CAUSSANEL COLLEGE OF ARTS AND SCIENCE

(Affiliated to Alagappa University, Karaikudi)

Accredited with 'A' Grade by NAAC

Recognized by UGC under 2(f) & 12(B)

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Type of Graduation	Under Graduation
Programme Name	**M.Sc Mathematics**
Regulation (CBCS)	2017

Outcome of the Programme

- To provide comprehensive curriculum to groom the students into qualitative scientific manpower
- Enable students to enhance mathematical skills and understand the fundamental concepts of pure and applied mathematics
- To provide qualitative education through effective teaching learning processes by introducing projects, participative learning and latest software tools.
- To inculcate innovative skills, team work, ethical practices among students so as to meet societal expectations
- To encourage collaborative learning and application of mathematics to real life situations
- To inculcate the curiosity for mathematics in students and to prepare them for future research.

Specific Outcome of the Programme

- Apply the knowledge of mathematical concepts in interdisciplinary fields
- Understand the nature of abstract mathematics and explore the concepts in further details
- Model the real-world problems in to mathematical equations and draw the inferences by finding appropriate solutions.
- Identify challenging problems in mathematics and find appropriate solutions
- Pursue research in challenging areas of pure/applied mathematics.
- Employ confidently the knowledge of mathematical software and tools for treating the complex mathematical problems and scientific investigations.
- Continue to acquire mathematical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics
- Comprehend and write effective reports and design documentation related to mathematical research and literature, make effective presentations
- Qualify national level tests like NET/GATE etc.
- Effectively communicate and explore ideas of mathematics for propagation of knowledge and popularization of mathematics in society.

Semester	Subject Code	Subject Title	Outcome	Specific Outcome
I	7MMA1C1	ALGEBRA - I	• This course is designed to give students a foundation for all future mathematics courses. The fundamentals of algebraic problem-solving are explained. Students will explore: foundations of Algebraic structures, Groups, Rings, Ideals, Fields, Homomorphism etc. The course also fulfills the objective to make students aware of the applicability of abstract mathematics in real	• Apply the knowledge of Algebra to attain a good mathematical maturity and enables to build mathematical thinking and skill. • Utilize the class equation and Sylow theorems to solve different related problems . • Identify and analyze different types of algebraic structures such as Solvable groups, Simple groups, Alternate groups to understand and use the fundamental results in Algebra.

			world problems.	• Design, analyze and implement the concepts of homomorphism and isomorphism between groups and rings for solving different types of problems, for example, Isomorphism theorems, quotient groups, conjugacy etc. • Create, select and apply appropriate algebraic structures such as finitely generated abelian groups, Ideals, Fields to explore the existing results. • Identify the challenging problems in modern mathematics and find their appropriate solutions.
I	7MMA1C2	ANALYSIS – I	• This course is designed to provide a deeper and rigorous understanding of fundamental concepts viz. metric spaces, continuous functions, sequences and series of numbers as well as functions, and the Riemann-Stieltjes integral etc. The main focus of this course will be on theoretical foundation of the above said concepts and it will cultivate the rigorous mathematical logics and skills in the students.	• Apply the knowledge of concepts of real analysis in order to study theoretical development of different mathematical techniques and their applications • Understand the nature of abstract mathematics and explore the concepts in further details • Identify challenging problems in real variable theory and find their appropriate solutions. • Deal with axiomatic structure of metric spaces and generalize the concepts of sequences and series, and continuous functions

				in metric spaces. • Use theory of Riemann-Stieltjes integral in solving definite integrals arising in different fields of science and engineering. • Extend their knowledge of real variable theory for further exploration of the subject for going into research.
I	7MMA1C3	DIFFERENTIAL GEOMETRY	• The objective of this course is to make students familiar with basic concepts of differential geometry so as to deal with geometry of curves and spaces using the methods of differential calculus.	• Understand the basic concepts and results related to space curves, tangents, normals and surfaces. • Explain the geometry of different types of curves and spaces. • Explain the physical properties of different curves and spaces. • Understand principal directions and curvatures, asymptotic lines and then apply their important theorems and results to study various properties of curves and surfaces. • Utilize Geodesics, it's all related terms, properties and theorems.
I	7MMA1C4	ORDINARY DIFFERENTIAL EQUATIONS	• The Objective of this course is to introduce ordinary differential equations and fundamental theorems for existence and	• Understand ordinary differential equations of various types, their solutions, and fundamental concepts about their existence.

			uniqueness. This course further explains the analytic techniques in computing the solutions of various ordinary differential equations appearing in various fields of science and technology.	• Understand the concept and applications of eigen value problems. • Understand differential equations of Strum Liouville type. • Apply various power series methods to obtain series solutions of differential equations. • Discuss various kinds of special functions in detail, their properties and relations. • Solve problems of ordinary differential equations arising in various fields.
I	7MMA1E1	NUMBER THEORY	• This course is designed to provide students an introduction to classical number theory and enable them to study higher courses in number theory, and to apply the learnt concepts of number theory using public-key cryptography.	• Apply the knowledge of Number theory and Cryptography to attain a good mathematical maturity and enables to build mathematical thinking and skill. • Utilize the congruences, Chinese remainder theorem, indices, residue classes, Legendre symbols to solve different related problems • Identify and analyze different types of divisibility tests, Euler's theorem, Wilson theorem, Mobius inversion formula to formulate and solve various related problems.

				• Design, analyze and implement the concepts of Diophantine equations for solving different types of problems, for example, sum of two and four squares. • Identify the challenging problems in modern mathematics and find their appropriate solutions.
II	7MMA2C1	ALGEBRA-II	• This course is designed to give students a foundation for advanced study in Algebra. The fundamental theorems of algebraic structures are explained. Students will explore the concepts of Polynomial rings, UFD, ED, PID, Field extensions, Einstein's irreducibility criterion, Galois extensions etc. Throughout the course, Advanced Core standards are taught and reinforced as the student learns how to apply the concepts in real-life situations.	• Apply the knowledge of Algebra to attain a good mathematical maturity and enables to build mathematical thinking and reasoning • Utilize the Polynomial rings, UFD, ED, PID to solve different related problems. • Identify and analyze different types of algebraic structures such as Algebraically closed fields, Splitting fields, Finite field extensions to understand and use the fundamental results in Algebra. • Design, analyze and implement the concepts of Gauss Lemma, Einstein's irreducibility criterion, separable extensions etc. • Create, select and apply appropriate algebraic structures such as Galois extensions,

				Automorphisms of groups and fixed fields, Fundamental theorem of Galois theory to understand and use the Fundamental theorem of Algebra. • Identify the challenging problems in advanced Algebra to pursue further research.
II	7MMA2C2	ANALYSIS – II	• This course is designed to consider theoretical foundations of concepts of mathematical analysis, viz. derivative, MVTs, functions of several variables, measure theory and integration that have many important applications in different branches of pure and applied mathematics. Further, the objective is enable students familiar with these concepts and their fruitful applications.	• Apply the knowledge of concepts of functions of several variables and measure theory in order to study theoretical development of different mathematical concepts and their applications. • Understand the nature of abstract mathematics and explore the concepts in further details • Utilize the concepts of derivative, MVTS for vector-valued functions in applications different fields for example management, industry and economics etc. • Recognize the need of concept of measure from a practical view point. • Understand measure theory and integration from theoretical point of view and apply its tools in different fields of

				applications. • Extend their knowledge of Lebesgue theory of integration by selecting and applying its tools for further research in this and other related areas
II	7MMA2C3	PARTIAL DIFFERENTIAL EQUATIONS	• The Objective of this course is to introduce first and higher order partial differential equations and their classification. This course explains various analytic methods for computing the solutions of various partial differential equations. It also explains various applications of partial differential equations in real physical phenomenon like wave equation of string, diffusion equations and heat flow equation to students.	• Understand partial differential equations of first order (linear and nonlinear), second and higher order. • Apply various analytic methods for computing solutions of various PDEs. • Determine integral surfaces passing through a curve, characteristic curves of second order PDE and compatible systems. • Understand the formation and solution of some significant PDEs like wave equation, heat equation and diffusion equation. • Apply the knowledge of PDEs and their solutions in order to understand physical phenomena.
II	7MMA2C4	MECHANICS	• To demonstrate knowledge of functional and extremum path and the application of the knowledge in solving some fundamental problems. To demonstrate the knowledge and	• Understand the concept of functional and determine stationary paths of a functional to deduce the differential equation for stationary paths. • Use Euler-Lagrange equation to

			understanding of the fundamental concepts in the dynamics of system of particles and Lagrangian and Hamiltonian formulation of mechanics. To represent the equations of motion for complicated mechanical systems using the Lagrangian and Hamiltonian formulation of classical mechanics.	find stationary paths and its applications in some classical fundamental problems. • Define and understand basic mechanical concepts related to discrete and continuous mechanical systems. • Describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism • Connect concepts and mathematical rigor in order to enhance understanding.
II	7MMA2E1	GRAPH THEORY	• Be familiar with the definitions and basic theory of graphs ,Be able to implement many of the standard algorithms of graph theory ,Be able to prove simple results in graph theory. State all of the technical definitions covered in the course (such as a graph, tree, planar graph, coloring, digraph, generating function, linear extension, and other terms).	• Illustrate different types of graph theory. • Define Euler Tours and Hamiltonian cycles and prove related theorems. • Explain Matchings and edge colouring. • Define edge chromatic number and some properties are proved. • Define independent sets and cliques and prove related theorems. • Define vertex colouring and prove theorems on vertex colouring. • Derive properties of planarity and Euler's formula. • Prove Five colour theorem.

III	7MMA3C1	COMPLEX ANALYSIS	• The objective of this course is to introduce and develop a clear understanding of the fundamental concepts of Complex Analysis such as analytic functions, Cauchy-Riemann relations and harmonic functions and to make students equipped with the understanding of the fundamental concepts of complex variable theory. In particular, to enable students to acquire skill of contour integration to evaluate complicated real integrals via residue calculus.	• Know the fundamental concepts of complex analysis. • Evaluate complex integrals and apply Cauchy integral theorem and formula • Evaluate limits and checking the continuity of complex function & apply the concept of analyticity and the Cauchy-Riemann equations. • Solve the problems using complex analysis techniques applied to different situations in engineering and other mathematical contexts. • Solve the problems using complex analysis techniques applied to different situations in engineering and other mathematical contexts. • Extend their knowledge to pursue research in this field.

III	7MMA3C2	TOPOLOGY-I	The objective of the course on **Topology** is to provide the knowledge of Topological Spaces and their importance. To acquaint students with the concept of Homeomorphism and the topological properties and important mathematical concepts which can be generalized in topological spaces, so that students may learn and appreciate the nature of abstract Mathematics.	• Understand the concepts of topological spaces and the basic definitions of open sets, neighbourhood, interior, exterior, closure and their axioms for defining topological space. • Understand the concept of Bases and Subbases, create new topological spaces by using subspace. • Understand continuity, compactness, connectedness, homeomorphism and topological properties. • Understand how points of space are separated by open sets, Housdroff spaces and their importance. • Understand regular and normal spaces and some important theorems in these spaces.
III	7MMA3C3	PROBABILITY AND STATISTICS	• The course is to enable the students with understanding of various types of probability distributions and testing of hypothesis problems. It aims to equip the students with standard concepts of statistical techniques and their utilization.	• . Apply the knowledge of statistical techniques in various experimental and industrial requirments. Define Probility set function, Expectation of a random variable. • Derive Chebyshev's inequality. • Describe conditional Distributions and expectations. • Solve the problems by using

				Chebyshev's inequality. • Illustrate the Poisson, Gamma and Chi-Square Distributions. • Solve the problems by using Bivariate Normal distribution. • Explain distributions of order statistics. • Prove the central limit theorem.
III	7MMA3E1	DISCRETE MATHEMATICS	• Prepare students to develop mathematical foundations to understand and create mathematical arguments require in learning many mathematics and computer sciences courses. To motivate students how to solve practical problems using discrete mathematics. Also, in this course basic concepts of Graph theory such as Trees, Eulerian Graphs, Matching, Vertex colourings, Edge colourings, Planarity, are introduced.	• Construct mathematical arguments using logical connectives and quantifiers. • Understand how lattices and Boolean algebra are used as tools and mathematical models in the study of networks. • Validate the correctness of an argument using statement and predicate calculus. • Learn how to work with some of the discrete structures which include sets, relations, functions, graphs and recurrence relation. • Understand the concepts Planarity including Euler identity. • Discuss and understand the importance of the concepts Matching's and Colourings'.
III	7MMA3E4	FUZZY MATHEMATICS	• Fuzzy logic is an extension or a superset of Boolean logic aimed at maintaining the concept of the	• Find crisp sets and fuzzy sets and discuss the types of fuzzy sets.

			partial truth.	• Classify the operations on fuzzy sets. • Illustrate fuzzy relation. • Explain fuzzy measures and classify possibility and necessity measures • Determine decision making in fuzzy environments and solve the correspondingL.P.P by simplex method
IV	7MMA4C1	FUNCTIONAL ANALYSIS	• This course will develop a deeper and rigorous understanding of fundamental concepts of functional analysis, their properties and related theorems.	• Explain the fundamental concepts of functional analysis and their role in modern mathematics. • Utilize the concepts of functional analysis, for example continuous and bounded operators, normed spaces, Hilbert spaces and to study the behavior of different mathematical expressions arising in science and engineering. • Understand and apply fundamental theorems from the theory of normed and Banach spaces including the Hahn-Banach theorem, the open mapping theorem, the closed graph theorem and uniform boundedness theorem. • Understand the nature of abstract mathematics and explore the concepts in further details.

				• Explain the concept of projection on Hilbert and Banach spaces.
IV	7MMA4C2	OPERATIONS RESEARCH	• This course is designed to introduce basic optimization techniques in order to get best results from a set of several possible solutions of different problems viz. linear programming problems, transportation problem, assignment problem and unconstrained and constrained problems etc. The major focus will be on formulation of real world phenomena from its physical considerations and implementation of optimization algorithms for solving these problems.	• Apply the knowledge of basic optimization techniques in order to get best possible results from a set of several possible solution of different problems viz. linear programming problems, transportation problem, assignment problem and unconstrained and constrained problems etc. • Formulate an optimization problem from its physical consideration. • Select and implement an appropriate optimization technique keeping in mind its limitations in order to solve a particular optimization problem. • Understand theoretical foundation and implementation of similar type optimization techniques available in the scientific literature. • Continue to acquire knowledge and skills of optimization techniques that are appropriate to professional activities • Extend their knowledge of basic optimization techniques to do

				interesting research work on these types of optimization techniques.
IV	7MMA4C3	TOPOLOGY-II	• The aim of this course is to give an overview of the most important concepts and results of the theory of topological vector spaces (TVS). As the name suggests, this theory beautifully connects topological and algebraic structures. The main focus will be the study of TVS over the reals and particular attention will be given to locally convex spaces (e.g. normed, seminormed and nuclear spaces).	• understand the general theory of topological vector spaces. • learn the basic properties of topological vector spaces. • define the structure of locally-convex topological vector spaces. • understanding and analyzing inductive and projective limits. • understand the structure of, Frechet spaces, Montel, Schwartz, and nuclear spaces.
IV	7MMA4E1	ADVANCED STATISTICS	• The course is to enable the students with understanding of various types of probability distributions and testing of hypothesis problems. It aims to equip the students with standard concepts of statistical techniques and their utilization.	• Tackle big data and draw inferences form it by applying appropriate statistical techniques. • Explore the basic ideas about measures of central tendency, dispersion and their applications in other statistical problems • Explain the different types of discrete and continuous distributions and their utilization. • Deal with formulation of hypotheses as per situations and their testing