KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Re-accredited by NAAC with 'A' Grade – 3.64 CGPA out of 4 (3rd Cycle)

College of Excellence (UGC)

Coimbatore – 641 029

DEPARTMENT OF MATHEMATICS (Aided)

COURSE OUTCOMES (CO)

M.Sc. Mathematics

For the students admitted
In the
Academic Year 2018-2019

Programme Code : 02		M.Sc Mathematics		
Course Code: 18PMA101		Core Paper 1 – Algebra		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	I	7	105	5

Course Objectives

1. To study groups, rings, fields and linear transformations which are widely used in many research fields and the concepts of mappings are applied in the subjects like analysis and topology.
2. To show the needs from which a modern mathematical attitude may grow and it is of great help in any further axiomatic study of mathematics.
3. To study the concept of linear transformations using matrices. Also, Contemporary mathematics and mathematical physics make extensive use of abstract algebra.

Course Outcomes (CO)

K1	CO1	Remembering the concept of rings, fields and extension fields.
K2	CO2	Understanding the difference between algebraic and transcendental extensions; be able to find the minimal polynomial for algebraic elements over a field and be able to prove whether a polynomial is irreducible over a given field.
K3	CO3	Applying Sylow's theorems to determine the structure of certain groups of small order and also Gauss lemma, Eisentein criterion for irreducibility of rationals.
K4	CO4	Analyzing Galois groups in simple cases and to apply the group theoretic information to deduce results about fields and polynomials.

Programme Code : 02		**M.Sc Mathematics**		
Course Code : 18PMA102		**Core Paper 2 -** REAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	I	6	90	5

Course Objectives

1. To learn about advanced topics in Riemann's Stieltjes Integrals.
2. To study the mean value theorem for Riemann and Riemann's Stieltjes integrals.
3. To study directional derivatives, total derivatives, Jacobian determinant and their applications.

Course Outcomes (CO)

K1	CO1	Remembering the upper and lower integrals and the Riemann conditions.
K2	CO2	Understanding the difference between necessary and sufficient conditions for Riemann's Stieltjes Integrals.
K3	CO3	Identifying the sufficient conditions for differentiability and mixed partial derivatives.
K4	CO4	Analyzing the Jacobian determinant to understand the Implicit and Inverse function theorems.

Programme Code : 02		M. Sc Mathematics		
Course Code:	18 PMA103	Core Paper 3-Ordinary Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	I	7	105	5

Course Objectives

1. To understand the concepts of fundamental matrix and successive approximation for finding solution.
2. To enable the students to know the concepts of non-homogeneous linear systems with constant co-efficient and periodic co-efficient.
3. To gain knowledge in the area of linear oscillations and non-linear oscillations.

Course Outcomes (CO)

K1	CO1	Remembering the different types of differential equations.
K2	CO2	Understanding the concept of linear oscillations and non-linear oscillations.
K3	CO3	Applying the notions of fundamental matrix and successive approximations in the system of differential equations.
K4	CO4	Analyzing the non-homogeneous linear systems with constant co-efficient and periodic co-efficient.

Course Code:18PMA104		**Core paper 4 -** NUMERICAL METHODS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	I	6	90	4

Course Objectives

1. To solve the linear equations, non-linear equations and interpolating the values using numerical methods.
2. To obtain the solution of Boundary Value Problems and Characteristic Value Problems using Numerical Methods.
3. To find the Solution of Ordinary Differential Equations and Partial Differential Equations using Numerical methods.

Course Outcomes (CO)

K1	CO1	Remembering various numerical methods for finding the solution of algebraic and transcendental equations.
K2	CO2	Demonstrating various numerical algorithms for solving simultaneous linear algebraic equations.
K3	CO3	Applying various numerical methods to solve differential equations.
K4	CO4	Analyzing the Boundary Value Problems and Characteristic Value Problems.

Programme Code : 02		M. Sc Mathematics		
Course Code : 18PMA205		**Core Paper 5 -** COMPLEX ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	II	7	105	4

Course Objectives

1. To study Cauchy's theorem and applying it for a rectangle and a disk.
2. To know various types of singularities and evaluation of definite integrals using residues.
3. To understand the concept of power series expansions and canonical products.

Course Outcomes (CO)

K1	CO1	Recalling rectifiable arcs and line integrals as functions of arcs.
K2	CO2	Explaining the concepts of Local mapping theorem, Cauchy residue theorem and its applications.
K3	CO3	Applying the Residue theorem on definite integrals.
K4	CO4	Analyzing the Riemann mapping theorem and Schwarz – Christoffel formula.

Programme Code : 02		**M.Sc Mathematics**		
Course Code: 18PMA206		Core Paper 6 - Partial Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**

2018-2020	II	6	90	5

Course Objectives

1. To study linear partial differential equations and non-linear partial differential equations.
2. To know the concept of partial differential equations and their role in modern mathematics.
3. To understand the concepts of wave equations and diffusion equations.

Course Outcomes (CO)

K1	CO1	Finding the solutions of the heat equation, wave equation and the Laplace equation subject to boundary conditions
K2	CO2	Understanding the method of separation of variables and the method of integral transforms.
K3	CO3	Applying calculus of variations in finding elementary solutions of diffusion equations.
K4	CO4	Analyzing the solutions of non-linear partial differential equations by using Charpit's and Jacobi's methods.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA207		Core Paper 7- MECHANICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	II	6	90	5

Course Objectives

1. To know the basic concepts of the Mechanical system.
2. To understand about the constraints, differential forms and Generating functions
3. To acquire knowledge about mechanical concepts to solve various problems in Mechanics.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of generalized co-ordinates and constraints.
K2	CO2	Explaining the derivation of Lagrange's and Hamilton equations.
K3	CO3	Applying Hamilton Principle for deriving Hamilton Jacobi Equation.
K4	CO4	Analyzing the Lagrange's and Poisson Brackets.

Programme Code : 02		M. Sc Mathematics		
Course Code:	18PMA208	Core Paper 8-Programming in C – Theory		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	II	5	75	3

Course Objectives

1. To understand the logical structure of a C program and to develop different programs in 'C' language.
2. To know the concepts of Arrays and Pointers.
3. To understand the File management in C.

Course Outcomes (CO)

K1	CO1	Remembering the structure of program development in C.
K2	CO2	Understanding the use of decision making and looping.
K3	CO3	Applying the concepts of Arrays in different programs.
K4	CO4	Examining the complexity of problems, modularize the problems into small modules and then convert them into programs.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA2CL		Core Practical 1-Programming in C - Practical		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	II	2	30	2

Course Objectives

1. To find the solutions of non-linear ordinary differential equations using C programs.
2. To get practical experience of the programs in Matrix manipulations and Dynamic memory allocations.
3. To enhance the students to develop the program writing skills for mathematical problems

Course Outcomes (CO)

K3	CO1	Utilizing C program for finding the Numerical solutions of Algebraic and Transcendental Equations.
K4	CO2	Analyzing the programs involving loops and functions.
K5	CO3	Applying, compiling and debugging programs in C language.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA309		**Core Paper 9 TOPOLOGY**		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	III	7	105	5

Course Objectives

1. To get basic knowledge in topology and topological spaces.
2. To study the concepts of Compactness and Connectedness.
3. To know the concept of countability axioms.

Course Outcomes (CO)

K1	CO1	Recalling the concept of Basis for a topology.
K2	CO2	Classifying the ideas of product topology and metric topology.
K3	CO3	Applying countability and separation axioms in proving Urysohn lemma and Urysohn Metrization theorem.
K4	CO4	Analyzing the concepts of limit point compactness and local compactness.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA310		Core Paper 10 FUNCTIONAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	III	7	105	5

Course Objectives

1. To know the concepts of Normed linear spaces, Banach spaces and Hilbert spaces.
2. To understand the ideas of Uniform boundedness principles, closed graph theorem and Open mapping theorem.
3. To comprehend the notions of spectral radius, the spectral theorem and Operators on Hilbert spaces.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of semi norms and Quotient spaces.
K2	CO2	Understanding the ideas of Uniform boundedness principles.
K3	CO3	Applying the concepts of eigen spectrum on normed linear spaces and spectral radius on Banach spaces.
K4	CO4	Analyzing the results of Adjoint, Self-Adjoint, Normal and Unitary Operators defined on Hilbert spaces.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA311		Core Paper 11 MATHEMATICAL STATISTICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	III	7	105	5

Course Objectives

1. To study the concepts of random variables and different types of distributions.
2. To determine the moments of the distribution function by using the characteristic functions.
3. To understand the Methods of finding estimates, Sample moments and their functions

Course Outcomes (CO)

K1	CO1	Remembering the random events and random variables of different distributions.
K2	CO2	Classifying the properties of characteristic functions of various distributions.
K3	CO3	Identifying the types of estimates for various probability distribution functions.
K4	CO4	Analyzing the functions by using various significance tests.

Programme Code : 02		M. Sc Mathematics		
Course Code: 18PMA412		**Core Paper 12**	**MATHEMATICAL METHODS**	
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	IV	7	105	5

Course Objectives

1. To study the concept of Fourier transforms .
2. To impart analytical ability in solving variational problems and integral equations.
3. To use calculus of variation to find the extremum of a functional.

Course Outcomes (CO)

K1	CO1	Finding the solution of Fredholm and Volterra Integral equations.
K2	CO2	Explaining the method to reduce the differential equations to Integral equations.
K3	CO3	Solving Maximum or minimum of a functional using Calculus of Variation Techniques.
K4	CO4	Analyzing the Euler's finite difference method, the Ritz method and Kantorovich's method.

Programme Code : 02		M. Sc Mathematics		
Course Code:18PMA413		Core Paper 13 CONTROL THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	IV	7	105	5

Course Objectives

1. To know the basic results of Differential Equations and Fixed Point Methods.
2. To study the basics of observability, controllability, stability, stabilizability, optimal Control of linear and nonlinear system.
3. To develop skills to review research papers in the field of Controllability Problems.

Course Outcomes (CO)

K1	CO1	Choosing ordinary differential equations through state-space representations towards analyzing and designing dynamical systems.
K2	CO2	Understanding mathematical techniques to formulate and solve control theory problems.
K3	CO3	Solving the stability of the given linear and nonlinear system using matrix theory.
K4	CO4	Analyzing various optimal control formulations and necessary conditions of optimal control.

Programme Code: 02		M. Sc Mathematics		
Course Code:18PMA414		Core Paper 14 OBJECT ORIENTED PROGRAMMING WITH C++ - THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	IV	5	75	3

Course Objectives

1. To enable the students to learn about the basic concepts of Object Oriented Programming Techniques, class structure, operators, functions in C++ and operators Overloading and Type Conversions.
2. To know the differences between object oriented programming and procedure oriented programming.
3. To apply object oriented techniques to solve the computing Problems.

Course Outcomes (CO)

K1	CO1	Finding solutions for problems in Mathematics, Engineering, Science and Technology using Object Oriented Programming.
K2	CO2	Classifying secured and unsecured data processing by applying Abstraction, Encapsulation and Information hiding.
K3	CO3	Constructing programmes using C++ features such as composition of objects, Inheritance and Polymorphism.
K4	CO4	Analyzing the concepts of Object Oriented Programming to solve real world problems.

Programme Code : 02	M. Sc Mathematics
Course Code:18PMA4CM	Core Practical 2 OBJECT ORIENTED

		PROGRAMMING WITH C++ - PRACTICAL		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	IV	2	30	2

Course Objectives

1. To identify and formulate the techniques of software development using Object Oriented Programming concepts.
2. To find the solution of complex problems spanning the breadth of the C++ Programming language.
3. To write programs for problems in various domains like Mathematics, Science, Technology and real world problems.

Course Outcomes (CO)

K3	CO1	Applying the concepts of Object Oriented Program for building object based applications.
K4	CO2	Analyzing different logic with suitable validations for a given problem.
K5	CO3	Interpret and design the Exception Handling Techniques for resolving run-time errors using file I/O.

Programme Code : 02	M. Sc Mathematics
Course code: 18PMA4Z1	Project
Batch 2018-2020	**Credits** :2

Course Objectives

1. To study the basic concepts related to the Project work.
2. To know the respective research fields.
3. To know the concept of writing a dissertation in an effective way.

Course Outcomes (CO)

K3	CO1	Applying the relative notions in the respective areas and finding the results.
K4	CO2	Analyzing results with the existing results.
K5	CO3	Interpreting the results with suitable examples.

Programme Code : 02	M. Sc Mathematics
Course code: 18PMA0D1	ALC 1 DISCRETE MATHEMATICS AND AUTOMATA THEORY
Batch 2018-2020	**Credits** 2

Course Objectives

1. To understand mathematical foundations to create mathematical arguments.
2. To enable to know how lattices and Boolean algebra are used as mathematical models of network systems.
3. To know about Automata Theory and its applications.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of Mathematical logic.
K2	CO2	Explaining the implication problems using truth table , replacement process and rules of inference.
K3	CO3	Solving normal forms of given logical expression.
K4	CO4	Analyzing Karnaugh map for simplifying the Boolean expression.

Programme Code : 02	M. Sc Mathematics
Course code: 18PMA0D2	ALC 2 ASTRONOMY
Batch 2018-2020	**Credits** 2

Course Objectives

1. To acquire the knowledge about the celestial objects and planets.
2. Develop skills to design observing projects with research telescopes and projects drawing upon data in the literature and in archives.

3. To be familiar with the appearance of a range of common astronomical objects, such as asteroids, comets, satellites, planets, stars, and galaxies.

Course Outcomes(CO)

K1	CO1 •	Defining about the observed properties of physical systems that comprise the known universe.
K2	CO2	Demonstrate their ability to read, understand, and critically analyze the astronomical/physical concepts
K3	CO3	Applying their physics and mathematical skills to problems in the areas of planetary science.
K4	CO4	Analyze to draw valid scientific conclusions and communicate those

		conclusions in a clear and articulate manner.

Programme Code : 02	M. Sc Mathematics
Course code: 18PMA0D3	ALC 3 INTERNET AND JAVA PROGRAMMING
Batch 2018-2020	**Credits** 2

Course Objectives

1 To understand the difference between C, C++ and Java Programs.
2 To explore the Java Applications and to identify the variations between Stand alone java applications and Web based applications.
3 To provide the advanced concepts in java programming like Package, Multi Thread and Applet.

Course Outcomes (CO)

K1	CO1	Remembering the basic concepts of OOPs, Data Types, Control Statements and Tokens.
K2	CO2	Understanding about the java statements.
K3	CO3	Applying the concept of Package, Thread and Applet in program
K4	CO4	Inspect the java concepts and get the new innovative ideas.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper FLUID DYNAMICS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	7	105	5

Course Objectives

1.To have a good understanding of the fundamental equation of viscous compressible fluid.
2.To enable to Bernoulli equations, Momentum theorems and its applications.
3.To understand the motion of solid bodies in fluid and sound knowledge of boundary layer theory.

Course Outcomes (CO)

K1	CO1	Defining the fundamental aspects of fluid flow behaviour.
K2	CO2	Classifying the flow patterns of a fluid (gas or liquid) depend on its characteristic.
K3	CO3	Utilizing the fluid dynamics to analyze the flow of air over the surface to calculate pressure, changes in velocity using the Blasius's equation.
K4	CO4	Analyzing the steady state kinetic energy equation for fluid flow systems and estimate pressure drop in fluid flow systems.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper - ADVANCED OPERATIONS RESEARCH			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	7	105	5

Course Objectives

1. It enables students to acquire the knowledge of mathematics and statistics.
2. The study helps to locate the best or optimal solutions to a problem.
3. It sharpens the students brain in making quick decisions in an administrative situation.

Course Outcomes (CO)

K1	CO1	Recalling various methods of solving linear programming problem.
K2	CO2	Classifying duality and dual simplex method, pure and mixed integer programming problem, solution of revised simplex method and bounded variable problems.
K3	CO3	Applying the concept of sequencing problem techniques to find total elapsed time for processing n jobs through 2 machines, n jobs through k machines and 2 jobs through k machines.
K4	CO4	Categorizing various types of queuing models and classify the queuing problems that belongs to which model and solve the given queueing system. Distinguish linear and non linear programming problems.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper FUNDAMENTALS OF ACTUARIAL MATHEMATICS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	7	105	5

Course Objectives

1 To use standard techniques of mathematics to solve problems in actuarial science

2. To calculate the values of Annuity and Annuity dues .

3. To know the concepts of Life insurance premiums, Temporary assurance, Whole Life assurance and the values of policies.

Course Outcomes (CO)

K1	CO1	Remembering the concept of Insurance policies and its benefits.
K2	CO2	Understanding the consequences of events involving risk and uncertainity.
K3	CO3	Applying various modelling techniques to evaluate quantitative risk analysis.
K4	CO4	Analysing the appropriate Life insurance plans suitable for the individual or concern.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper CRYPTOGRAPHY			
Batch 2018-2020	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1. To enable the students to acquire the knowledge about Classical Cipher Systems, Shift Registers and Public Key systems.
2. To be familiar with information security awareness and a clear understanding of its importance.
3. To be exposed to the importance of integrating people, processes and technology.

Course Outcomes (CO)

K1	CO1	Remembering the basic encryption techniques.
K2	CO2	Understanding the cryptographic theories, principles and technique used in security properties.
K3	CO3	Constructing a range of different cryptosystems from an applied view point.
K4	CO4	Analyzing the methods of Cryptography

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper SYSTEMS ANALYSIS AND DESIGN			
Batch 2018-2020	**Hours / Week** 4	**Total Hours** 60	**Credits** 5

Course Objectives

1. To enable the learners to understand the concepts of Foundations for systems development, Structuring system requirements and Designing Data bases.
2. To explain the principles, methods and techniques of systems development.
3. To elaborate on the application areas for different types of methods.

Course Outcomes (CO)

K1	CO1	Defining and describe the phases of the system development life cycle.
K2	CO2	Demonstrating the forms and reports and designing interfaces.
K3	CO3	Building the system development alternatives.
K4	CO4	Examining the system analysis problems.

Programme Code : 02	M. Sc Mathematics		
Non-Major Elective Paper VISUAL BASIC AND ORACLE			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	4	**60**	5

Course Objectives

1. To develop visual programming skills for modern software development.
2. To get the knowledge on Graphical User Interface.
3. To apply Visual Basic controls in data base management system.

Course Outcomes (CO)

K1	CO1	Remembering the fundamentals of visual basic and procedures.
K2	CO2	Understanding the Visual Basic controls and command button properties.
K3	CO3	Making use of visual data manager and data bound control for the database programming with Visual Basic.
K4	CO4	Analyzing the connection between ORACLE and VB.

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper : FUZZY LOGIC AND NEURAL NETWORKS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	4	60	5

Course Objectives

1. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy operations and fuzzy logic.
2. To know the concepts of neural networks and neuro-modeling.
3. To study the basics of neural network architectures and some learning algorithms.

Course Outcomes (CO)

K1	CO1	Recalling the difference between crisp set theory and fuzzy set theory.
K2	CO2	Explaining the concepts of operations on fuzzy set.
K3	CO3	Applying the learning methods in neural network architectures.
K4	CO4	Examining the Back propagation learning algorithm.

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper MEASURE AND INTEGRATION			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2018-2020	4	60	5

Course Objectives

1. To understand the concepts of Measurable functions and Integrable functions.
2. To know about Lebesgue measure and Lebesgue integral.
3. To apply measurable functions in convegence theorems and The Radon – Nikodym theorem.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of Measure and outer measure
K2	CO2	Classifying the difference between various measures
K3	CO3	Applying measure theory in theorems like monotone convergence theorem , bounded convergence theorem .
K4	CO4	Analyzing L^p spaces.

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Re-accredited by NAAC with 'A' Grade – 3.64 CGPA out of 4 (3rd Cycle)

College of Excellence (UGC)

Coimbatore – 641 029

DEPARTMENT OF MATHEMATICS (Aided)

COURSE OUTCOMES (CO)

M.Sc. Mathematics

For the students admitted
In the
Academic Year 2019-2020

Programme Code : 02		M.Sc Mathematics		
Course Code: 19PMA101		Core Paper 1 – Algebra		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	I	7	105	5

Course Objectives

1. To study groups, rings, fields and linear transformations which are widely used in many research fields and the concepts of mappings are applied in the subjects like analysis and topology.
2. To show the needs from which a modern mathematical attitude may grow and it is of great help in any further axiomatic study of mathematics.
3. To study the concept of linear transformations using matrices. Also, Contemporary mathematics and mathematical physics make extensive use of abstract algebra.

Course Outcomes (CO)

K1	CO1	Remembering the concept of rings, fields and extension fields.
K2	CO2	Understanding the difference between algebraic and transcendental extensions; be able to find the minimal polynomial for algebraic elements over a field and be able to prove whether a polynomial is irreducible over a given field.
K3	CO3	Applying Sylow's theorems to determine the structure of certain groups of small order and also Gauss lemma, Eisentein criterion for irreducibility of rationals.
K4	CO4	Analyzing Galois groups in simple cases and to apply the group theoretic information to deduce results about fields and polynomials.

Programme Code : 02		M.Sc Mathematics		
Course Code : 19PMA102		Core Paper 2 - REAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	I	6	90	5

Course Objectives

1. To learn about advanced topics in Riemann's Stieltjes Integrals.
2. To study the mean value theorem for Riemann and Riemann's Stieltjes integrals.
3. To study directional derivatives, total derivatives, Jacobian determinant and their applications.

Course Outcomes (CO)

K1	
K2	
K3	
K4	

Programme Code : 02		M. Sc Mathematics		
Course Code: 19 PMA103		Core Paper 3-Ordinary Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	I	7	105	5

Course Objectives

1. To understand the concepts of fundamental matrix and successive approximation for finding solution.
2. To enable the students to know the concepts of non-homogeneous linear systems with constant co-efficient and periodic co-efficient.
3. To gain knowledge in the area of linear oscillations and non-linear oscillations.

Course Outcomes (CO)

K1	CO1	Remembering the different types of differential equations.
K2	CO2	Understanding the concept of linear oscillations and non-linear oscillations.
K3	CO3	Applying the notions of fundamental matrix and successive approximations in the system of differential equations.
K4	CO4	Analyzing the non-homogeneous linear systems with constant co-efficient and periodic co-efficient.

Programme Code : 02		M. Sc Mathematics		
Course Code:19PMA104		**Core paper 4 -** NUMERICAL METHODS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	I	6	90	4

Course Objectives

1. To solve the linear equations, non-linear equations and interpolating the values using numerical methods.
2. To obtain the solution of Boundary Value Problems and Characteristic Value Problems using Numerical Methods.
3. To find the Solution of Ordinary Differential Equations and Partial Differential Equations using Numerical methods.

Course Outcomes (CO)

K1	CO1	Remembering various numerical methods for finding the solution of algebraic and transcendental equations.
K2	CO2	Demonstrating various numerical algorithms for solving simultaneous linear algebraic equations.
K3	CO3	Applying various numerical methods to solve differential equations.
K4	CO4	Analyzing the Boundary Value Problems and Characteristic Value Problems.

Programme Code : 02	M. Sc Mathematics			
Course Code	**:** 19PMA205	**Core Paper 5 -** COMPLEX ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	II	7	105	4

Course Objectives

1. To study Cauchy's theorem and applying it for a rectangle and a disk.
2. To know various types of singularities and evaluation of definite integrals using residues.
3. To understand the concept of power series expansions and canonical products.

Course Outcomes (CO)

K1	CO1	Recalling rectifiable arcs and line integrals as functions of arcs.
K2	CO2	Explaining the concepts of Local mapping theorem, Cauchy residue theorem and its applications.
K3	CO3	Applying the Residue theorem on definite integrals.
K4	CO4	Analyzing the Riemann mapping theorem and Schwarz – Christoffel formula.

Programme Code : 02		**M.Sc Mathematics**		
Course Code: 19PMA206		Core Paper 6 - Partial Differential Equations		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	II	6	90	5

Course Objectives

1. To study linear partial differential equations and non-linear partial differential equations.
2. To know the concept of partial differential equations and their role in modern mathematics.
3. To understand the concepts of wave equations and diffusion equations.

Course Outcomes (CO)

K1	CO1	Finding the solutions of the heat equation, wave equation and the Laplace equation subject to boundary conditions
K2	CO2	Understanding the method of separation of variables and the method of integral transforms.
K3	CO3	Applying calculus of variations in finding elementary solutions of diffusion equations.
K4	CO4	Analyzing the solutions of non-linear partial differential equations by using Charpit's and Jacobi's methods.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA207		Core Paper 7- MECHANICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	II	6	90	5

Course Objectives

1. To know the basic concepts of the Mechanical system.
2. To understand about the constraints, differential forms and Generating functions
3. To acquire knowledge about mechanical concepts to solve various problems in Mechanics.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of generalized co-ordinates and constraints.
K2	CO2	Explaining the derivation of Lagrange's and Hamilton equations.
K3	CO3	Applying Hamilton Principle for deriving Hamilton Jacobi Equation.
K4	CO4	Analyzing the Lagrange's and Poisson Brackets.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA208		Core Paper 8-Programming in C – Theory		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	II	5	75	3

Course Objectives

1. To understand the logical structure of a C program and to develop different programs in 'C' language.
2. To know the concepts of Arrays and Pointers.

3. To understand the File management in C.

Course Outcomes (CO)

K1	CO1	Remembering the structure of program development in C.
K2	CO2	Understanding the use of decision making and looping.
K3	CO3	Applying the concepts of Arrays in different programs.
K4	CO4	Examining the complexity of problems, modularize the problems into small modules and then convert them into programs.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA2CL		Core Practical 1-Programming in C - Practical		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	II	2	30	2

Course Objectives

1. To find the solutions of non-linear ordinary differential equations using C programs.
2. To get practical experience of the programs in Matrix manipulations and Dynamic memory allocations.
3. To enhance the students to develop the program writing skills for mathematical problems

Course Outcomes (CO)

K3	CO1	Utilizing C program for finding the Numerical solutions of Algebraic and Transcendental Equations.
K4	CO2	Analyzing the programs involving loops and functions.
K5	CO3	Applying, compiling and debugging programs in C language.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA309		**Core Paper 9 TOPOLOGY**		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	III	7	105	5

Course Objectives

1. To get basic knowledge in topology and topological spaces.

2. To study the concepts of Compactness and Connectedness.
3. To know the concept of countability axioms.

Course Outcomes (CO)

K1	CO1	Recalling the concept of Basis for a topology.
K2	CO2	Classifying the ideas of product topology and metric topology.
K3	CO3	Applying countability and separation axioms in proving Urysohn lemma and Urysohn Metrization theorem.
K4	CO4	Analyzing the concepts of limit point compactness and local compactness.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA310		Core Paper 10 FUNCTIONAL ANALYSIS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	III	7	105	5

Course Objectives

1. To know the concepts of Normed linear spaces, Banach spaces and Hilbert spaces.
2. To understand the ideas of Uniform boundedness principles, closed graph theorem and Open mapping theorem.
3. To comprehend the notions of spectral radius, the spectral theorem and Operators on Hilbert spaces.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of semi norms and Quotient spaces.
K2	CO2	Understanding the ideas of Uniform boundedness principles.
K3	CO3	Applying the concepts of eigen spectrum on normed linear spaces and spectral radius on Banach spaces.
K4	CO4	Analyzing the results of Adjoint, Self-Adjoint, Normal and Unitary Operators defined on Hilbert spaces.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA311		Core Paper 11 MATHEMATICAL STATISTICS		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	III	7	105	5

Course Objectives

1. To study the concepts of random variables and different types of distributions.
2. To determine the moments of the distribution function by using the characteristic functions.
3. To understand the Methods of finding estimates, Sample moments and their functions

Course Outcomes (CO)

K1	CO1	Remembering the random events and random variables of different distributions.
K2	CO2	Classifying the properties of characteristic functions of various distributions.
K3	CO3	Identifying the types of estimates for various probability distribution functions.
K4	CO4	Analyzing the functions by using various significance tests.

Programme Code : 02		M. Sc Mathematics		
Course Code: 19PMA412		**Core Paper 12**	**MATHEMATICAL METHODS**	
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	IV	7	105	5

Course Objectives

1. To study the concept of Fourier transforms .
2. To impart analytical ability in solving variational problems and integral equations.
3. To use calculus of variation to find the extremum of a functional.

Course Outcomes (CO)

K1	CO1	Finding the solution of Fredholm and Volterra Integral equations.
K2	CO2	Explaining the method to reduce the differential equations to Integral equations.
K3	CO3	Solving Maximum or minimum of a functional using Calculus of Variation Techniques.
K4	CO4	Analyzing the Euler's finite difference method, the Ritz method and Kantorovich's method.

Programme Code : 02		M. Sc Mathematics		
Course Code:19PMA413		Core Paper 13 CONTROL THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	IV	7	105	5

Course Objectives

1. To know the basic results of Differential Equations and Fixed Point Methods.
2. To study the basics of observability, controllability, stability, stabilizability, optimal Control of linear and nonlinear system.

3. To develop skills to review research papers in the field of Controllability Problems.

Course Outcomes (CO)

K1	CO1	Choosing ordinary differential equations through state-space representations towards analyzing and designing dynamical systems.
K2	CO2	Understanding mathematical techniques to formulate and solve control theory problems.
K3	CO3	Solving the stability of the given linear and nonlinear system using matrix theory.
K4	CO4	Analyzing various optimal control formulations and necessary conditions of optimal control.

Programme Code: 02		M. Sc Mathematics		
Course Code:19PMA414		Core Paper 14 OBJECT ORIENTED PROGRAMMING WITH C++ - THEORY		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	IV	5	75	3

Course Objectives

1. To enable the students to learn about the basic concepts of Object Oriented Programming Techniques, class structure, operators, functions in C++ and operators Overloading and Type Conversions.
2. To know the differences between object oriented programming and procedure oriented programming.
3. To apply object oriented techniques to solve the computing Problems.

Course Outcomes (CO)

9999999999999K1	CO1	Finding solutions for problems in Mathematics, Engineering, Science and Technology using Object Oriented Programming.
K2	CO2	Classifying secured and unsecured data processing by applying Abstraction, Encapsulation and Information hiding.
K3	CO3	Constructing programmes using C++ features such as composition of objects, Inheritance and Polymorphism.
K4	CO4	Analyzing the concepts of Object Oriented Programming to solve real world problems.

Programme Code : 02		M. Sc Mathematics		
Course Code:19PMA4CM		Core Practical 2 OBJECT ORIENTED PROGRAMMING WITH C++ - PRACTICAL		
Batch	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	IV	2	30	2

Course Objectives

1. To identify and formulate the techniques of software development using Object Oriented

Programming concepts.

2. To find the solution of complex problems spanning the breadth of the C++ Programming language.
3. To write programs for problems in various domains like Mathematics, Science, Technology and real world problems.

Course Outcomes (CO)

K3	CO1	Applying the concepts of Object Oriented Program for building object based applications.
K4	CO2	Analyzing different logic with suitable validations for a given problem.
K5	CO3	Interpret and design the Exception Handling Techniques for resolving run-time errors using file I/O.

rogramme Code : 02	M. Sc Mathematics
Course code: 19PMA4Z1	Project
Batch 2019-2021	**Credits** :2

Course Objectives

1. To study the basic concepts related to the Project work.
2. To know the respective research fields.
3. To know the concept of writing a dissertation in an effective way.

Course Outcomes (CO)

K3	CO1	Applying the relative notions in the respective areas and finding the results.
K4	CO2	Analyzing results with the existing results.
K5	CO3	Interpreting the results with suitable examples.

Programme Code : 02	M. Sc Mathematics
Course code: 19PMA0D1	ALC 1 DISCRETE MATHEMATICS AND AUTOMATA THEORY
Batch 2019-2021	**Credits** 2

Course Objectives

1. To understand mathematical foundations to create mathematical arguments.
2. To enable to know how lattices and Boolean algebra are used as mathematical models of network systems.
3. To know about Automata Theory and its applications.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of Mathematical logic.
K2	CO2	Explaining the implication problems using truth table , replacement process and rules of inference.
K3	CO3	Solving normal forms of given logical expression.
K4	CO4	Analyzing Karnaugh map for simplifying the Boolean expression.

Programme Code : 02	M. Sc Mathematics
Course code: 19PMA0D2	ALC 2 ASTRONOMY
Batch 2019-2021	**Credits** 2

Course Objectives

1. To acquire the knowledge about the celestial objects and planets.
2. Develop skills to design observing projects with research telescopes and projects drawing upon data in the literature and in archives.
3. To be familiar with the appearance of a range of common astronomical objects, such as asteroids, comets, satellites, planets, stars, and galaxies.

Course Outcomes(CO)

K1	CO1 •	Defining about the observed properties of physical systems that comprise the known universe.
K2	CO2	Demonstrate their ability to read, understand, and critically analyze the astronomical/physical concepts
K3	CO3	Applying their physics and mathematical skills to problems in the areas of planetary science.
K4	CO4	Analyze to draw valid scientific conclusions and communicate those conclusions in a clear and articulate manner.

Programme Code : 02	M. Sc Mathematics
Course code: 19PMA0D3	ALC 3 INTERNET AND JAVA PROGRAMMING
Batch 2019-2021	**Credits** 2

Course Objectives

1. To understand the difference between C, C++ and Java Programs.
2. To explore the Java Applications and to identify the variations between Stand alone java applications and Web based applications.
3. To provide the advanced concepts in java programming like Package, Multi Thread and Applet.

Course Outcomes (CO)

K1	CO1	Remembering the basic concepts of OOPs, Data Types, Control Statements and Tokens.
K2	CO2	Understanding about the java statements.
K3	CO3	Applying the concept of Package, Thread and Applet in program
K4	CO4	Inspect the java concepts and get the new innovative ideas.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper FLUID DYNAMICS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	7	105	5

Course Objectives

1.To have a good understanding of the fundamental equation of viscous compressible fluid.
2.To enable to Bernoulli equations, Momentum theorems and its applications.
3.To understand the motion of solid bodies in fluid and sound knowledge of boundary layer theory.

Course Outcomes (CO)

K1	CO1	Defining the fundamental aspects of fluid flow behaviour.
K2	CO2	Classifying the flow patterns of a fluid (gas or liquid) depend on its characteristic.
K3	CO3	Utilizing the fluid dynamics to analyze the flow of air over the surface to calculate pressure, changes in velocity using the Blasius's equation.
K4	CO4	Analyzing the steady state kinetic energy equation for fluid flow systems and estimate pressure drop in fluid flow systems.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper - GRAPH THEORY			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	7	105	5

Course Objectives

1. It enables students to impart the different concepts of theory of graphs.

2. The study helps to modelling the real word problems to get solutions.
3. It motivates the students to pursue research.

Course Outcomes (CO)

K1	CO1	Remembering different types of graphs and their applications
K2	CO2	Understand various operations on graphs
K3	CO3	Analysis the applications of different parameters of a graph.
K4	CO4	Applying the concept of chromatic and domination numbers and its real life applications

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper FUNDAMENTALS OF ACTUARIAL MATHEMATICS			
Batch 2019-2021	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1 To use standard techniques of mathematics to solve problems in actuarial science

2. To calculate the values of Annuity and Annuity dues .

3. To know the concepts of Life insurance premiums, Temporary assurance, Whole Life assurance and the values of policies.

Course Outcomes (CO)

K1	CO1	Remembering the concept of Insurance policies and its benefits.
K2	CO2	Understanding the consequences of events involving risk and uncertainity.
K3	CO3	Applying various modelling techniques to evaluate quantitative risk analysis.
K4	CO4	Analysing the appropriate Life insurance plans suitable for the individual or concern.

Programme Code : 02	M. Sc Mathematics		
Major Elective Paper CRYPTOGRAPHY			
Batch 2019-2021	**Hours / Week** 7	**Total Hours** 105	**Credits** 5

Course Objectives

1. To enable the students to acquire the knowledge about Classical Cipher Systems, Shift Registers and Public Key systems.
2. To be familiar with information security awareness and a clear understanding of its importance.
3. To be exposed to the importance of integrating people, processes and technology.

Course Outcomes (CO)

K1	CO1	Remembering the basic encryption techniques.
K2	CO2	Understanding the cryptographic theories, principles and technique used in security properties.
K3	CO3	Constructing a range of different cryptosystems from an applied view point.
K4	CO4	Analyzing the methods of Cryptography

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper SYSTEMS ANALYSIS AND DESIGN			
Batch 2019-2021	**Hours / Week** 4	**Total Hours** 60	**Credits** 5

Course Objectives

1. To enable the learners to understand the concepts of Foundations for systems development, Structuring system requirements and Designing Data bases.
2. To explain the principles, methods and techniques of systems development.
3. To elaborate on the application areas for different types of methods.

Course Outcomes (CO)

K1	CO1	Defining and describe the phases of the system development life cycle.
K2	CO2	Demonstrating the forms and reports and designing interfaces.
K3	CO3	Building the system development alternatives.
K4	CO4	Examining the system analysis problems.

Programme Code : 02	M. Sc Mathematics		
Non-Major Elective Paper VISUAL BASIC AND ORACLE			
Batch 2019-2021	**Hours / Week** 4	**Total Hours** **60**	**Credits** 5

Course Objectives

1. To develop visual programming skills for modern software development.

2. To get the knowledge on Graphical User Interface.
3. To apply Visual Basic controls in data base management system.

Course Outcomes (CO)

K1	CO1	Remembering the fundamentals of visual basic and procedures.
K2	CO2	Understanding the Visual Basic controls and command button properties.
K3	CO3	Making use of visual data manager and data bound control for the database programming with Visual Basic.
K4	CO4	Analyzing the connection between ORACLE and VB.

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper : FUZZY LOGIC AND NEURAL NETWORKS			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	4	60	5

Course Objectives

1. To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy operations and fuzzy logic.
2. To know the concepts of neural networks and neuro-modeling.
3. To study the basics of neural network architectures and some learning algorithms.

Course Outcomes (CO)

K1	CO1	Recalling the difference between crisp set theory and fuzzy set theory.
K2	CO2	Explaining the concepts of operations on fuzzy set.
K3	CO3	Applying the learning methods in neural network architectures.
K4	CO4	Examining the Back propagation learning algorithm.

Programme Code : 02	M. Sc Mathematics		
Non Major Elective Paper MEASURE AND INTEGRATION			
Batch	**Hours / Week**	**Total Hours**	**Credits**
2019-2021	4	60	5

Course Objectives

1. To understand the concepts of Measurable functions and Integrable functions.

2. To know about Lebesgue measure and Lebesgue integral.
3. To apply measurable functions in convegence theorems and The Radon – Nikodym theorem.

Course Outcomes (CO)

K1	CO1	Remembering the concepts of Measure and outer measure
K2	CO2	Classifying the difference between various measures
K3	CO3	Applying measure theory in theorems like monotone convergence theorem , bounded convergence theorem .
K4	CO4	Analyzing L^p spaces.