VIDYANAGAR COLLEGE
VIDYANAGAR, P.O.- CHARASHYAMDAS, SOUTH 24 PARGANAS,PIN-743503
DEPARTMENT OF MATHEMATICS
UG (B.Sc.) HONOURS AND GENERAL PROGRAMME OUTCOMES:

The CBCS Course curriculum is well designed and very promising where the core course would help to enrich the subject knowledge of the students and generic electives make integration among various interdisciplinary coursers. The introduction of Skill Enhancement Courses (SEC) and Discipline Specific Courses (DSE) would help to gain more powerful knowledge not only in their core Mathematics subject but also in interrelated multidisciplinary subjects and also helps them to become familiar and expert in handling different mathematics based software after proper training. In brief the student graduated with this type of curriculum would be able to accumulate the subject knowledge along with the necessary skills to suffice their capabilities for academia, entrepreneurship and industry.

Programme outcome (PO)
Name of the Programme: B.Sc. (Hons.)

PO	Description
PO1	**Gain a depth knowledge in the discipline of science by exchanging problem solving skills.**
PO2	**Acquire through understanding about scientific methods and apply these in solving scientific problems by analyzing practical data using qualitative and quantitative methods**
PO3	**Solve problems in different fields like health, industries etc. and can carry out research projects independently in various kind of industries.**
PO4	**Develop scientific, communicative and numerical skills and make rewarding careers in science and education by facing challenging competitive exams.**
PO5	**Acquire innovative ideas through practical experiments**
PO6	**Demonstrate the ability to communicate mathematical ideas clearly. They will use correct mathematical terminology and proper mathematical notations.**
PO7	**Develop and maintain problem solving skills.**
PO8	**Write and understand basic proof of mathematics.**

PROGRAMME SPECIFIC OUTCOMES

Name of the Programme: B.Sc. (Hons.)

PO	Description
PSO1	**Gain a strong knowledge in different areas of mathematics and solve real life problems by mathematical models.**
PSO2	**Gain numerical skills and exploring these ideas in competitive examinations, internships with confidence.**
PSO3	**Developing problem solving skills to solve day to day problems**
PSO4	**Apply knowledge of principles, concepts and results in specific subject area to analyze their impact both locally and globally.**
PSO5	**Doing research in the field of mathematics, Engineering, information technology, computer science and social science.**
PSO6	**Gain scientific knowledge and skills in mathematics, statistics or its allied areas.**
PSO7	**Develop and maintain problem solving skills in mathematics.**
PSO8	**Write and understand basic proof of mathematics in lower to higher level.**

Course Outcomes

Semester	Course Code	Course Outcomes
SEM-I	CC-1-1-TH and CC-1-1-TU Calculus, Geometry& Vector analysis	Upon successful completion of this course, students will be able to: ➢ Compute limits, derivatives, and integrals. ➢ Analyze functions using limits, derivatives, and integrals. ➢ Recognize the appropriate tools of calculus to solve applied problems. ➢ Get an overview of basic calculus, hyperbolic functions, curve tracing, applications of L'Hospitals rule in different of mathematics. ➢ Describe the various forms of equation of a plane, straight line, Sphere, Cone and Cylinder. ➢ Find the angle between planes, Bisector planes, Perpendicular distance from appoint to a plane, Image of a line on a plane, Intersection of two lines. ➢ Define coplanar lines and illustrate. ➢ Compute the angle between a line and a plane, length of perpendicular from a point to a line. ➢ Define skew lines, calculate the Shortest distance between two skew lines. ➢ Find and interpret the gradient curl, divergence for a function at a given point. ➢ Interpret line, surface and volume integrals, evaluate integrals by using Green's Theorem, Stokes theorem & Gauss's Theorem. ➢ Get an overview of 2D and 3D figures in geometry

Semester	Course Code	Course Outcomes
		Students will be able to ➢ Employ De Moivre's theorem in a number of applications to solve numerical problems . ➢ Apply Cardons method (solve cubic equation) and Ferrari's method (solve Bi-quadratic equation).

SEM-I	**CC-1-2-TH and CC-1-2-TU** **Algebra**	➢ Apply the inequality to the problems of maxima and minimum. ➢ Complex functions are really helpful for understand the complex analysis. ➢ Complex numbers are used in real life applications such as electricity, and also to signal processing , which is use full in cellular technology and wireless technologies, as well as radar and even biology(brain waves). ➢ Anyone can judge about dependency between two rows and two columns of a matrix with the help of rank. ➢ In our real life we use system of linear equations in the regards of age problem, speed related problems, wages and hourly rate problems.
SEM-II	**CC-2-3-TH and CC-2-3-TU** **Real Analysis**	This course will enable the students to : ➢ To define sequence in terms of functions from R to subset of R. ➢ Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence. ➢ Enumerate the limits of functions ,infinite limits and limit at infinity ➢ Demonstrate, describe, and recognize ways in which limit do not exit. ➢ Evaluate one sided limits and describe relationship between limits and one sided limits. ➢ Develop solutions for tangent and area problems using the concepts of limits, derivatives. ➢ Draw graphs of algebraic and transcendental functions considering limits continuity and differentiability at a point. ➢ Articulate the relationship between derivatives and integrals using the fundamental theorems of calculus. ➢ Predict in various cases, like where the speed in a given curve was maximum without differentiation by Rolle's theorem.

Semester	Course Code	Course Outcomes
SEM-II	CC-2-4-TH and CC-2-4-TU Group Theory-I	➢ The course will enable the students to: ➢ Recognize the mathematical objects called groups. ➢ Link the fundamental concepts of groups and symmetries of geometrical objects.
SEM-III	CC-3-5-TH and CC-3-5-TU Theory of Real Functions	➢ To enumerate the limits of functions, infinite limits and limit at infinity ➢ To demonstrate, describe and recognize ways in which limit do not exit. ➢ To evaluate one sided limits and describe relationship between limits and one sided limits. ➢ To develop solutions for tangent and area problems using the concepts of limits, derivatives . ➢ To draw graphs of algebraic and transcendental functions considering limits continuity and differentiability at a point. ➢ To articulate the relationship between derivatives and integrals using the fundamental theorems of calculus. ➢ To predict in various cases, like where the speed in a given curve was maximum without differentiation by Rolle's theorem.
	CC-3-6-TH and CC-3-6-TU Ring Theory and Linear Algebra-I	➢ To know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields. ➢ To learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields. ➢ Ring theory has many applications to the study of geometric objects, to topology and in many cases their links to other branches of algebra are quite well understood. ➢ The polynomial ring, Homomorphism, Ideal, Integral Domain all are very important for higher study and interview. ➢ There is a fantastic relation between linear transformations and matrix representation. ➢ A student can study L.T by knowing matrix properties.
	CC-3-7-TH and CC-3-7-TU	➢ Will be able to explain the concept of differential equation.

	ODE & Multivariate Calculus-I	➢ Will be able to solve first-order ordinary differential equations. ➢ Will be able to find solution of higher order linear differential equations. ➢ Will be able to solve systems of linear differential equations. ➢ Areas of surface integrals and curvature. ➢ Maxima and minima, lagrange multiplier ,directional derivatives, level sets. ➢ Any of the operations of vector calculus including gradient, divergence, and curl. ➢ Multivariate calculus can be applied to analyze deterministic systems that have multiple degrees of freedom . ➢ It is used in many fields of natural and social science and engineering to model and study high dimensional systems that exhibit deterministic behavior.
SEM-IV	**CC-4-8-TH and CC-4-8-TU** **Riemann Integration & Series of Functions**	➢ ➢ Improper Integrals are very common in probability and statistics. ➢ The Laplace transform, the Fourier transform and many special functions like Beta and Gamma are defined using improper integrals, which appear in a lot of problems and computations. ➢ By the help of uniform convergence students can conclude easily compactness, connectedness of a set.
	CC-4-9-TH and CC-4-9-TU **PDE& Multivariate Calculus-II**	➢ Students will have the knowledge and skills to: ➢ Apply arrange of techniques to find solutions of standard Partial Differential Equations (PDE) ➢ Understand basic properties of standard PDE's. ➢ Demonstrate accurate and efficient use of Fourier analysis techniques and their applications in the theory of PDE's. ➢ Demonstrate capacity to model physical phenomena using PDE's (in particular using the heat and wave equations). ➢ Apply problem-solving using concepts and techniques from PDE's and Fourier analysis applied to diverse situations in physics,

		➢ Use double, triple and line integrals in applications, including Green's Theorem, Stokes' Theorem and Divergence Theorem. ➢ Synthesize the key concepts of differential, integral and multivariate calculus.
Semester	**Course Code**	**Course Outcomes**
SEM-IV	**CC-4-10-TH and CC-4-10-TU** **Mechanics**	➢ To understand the D'Alemberts principle and simple applications. ➢ To study the concept of Equations of motion and the equivalent one dimensional problem. ➢ To understand the Kepler's problem and inverse square law of force.
SEM-V	**CC-5-11-TH and CC-5-11-TU** **Probability & Statistics**	➢ To determine whether two events are mutually exclusive and whether two events are independent. ➢ To understand continuous probability density functions in general. ➢ Torecognize the standard normal probability distribution and apply it appropriately. ➢ To recognize central limit theorem problems. ➢ To describe hypothesis testing in general and in practice. ➢ To conduct and interpret hypothesis tests for two population proportions. ➢ To discuss basic ideas of linear regression and correlation.
	DSE-B-5-1-TH and DSE-B-5-1-TU	➢ Students will have the knowledge and skills to ➢ Formulate a given simplified description of a suitable real-world problem as a linear programming model in general, standard and canonical forms. ➢ sketch a graphical representation of a two-dimensional linear programming model given in general, standard or canonical form. ➢ Classify a two-dimensional linear programming model by the type of its solution. ➢ Solve a two-dimensional linear programming problem graphically

	Linear Programming & Game Theory	➢ use the simplex method to solve small linear programming models by hand, given a basic feasible point. ➢ The transportation model can be defined as the determination of only one commodity that is being transported from one destination to various locations. ➢ To distinguish a game situation from a pure individual's decision problem, ➢ To explain concepts of players, strategies, payoffs, rationality, equilibrium, ➢ To describe sequential games using game trees, and to use the backward induction to solve such games.
SEM-VI	**CC-6-13-TH and CC-6-13-TU** **Metric Space & Complex Analysis**	**Students will able to** ➢ This course provide the ideas of metric spaces, open ball, bounded set, limit point and subspace of the metric spaces. ➢ Convergence sequence, Cauchy sequence, continuous mapping and uniform continuity. ➢ Concept of compactness, connectedness. ➢ Contraction mapping, Banach fixed point theorem and its application to ordinary differential equations. ➢ Know the concept of Stereographic projection, continuity of functions, differentiability, analytic functions, power series, Cauchy integral formula.
	CC-6-14-TH and CC-6-14-P **Numerical Methods and Labs**	➢ Define Basic concepts of operators Δ, E, ∇ ➢ Find the difference of polynomial ➢ Solve problems using Newton forward formula and Newton backward formula. ➢ Derive Gauss's formula and Stirling formula using Newton forward formula and Newton backward formula. ➢ Find maxima and minima for differential difference equation ➢ DeriveSimpson's1/3,3/8rulesusingtrapezoidalrule ➢ Find the solution of the first order and second order equation with constant coefficient ➢ Find the summation of series finite difference techniques

		➢ Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods.
	DSE-A-6-2-TH and DSE-A-6-2-TU **Differential Geometry**	Students will able to ➢ About the tensor and their properties like metric tensor, Riemannain space, covariant differentiation, Einstiens space. ➢ Theory of Space curves and theory of surfaces. ➢ Ideas of developables and geodesics.
SEM-VI	**DSE-B-6-2-TH and DSE-B-6-2-TU** **Point Set Topology**	Students will able to ➢ Provide the ideas of topological spaces, basis, sub-basis, metric topology, topological invariant, isometry and metric invariants. ➢ Know about the separation axioms of topological spaces, connectedness, compactness and Bolzano-Wierstrass property of topological spaces.

Choices for Skill enhancement Courses (SEC)
SEC-I (Semester-III)
NOTE: *A student has to opt for any one of the subjects available under each category.*

Course Outcome for Mathematics Honours SEC (Semester-III)

Sem-III	**SEC-A-TH** **C-Programming Language**	Students will able to ➢ Overview of theoretical computers, programming language, importance of C programming. ➢ Programming Paradigms, brief history of C, C++ and differences between them. ➢ Template class in C++, copy instructor, subscript and function call operator, exception handling.

Course Outcome for Mathematics Honours SEC (Semester-IV)

Sem-IV	**SEC-B-TH** **Mathematical logic**	Students will able to know about the ➢ Fundamental concept of logical arguments, idea of Boolean algebra. ➢ Concept of propositions, derivations, truth table, CNF, DNF. ➢ Tautology, distinguish an illogical statement from logic statement.

Course outcome (PO)
Name of the Programme: B.Sc. (Gen.)

Course Outcomes:

Sem-I	CC-1-1-TH & CC-1-1-TU Algebra-I, Differential Calculus-I, Differential Equation-I and Coordinate Geometry	Students will able to know about ➢ Complex numbers, Polynomials. Rolle's theorem and its direct applications. ➢ Rank of a matrix, consistency and solution of a system of linear equations with not more than 3 variables by matrix method. ➢ Rational numbers, real valued functions defined on an interval, limit and continuity of a function. ➢ Derivative, successive derivative, partial derivatives, chain rule, Euler's theorem on homogeneous function of two and three variables and applications of Differential Calculus. ➢ Order, degree and solution of an ordinary differential equation and its formation. ➢ Transformations of Rectangular axes, general equation of second degree in x and y. ➢ Pair of straight lines, Polar equation of straight lines and circles, equations of tangent and normal. Sphere and its tangent plane. Right circular cone.

Sem-II	**CC-2-2-TH & CC-2-2-TU** **Differential Calculus-II, Differential Equation-II, Vector Algebra and Discrete Mathematics.**	Students will able to know about ➢ Sequence of real numbers, concept of convergence and divergence of sequence and series, Cauchy's general principle. ➢ Real values functions defined on an interval, indeterminate forms, applications of the principle of maxima and minima. ➢ Linear Homogeneous and non-homogeneous differential equations. Simple eigen value problems. ➢ Linear and non linear partial differential equations and its formation. Lagrange's and Charpit's method. ➢ Vectors and its applications to geometry. Collinear and coplanar vectors. Applications of vectors to problems of Mechanics. ➢ Integers, congruences, application of congruences, congruence classes. ➢ Boolean algebra, logic gates, minimization of circuits.

Sem-III	**CC-3-3-TH & CC-3-3-TU** **Integral Calculus, Numerical methods, Linear programming**	Students will able to know about ➢ Evaluation of definite integrals and its application to conics, reduction formula, Beta-Gamma function and their convergence. ➢ Define Basic concepts of operators Δ, E, ∇ ➢ Problem of interpolation, difference tables, ➢ Newton forward formula and Newton backward formula. ➢ Find maxima and minima for differential difference equation ➢ Simpson's 1/3 rule, trapezoidal rule. ➢ Bisection and Newton Raphson method with geometrical significance. ➢ Linear programming problems and its formation, hyperplane, convex sets, simplex method, two phase method, duality. ➢ Fundamental theorem of linear programming problem, transportation and assignment problems and their optimal solutions.

Sem-IV	**CC-4-4-TH & CC-4-4-TU** **Algebra-II, Computer Science and programming, Probability and Statistics**	Students will able to know about ➢ Introduction to group theory, ring, field, sub-ring, subfield. ➢ The vector space over a field, real quadratic form involving not more than three variables. ➢ Characteristic equation of square matrix, Cayley Hamilton theorem. ➢ Computer science and programming. Operating system, hardware and software. ➢ Positional number system, binary and decimal number system. ➢ Programming language like BASIC. FORTRAN, C, C++, COBOL, PASCAL , etc. ➢ Algorithms and flow chart. ➢ Elements of probability theory. ➢ Binomial, Poisson and Normal Distribution and their properties. ➢ Elements of Statistical Methods. ➢ Sampling theory and Bivariate frequency distribution.

Sem-V	**DSE-A-TH** **DSE-A-TU** **Particle Dynamics**	Students will able to know about ➢ Velocity and Acceleration of a particle, tangent and normal components. ➢ Concept of force, Newton's laws of motion, conservation of energy and momentum. ➢ Study of motion of a particle in a straight line. Simple harmonic motion, Forced and Damped oscillation. ➢ Motion in two dimensions. ➢ Central orbit, Kepler's law of motion, motion under inverse square law.

Sem-VI	**DSE-B-TH** **DSE-B-TU** **Advanced Calculus**	Students will able to know about ➢ Concept of sequence and series of functions, uniform convergence, boundedness, continuity, differentiability and integrability of the limit function. ➢ Power series, Radius of convergence, periodic function, Fourier series, Dirichlet's condition. ➢ Laplace transform and its applications to ordinary differential equations, existence theorem.