B.A/B.Sc (NM and CS)

## Programme Specific Outcomes (Mathematics)

**PSO1:** Develops analytical abilities for data analysis which requires percentage, average, regression, linear expressions.

**PSO2:** Enable to approach problems in analytical way, formulate theories and apply them to solve problems.

**PSO3:** Enable to arrange things or actions in a certain order or pattern according to a specific rule or set of rules.

**PSO4:** Improves the logical reasoning, enhances the critical thinking and investigating skills.

**PSO5:** Provides basic knowledge to understand coding theory, image processing.

**PSO6:** Enables higher studies and research in the field of Mathematics.

**PSO7:** Offers job opportunities in teaching, cryptography, mathematical modelling.

**PSO8:** Understand various real- world problems, expresses through mathematical models and solves through various analytical and numerical methods.

**PSO9:** Gives the capability to build career as Numerical Analyst, Statistician, Market researcher, Computer programmer, information technologist etc.

**PSO10:** Helps to understand various natural phenomena like simple harmonic motion, motion of celestial bodies.

**PSO11: Teaching:** A mathematics Graduate can works as teacher in school and can run their own coaching centre .

**PSO12: Base for Higher Study:** Enable the students for higher studies and research in the field of Mathematics, Statistics, Operational Research.

**PSO13: Wide career prospects** : There is a demand of mathematics students in fields as statistics, engineering, computer science ,insurance, economics, astronomy, banking and accounts.

**PSO14: Competitive Exam**: A student of mathematics is good in logical reasoning and basic maths, there fore able to clear competitive exam.

## COURSE OUTCOME OF MATHEMATICS BA /B SC (NM & CS)

**(ALGEBRA)**

**Paper code: BM -- 111**

**CO 1:** Algebra makes the students being able to understand and answer on the topics of matrices and their uses. Algebra helps the students transfer their mathematical knowledge to more algebraic generalizations.

**CO 2:** Students will solve problems using equations, graphs and tables to investigate linear relationships. Also, students will be able to use Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations.

**CO 3:** Also, it develops the ability of finding Relations between the roots and coefficients of general polynomial equation in one variable. And it deals with the solutions of quadratic, cubic and Biquadratic equations.

**(CALCULUS)**

**Paper code: BM – 112**

**CO 1:** Calculus gives the students ability to understand the basic properties of limit, continuity and differentiation.

**CO 2:** Students will learn different forms of Maclaurin and Taylor series expansions, different type of asymptotes and curvature and about tracing of different types of curves, reduction formulae and Rectification.

**CO 3:** Students will be able to calculate Quardrature (area), Sectorial area and area bounded by closed curves, Volumes and surfaces of solids of revolution.

**CO 4:** Learn about anti-derivative and the fundamental theorem of calculus and its applications, to use concept of integration to evaluate geometric area and solve other applied problems

**(SOLID GEOMETRY)**

**Paper code : BM – 113**

**CO 1:** Solid Geometry deals with the geometry of the 3D surfaces like sphere, cone, cylinder, paraboloid. In this we identify, describe, compare and classify different geometric solids and visualize and represent geometric figures with special attention to spatial relationship.

**CO 2:** After completing this course of B.Sc., the students will be able to understand and answer on the formation of these surfaces and some other geometric features of these surfaces.

**CO 3:** From this paper, the students learn the tracing of 2D and 3D surfaces also. Develop an appreciate of geometry and means of describing physical world.

**(NUMBER THEORY AND TRIGONOMETRY)**

**Paper code : BM – 121**

**CO 1:** from this course, the students will be able to find quotients and remainders from integral divison.

**CO 2:** They will learn about different concepts of Congruence and related theorems and different tyes of functions such as Greatest integer function [x]. The functions d(n) and σ(n)). Mobius function and Mobius inversion formula.

**CO 3:** Also, they will be able to know about De Moivre's Theorem and its Applications, Expansion of trigonometrical functions, Direct circular and hyperbolic functions and their properties, Inverse circular and hyperbolic functions and their properties, Logarithm of a complex quantity, Gregory's series, Summation of Trigonometry series.

**(ORDINARY DIFFERENTIAL EQUATIONS)**

**Paper code : BM – 122**

**CO 1:** Ordinary differential equation makes the students being able to understand and answer on the Geometrical meaning of a differential equation, Exact differential equation and solutions of different type of linear and non linear differential equations.

**CO 2:** As many of the real world phenomena are expressible in terms of differential equations and from this paper, the students learn to solve different mathematical models written in terms of ordinary differential equations.

**CO 3:** Also, students learn the concepts of integration from this paper. Identify a general method for constructing solutions to inhomogeneous linear constant coefficient second-order equations.

**(VECTOR CALCULUS)**

**Paper code : BM – 123**

**CO 1:** Vector Calculus is widely used in engineering mathematics. The students will be able to understand and answer about vectors, product of vectors, directional derivatives, Gradient, divergence and curl related concepts.

**CO 2:** Further, this paper helps the students to find line, surface and the volume integrals of the surfaces. This paper has lots of importance in physics and other applied branches of Mathematics.

**CO 3:** Vector Calculus helps us to understand how to mathematically describe physical and abstract quantities that have both magnitude and direction, increases knowledge of properties of functions whose domain consists of real numbers and range consists of vectors including differentiation and integration.

**BM – 231 Advanced Calculus**

**CO 1:** The students will be able to understand concepts of Continuity, Uniform continuity, differentiation.

**CO 2:** They will learn about geometrical interpretations and problem solving on Darboux, MVT, Rolle's Theorem and Taylor's Theorem with various forms of remainders.

**CO 3:** Understanding of continuity of real functions and differentiability of real functions with its related theorems.

**Paper-BM:352, Groups and Rings**

**CO 1:** The students will be able to understand the importance of algebraic properties, group structures to finite permutation groups, group generators with specific conditions. Symmetry using group theory.

**CO 2:** The students learn group homomorphism, ring homomorphism, Euclidean Domain, Unique Factorization Domain, principal Ideal domain, polynomial Rings.

**CO 3:** Recognition of rings, subrings, integral domain and fields, characterstics of a ring, Ideal and quotient rings.

**CO15: Paper-BM:353, Numerical analysis**

**CO 1:**Numerical analysis deals with the study of various numerical methods. As many of the non linear problems does not have an exact solution and in particular, it is too difficult to find the exact solution. So, in such cases, only approximate solution can be obtain with the hel of numerical methods.

**CO 2:** The course aims at familiarizing the students with difference operators, interpolation with equal and unequal intervals, central difference interpolation, probability distribution of random variables, numerical integration, numerical solution of ordinary differential equations.

**CO 3:** The students should be shown the ability of working independently and with groups.

**Paper :BM-361,real and complex analysis**

**CO 1:** The students will be able to understand the , Jacobians, Beta and Gama functions, double and triple integrals , Drichlet integrals,change of order of integration in double integrals.

**CO 2:** Fourier series :Fourier expansion of piecewise monotonic functions ,properties of fourier coefficients ,Drichlets condition , Parseval identity for Fourier series ,fourier series for even and odd functions ,Half range series ,change of intervals ,extended complex plane ,stereographic projection of complex numbers, continuity and differentiability of complex functions ,Analytic functions ,Cauchy Riemann equations, harmonic functions.

**CO 3:** They also learn mapping by elementary functions:Translation ,Rotation ,Magnification and Inversion ,Conformal mappings,Mobius transformations, fixed point ,cross ratio ,invariant points, critical mapping.

**BM-362,Linear Algebra,**

**CO 3:** Also, they will be able to find limit and continuity. Partial differentiation, extremum of real valued functions of two variables, properties of Homogenous functions, various concepts of curves and surfaces in differential geometry.

**BM – 232 Partial Differential Equations**

**CO 1:** After completing this course, students will be able to understand Partial differential equations, Formation, order and degree, Linear and Non-Linear Partial differential equations.

**CO 2:** The students learn different type of techniques for investigating the linear partial differential equations in one and two dimensions such as Laplace's equation. Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

**CO 3:** Students will be able to expand one variable functions in series along basis of orthogonal functions.

**BM – 233 Statics**

**CO 1:** Students will be able to understand Composition and resolution of forces. Parallel forces. Moments and Couples, Analytical conditions of equilibrium of coplanar forces.

**CO 2:** Demonstrate understanding of principle of kinematics and kinetics of particles and planar rigid body and identify techniques for measurement using instrumentation with recognition of the principle of data collections.

**CO 3:** Friction. Centre of Gravity, Virtual work. Forces in three dimensions. Poinsots central axis, Wrenches. Null lines and planes. Stable and unstable equilibrium.

**CO10:BM – 241 Sequences and Series**

**CO 1:** The students will be able to understand Boundedness of the set of real numbers: least upper bound, greatest lower bound of a set, neighbourhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. **CO 2:** Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem and Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequence's, Subsequentially limits, Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series.

**CO 3:** Hyper Harmonic series or p-series, also Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's Nth root test, Gauss Test, Cauchy's integral test, Cauchy's+ condensation test, Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: Abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem,

Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only). Multiplication of series, Cauchy product of series, (definitions and examples only) Convergence.

**BM – 242 Special Functions And Integral Transforms**

**CO 1:** The course deals with the study of different functions, polynomials, different transformations and their applications for solving ordinary differential equations and partial differential equations.

**CO 2:** Students will be able to demonstrate a sound understanding of elementary functions, analytically Cauchy Riemann equations.

**CO 3:** After completing this course, students will be able to understand Series solutions of differential equations, Beta and Gamma functions, Bessel equation, Legendre and Hermite functions, Laplace transforms, Fourier transforms.

**CO12: BM – 243 Programming in C & Numerical Methods**

**CO 1:** The students will be able to understand Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / outputs functions, Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Pre-processors and Arrays, Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters.

**CO 2:** Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Pointers Data type, Pointers and Arrays, Pointers and Functions. Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method.

**CO 3:** Newton's iterative method for finding pth root of a number, Order of convergence of above methods, Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method. This enables to understand various real- world problems, expresses through mathematical models and solves through various analytical and numerical methods.

**Paper-BM:351, Real analysis**

**CO 1:** The students understands Riemann integral ,integrability of continuous and monotone functions ,the fundamental theorem of integral calculus ,mean value theorems of integral calculus, improper integral and their convergence ,comparison tests ,abels and Driehlets tests , Frullani's integral integral as a function of parameters.

**CO 2:** They will be able to define and understand the series of real numbers and their convergence. Students will be able to use the Bolzano Weistrass Theorem.

**CO 1:** The students will know about vector spaces and subspaces sum and direct sum of subspaces, linear span, linear dependence and independence finite dimensional vector spaces ,invariance of the number of elements of basis sets ,dimensions ,quotient space and its dimension, homomorphism and isomorphism of vector spaces.

**CO 2:** The students learn linear transformation and linear forms of vector spaces, dual spaces and bidual spaces, null space and range space of a linear transformation, rank and nullity theorem , algebra of linear transformations, minimal polynomial of linear transformations , singular and non singular linear transformations

**CO 3:** The students learn inner product spaces, Cauchy-schwarz inequality ,orthogonal vectors, orthogonal complements , orthogonal sets and basis, Bessel inequality of finite dimensional vector spaces, Gram-Schmidt orthogonalization process, adjoint of linear transformation and its properties, Unitary linear transformations.

**Paper :BM-363, Dynamics**

**CO 1:** The students know about velocity and accerlation along radial, transverse ,tangential and normal directions.

**CO 2:** They also understands relative velocity and accerlation ,simple harmonic motion ,elastic strings, mass, momentum and force, Newtons laws of motion, work power and energy, definition of conservative forces and impulsive forces ,motion on smooth and rough plane curves.

**CO 3:** The students learn projectile motion of the particle in plane, vector angular velocity ,general motion of the rigid body: Central orbits , Keplers law of motion, motion of the particle in three dimensions, accerlation in terms of different co-ordinate systems.

**BBA-104: Business Mathematics-I**

After completing this course

**CO1** students will be able to understand and solve the problems related to Set theory, logical statements and truth tables.

**CO2** Students able to solve linear and quadratic equations.

**CO3** Students learn about Permutations and combinations. Binomial theorem.

**CO4** will gain knowledge on the topic Limit and continuity, differential calculus (including maxima and minima; excluding trigonometric functions),

**CO5** Learn detailed knowledge of Matrices and determinate, solution to linear equations by using Cramer's rule and matrix inversion method.

**BBA-112: Business Mathematics-II**

**CO1** students will be able to understand and solve the problems related to Plane Analytical Geometry.

**CO2** Learn about on Arithmeticrithmetic, geometric and harmonic progressions.

**CO3** Obtain knowledge on ntegral calculus, definite integral and its application in business.

Learn the basics of Logarithm, Law of operations, log tables,

**CO4** Will able to learn practical problems of compound interest.

**FOR B.COM.**

**( BUSINESS MATHEMATICS-I )**

**Paper code BC – 105**

**CO1** the students will be able to understand and answer on the topic of Logarithms, Anti-logarithms.

**CO2** Get knowledge on Sequences and Series: Arithmetic & Geometric Progressions.

**CO3** Will be able to learn basics of Differentiation with its applications.

**CO4** Will understand the concept of Matrices and Determinants and able to solve linear equations.

**CO5** Students acquired knowledge of Compound Interest and Annuities and able to solve; problems relating this topic

**CO8( BUSINESS MATHEMATICS-II )**

**Paper code: BC – 205**

**CO1** the students will be able to understand and answer on the topic of Permutations and Combinations,

**CO2** Students able to understand basics of Binomial Theorem.

**CO3** Able to solve Linear inequalities and it's graphical solution.

**CO4** Able to learn about data representation and interpretation introduction and representation of data: significance of diagrams and graphs.