PROGRAMME SPECIFIC OUTCOMES (PSO)

MATHEMATICS (HONOURS)

2020-2021

PSO1: At the end of the course the students are capable of applying mathematical modelling as required in various subjects such as physical sciences, economics and business studies.

PSO2: The students are capable of expressing and formulating applied problems in terms of mathematical and statistical languages.

PSO3: The students are able to use computational and algorithmic versions to solve real life problems.

PSO4: The students study mathematical logic which develops the spirit of analytical thinking in them.

PROGRAMME OUTCOMES (PSO)

MATHEMATICS (HONOURS)

2020-2021

	PROGRAMME OUTCOME	**DESCRIPTION**
PO1	Critical Thinking	Upon completion of the course in mathematics the student will understand the fundamental role of the concepts of limit, continuity, derivability and apply them in solving problems arising in physical and social sciences.
PO2	Effective Communication	The language of mathematics is the universal language to formulate, analyze, and derive conclusions of problems solvable through traditional as well as computational methods.
PO3	Social Interaction	The student will be able to identify and describe the underlying principles behind mathematical techniques relevant to academia, industry and government.
PO4	Ethics	Students will appreciate the central role of mathematics in our society and use this as a basis for ethical behaviour in issues facing mathematicians including an understanding of rational handling of modern computational and numerical methods, environmental issues and key issues facing our society in energy and bio mathematical modelling.
PO5	Environment and Sustainability	Mathematics is crucial to finding sustainable solutions to far reaching challenges, including space science, earth sciences, healthcare and environmental protection.
PO6	Self-directed and Lifelong Learning	Mathematics plays the key role to facilitate the evolution of our modern society. This area helps B.Sc. mathematics graduates to express theoretical and applied concepts through effective writing and oral communication skills.

COURSE OUTCOMES (CO)

MATHEMATICS (HONOURS)

2020-2021

SEMESTER	COURSE	PAPER		COURSE OUTCOME
I	CC2	Algebra	CO1	Students will learn Complex numbers, Theory of equations, Inequality, Linear difference equations, Relation, Mapping, integers, matrix.
II, V	CC4, CC12, DSE A(1)	Group Theory	CO2	Students will learn Basic properties of groups, dihedral groups, cycle decomposition and symmetric groups, subgroups, cosets, and Lagrange's Theorem; cyclic groups and subgroups, quotient groups and normal subgroups; Isomorphism Theorems, alternating groups group actions, Cayley's Theorem, Class Equation, Sylow's Theorem and applications; simplicity of An; direct products, the Fundamental Theorem of Finitely Generated Abelian Groups and applications.
III, V	CC6, CC12, DSE A(1)	Ring Theory	CO3	Students will learn Basic properties of rings and subrings; homomorphisms, isomorphisms, quotient rings and the Isomorphism Theorems; ideals, prime ideals, maximal ideals, integral domains, Rings of fractions; Chinese Remainder Theorem, Euclidean Domains, Principal Ideal Domains, Unique Factorization Domains, polynomial rings, factorization in one variable, Gauss' Lemma, irreducibility criteria, Eisenstein's Criterion.

III	CC6	Linear Algebra	CO4	Students will learn Vector spaces, spanning sets, independence, bases, subspaces, quotient spaces, linear transformations and their matrix representation, computation of the image, rank, nullity and kernel of a linear transformation; change of basis, similarity; determinants; eigenvalues and eigenvectors; characteristic and minimal polynomials, Gram-Schmidt orthonormalization process, Hessian matrix, Sylvester's law of inertia, Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms (Jordan & rational).
V	CC11	Probability & Statistics	CO5	Students will learn Random experiment, Sample space, probability axioms, probability, Conditional probability, probability mass/density functions, mathematical expectation, moments, distributions, Joint cumulative distribution function, joint probability density functions, moments, covariance, correlation, regression, Bivariate normal distribution, Markov and Chebyshev's inequality, Convergence, weak law of large numbers and strong law of large numbers, Central limit theorem, Sampling and Sampling Distributions, Sampling Distributions, Estimation of parameters, Maximum likelihood method, Statistical hypothesis, Bivariate frequency Distribution
II, III	CC3, CC5	Real Analysis	CO6	Students will learn Basic Calculus, Real number system, convergence of sequences and series, continuity, differentiability, Riemann integral, sequences and series of functions, uniformity, and the interchange of limit operations, improper integral, Fourier series

VI	CC13	Complex Analysis	CO7	Students will learn Stereographic projection. Regions in the complex plane. Limits, Continuity of functions of complex variable, Derivatives, Cauchy-Riemann equations, sufficient conditions for differentiability, Analytic functions, exponential function, logarithmic function, trigonometric functions, hyperbolic functions, Mobius transformation, Power series, Contours, complex integration along a contour and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem , Cauchy integral formula.
VI	CC13, DSE B(2)	Topology & Metric Space	CO8	Students will learn Topological space, comparing topologies; subspace, finite product topologies, closed sets and limit points, continuous functions, metric topology, quotient topology (including projective spaces and gluing cells), connectedness in the real line and in general spaces, components, compactness, limit point compactness, countability axioms, separation axioms, normal spaces and Urysohn's Lemma, complete metric spaces, Banach contraction.
I	CC1	Calculus	CO9	Students will learn Hyperbolic functions, higher order derivatives, curve tracing, applications of calculus, Reduction formulae, Parametric equations and parametrizing curve, area under a curve, area and volume of surface of revolution.
VI	CC14	Numerical Methods	CO10	Students will learn Errors,Operators, Interpolation, numerical differentiation and integration, solution of nonlinear equations, system of linear equations, eigenvalue problems, numerical solution of ODE
III	CC7	Differential Equation	CO11	Students will learn Ordinary Differential Equation and Partial Differential Equation

III	CC7	Multivariate Calculus	CO12	Students will learn Topology of R^n, functions from R^n to R^m, limit and continuity, partial derivatives, total derivative and differentiability, directional derivatives, Extrema of functions of two variables, Lagrange multipliers, constrained optimization problems. Multiple integral, vector field, divergence, curl, Line integrals, applications, Green's theorem, surface integrals, Stoke's theorem, Divergence theorem.
I	CC1	Geometry	CO13	Students will learn Rotation of axes and second degree equations, classification of conics using the discriminant, tangent and normal, polar equations of conics. Plane, Straight lines in 3D: Equation (Symmetric & Parametric form). Direction ratio and direction cosines, Spheres. Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid. Tangent and normals of conicoids.
I	CC1	Vector	CO14	Students will learn Vector and Scalar, Position Vector, Product of two or more vectors, Applications of Vector algebra, Triple product, vector equations, applications to geometry and mechanics — concurrent forces in a plane, theory of couples, system of parallel forces. Introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions of one variable.
IV	SEC B	Mathematical Logic	CO15	Students will learn Propositional and Predicate Logic
V	DSE B(1)	LPP	CO16	Students will learn Definition and formation of LPP, Hyperplane and Convex set, Simplex method, Two phase method, Duality,

				Transportation & Assignment, Game Theory
VI	DSE A(2)	Mathematical Modelling	CO17	Students will learn Power series solution of Bessel's equation and Legendre's equation, Laplace transform and application to IVP Monte Carlo simulation modelling, generating random numbers, queuing models, Overview of optimization modelling, Linear programming model.
IV	CC10	Mechanics	CO18	Students will learn Coplanar forces in general, An arbitrary force system in space, Equilibrium in the presence of sliding Friction force, Virtual work, Stability of equilibrium, Kinematics of a particle, Newton laws of motion and law of gravitation, Problems in particle dynamics, Planar motion of a particle, Motion of a particle in three dimensions, linear momentum principle, angular momentum principle, energy principle.
III	SEC A	C Programming	CO19	Students will learn Operation and Expressions, Decision Making and Branching, Control Statements, Arrays, User-defined Functions, Introduction to Library functions

CO-PO MAPPING

MATHEMATICS (HONOURS)

2020-2021

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	✓	✓	✓			✓

CO2	✓	✓	✓			✓
CO3	✓	✓	✓			✓
CO4	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓
CO6	✓	✓	✓			✓
CO7	✓	✓		✓	✓	✓
CO8	✓	✓				✓
CO9	✓	✓	✓	✓	✓	✓
CO10	✓	✓	✓	✓	✓	✓
CO11	✓	✓	✓	✓		✓
CO12	✓	✓	✓	✓		✓
CO13	✓	✓	✓		✓	✓
CO14	✓	✓				✓
CO15	✓	✓	✓		✓	✓
CO16	✓	✓	✓		✓	✓
CO17	✓	✓	✓			✓
CO18	✓	✓			✓	✓
CO19	✓	✓	✓	✓	✓	✓