE. Also, formation and solution of second order ODE. skill for solving problems on pair of straight lines, classification of conics and reduction of their standard forms, tangents, normal, chords of a conic in two-dimensional analytical. skill three-dimensional analytical geometry plane, straight line, sphere and cone.
AECC1	BNGM/ENGC/URDM	
CC3	Real Analysis	<p>On completion of this course, the students will go through</p> <ol style="list-style-type: none"> Real number system as a complete ordered field with celebrated Bolzano Weierstrass theorem, open set, closed set and dense set in \mathbb{R}. the concept of sequence, convergence of a sequence and its important theorems. concept of a series as a sequence of partial sum, series of positive terms, series of arbitrary terms and related theorems. This course will make a foundation of metric space in CC-13 of SEM-6 and point set Topology in DSE-B (2).1 of SEM-6.
CC4	Group Theory-I	<p>On completion of this course, the students will acquire knowledge on</p> <ol style="list-style-type: none"> basic concept of group theory with the help of several examples, several properties, concept of sub-groups, center of a group and centralizer of a group. the concept of cyclic group, finite group, permutation group, coset and its applications along with Lagrange's theorem and Fermat's theorem. the concept of Normal subgroup, Quotient group, Cayley's theorem, properties of isomorphisms. First, Second and Third isomorphism theorems. basic group theory and skill to solve the related problems that will make a foundation for the second part of this course to be given in Semester – 5 in the course of CC-12
AECC2	ENVS	
CC5	Theory of Real Functions	<p>On completion of this course, the students will acquire knowledge on</p> <ol style="list-style-type: none"> limit, continuity, uniform continuity of a function (ϵ-δ) approach, sequential criterion, properties of continuous and uniform continuous function, related theorems. Types of discontinuity of a function. differentiability of a function at appoint. Relation between continuity and differentiability of a function and the theorems. the concept of maxima and minima of a function in an interval and applications towards various problems. This portion plays to key role in the applied sciences, especially on ordinary differential equations, Multivariate Calculus-I in CC-7 of SEM-3.

CC6	Ring Theory & Linear Algebra-I	On completion of this course, the students will acquire knowledge on 1. rings, properties of rings, subring, integral domains, fields, subfield, characteristic of a ring, ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals. Ring homomorphisms, properties of ring homomorphisms, isomorphism and related theorems. 2. vector spaces, subspaces, algebra of subspaces, significance of subspace, quotient spaces, linear transformation, algebra of linear transformations, Isomorphisms, eigenvalues, eigenvectors and characteristic equation of a matrix. This portion plays to key role in the higher study on linear algebra, specifically help to study CC-12 of SEM-6.
CC7	Ordinary Differential Equation & Multivariate Calculus-I	On completion of this course, the students will acquire knowledge on 1. acquire elementary knowledge and skill of solving problems on certain types of linear and non-linear partial differential equations, also acquire knowledge on certain types of second order partial differential equations and their applications in Mathematical Physics. 2. solving various problems related to vector calculus which has useful applications in various branches of Mathematics and Physics. 3. solving various problems related to multivariate calculus, which is a powerful tool for understanding the geometry of real n-dimensional space.
SEC A	C Programming Language	On completion of this course, the students will acquire knowledge on 1. foundation of computer, different generation, hardware and software, algorithm, flowchart. 2. solving various problems with C-programming which may/may not be solved analytically. 3. solving various problems related to numerical analysis, dynamical system, non-linear system with the help of computer programming as most of the usual software like R / Python / Mat-Lab / Mathematica depends on C-programming.
GE3	Mathematics GE-3	On completion of this course, the students will acquire 1. concept of improper integration, Beta and Gamma functions, convergence of improper integration and its applications. 2. concept of numerical methods, interpolation, differentiation, integration and numerical solution of transcendental equations. 3. knowledge on linear programming and basic idea of linear algebra, different methods of LPP and problem-solving skills.
CC8	Riemann Integration & Series of Functions	On completion of this course, the students will acquire knowledge on 1. Reimann integration which is a generalization of definite integration. Concept of negligible set, application of Lebesgue theorem, properties of integrable function, algebra of integrable function, concept of primitive, celebrated Fundamental theorem of integral calculus. 2. occurrence of improper integral and their convergence, beta and Gamma functions and their applications. 3. concept of sequence of functions, point of convergence, uniform convergence, power series and their convergence to the limit function.
CC9	Partial differential equation & Multivariate Calculus-II	On completion of this course, the students will acquire 1. elementary knowledge and skill for solving problems of certain types of linear and non-linear partial differential equations, also acquire knowledge on certain types of second order partial differential equations and their applications in Mathematical Physics. 2. elementary knowledge and skill of solving problems on multiple integral and centre of gravity, surface and volume of revolution. knowledge on vector calculus and their applications in Mathematical Physics.
CC10	Mechanics	On completion of this course, the students will acquire 1. knowledge and skill for solving problems on Analytical Statics related to coplanar forces, friction, virtual work, forces in three dimension, stable and unstable equilibrium and centre of gravity. 2. knowledge of rectilinear and planar motion of a particle in both cartesian and polar system, simple harmonic motion, central orbit, motion under inverse square law and planetary motion. 3. knowledge and skill for solving problems on system of many particles, collision of elastic bodies, work-power-energy.
SEC B	Scientific computing with Sage Math & R	On completion of this course, the students will acquire knowledge on 1. basic concept and skill on numerical and symbolic computations using mathematical functions. 2. solving various problem graphically and few functions through plotting in a given interval. Plots of curves with asymptotes, superimposing multiple graphs in one plot like plotting a curve along with a tangent on that curve. 3. solving a system of linear equations, finding roots of a given polynomial, solving differential equations.

GE4	Mathematics GE-4	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. concept of group theory, ring theory, field, sub-field and its applications. Also the concept of vector space, Euclidean space, real quadratic form, eigenvalue and eigenvector. 2. basic knowledge on computer hardware, software, positional number system, idea of different Languages like BASIC, FORTRAN, C, C++, COBOL, PASCAL, etc. 3. knowledge on ordinary differential equation and the existence and uniqueness of solution of ODE. 4. basic concept of mathematical probability, conditional probability, distribution, expectation one and two dimensions. 5. skill for handling statistical data, computation of sample mean, variance and other characteristics.
CC11	Probability & Statistics	<p>On completion of this course, the students will acquire knowledge</p> <ol style="list-style-type: none"> 1. on various aspects of the theory of mathematical Probability and skill for solving problems related to various one and two-dimensional probability distributions. 2. on the basic concept of statistical theory build up on the basis of probability theory and skill for solving problems on parameter estimation, like point and interval estimation, concept of hypothesis and their various application based on real life data.
CC12	Group Theory-II & Linear Algebra-II	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. on vector space that will allow them to appreciate Linear algebra as a tool for learning Geometry of higher dimensional spaces through the language of Algebra. They will also be able to solve problems related to matrix theory up to orthogonalization. This will be continued further in CC-12 of Semester-6. 2. on Euclidian Space which will help them to understand the mathematical theory behind the Linear Programming problems to be taught in DSE-B(1).2 of Semester-5.
DSE A1	Bio Mathematics	<p>On completion of this course, the students will acquire knowledge</p> <ol style="list-style-type: none"> 1. on application of dynamical systems, about which they acquired knowledge in CC-7 of SEM-3. 2. on mathematical modelling on biological problems. Since most of the natural phenomenon in the real life are complex in nature, generally we can not investigate by any exact model. In this discipline specific elective paper, they will acquire some techniques by which mathematical model can explain such complex models. 3. on the behavior of discrete and continuous population and their behaviors, which are studied by applying the different tolls of linear and non-linear system of ODE and PDE.
DSE B1	Linear Programming & Game Theory	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. fundamental knowledge on the theory of basic and basic feasible solutions and their properties, convex sets based on the knowledge of linear algebra studied in previous semesters. 2. the skills on the solution of a Linear Programming Problem by Simplex Method. Also acquire knowledge on duality, transportation problem, assignment problem and travelling salesman problem. 3. some knowledge on the basic theory of game problems and their solution by different methods which has many applications in Economics.
CC13	Metric Space & Complex Analysis	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. concept of metric space and its properties, convergence sequence, Cauchy sequence, completeness property, Cantor's intersection theorem. 2. continuous mapping, uniform continuity, sequential compactness, Heine-Borl theorem in R. 3. some of the elementary knowledge of Complex analysis, Analytic function, contour integration and its applications.
CC14	Numerical Methods	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. concept and theoretical knowledge of numerical analysis, that will lay the foundation for solving such problems via computer programming to be done side by side using their knowledge of programming language C already acquired from the course SEC-A of Semester – 3. 2. basic skill for solving problems via computer programming related to various numerical methods on interpolation, numerical differentiation and integration, differential equations and finding roots of an equation.
CC14P	Numerical Methods Lab.	<p>On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. practical knowledge of numerical methods and how to compute the value of a measurable quantity with more accuracy. 2. knowledge for computing micro-level computations with the help of computer with desired accuracy. For this purpose, they already acquired knowledge on C-Programming in SEC-A in SEM-3.

DSE A2	Fluid Statics & Elementary Fluid Dynamics	<p>On completion of this course, the students will acquire knowledge</p> <ol style="list-style-type: none"> 1. to understand the concept of fluid statics and dynamics of fluid particles. 2. on hydrostatic force and use of law of conservation mass to fluid flow and also the concept of volume conservation of fluid. Also acquire knowledge on Lagrangian and Eulerian system and their relations. 3. on Bernoulli's equation to fluid flow problems and boundary layer theory to determine lift and drag forces on a submerged body and also Renold's number.
DSE B2	Topology	<p>Course Outcomes: On completion of this course, the students will acquire</p> <ol style="list-style-type: none"> 1. concept of topological spaces, basis and sub-basis for a topology, continuity of a function in topological space, finite product topology, homeomorphism, isometry and metric invariants. 2. concept of separation axioms of topological spaces, connected and compactness in Topological spaces. <p>This course is a basis of modern Mathematics. Topological spaces are a generalization of metric spaces.</p>