Department of Mathematics
Nesamony Memorial Christian College, Marthandam
M. Sc. Mathematics
Course Outcome

Semester – I				M. Sc. Mathematics	
Part	**Course Name**	**Course Code**	**Credit**	**Hours**	**Course Outcome**
Part - A	Core Course – I: **Group Theory**	VMAC11	5	6	Students will be able to **CO1** Recall basic counting principle, characterization of normal subgroups, group homomorphism and application **CO2** Define Solvable groups, automorphisms and Cayley's Theorem. **CO3** Explain Permutation Groups and Another Counting Principle. **CO4** Explain Sylow's theorems and apply the theorem to find number of Sylow subgroups **CO5** Define direct products, examine the properties of finite abelian groups
	Core Course - II: **Real Analysis**	VMAC12	5	6	Students will be able to **CO1** Analyze and evaluate functions of bounded variation and Rectifiable Curves. **CO2** Describe the concept of Riemann-Stieltjes integral and its properties. **CO3** Demonstrate the concept of step function, upper function, Lebesgue function and their integrals. **CO4** Construct various mathematical proofs using the properties of Lebesgue integrals and establish the Levi monotone convergence theorem. **CO5** Formulate the concept and properties of inner products, norms and measurable functions.
	Core Course - III: **Ordinary Differential Equations**	VMAC13	4	6	Students will be able to **CO1** Establish the qualitative behaviour of solutions of systems of differential equations. **CO2** Recognize the physical phenomena modelled by differential equations and dynamical systems. **CO3** Analyze solutions using appropriate methods and give examples. **CO4** Formulate Green's function for boundary value problems. **CO5** Understand and use various theoretical ideas and results that underlie the mathematics in this course.

	Elective - I: **Graph Theory and Applications**	VMAE11	3	6	Students will be able to **CO1** Demonstrate the concept of different structures and types about graphs and explain its applications. **CO2** Determine the properties of trees and applications in network and study the concepts of connections in graphs. **CO3** Acquire the knowledge about Euler Tours, Hamilton Cycles and Matchings in Graphs. **CO4** Analyze the concept of edge colouring, independent sets and cliques in Graphs **CO5** Explain the concept of vertex colourings.
	Elective - II: **Analytic Number Theory**	VMAE15	3	6	Students will be able to **CO1** Study the basic concepts of elementary number theory **CO2** Explain several arithmetical functions and construct their relationships **CO3** Apply algebraic structure in arithmetical functions **CO4** Demonstrate various identities satisfied by arithmetical functions **CO5** Determine the application to $\mu(n)$ & $\wedge(n)$ and several equivalent form of prime number theorem
Semester – II M. Sc. Mathematics				
Part - A	Core Course – IV: **Ring Theory and Lattices**	VMAC21	5	6	Students will be able to **CO1** Demonstrate competence with the basic ideas of algebra including the concepts of ideals and quotient Rings. **CO2** Understand the concept of the Particular Euclidean ring. **CO3** Able to demonstrate about the Polynomial rings over Commutative rings. **CO4** Appreciate the significance Radicals **CO5** Acquired the knowledge of direct sum of rings
	Core Course - V: **Real Analysis - II**	VMAC22	5	6	Students will be able to **CO1** Understand measurable function and Lebesgue outer measure **CO2** Explain Rieman and Lebesgue Integral. **CO3** Understand and describe the basic concepts of Fourier series and Fourier integrals with respect to the orthogonal system. Analyze and evaluate the difference between transforms of various functions. **CO4** Explain directional derivative, total derivative, matrix of linear function and sufficient condition for differentiability **CO5** Explain implicit functions and Extremum problems with side conditions.
	Core Course - VI: **Probability Theory**	VMAC23	4	6	Students will be able to **CO1** To define Random Events, Random Variables, to describe Probability, to apply Bayes, to define Distribution Function, to find Joint Distribution function, to find Marginal Distribution and

					Conditional Distribution function, to solve functions on random variables. **CO2** To define Expectation, Moments and Chebyshev Inequality, to solve Regression of the first and second types. **CO3** To define Characteristic functions, to define distribution function, to find probability generating functions, to solve problems applying characteristic functions **CO4** To define One point, two-point, Binomial distributions, to solve problems of Hypergeometric and Poisson distributions, to define Uniform, normal, gamma, Beta distributions, to solve problems on Cauchy and Laplace distributions **CO5** To discuss Stochastic convergence, Bernoulli law of large numbers, to elaborate Convergence of sequence of distribution functions, to prove Levy-Cramer Theorems and de Moivre-Laplace Theorems, to explain Poisson, Chebyshev, Khintchine Weak law of large numbers, to explain and solve problems on Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.
	Elective - III: **Research Methodology**	VMAE21	3	5	Students will be able to **CO1** Discuss to know about writing style **CO2** Discuss the Tips and Strategies **CO3** To know about the research project **CO4** Discuss the different components of Research Project **CO5** To learn the Publication and presentation of research articles and Tool kits
	Elective - IV: **Operations Research**	VMAE25	3	5	Students will be able to **CO1** Be able to build and solve Transportation and Assignment problems using appropriate method **CO2** Learn the constructions of network and optimal scheduling using CPM and PERT **CO3** Ability to construct linear integer programming models and solve linear integer programming models using branch and bound method **CO4** Understand the need of inventory management. **CO5** To understand basic characteristic features of a queuing system and acquire skills in analyzing queuing models
	SEC - I: **Mathematical Documentation using LaTex**	VMASE11	2	2	Students will be able to **CO1** To learn the latest techniques in Latex for the preparation of printable documents **CO2** To avoid difficulty while typing a project or thesis comparing other mathematical software. **CO3** To write mathematical equations and to draw graphs using Latex **CO4** To fix footnotes and header **CO5** To create tables and type formulae in Mathematics

					Semester – III M. Sc. Mathematics
Part - A	Core Course –VII: **Advanced Algebra -I**	WMAM31	5	6	Students will be able to **CO1** Explain dual space, modules and linear Transformation **CO2** Describe the concept of Triangular Matrices **CO3** Demonstrate the concept of Nilpotent and Jordan form of Matrices **CO4** Define Rational Canonical form of Matrix, Trace and Transpose and Determinants **CO5** Explain Hermitian, Unitary and Normal Transformations
	Core Course -VIII: **Complex Analysis**	WMAM32	4	6	Students will be able to **CO1** Explain analytic functions and power Series. **CO2** Explain index of a point, integral formula, higher derivatives and removable singularities **CO3** Demonstrate the concept of the general form of Cauchy's theorem **CO4** Describe the concept of definite integral and harmonic functions. **CO5** Develop Taylor and Laurent series.
	Core Course -IX: **Topology**	WMAM33	5	6	Students will be able to **CO1** Define and illustrate the concept of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space. **CO2** Understand continuous functions, the product topology and metric topology. **CO3** Understand Connected spaces, Components and Local Connectedness **CO4** Understand Compact spaces, Limit Point Compactness and Local Compactness. **CO5** Develop qualitative tools to characterize connectedness and compactness
	Core Course -X: **Calculus of Variations and Integral Equations**	WMAM34	4	5	Students will be able to **CO1** Understand the Calculus of Variations and Applications **CO2** Understand the Constraints and Lagrange's Multipliers **CO3** Integral Equations **CO4** Explain the causes and effects of Linear Equations **CO5** Explain the Hilbert Schmidt theory
	Elective - V: **Mathematical Python Theory**	WMAE32	4	4	Students will be able to **CO1** demonstrate Problem Solving Techniques and Algorithmic Problem Solving **CO2** Understanding of basic Python and Python functions in mathematical problem solving
Part - B	SEC - II: **Programming in C++**	WMASE33	2	3	Students will be able to **CO1** To understand the structure of C++ program **CO2** Explain Control Structures- Functions in C++. **CO3** Explain all functions classes and Objects.

					CO4 Explain the Nesting of member functions **CO5** Explain Constructors and Destructors
	Internship / Industrial Activity/ Field visit/ Research Knowledge updation Activity / Literacy **Internship Report to be submitted to the Department** (Carried out in minimum 20 hours)		2	External Valuation required	On completion of this course, students will / can; **CO1** Enhance the professional competency to conduct field work. **CO2** Gain practical knowledge related to their studies. **CO3** Help student to understand the subject theories and methodology better. **CO4** Gain particle skill and knowledge. **CO5** Increase the employment prospect of the student
			Semester – IV	M. Sc. Mathematics	

Part - A	Core Course –XI:
	**Advanced Algebra
	-II**
		WMAM41	5	6	Students will be able to
					CO1 Prove theorems by applying algebraic ways of thinking like extension fields and Algebraic
					    extensions.
					CO2 Explain the nature of roots of Polynomials.
					CO3 Compose clear and accurate proofs using the concepts of Galois Theory.
					CO4 Bring out insight into Finite fields
					CO5 Demonstrate knowledge and understanding of fundamental concepts including a theorem of
					    Frobenius, Integral Quaternions and the Four - Square theorem.

	Core Course -XII: **Functional Analysis**	WMAM42	4	6	Students will be able to **CO1** Understand the Banach spaces and Transformations on Banach Spaces. **CO2** Prove open mapping theorem. **CO3** Describe operators and fundamental theorems. **CO4** Validate spectral theorem. **CO5** Analyze and establish the regular and singular elements
	Project with Viva Voce	WMAM43	7	10	On completion of this course, students will / can; **CO1** Gives the student a skill such as problem solving, and helps to develop additional skills integral to their Future , such as critical thinking and time management. **CO2** Enhance their knowledge through practicals and experience.

					CO3 Be developed interpersonal skills and decision-making skills. **CO4** Give a platform to demonstrate his/her abilities. **CO5** Be able to identify the strength and weakness, which will help them to enhance and improve their ability.
	Elective - VI: **Mathematical Python - Practical**	WMAE42	4	5	Students will be able to **CO1** Write programs using advanced concepts of Python. **CO2** Write, Test and Debug Python Programs. **CO3** Implement Conditionals and Loops for Python Programs. **CO4** Use functions and represent Compound data using Lists, Tuples and Dictionaries. **CO5** Read, write and manipulate data from & to files in Python.
Part - B	SEC - III: **Programming in C++ -Practical**	WMASE43	2	3	
Part - C	Extension Activity /Pollution Awareness/Literacy / Voluntary Services **Report to be submitted to the Department**		1	External Valuation required	On completion of this course, students will / can; **CO1** Is a learning-teaching methods connect meaningful community service to academic curricula **CO2** Service-learning blends community service goals and formal and informal (standard/academic and experiential/non-standard) educational goals in a manner that benefits participants and recipients. **CO3** Extension activities and learning is a set of techniques and tools that can strengthen community relationships and connections. **CO4** Extension contributes to national development programmers. **CO5** It enhances leadership and team work qualities among the students