<u>**Department of Mathematics**</u>

<u>**Programme Outcomes, Course Outcomes and Programme Specific Outcomes**</u>

<u>**Mathematics Honours**</u>

<u>**Programme Outcome**</u>

P01 Critical Thinking

Acquired the knowledge with facts and figures related to mathematics. Demonstrate mathematical thinking, skills, progressing from a procedural and computational understanding of mathematics to logical reasoning, abstraction, generalization, formal proof and pattern recognition.

P02 Effective Communication

Improve communication with precision, clarity, organization, proper terminology and notation. Develop the ability of mathematics to communicate scientific information and research results in written and oral formats.

P03 Social Interaction

Provide knowledge about mathematical properties and its application for developing technology to ease the problems related to the society. Learn professionally including the ability to work in teams and apply basic ethical principles in society.

P04 Ethics

Imbibed of mathematical knowledge and skills appropriately it gives us professional activities and demonstrate highest standard of ethical issues in mathematics.

P05 Environment and Sustainability

Understood the basic concepts , fundamental principles, and the scientific theories related to various mathematical phenomena and their relevancies in the day-to-day life automatically enhance our awareness about social evils, blind faith etc.

P06 Self directed and Lifelong Learning

Continue to increase the knowledge of mathematics we realized that pursuit of knowledge is a lifelong activity and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life

Course Outcome

CO 1

- Its acquainted applications of differentiation in business, economics in life sciences. How to integrate a function by reduction formula if needed.
- Preliminary concept of two dimensional and three dimensional geometry.
- Vector analysis and graphical demonstration.

CO 2

- Elaborate discussions on complex number, inequality, and linear difference equation upto 2nd order.
- Concept of relations, mapping, integers, partial order relation, linear order relation Euclid's Theorem, congruence relation, Chinese remainder theorem,
- Matrix Equation ,Applications of linear systems.

CO 3

- Intuitive idea of real numbers and concept of neighbourhood of a point. Bolzano Weirstrass Theorem, Order completeness,Dense sets in R,
- Discussions on sequence of real number, Subseuential limits and behaviour of infinite series.
- Graphical demonstration.

CO 4
- Preliminary idea of group theory., Normalizer, centralizer, centre of a group, product of two subgroups
- Properties of cyclic groups.
- Normal subgroups and its properties, Caley's Theorem, First, second and Third Isomorphisms

CO 5
- Limit and continuity of functions, Uniformoty Continuity of Functions
- Differentiability of functions, Darboux Theorem, Rolle's Theorem, Lagranges and Cauchy Mean Value Theorem
- Mean value theorems and consequence of L' Hospital's rule.
- Elaborate discussions on local maximum and minimum of functions

CO 6
- Elaborate discussions on Ring theory, Field, Ideal, Ideal generated by subset of a ring, Factor rings, Prime idealsand maximal Ideals, Ring Isomorphism Theorem (First, Second and Third)
- Concept of vector spaces.

• Linear transformation.
• Cayley-Hamilton theorem and its use in finding inverse of a matrix.

CO 7
• Discussions about ordinary differential equations., Basic Theory of linear systems in normal form, Homogeneous Linear system equations with constant coefficient , Linear equation second Order, Wronskian, Planar Linear autonomous system, Equilibrium (critical) points, power series solution of a differential equations
• Multivariate calculus-I

CO 8

• Concept of Riemann of integration, Necessary and sufficient conditions for Riemanian integrability,
• Fundamental theorem of integral calculus.,
• First mean value theorem of integral calculus
• Discussions on improper integral.
• Series of Functions, Power series, Fourier Series

CO 9

• Fundamental idea of partial differential equations.
• Cauchy problem of finite and infinite string.
• Multiple integrals.
• Intuitive idea of vector field.
• Multivariate Calculus II, Green's theorem, surface integrals Stoke's Theorem and The Divergence Theorem

CO 10

• Coplanar forces in general and equilibrium in the presence of sliding frictional forces, an arbitrary force system in space
• Concept of virtual work and stability of equilibrium.
• Discussions on kinematics of a particle and principle of momentum and energy.
• Problem in particle dynamics.
• Planar motion of a particle and motion of particle in three dimensions.
• Many particle system: the linear momentum principle
• The angular momentum principle and the energy principle.

CO 11

• Elaborate discussions on Probability:
• Discussions on Statistics.
• Graphical demonstration.
• Statistical Hypothesis
• Graphical Demonstration

CO 12

• Elaborate idea on automorphism of a group, application of a factor group, Fundamental theorem for finite abelian group

- External direct product of groups and its properties.
- Concept of inner product space., Gram-Smidt orthonormalisation process, Bessel's inequality
- Eigen spaces and minimal polynomial of a linear operator, Caley Hamilton theorem, the minimal polynomial for a linear operatorand canonical forms (Jordan & rational)

CO 13

- Preliminary idea of metric space, convergent sequence Cauchy sequence, Cantor intersection theorem in metric spaces
- Contraction mappings and Banach fixed theorem and its application to ordinary differential equations.
- Concept of Stereographic projection.
- Fundamental concept of limit and continuity of functions of complex variables.
- Complex integration.
- Power series: Cauchy hardamard theorem Analytic function represented by power series and uniqueness of power series.

CO 14

- Concept of errors, polynomial approximation, and method of interpolation.
- Numerical differentiation and integration.
- Numerical solution of non-linear and ordinary differential equations.
- Solution of the system of linear algebraic equations.

Programme Specific Outcome

PSO1 : Mathematics will help us to apply critical thinking skills to solve problems that can be modeled mathematically, to critically interpret numerical and graphical data.

PSO2 : The Department of Mathematics offers excellent opportunities for analyze complex mathematical problem in both pure and applied mathematics.

PSO3 : Propose new mathematical questions, to read and construct mathematical arguments and proofs, to use computer technology appropriately to solve problems and to promote understanding, to apply mathematical knowledge to a career related to mathematical sciences or in post-baccalaureate studies.

PSO4 : It has been a continuous effort from the department to develop the research skills among the students by providing them different projects not in the syllabi and to think in different way.

B.Sc. General Programme in Mathematics

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Course Outcomes

CO 01
Students are encouraged to study the complex number in details, specially they can use the De Moivre's theorem to find the root of the equations. Students can find the nature of a root by Descartes rule of sign and using the Strum function.

Student acquired detail of real number systems, limit, continuity and differentiability of a real valued functions and several variable functions.

Discussions about ordinary differential equations. Second order linear equation have been solved by different methods e.g., Variation of parameters and undetermined coefficients.

General equation of second degree has been classified by using transformation of axes.

CO 02
.• Differentiability of functions,
 Rolle's Theorem, Lagranges and Cauchy Mean Value Theorem
• Mean value theorems and consequence of L' Hospital's rule.
• Elaborate discussions on local maximum and minimum of functions
• Sequence and infinite series of real numbers.
• Application to the problems of mechanics though vector algebra.
• Principle of mathematical induction
• Linear Diophantine equation, Euclid's theorem
• Congruence relations and its' Applications and congruence class.

CO 03

- Reduction formula of integration and working knowledge of double integral.
- Numerical methods for integration and numerical solutions of algebraic and transcendental equations .
- Linear Programming problems and its' application on real life and corporate sector.

CO 04

- Preliminary idea of group , ring and field theory and its' application on different area.
- Application of Caley Hamilton theorem
- Some knowledge of computer language, e.g, C, C++ and Fortran
- Basic knowledge of probability and statistics and its'applications.

CO 05 SEC A (Skill Enhancement Course)

- Some applications of computer language.

CO06 SEC B (Skill Enhancement Course)

- Propositional logic
- Predicate logic

CO 07 SEC A (Skill Enhancement Course)

- Application of C++
- Difference between C and C++

CO 08 SEC B (Skill Enhancement Course)

- Concepts of ordered sets , maps between ordered sets, duality Principle, maximal and minimal elements

CO 09 DSE –A (Discipline Specific Elective)

- Study of motion of a particle in straight lines and two dimensions, Central force and its' orbit.

CO 10 DSE –A (Discipline Specific Elective)

- Elementary property of graph theory and its'applications

CO 11 DSE –B (Discipline Specific Elective)

- Concepts of pointwise and uniform convergence of sequences and series of functions
- Solutions of differential equation by Laplace transform

- Fourier series and determination of Fourier coefficients.

CO 12 DSE –B (Discipline Specific Elective)

- Comparison NPV and IRR Bonds., bond prices, floating rate bonds.

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PO/CO MAPPING (MATHEMATICS)

	P01	P02	P03	P04	P05	P06
C01			*			
C02	*					
C03	*					
C04	*			*		
C05	*			*		*
C06	*					
C07		*			*	
C08	*					
C09			*			
C010			*			
C011	*	*				*
C012	*					
C013	*					
C014		*				