DEPARTMENT OF MATHEMATICS

PROGRAMME OUTCOMES OF UNDERGRADUATE PROGRAMMES	
(2019 ONWARDS)	
NAME OF THE PROGRAMME: B.Sc MATHEMATICS	
PO1	Utilized the principles of scientific enquiry, thinking analytical, clearly and critically, while solving problems and making decision.
PO2	Have an appropriate set of professional skills to ensure a productive career.
PO3	Be able to analyze, test, interpret and form independent judgments in both academic and non-academic contexts.
PO4	Be prepared for life-long learning.
PO5	Communicated effectively with whom they are interacting and the society to make effective presentations to give and receive clear instructions.
PO6	Exhibit positive attitudes and values toward the discipline, so that they can contribute to an increasingly complex and dynamic society.

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COURSE OUTCOMES OF UNDERGRADUATE PROGRAMMES(2021 ONWARDS)

Name of the programme : B.Sc Mathematics

Course Code	Course Title		Course Outcome
		SEMESTER – I	
21UMA01	CLASSICAL ALGEBRA	CO 1	Gain knowledge about binomial, exponential and logarithmic series
		CO 2	Examine the consistency of linear equations and application of Cayley-Hamilton theorem
		CO 3	Know the application of relations between the roots and coefficients of an equation
		CO 4	Analyse the method of solving reciprocal equations and diminishing the·roots of an equation
		CO 5	Examine the existence of roots of an equation and determine the roots by using Newton's and Horner's methods
21UMA02	CALCULUS	CO 1	Gain knowledge about curvature and envelopes.
		CO 2	Gain knowledge about integration and its applications.
		CO 3	Students will be able to find maxima and minima, critical points and inflection points of functions.
		CO 4	Acquire the basic knoeledge of curvature and radius of curvature.
		CO 5	Demonstrate the partial derivatives, higher derivatives,total differential coefficients.
21UMAA01	ALLIED MATHEMATICS I - ALGEBRA AND CALCULUS	CO 1	Know the application of relations between the roots and coefficients of an equation and diminishing the roots of an equation
		CO 2	Ability to solve the consistency of linear equations and application of Cayley-Hamilton theorem
		CO 3	Understanding the concepts of Cartesian co-ordinates, parametric co-ordinates and polar co-ordinates.
		CO 4	Understand the basic properties of PDE.
		CO 5	Gain the skill to solve problems.

SEMESTER – II			
21UMA03	ANALYTICAL GEOMETRY OF 2D & 3D	CO 1	To gain knowledge about Conic 2D
		CO 2	Understand the concepts of coplanar lines and skew lines and find the shortest distance between them
		CO 3	To gain the knowledge about sphere and identify the characteristics of sphere
		CO 4	Enhance the fundamental concepts of cone and cylinder
		CO 5	To develop the concepts of coincoides.
21UMA04	TRIGONOMETRY & VECTOR ANALYSIS	CO 1	Recall the basic concepts and understand the expansions of Trigonometric functions
		CO 2	Acquire knowledge on Hyperbolic functions and Logarithm of complex numbers
		CO 3	Gain knowledge on the concept of divergence, curl and integration of vector point functions
		CO 4	Analyse and work with the problems related to line integrals, surface and volume integrals.
		CO 5	Solve the problems related to Gauss Stoke's and Green's theorems.
21UMAA02	ALLIED MATHEMATICS II - DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS	CO 1	Understanding the concepts of maxima and minima
		CO 2	Developing the knowledge in Numerical Methods problem solving.
		CO 3	Understanding the second order differential equations with constant coefficients.
		CO 4	Solving the simple problems in inverse Laplace and its Applications.
		CO 5	Gain the skill to solve problems.
SEMESTER III			
19UMA05	STATICS	CO 1	Analyze different structural elements like trusses,frames and beams.
		CO 2	Demonstrate an understanding of the principles of kinematics and kinetics of particles and planar rigid bodies

		CO3	An ability to construct free body diagrams and to calculate the reactions necessary to ensure static equilibrium.	
		CO4	Knowledge of internal forces and moments in members.	
		CO5	An ability to calculate centroids and momnents in interia.	
19UMA06	DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORM	CO1	Students will be able to classify the differential equations with respect to order and linearity.	
		CO2	Linear equations, linear differential equations with constant coefficients.	
		CO3	Students will be able to understand the basic properties of standard PDE's and solve the problem in Clariaut's form.	
		CO4	Have a sound knowledge of Laplace Transform and properties.	
		CO5	Have sufficient exposure to get the solution of certain linear differential equation using Laplace Transform and inverse Laplace Transform	
SEMESTER-IV				
19UMASP01	SBEC I-OFFICE AUTOMATION PRACTICALS	CO1	Students will surge their knowledge about presentation using powerpoint.	
		CO2	Students will familiar with concepts of MS work.	
		CO3	Demonstrate cut, copy,paste, replace,find texts in a word documents.	
		CO4	Students will be able to formate a table by insert rows/columns, delete rows/columns, cell merging/splitting, cell alignment.	
		CO5	Students create and edit a table by selecting number of rows/columns, rows/columns heading, rows/columns width, row height, spacing text editing.	

19UMA07	DYNAMICS	CO1	Solve mechanics problems in one dimnsion that involve one or more of the forces of gravity, friction and air resistance.
		CO2	Solve problems relating to the motion of a projectiole in the absence of air resistance.
		CO3	An ability to constract free-body diagrams.
		CO4	An understanding of the analysis of distributed loads.
		CO5	Knowledge of internal forces and moments in members.
		CO6	Apply Kepler's laws to solve the problems.
19UMA08	TRIGONOMETRY AND ANALYTICAL GEOMETRY OF 3D	CO1	To gain knowledge about Conic 2D.
		CO2	Understand the concepts of coplanar lines and skew lines and ind the shortest distance betwee them.
		CO3	To gain the knowledge about sphere and identify the characteristics of sphere.
		CO4	Enhance th efundamental concepts of cone and cylinder.
		CO5	To develop the concepts of coincides.
		CO6	Recall the basic concepts and underatand the expansions of trigonometric functions.
19UMAS01	SBEC II- QUANTITATIVE APTITUDE-I	CO1	Quantitative aptituddes are ideal tools to confirm th epresence of their attributes.
		CO2	mnake sense of problems, develop strategies to find solutions and pressevere in solving them.
		CO3	Use appropriate technology in a given context.
		CO4	Quantitative Serves students who are focused on developing quantitative literacy skillls that will be meaningful for theior profesional and personal lines.
		CO5	Quantitative Serves students who are focused on developing quantitative literacy skillls that will be meaningful for theior profesional and personal lines.

	SEMESTER-V			
19UMA09	MODERN ALGEBRA-I	CO1	Students will be able to understand th eimportance of algebraic propoerties with regard to working within various nmber systems.
		CO2	Understand the concepts of group structure to finite permutation groups.
		CO3	Algebraic structure that helps better understand polynomials.
		CO4	Explain th esignificance of the notion of a normal subgroups and of a simple group.
		CO5	Familiarize with rings, integral domains, firelds and divisors of zero.
		CO6	Acquire the basic knowledge and the structure of group, subgroup and cyclic groups.
19UMA10	REAL ANALYSIS-I	CO1	Students will be able t describe fundamental properties of the real number that lead to the formal development of real analysis.
		CO2	Comprehend rigorous arguments developing the theory underpinning real analysis.
		CO3	Develop skill in checking the uniform convergence of series usinbg various tests of convergence.
		CO4	Demonstate an understanding of limits and how they are used in sequences, series, differentiation an dintegration.
		CO5	Understand th enotion of countable, uncountable sets, open sets and interior of sets.
19UMA11	COMPLEX ANALYSIS-I	CO1	Determine when and where a given function is analytic.
		CO2	Students will be able to find the series development of an analytic function.
		CO3	Identify curves and regions in the complex plane defined by simple expressions.
		CO4	Describe basic properties of comploex integration and having th eability to compute such integrals.
		CO5	Students will be able to understand th ecalculation of residues and apply to evelute integration of functions with poles on the real axis.

19UMAE01	ELECTIVE I-OPERATIONS REEARCH	CO1	Formulate simple reasoning and learning optimization problems.
		CO2	Analyze a problem and can select a suitable strategy.
		CO3	apply an appropriate method to obtain the solution to a problem.
		CO4	Manipulate the basic mathematical structures underlying these methods.
		CO5	Evalute analytically th elimitations of these methods.
19UMAE03	ELECTIVE II-DISCRETE MATHEMATICS	CO1	Underestand the statements and notations, connectives, tautoogical implications and other connectives.
		CO2	Evalute the concepts of Lattices and Boolean algebra with their properties and the representation and minimization of Boolean functions.
		CO3	Described useful standard library functions, create functions and declare parameters.
		CO4	Studdents will learn mathematical concepts and terminologies.
		CO5	Understand the concepts of graphs and trees, their types and applications in nstudy of shortest path algorithms and spanning tree.
19UMAS02	SBEC III-C PROGRAMMING	CO1	Apply th econcepts of objects-oriented programming.
		CO2	Symbolic commands. Use arithmetic operators, logical operators, relational operators, increment and decrement.
		CO3	Operators and conditional operators while writing a C program. Know thedecision making using IF statement, IF ELSE statement, and to have jumps in.L
		CO4	Understand the needs for user defined functions, return values and their types, calling.
		CO5	Functions and category of functions.

19UMASP02	C PROGRAMMING LAB	CO1	Implement programming techniques to solve problems in C programming language.
		CO2	Dsemonstrate the basic object oriented and structures programming concepts.
		CO3	Illustrate th eprocess of data dile manipulations using C.
		CO4	Apply th econcepts of objects-oriented programming.
		CO5	Ability to areate simple programs using clases and objects in C.
		CO6	Students will be able to choose appropriate data structure to represent data items in real world problems.
SEMESTER-VI			
19UMA12	MODERN ALGEBRA-II	CO1	Characterize linear transformation as one-tone, onto.
		CO2	Characterize a set of vectors and linear systems using th econcepts of linear independence.
		CO3	Interpret basic absolute value expressions.
		CO4	To simplify algebraic expressions, using the commutative, associative and distributive propeerties.
19UMA13	REAL ANALYSIS-II	CO1	Understand concepts of connectedness, completeness and compactness of metric spaces.
		CO2	Understand basic concepts of Riemann Integration and solving simple problems.
		CO3	Solving problems by using theorems on derivatives.
		CO4	Develop th eability to reflect on problems that are quite significant in the field of real analysis.
		CO5	To understand the concepts of limit for real functions and be able to calculate limits of standard functions and construct simple proofs involving this concepts.

19UMA14	COMPLEX ANALYSIS-II	CO1	Develop a reasoned argument in handling problems about functions.
		CO2	Know th econcepts of limits, continuity and analytical functions.
		CO3	Solve complex integrals.
		CO4	Discuss convergence of sequences and sseries, Taylor series and Laurents series.
		CO5	Find different singularities and residues.
19UMA15	GRAPH THEORY	CO1	Students will be able to know the basic concepts of graphs, automorphism of a simple graph, line graphs and operations on graphs, graph products, directed graph and tournaments.
		CO2	Undersatand theorems and concepts related to trees and aply thesein everday life problems.
		CO3	Understand more about Eulerian and Hamiltonian graphs.
		CO4	Familiarize with different types of graphs, connectivity and properties.
		CO5	Illustrate the fundamental applications of graph theory in different walks of life.
19UMAE05	NUMERICAL ANALYSIS	CO1	It is used for solving a system of equations and used in all brancehes of engineering.
		CO2	To solve a system of linear equations.
		CO3	To learn about interpolation polynomials.
		CO4	Students will be able to demonstrate ability to think critically by developing and implementing algorithms for solving application problems.
		CO5	Students will be able to work effectively with others to complete assignments.
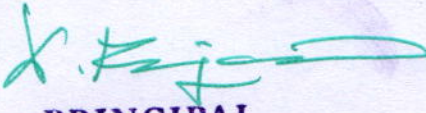
19UMAS03	LATEX-THEORY	CO1	Students will be able to successfully install LATEX and its related components on a home/personal computer.
		CO2	Understand for writing all scientific papers and presentations in mathematics.
		CO3	Students preparing a short lecture note and a short presentation in ATEX.
		CO4	Students will be able to construct structures, table inclusion, header and footer, bibilography managemnts, etc.
		CO5	Understand about the mathematics document preparations.
		CO6	Students will prepare the LATEX document and the e-content.
19UMASP03	LATEX PRACTICALS	CO1	Make different alignments in a document and an application for a job.
		CO2	Generate bio-data and table structures.
		CO3	Create mathematical statements using LATEX.
		CO4	Prepare articles and inserting pictures.
		CO5	Prepare question paper and powerpoint presentation in LATEX format.

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(2019 ONWARDS)	
NAME OF THE PROGRAMME: M.Sc MATHEMATICS	
PO1	Use fundamental principle of Mathematics and Computing to identify, formulate research literature for solving complex problems, reaching appropriate solutions.
PO2	Use expertise research-based knowledge and methods including skills for analysis and development of information to reach valid conclusions.
PO3	Gain confidence for self and continours learning to improve knowledge and competence as a member or leader of a team. (Individual and Teamwork)
PO4	Demonstrate an understanding of the basic concepts in mathematics, statistics, operations research and their importance in the solution of some real-world problems.
PO5	To create a research aptitude and culture in young minds.
PO6	To encourage students to pursue higher studies in mathematics.
PO7	To ensure that the learning of mathematics becomes more alive, vibrant, relevant and meaningul and understand the world around them through Mathematics.
PO8	To motivate students to uphold scientific integrity and objectivity in professional endeavors.

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COURSE OUTCOMES OF UNDERGRADUATE PROGRAMMES(2021 ONWARDS)

Name of the programme : M.Sc Mathematics

Course Code	Course Title		Course Outcome
SEMESTER – I			
21PMA01	LINEAR ALGEBRA	CO 1	Students will able to describe a diagonalizable operator T in a language of invariant direct sum decompositions.
		CO 2	Make use of matrix theory for solving system of linear equations and compute eigen values and eigen vectors required for matrix diagonalization process.
		CO 3	Demonstrate an understanding of vector spaces and subspaces.
		CO 4	Students will able to recognize the concepts of the terms span, linear independent, basis and dimension and apply these concepts to various vector spaces and subspaces.
		CO 5	This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subjects.
21PMA02	REAL ANALYSIS - I	CO 1	Acquire the knowledge of countable sets, uncountable sets and compact sets in metric spaces.
		CO 2	Demonstrate Riemann Stieltjes integral and examine the properties of integration and differentiation.
		CO 3	Analyze the convergence in sequences and series.
		CO 4	Attainment of a deeper and wider knowledge of sequence and series of functions and uniform convergences.
		CO 5	A deeper knowledge on Weierstrass Approximation Theory and algebraic completeness of complex field.
21PMA03	ORDINARY DIFFERENTIAL EQUATIONS	CO 1	Obtain serries solutions for second order ordinary differential equations both at ordinary and regular singular points.
		CO 2	Analyze the existence and uniqueness solution of initial value problems.
		CO 3	Understand to solve a homogenous linear system by the eigen value method.

		CO 4	Students will be able to distinguish between linear, non-linear, partial and ordinary differential equations.
		CO 5	Students gained th eknowledge about the properties of Bessel functions and Legendre polynomial.
21PMA04	MECHANICS	CO 1	At the end of the course, the students will understan the formation of differential equations which will help to study the dynamics of mechanical syatems.
		CO 2	To understand th elaws of friction and equilibrium of a particle on a rough inclined plane under a force.
		CO 3	To collect the basic concept of forces and understand the Varignon's theorem.
		CO 4	To understand the path of a projectile is a parabola and to apply the concepts of projectile.
		CO 5	To unddestand the impluse and impulsive force and to gain knowledge about collision of elastic bodies.
		CO 6	To understand the geometrical representation of simple harmonic motion and solve the problems on the simple pendulum.
21PMAE01	ELECTIVE-DISCRETE MATHEMATICS	CO 1	Express logic sentence in terms of predicates, quantifiers and logicl connectives.
		CO 2	Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction and mathematical induction.
		CO 3	Solve mathematics problems that involve computing permutations and combinations of a set, fudamental enumeration principles.
		CO 4	Evalute Boolean functions andsimplify expressions using the properties of Boolean algebra.
SEMESTER – II			
21PMA05	ABSTACT ALGEBRA	CO 1	Students will be able to describe a diagonalizable operator T in a language of invariant direct sum decompositions.
		CO 2	Make use of matrix theory for solving system of linear equations and compute eigen values and eigen vectors required for matrix diagonalization process.
		CO 3	Demonstrate an understanding of vector spaces and subspaces.

		CO 4	Students will be able to recognize the concepts of the terms span, linear independent, basis and dimension and apply these concepts to various vector spaces and subspaces.
		CO 5	This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subjects.
21PMA06	REAL ANALYSIS - II	CO 1	Acquire the knowledge of countable sets, uncountable sets and compact sets in metric spaces.
		CO 2	Demonstrate Riemann Stieltjes integral and examine the properties of integration and differentiation.
		CO 3	Analyze the convergence in sequences and series.
		CO 4	Attainment of a deeper and wider knowledge of sequence and series of functions and uniform convergences.
		CO 5	A deeper knowledge on Weierstrass Approximation Theory and algebraic completeness of complex field.
21PMA07	PARTIAL DIFFERENTIAL EQUATIONS	CO 1	Be competent in solving linear PDE's using classical methods
		CO 2	Provide geometrical meaning of second partial derivative with respect to one variable.
		CO 3	Calculate the firsr and second partial derivatives.
		CO 4	Apply chain rule for functions on curves.
		CO 5	Classify the fundamental principles of PDE's to solve hyperbolic,parabolic and elliptic equations.
21PMAE03	ELECTIVE : NUMERICAL ANALYSIS	CO 1	Learn the principles for designing numerical schemes for differential equations.
		CO 2	Be able to analysis the consistency, stability and convergence of a numerical scheme.
		CO 3	Be able to know, for each type of differential equations, the kind of numerical methods are best suited for and the reasons behind these choices.
		CO 4	Be able to make a connection between the mathematical equations or properties and the corresponding physical meanings.
		CO 5	Be able to use a programming language or mathematical software to implement and test the numerical schemes.

21PHR01	HUMAN RIGHTS	CO 1	Understand the historical growth of the idea of human rights.
		CO 2	Students will able to demonstrate an awareness of the international context of human rights.
		CO 3	Being able to engage critically and creatively with the potential and limits of human rights law and sustainable developement.
		CO 4	Students will able to compare and assess the various theories proposed as the basis for the production of human rights.
		CO 5	Assess the structure, major institutions and jurisprudence of the international human rights system.

SEMESTER - III			
19PMA08	PARTIAL DIFFERENTIAL EQUATIONS	CO1	Be compentent in solving linear PDEs using classical methods.
		CO2	provide geometrical meaning of second partial derivative with respect to one variable
		CO3	Calculate the first and second partial derivatives.
		CO4	Apply chain rule for functions on curves.
		CO5	Classify the fundamental principles of PDE`s to solve hyperbolic, parabolic and elliptic equations.
19PMA09	TOPOLOGY	CO1	Observed the differences between metric space and topological spaces and their role in mathematics
		CO2	Students will understand terms, definitions and theorem related to topology.
		CO3	Demonstrate the basic results about completenesws, connectedness and convergence within theses structures.
		CO4	Investigate whether a given family of subsets is a topology or not.
		CO5	Understand and apply relationship between base and sub base of a topology.
		CO6	Prepare and motivate students for research studies in mathematics and related fields.
		CO7	Knowledge gained about compact, locally compact and point wise compact.

19PMA10	MEASURE THEORY AND INTEGRATION	CO1	At the end of the course, the students will be able get the knowledge of measure and outer measure, generalization of integrals with help of measures.
		CO2	Understand and the fundamental concepts of measure and Lebesgue measure.
		CO3	Describe the short coming of Riemann integral and benedits of Lebesgue integral.
		CO4	Explain the general principles of measure theory and integration in such concentrate subjects as the theory of probability.
		CO5	Explain the concept of length, area, volume using Lebesgues theory.
		CO6	The students will develoop a perspective on the broader impact of measure theory in ergodic theory and have the ability to pursue further studies in this and related area.
19PMA11	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	CO1	To know different types variation problems and finding their extremals.
		CO2	To find solution of Fredholm and Volterra integral equations through different methods.
		CO3	Students will be able to recognize difference between volterra and Fredholm equations, first kind and second kind of homogeneous and non-homegenous equations etc.
		CO4	Studnets illustrate different methods to solve integral equations.
		CO5	Students will be able to learn variation principles.
		CO6	Develop the skills while doing/solving the various problems by using integral equations in all engineering sciences.

19PMAE05	DIFFERENTIAL GEOMETRY	CO1	calculate the curvature and torsion of a curve.
		CO2	Find the osculating surface and osculating curve at any point of a given curve.
		CO3	Calculate the first and second fundamental forms of surface.
		CO4	Calculate the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface.
		CO5	Enumerate some standard examples in geometry, such as surfaces of constant Gaussian curvature and geodesic curvature.
		CO6	Identificatin of important types of curves in surfaces, space curve and asymptotic curves.
SEMESTER - IV			
19PMA12	FUNCTIONAL ANALYSIS	CO1	Understand the relationship between metric spaces, normed space, inner product space.
		CO2	Understand properties of continuous linera functional on Banach space.
		CO3	Understand various types of operators on Hilbert space.
		CO4	Know regular elements, singular elements, spectrum of Banch algebra & its ideals.
		CO5	The students have knowledge of Hahn-banach theorem, the open mapping theorem and closed.
		CO6	Demonstrate the concept of positive, self adjoint, projections, normal and unitary operators.
		CO7	Defined the definition of inner product spaces, Hilbert spce with examples.
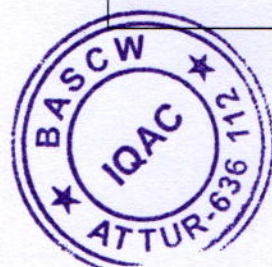
19PMA13	PROBABILITY THEORY	CO1	To get the knowledge of Random variables and Random events.
		CO2	To understant characteristic funtion and properties of characteristic function.
		CO3	Students will be able to develop problem solving technique to solving real world events.
		CO4	Understand to apply selected probability distributions to solve problems.
		CO5	Students will be able to define the principal concepts about probability.
		CO6	Students will be able to apply key concepts of probability, including discrete and continuous random variablem probability distributions, conditioning, independence, expectations and variances.
		CO7	Interpret the basic rules and theorems in probability including Baye`s theorem.
19PMA14	GRAPH THEORY	CO1	To identify the graphs of connectivity and tree.
		CO2	To find the independent set and cycle graph.
		CO3	To understand graph coloring and to check planarity.
		CO4	Students gained knowledge about classes of graphs, bigraphs, line graphs, complete graph and complementation of graphs.
		CO5	Demonstrate the basic concepts of trees and spanning tree.
		CO6	Understand the concepts of connectivity and edge connectivity.
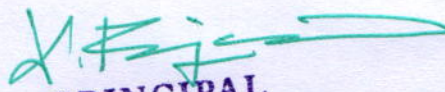
19PMAE07	NUMBER THEROY	CO1	Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues and quadratic non-residues.
		CO2	Formulate and prove conjectures about numeric patterns.
		CO3	Produce rigorous arguments centered on the material of number theory, most notably in the use of Mathematical induction and the well-ordered principle in the proof of theorems.
		CO4	Enable the students to learn about some important results in the theory of numbers including the prime number theorem, chinese remainder theorem, wilson`s theorem and their consequences.
		CO5	Students know about open problems in number theory, namely the goldbach conjecture and twin-prime conjecture.
		CO6	Students familiarize with modular arithmetic and find primitive roots of prime and composite numbers.

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