

[Govt. Aided First Grade College & Affiliated to University of Calicut. Re-Accredited by NAAC with A Grade]

OFFICE OF THE PRINCIPAL

PEOs, PSOs, POs & COs M.Sc MATHEMATICS

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Table 1: Programme Educational Objectives of M.SC MATHEMATICS	
PEO1	Have significant opportunities in various service domains at National and International levels like banking, insurance, government jobs, consultancy, teaching, defense, industry, research and entrepreneurial pursuit.
PE02	Have leadership quality to handle all kind of circumstances in diversities by providing interdisciplinary and multidisciplinary learning environment.
PE03	Inculcate value system while working in a team assigned with a important targets they will contribute through their critical thinking and mathematical competence holding the ethical values.
PEO4	Achieve peer recognition as an individual or as a team member having specialized knowledge and expertise to investigate, formulate, analyze and implement on the problems of pure, applied and computational mathematics to compete at global level.
PE05	Have continuous learning attitude to adopt new skills and techniques to overcome the problems related with new technologies.

2. PROGRAMME SPECIFIC OUTCOMES (PSOs)

Table 2: Programme Specific Outcomes of M.SC MATHEMATICS	
PS01	Understand the mathematical concepts and applications in the field of algebra, analysis, computational techniques, optimization, differential equations, engineering and actuarial science.
PS02	Adopt changing scientific environment in the process of sustainable development by using mathematical tools.
PS03	Handle the advanced techniques in algebra, analysis, computational techniques, optimization, differential equations, engineering, finance and actuarial science to analyze and design algorithms solving variety of problems related to real life problems.
PS04	Have necessary skills and expertise in the field of research and developments through seminar and dissertation.











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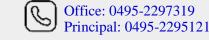
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3. PROGRAMME OUTCOMES (POs)

Table 3: Programme Outcomes of M.SC MATHEMATICS	
P01	KNOWLEDGE DOMAIN: Demonstrate an understanding of the basic concepts in mathematics, statistics, operations research and their importance in the solution of some real- world problems
P02	PROBLEM ANALYSIS: Analyze and solve the well-defined problems in mathematics statistics, and operations research. Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decision. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.
P03	PRESENTATION AND INTERPRETATION OF DATA: Demonstrate the ability to manipulate and visualize data and to compute standard statistical summaries.
P04	ETHICS: Analyze relevant academic, professional and research ethical problems and commit to professional ethics and responsibilities with applicable norms of the data analysis and research practices.
P05	MODERN TOOL USAGE: Learn, select, and apply appropriate methods and procedures, resources and computing tool such as LATEX, MATLAB etc with an understanding of the limitations.
P06	COMMUNICATION: Effectively communicate about their field of expertise on their activities, with their peer and society at large. Such as, being able to comprehend and write effective reports and design documentation, make effective presentations.
P07	PROJECT MANAGEMENT: Apply Knowledge and understanding of principles of mathematics and statistics effectively as an individual, and as a member or leader in diverse teams to manage projects in multidisciplinary environment.
P08	INDIVIDUAL AND TEAM WORK: Work effectively as an individual, as a member or leader of various teams, and in multi-disciplinary settings.
P09	DESIGN/DEVELOPMENT OF SOLUTIONS: Model the real-world problems in to mathematical equations and draw the inferences by finding appropriate solutions.
P010	LIFE-LONG LEARNING: Continue to acquire mathematical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics.









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4. COURSE OUTCOMES (COs)

COURSE 1: ALGEBRA - I

- Students will have a working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element.
- CO2 Students will be knowledgeable of different types of subgroups such as normal subgroups, cyclic subgroups and understand the structure and characteristics of these subgroups.
- CO3 Students will be introduced to and have knowledge of many mathematical concepts studied in abstract mathematics such as permutation groups, factor groups and Abelian groups.
- CO4

 Students will see and understand the connection and transition between previously studied mathematics and more advanced mathematics. The students will actively participate in the transition of important concepts such homomorphisms & isomorphisms from discrete mathematics to advanced abstract mathematics.
- Students will gain experience and confidence in proving theorems. A blended teaching method will be used requiring the students to prove theorems give the student the experience, knowledge, and confidence to move forward in the study of mathematics.

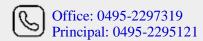
COURSE 2: LINEAR ALGEBRA

- Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.
- Use visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in R² and R³, as well as conceptually extend these results to higher dimensions.
- Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions
- COMmunicate and understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism
- Cos Critically Analyse and construct mathematical arguments that relate to the study of introductory linear algebra.

COURSE 3: REAL ANALYSIS I



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Table 4: Courses Outcomes of M.SC MATHEMATICS			
C01	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.		
C02	Comprehend regions arguments developing the theory underpinning real analysis.		
CO3	Demonstrate an understanding of limits ad how that are used in sequences, series and differentiation.		
C04	Construct rigorous mathematical proofs of basic results in real analysis.		
C05	Appreciate how abstract ideas and regions methods in mathematical analysis can be applied to important practical problems.		
COUR	COURSE 4: DISCRETE MATHEMATICS		
C01	Be familiar with fundamental mathematical concepts and terminology of discrete mathematics and discrete structures.		
C02	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.		
C03	Understand graph, subgraphs, connected and disconnected graphs etc.		
C04	Solve problems involving vertex, edge connectivity and planarity		
C05	Know the theory of Computation and Finite Automata		
COUR	COURSE 5: NUMBER THEORY		
C01	Prove results involving divisibility and greatest common divisors.		
C02	Solve systems of linear congruences.		
C03	Find integral solutions to specified linear Diophantine Equations		
C04	Apply Euler-Fermat's Theorem to prove relations involving prime numbers.		
C05	Apply the Wilson's theorem.		











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Table 4: Courses Outcomes of M.SC MATHEMATICS		
COUR	COURSE 6: ALGEBRA II	
C01	Explain the fundamental concepts of field extensions and Galois theory and their role in modern mathematics and applied contexts.	
C02	Demonstrate accurate and efficient use of field extensions and Galois theory.	
C03	Demonstrate capacity for mathematical reasoning through analysing, proving and explaining concepts from field extensions and Galois theory.	
C04	Apply problem-solving using field extensions and Galois theory applied to diverse situations in physics, engineering and other mathematical contexts.	
C05	Analyse and construct geometric numbers,	
COURSE 7: REAL ANALYSIS II		
C01	Understand the fundamentals of measure theory and be acquainted with the proofs of the fundamental theorems underlying the theory of integration	
C02	Understanding of how these underpin the use of mathematical concepts such as volume, area, and integration.	
C03	Develop 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.	
C04	Explain the concept of length, area, volume using Lebesgue's theory.	
C05	Apply the general principles of measure theory and integration in such concrete subjects as the theory of probability or financial mathematics.	
COURSE 8: TOPOLOGY		
C01	Demonstrate knowledge and understanding of concepts such as open and closed sets, interior, closure and boundary.	
C02	Create new topological spaces by using subspace, product and quotient topologies.	
C03	Use continuous functions and homeomorphisms to understand structure of topological spaces.	
C04	Demonstrate knowledge and understanding of metric spaces.	



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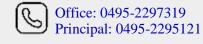
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Table 4: Courses Outcomes of M.SC MATHEMATICS	
C05	Apply theoretical concepts in topology to understand real world applications
COUR	SE 9: ODE AND CALCULUS OF VARIATIONS
CO1	Identify, analyse and subsequently solve physical situations whose behaviour can be described by ordinary differential equations
C02	Competence in solving applied problems which are linear and nonlinear form
C03	Solve the problems choosing the most suitable method
C04	determine the solution of differential equations with initial and boundary value problems
C05	enhance and develop the ability of using the language of mathematics in analysing the real- world problems of sciences and engineering.
COURSE 10: OPERATIONS RESEARCH	
C01	Formulate some real life problems into Linear programming problem.
C02	Use the simplex method to find an optimal vector for the standard linear programming problem and the corresponding dual problem
C03	Prove the optimality condition for feasible vectors for Linear programming problem and Dual Linear programming problem.
C04	Find optimal solution of transportation problem and assignment problem
C05	Formulate and solution of linear programming model of two person zero sum game
COURSE 11: PROGRAMMING WITH SCILAB (PCC)	
C01	Install and learn basics of Scilab Language
C02	Using functions, loops and conditional statements
C03	Handling Complex numbers, Polynomials, Vectors, Matrices











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Table 4: Courses Outcomes of M.SC MATHEMATICS		
C04	Handling Graphics and plots	
C05	Solutions to ODEs	
COUR	COURSE12:SCIENTIFIC PROGRAMMING WITH PYTHON(PCC)	
C01	To learn basics of the Python Language	
C02	To use control statements, functions and modules	
C03	To use data structures like lists, tuples, sequences	
C04	To use graphs and plots	
C05	To find solutions to ODEs and Numerical Analysis problems	
COURSE 13: MULTIVARIABLE CALCULUS AND GEOMETRY		
CO1	Manipulate vectors to perform geometrical calculations in three dimensions	
C02	Understand the basic concepts and know the basic techniques of differential and integral calculus of functions of several variables.	
C03	Apply the theory to calculate the gradients, directional derivatives, arc length of curves, area of surfaces, and volume of solids.	
C04	Solve problems involving maxima and minima, line integral and surface integral, and vector calculus.	
C05	Develop mathematical maturity to undertake higher level studies in mathematics and related fields.	
COUR	COURSE 14: COMPLEX ANALYSIS	
C01	Perform basic algebraic manipulation with complex numbers.	
C02	Understand the geometric interpretation of complex numbers.	











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Table -	4: Courses Outcomes of M.SC MATHEMATICS	
C03	Know methods of finding the nth roots of complex numbers and the solutions of simple polynomial equations.	
C04	Compute definite integrals using residue calculus.	
C05	Appreciate the existence of special functions and their use in a range of contexts.	
COUR	COURSE 15: FUNCTIONAL ANALYSIS	
C01	Be familiar with the completeness in normed linear spaces	
C02	Understand the concepts of bounded linear transformation, equivalent formulation of continuity and spaces of bounded linear transformations.	
C03	Describe the solvability of linear equations in Banach Spaces, weak and strong convergence and their equivalence in finite dimensional space.	
C04	Learn the properties of compact operators.	
C05	Understand uniform boundedness principle and its consequences	
COURSE 16: PDE AND INTEGRAL EQUATIONS		
C01	Apply a range of techniques to find solutions of standard Partial Differential Equations (PDE)	
C02	Understand basic properties of standard PDE's.	
C03	Demonstrate accurate and efficient use of Fourier analysis techniques and their applications in the theory of PDE's.	
C04	Demonstrate capacity to model physical phenomena using PDE's (in particular using the heat and wave equations).	
C05	Apply problem-solving using concepts and techniques from PDE's and Fourier analysis applied to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts.	
COUR	SE 17: CODING THEORY	











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Table 4: Courses Outcomes of M.SC MATHEMATICS	
C01	Understand and apply the techniques of error detection and correction, to prove the properties of the codes studied.
C02	Demonstrate the familiarity with issues arising from the applications of these coding.
CO3	Apply their knowledge to invent new coding algorithms.
C04	Analyse the performance of error control codes Apply convolution codes for performance analysis & cyclic codes for error detection and correction
C05	Design BCH code for Channel performance improvement against burst errors.
COURSE 18: CRYPTOGRAPHY	
C01	Understand various Cryptographic Techniques
C02	Apply various public key cryptography techniques
C03	Implement Hashing and Digital Signature techniques
C04	To be able to secure a message over insecure channel by various means
C05	To learn about how to maintain the Confidentiality, Integrity and Availability of a data
COURSE 19:MEASURE AND INTEGRATION	
C01	Define and understand basic notions in abstract integration theory, integration theory on topological spaces and the n-dimensional space.
C02	Describe and apply the notion of measurable functions and sets and use Lebesgue monotone and dominated convergence theorems and Fatous' Lemma.
C03	Describe the construction of and apply the Lebesgue integral,
C04	describe the construction of product measures and use Fubini's theorem.
C05	Describe the notion of absolute continuity and singularities of measures.











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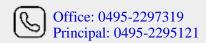
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COURSE 20: PROBABILITY THEORY Understand the axiomatic formulation of modern probability theory and consider random C01 variables as an internal requirement for the analysis of random phenomena. Characterize probability models and function of random variables based on single and C₀₂ multiples random variables Evaluate and apply moments and characteristic functions and understand the concept of C03 inequalities and probabilistic limits. Understand the concept of random processes and determine covariance and spectral density C04 of stationary random processes. Demonstrate the specific applications to Poisson and Gaussian processes and representation C₀5 of low pass and band pass noise models. **COURSE 21: ADVANCED FUNCTIONAL ANALYSIS** CO1 Formulate and prove theorems concerning analytic functions CO2 Use and analyse conformal maps CO3 Discuss the theory of analytic continuation CO4 Properties of solutions to complex differential equations CO5 Evaluate complex integrals by using Cauchy-Goursat Integral Theorem **COURSE 22 :ADVANCED COMPLEX ANALYSIS** CO1 Formulate and prove theorems concerning analytic functions CO2 Use and analyse conformal maps CO3 Discuss the theory of analytic continuation CO4 Properties of solutions to complex differential equations











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Table 4: Courses Outcomes of M.SC MATHEMATICS		
C05	Evaluate complex integrals by using Cauchy-Goursat Integral Theorem	
COUR	SE 23: ALGEBRAIC NUMBER THEORY	
C01	Define the key notions of algebraic number theory and outline their interrelation.	
C02	The concept (definition and significance) of algebraic numbers and algebraic integers	
C03	Understand the fundamental theorems of the course and apply them in specific cases.	
C04	Explain the concept of "geometry of numbers" according to Minkowski.	
C05	The definition of the Class Group.	
COURSE 24: ALGEBRAIC TOPOLOGY		
C01	Explain the fundamental concepts of algebraic topology and their role in modern mathematics and applied contexts.	
C02	Demonstrate accurate and efficient use of algebraic topology techniques.	
C03	Demonstrate capacity for mathematical reasoning through analysing, proving and explaining concepts from algebraic topology.	
C04	Apply problem-solving using algebraic topology techniques applied to diverse situations in physics, engineering and other mathematical contexts.	
C05	find algebraic invariants that classify topological spaces up to homeomorphism, though usually most classify up to homotopy equivalence,,	
COUR	COURSE 25: COMMUTATIVE ALGEBRA	
C01	Knows basic definitions concerning elements in rings, classes of rings, and ideals in commutative rings.	
C02	Know constructions like tensor product and localization, and the basic theory for this.	
C03	Know basic theory for noetherian rings and Hilbert basis theorem	











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Table 4: Courses Outcomes of M.SC MATHEMATICS		
C04	Have insight in the correspondence between ideals in polynomial rings, and the corresponding geometric objects: affine varieties.	
C05	Know the theory of Gröbner bases and Buchberger's algorithm	
COUR	COURSE 26: DIFFERENTIAL GEOMETRY	
C01	Analyse the equivalence of two curves by applying some theorems.	
C02	Express definition and parametrization of surfaces.	
CO3	Explain differential maps between surfaces and find derivatives of such maps.	
C04	List topological aspects of surfaces	
C05	Give examples of manifolds and investigate their properties.	
COURSE 27: FLUID DYNAMICS		
C01	Describe the motion of fluids.	
C02	Identify derivation of basic equations of fluid mechanics and apply	
C03	Make dimensional analysis and similitude.	
C04	Apply the similitude concept and set up the relation between a model and a prototype.	
C05	Identify how to derive basic equations and know the related assumptions.	
COURSE 28: GRAPH THEORY		
C01	Solve problems using basic graph theory	
C02	Identify induced subgraphs, cliques, matchings, covers in graphs	
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C04	Determine whether graphs are Hamiltonian and/or Eulerian
C05	Model real world problems using graph theory
COURSE 29: REPRESENTATION THEORY	
C01	Give an account of important concepts and definitions in representation theory for finite groups
C02	Exemplify and interpret important concepts in specific cases
C03	Formulate important results and theorems
C04	Describe the main features of the proofs of important theorems
C05	Use the theory, methods and techniques of the course to solve mathematical problems.
COURSE 30: WAVELET THEORY	
C01	To understand basic properties of Discrete Fourier Transforms
C02	To understand the Fast Fourier Transforms
C03	To apply Wavelets on Z _N
C04	To apply Fourier Transform and convolution
C05	To apply Multi-resolution analysis using wavelets





