ST. JOSEPH'S COLLEGE, DEVAGIRI, CALICUT
(AUTONOMOUS)

POST GRADUATE DEGREE PROGRAMME

ST. JOSEPH'S CHOICE BASED CREDIT SEMESTER SYSTEM
(SJCBCSSUG)

MASTER OF SCIENCE
IN
MATHEMATICS

Course Outcome
(2019Admn Onwards)

COURSE OUTCOMES

CORE COURSES

SEMESTER I
FMTH1C01: ABSTRACT ALGEBRA

COs	COURSE OUTCOMES
CO1	Learn factor group computation.
CO2	Understand the notion of group action on a set.
CO3	Learn Sylow theorems and its applications.
CO4	Understand the notion of free groups.
CO5	Understand the concept rings of polynomials
CO6	Learn group presentation.

SEMESTER I
FMTH1C02: LINEAR ALGEBRA

COs	COURSE OUTCOMES
CO1	Learn basic properties of vector spaces.
CO2	Understand the relation between linear transformations and matrices.
CO3	Understand the concept of diagonalizable and triangulable operators and various fundamental results of these operators.
CO4	Understand Primary decomposition Theorem.
CO5	Learn basic properties inner product spaces.

SEMESTER I
FMTH1C03: REAL ANALYSIS I

COs	COURSE OUTCOMES
CO1	Learn the topology of the real line
CO2	Understand the notions of Continuity, Differentiation and Integration of real functions
CO3	Learn Uniform convergence of sequence of functions, equicontinuity of family of functions, and Weierstrass theorems

SEMESTER I
FMTH1C04: DISCRETE MATHEMATICS

COs	COURSE OUTCOMES
CO1	Understand the fundamentals of Graph Theory
CO2	Learn the structure of graphs and familiarize the basic concepts to analyze different problems in different branches
CO3	Acquire a basic knowledge of formal languages, grammar and automata
CO4	Learn equivalence of deterministic and nondeterministic finite accepters
CO5	Learn the concepts of partial order relation and total order relation

SEMESTER I
FMTH1C05: NUMBER THEORY

COs	COURSE OUTCOMES
CO1	Be able to effectively express the concepts and results of number theory
CO2	Learn basic theory of arithmetical functions and Dirichlet multiplication, averages of some arithmetical functions
CO3	Understand distribution of prime numbers and prime number theorem.
CO4	Learn the concept of quadratic residues and Quadratic reciprocity laws.
CO5	Get a basic knowledge in Cryptography

SEMESTER II
FMTH2C06: GALOIS THEORY

COs	COURSE OUTCOMES
CO1	Get a basic knowledge in Galois Theory
CO2	Learn how to apply Galois Theory in various contexts
CO3	Learn different types of extensions of fields
CO4	Learn automorphisms of fields

SEMESTER II
FMTH2C07 REAL ANALYSIS II

COs	COURSE OUTCOMES
CO1	Learn why and for what the theory of measure was introduced
CO2	Learn the concept of measures and measurable functions
CO3	Learn Lebesgue integration and its various properties
CO4	Learn how to generalize the concept of measure theory.
CO5	Learn that a measure may take negative values.

SEMESTER II
FMTH2C08: TOPOLOGY

COs	COURSE OUTCOMES
CO1	Be proficient in the abstract notion of a topological space, where continuous function are defined in terms of open set not in the traditional $\varepsilon - \delta$ definition used in analysis
CO2	Realize Intermediate value theorem is a statement about connectedness, Bolzano weierstrass theorem is a theorem about compactness and so on
CO3	Learn the concept of quotient topology
CO4	Learn five properties such as T0, T1, T2, T3 and T4 of a topological space X which express how rich the open sets is. More precisely, each of them tells us how tightly a closed subset can be wrapped in an open set.

SEMESTER II
FMTH2C09: ODE AND CALCULUS OF VARIATIONS

COs	COURSE OUTCOMES
CO1	Learn the existence of uniqueness of solutions for a system of first order ODEs
CO2	Learn many solution techniques such as separation of variables, variation of parameter power series method, Frobeniious method etc.
CO3	Learn method of solving system of first order differential calculus equations
CO4	Get an idea of how to analyze the behavior of solutions such as stability, asymptotic stability etc.
CO5	Get a basic knowledge of Calculus of variation

SEMESTER II

FFMTH2C10: OPERATIONS RESEARCH

COs	COURSE OUTCOMES
CO1	Learn graphical method and the simplex algorithm for solving a linear programming problem
CO2	Learn more optimization techniques for solving the linear programming models transportation problem and integer programming problem
CO3	Learn optimization techniques for solving some network related problems.
CO4	Learn sensitivity analysis and parametric programming, which describes how various changes in the problem affect its solution

SEMESTER III

FMTH3C11: MULTIVARIABLE CALCULUS AND GEOMETRY

COs	COURSE OUTCOMES
CO1	Be proficient in differentiation of functions of several variables.
CO2	Understand curves in plane and in space.
CO3	Get a deep knowledge of Curvature, torsion, Serret-Frenet formulae
CO4	Learn Fundamental theorem of curves in plane and space.
CO5	Learn the concept of Surfaces in three dimension, smooth surfaces, surfaces of revolution
CO6	Learn explicitly tangent and normal to the surfaces
CO7	Get a thorough understanding of oriented surfaces, first and second fundamental forms surfaces, gaussian curvature and geodesic curvature and so on.

SEMESTER III

FMTH3C12: COMPLEX ANALYSIS

COs	COURSE OUTCOMES
CO1	Learn the concept of (complex) differentiation and integration of functions defined on the complex plane and their properties
CO2	Be thorough in power series representation of analytic functions, different versions of Cauchy's Theorem.
CO3	Get an idea of singularities of analytic functions and their classifications
CO4	Learn different versions of maximum modulus theorem

SEMESTER III
FMTH3C13: FUNCTIONAL ANALYSIS

COs	COURSE OUTCOMES
CO1	Learn the concept of normed linear spaces and Hilbert spaces.
CO2	Learn various properties operators defined on both normed and Hilbert spaces.
CO3	Understand the concept dual space.
CO4	Learn the completeness of the space bounded linear operators

SEMESTER III
FMTH3C14: PDE AND INTEGRAL EQUATIONS

COs	COURSE OUTCOMES
CO1	Learn a technique to solve first order PDE and analyse the solution to get information about the parameters involved in the model
CO2	Learn explicit representations of solutions of three important classes of PDE Heat equations Laplace equation and wave equation for initial value problems
CO3	Get an idea about Integral equations
CO4	Learn the relation between Integral and differential Equations

SEMESTER III
FMTH3E01: ELECTIVE: CODING THEORY

COs	COURSE OUTCOMES
CO1	The basics of coding theory.
CO2	Learn to detect and correct the error patterns.
CO3	Learn to implement the fundamental concepts in linear algebra to coding theory
CO4	Understand about different types of coding and decoding methods and develop the problem solving ability.
CO5	Attain the skills to represent cyclic codes in terms of polynomials

SEMESTER III

FMTH3E02: ELECTIVE: CRYPTOGRAPHY

COs	COURSE OUTCOMES
CO1	Understand the fundamentals of cryptography and cryptanalysis
CO2	Acquire a knowledge of Claude Shanon's ideas to cryptography, including the concepts of perfect secrecy and the use of information theory to cryptography
CO3	Learn to use substitution -permutation networks as a mathematical model to introduce many of theconcepts of modern block cipher design and analysis including differential and linear ryptoanalysis
CO4	Familiarize different cryptographic hash functions and their application to the construction of message authentication codes

SEMESTER III

FMTH3E03: ELECTIVE: MEASURE AND INTEGRATION

COs	COURSE OUTCOMES
CO1	Learn how a measure will be helpful to generalize the concept of an integral
CO2	Learn how a smallest sigma algebra containing all open sets be constructed on a topological space which ensures the measurability of all continuous function and how a measure called Borel measure is defined on this sigma algebra which ensures the integrability of a huge class of continuous functions
CO3	Understand the regularity properties Borel measures.
CO4	Realize a measure may take real values even complex values.
CO5	Learn to characterize bounded linear functionals on Lp.
CO6	Learn product measure and their completion

SEMESTER III

FMTH3E04: ELECTIVE: PROBABILITY THEORY

COs	COURSE OUTCOMES
CO1	Understand the concept of random variables, probability and distribution function of a random variable
CO2	Apply the knowledge of convergence a sequence of random variables almost surely, in probability and distribution
CO3	Apply the knowledge of central limit theorem in relevant situations
CO4	Develop problem solving techniques to solve real world problems
CO5	Able to translate real world problems into probability models
CO6	Evaluate and apply moments and characteristic functions and understand the concept of inequalities

SEMESTER III

FMTH3E05: ELECTIVE: GRAPH THEORY

COs	COURSE OUTCOMES
CO1	Learn different types of graphs
CO2	Learn the concept matching in graphs and related results.
CO3	Understand what is meant by coloring
CO4	Learn Planar Graphs

SEMESTER IV

FMTH4C15: ADVANCED FUNCTIONAL ANALYSIS

COs	COURSE OUTCOMES
CO1	Understand the notions of Fredholm theory of compact Operators and their properties
CO2	Apply the theory to understand and solve some problems of integral equations at an appropriate level of difficulty
CO3	Describe the construction of the spectral integral.
CO4	Recognize the fundamentals of Banach spaces and Banach Algebras

SEMESTER IV

FMTH4E06: ELECTIVE: ADVANCED COMPLEX ANALYSIS

COs	COURSE OUTCOMES
CO1	Get a deep knowledge about the space of continuous functions from an open set in the complex plane to a region of the complex plane
CO2	Learn a technique to extend the domain over which a complex analytic function is defined
CO3	Understand that there is a unique conformal map f of the unit disk onto a simply connected domain of the extended complex plane such that f(0) and arg f′(0) take given values
CO4	Express some functions as infinite series or products

SEMESTER IV

FMTH4E07: ELECTIVE: ALGEBRAIC NUMBER THEORY

COs	COURSE OUTCOMES
CO1	Understand that abstract algebra may be used to solve certain problems in Number Theory
CO2	Learn about arithmetic of algebraic number fields
CO3	Understand that the familiar unique factorization property may fail in the case of ring of integers of some quadratic fields while a unique factorization theory holds for ideals of ring of integers of a number field
CO4	Learn finiteness of class numbers
CO5	Understand that the notions of algebraic numbers may be applied to prove Kummer's special case of Fermat's Last Theorem

SEMESTER IV

FMTH4E08: ELECTIVE: ALGEBRAIC TOPOLOGY

COs	COURSE OUTCOMES
CO1	Learn how basic geometric structures may be studied by transforming them into algebraic questions
CO2	Learn basics of homology theory and apply it to get a generalization of Eulers formula to a general polyhedral.
CO3	Learn to associate a group called fundamental group to every topological space.
CO4	Learn that two objects that can be deformed into one another will have the same homology group and that homemorphic spaces have isomorphic fundamental groups
CO5	Learn Brouwer fixed point theorem and related results

SEMESTER IV

FMTH4E09: ELECTIVE: COMMUTATIVE ALGEBRA

COs	COURSE OUTCOMES
CO1	Basic properties of commutative rings, ideals and modules over commutative rings,
CO2	Learn uniqueness theorem for a decomposable ideal.
CO3	Learn integrally closed domain and valuation ring.
CO4	Understand the basic theory of Noetherian and Artin Rings

SEMESTER IV
FMTH4E10: ELECTIVE: DIFFERENTIAL GEOMETRY

COs	COURSE OUTCOMES
CO1	Understand how calculus of several variables can be used to develop the geometry of n-dimensional oriented n- surface in $\mathbb{R}^{n+1}$
CO2	Understand locally n- surfaces and parametrized n- surfaces are the same
CO3	Develop a knowledge of the Gauss and Weingarten maps and apply them to apply them to describe various properties of surfaces

SEMESTER IV
FMTH4E11: ELECTIVE: FLUID DYNAMICS

COs	COURSE OUTCOMES
CO1	Learn the concept of Equation of Motion and how they relate the dynamics of flow to the pressure and density fields
CO2	Learn the concepts of streaming motions and Aerofoils
CO3	Learn the concepts of Sources and Sinks
CO4	Get an idea of Stream function and its uses to plot stream lines which represent trajectories of particles in a steady flow

SEMESTER IV
FMTH4E13: ELECTIVE: REPRESENTATION THEORY

COs	COURSE OUTCOMES
CO1	Learn the concept of G-Modules and commutant algebra.
CO2	Learn the concepts of orthogonality relations and the finite abelian groups.
CO3	Learn the concepts of induced representations and normal subgroups

SEMESTER IV

FMTH4E14: ELECTIVE: WAVELET THEORY

COs	COURSE OUTCOMES
CO1	Learn the concept of discrete Fourier Transforms and its basic properties.
CO2	Learn how to construct Wavelets on $\mathbb{Z}_N$ and $\mathbb{Z}$.
CO3	Learn Wavelets on $\mathbb{R}$ and construction of MRA