Session 2019-20

Programme and Course Outcome

M.Sc Math

Multani Mal Modi College, Patiala

Program Outcomes (POs)

The students has

PO1: Ability to communicate various concepts of mathematics effectively using examples and their geometrical visualizations.

PO2: Capability of demonstrating comprehensive knowledge of mathematics.

PO3: Ability to employ critical thinking in understanding the concepts in every area of mathematics.

PO4: Ability to analyze the results and apply them in various problems appearing in different branches of mathematics.

PO5: Ability to provide new solutions using the domain knowledge of mathematics

PO6: Capability for inquiring about appropriate questions relating to the concepts in various fields of mathematics.

PO7: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

Course Outcomes (COs)

Semester-I

MM-401: Algebra-I

MM-402: Mathematical Analysis

MM-403: Topology-I

MM-404: Differential Geometry

CS -405A: Introduction to Computer and Programming using C

CS -405B: Software Laboratory –I (C-Programming)

Semester-II

MM-501: Algebra- II (Rings and Modules)

MM-502: Topology-II

MM-503: Differential Equations-I

MM-504: Functional Analysis

MM-505:Complex Analysis

Course Outcomes: After completion of the course the student will be able to:

Algebra-I

CO1:Exhibit and recall the previous learning of algebraic structures groups and rings.

CO2: Understand the concepts of Composition series, Solvable and Nilpotent groups, and permutation groups.

CO3: Understand the concepts of structure theory of groups, Field of quotients and Ring of Endomorphism of abelian groups.

CO4: Apply group action theory to derive class equation.

CO5: Use and apply concepts of group theory to other algebraic structures.

CO6: Recognize and use Sylow's theorems to characterize certain finite groups

CO7: Use and apply the concepts of group theory in Galois theory, Algebraic geometry, Combinatorics.

Mathematical Analysis

CO1: Solve problems based on Functional of several variables including Inverse function theorem, Implicit function theorem.

CO2: Understand Measure spaces and Lebesgue measure

CO3: Identify Measurable function ,Riemann and lebesgue integrals.

CO4: Understand Differentiation ,Functions of bounded variation, Differentiation of an Integral, Absolute Continuity, Convex Functions and Jensen's inequality.

CO5: Describe the applications in probability theory, real analysis, and many other fields in mathematics as Functional Analysis, Approximation Theory and PDE.

Topology-I

CO1: Differentiate between finite, countable, and uncountable sets.

CO2: Understand the concept open-sets; Closed Set; Nhd of a point; Interior & Exterior points.

CO3: Determine and construct Topology by the collection of open-Closed sets or on the basis of nhd at each point.

CO4: Understand the basic properties of connected spaces.

CO5: Understand basic properties of compact spaces, and locally compact spaces

CO6: Apply the results to describe the space-time structure of universe.

CO7: Apply the results in physics to study the string theory.

Differential Geometry

CO1: Recoganise and recall the basic concepts of Curve.

CO2: Understand the role of Serret-Frenet formulae on curves.

CO3: Know the Interpretation of the curvature tensor, Geodesic curvature, Gauss and Weingarten formulae.

CO4: Understand the role of Gauss's Theorema Egregium and its consequences.

CO5: Apply problem-solving with differential geometry to diverse situations in physics, engineering and in other mathematical contexts.

CS -405A: Introduction to Computer and Programming using C & Software Laboratory –I (C-Programming)

After completion of this course, students will be able to:

CO-1: Design algorithms and flowchart to solve programming problems.
CO-2: Write, compile and debug programs in C language. Use different data types, operators and console I/O function in a computer program.
CO-3: Design programs involving decision control statements, loop control statements and case control structures.
CO-4: Understand the implementation of arrays, pointers and functions and apply the dynamics of memory by the use of pointers.
CO-5: Comprehend the concepts of structures and union: declaration, initialization and implementation.
CO-6: Use the file operations, character I/O, string I/O, file pointers, and create/update basic data files.

Algebra-II (Rings and Modules)

CO1: Exhibit and recall the previous learning of algebraic structures like Groups,Rings and Vector spaces.

CO2: Define and construct algebraic structures like Unique Factorization Domains, Principal Ideal Domains, Euclidean Domains, Polynomial rings over UFD.

CO3: Develop new structures based on a given structure and compare them.

CO4: Apply theory of modules over PID to Jordan and rational canonical forms.

CO5: Classify different types of Modules and Radicals.

CO6: Apply the concepts of modules to Commutative Algebra and Homology Algebra.

Topology-II

CO1: Define and construct the subspace topology, filter and filter base.

CO2: Understand Urysohn lemma and the Tietze extension theorem.

CO3: Understand and construct the Identification topology.

CO4: Differentiate between T-1,T-2,T-3 and T-4 separation axioms and apply them to prove other properties.

CO5: Apply in biology to study the effects of certain enzymes on DNA.
CO6: Apply the fundamental group of a topological space to homotopy theory.

Differential Equations-I

CO1: Know the concepts of existence, uniqueness and continuity of the solutions of

first order ordinary differential equations.
CO2: Identify the properties of the zeros of solutions of linear nth order ordinary differential equations.
CO3: Analyze the dependence of solutions on initial conditions and parameters.

CO4: Demonstrate the knowledge of eigen values and eigen functions of Sturm-Liouville systems.

Functional Analysis

CO1: Understand and apply fundamental theorems Hahn-Banach theorem in Normed Linear Spaces and its applications,Uniformboundedness principle, Open mapping theorem, Closed graph theorem.

CO2: Understand Hilbert spaces including Orthogonality, Orthonormal sets, Bessel's inequality, Parseval's theorem.

CO3: Use and derive Basic definitions and theorems of functional analysis

CO4: Differentiate between Banach Space and Hilbert Space

CO5: Apply contraction and approximation theory in differential equations and integral equations.

Complex Analysis

CO1: Evaluate complex integrals using Cauchy residue and Cauchy integral theorems.

CO2: Learn and apply the concept of analyticity , analytic continuation, Cauchy-Riemann equations, Taylor and Laurent series expansions of analytic functions,

CO3: Classify the nature of singularity, poles and residues and application of Cauchy Residue theorem.

CO4: Solve the problems using complex analysis techniques applied to different situations in engineering and other mathematical contexts.

CO5: Establish the capacity for mathematical reasoning through analysing, proving and explaining concepts from complex analysis

CO6: Extend their knowledge to pursue research in this field.

Semester-III

MM 601 :Differentiable Manifolds
MM 602 : Field Theory
MM 603 : Differential Equations-II
MM 607:Classical Mechanics
MM 609:Optimization Techniques-I

Semester-IV
MM 702:Theory of Linear Operators
MM 709: Algebraic Coding Theory
MM 710: Commutative Algebra
MM 711: Operations Research
MM 716:Mathematical Methods

Course Outcomes: After completion of the course the student will be able to:

Differentiable Manifolds

CO1: Understand about differentiation of functions of several variables, tangent vector, vector field, differential forms and Connections.

CO2: DIscuss notion of Riemannian manifolds and the submanifolds of Riemannian manifolds. Also, they will be aware of the complex structure and the submanifolds of complex manifolds.

CO3: Define the various manifold concepts that are introduced during the course and know how to apply and interpret them.

CO4: Use the theory, methods and techniques of the course to solve problems in higher dimensions .

CO5: Extend their knowledge to pursue research in this field.

Field Theory

CO1: Exhibit and recall the previos learning of Polynomial rings.
CO2: Understand the concepts of Algebraic Extensions, Algebraically closed field and normal extensions.
CO3: Apply the knowledge of field theory to solve problems related to algebraic and geometric construction.
CO4: Construct Galois groups and Connect Group theory and Field theory using Fundamental theorem of Galois theory.
CO5: Apply Galois theory to solve problems in Compass and Straightedge construction.
CO6: Use the results of Finite Field theory in Algebraic Coding Theory and Cryptography.

Differential Equations-II

CO1: Analyse the existence of solutions of first order differential equations for complex system.

CO2: Understand the uniqueness and continuation of solutions of first order differential equations for complex system.

CO3: Understand the Maximum and minimum solution of first order differential equations for complex system.

CO4: Formulate and solve initial and boundary value problems for the Laplace equations in polar, spherical and cylindrical coordinates

CO5: Derive Dirichlet's problem for semi-infinite space and for a sphere.

CO6: Derive the family of Equipotential surface and prove Kelvin inversion theorem.

Classical Mechanics-I

CO1: Have a deep understanding of Newton's laws and Keplar's laws.

CO2: Understand the concept of Lagrangian formulation and Apply Lagrangian methods to complex motion problems.

CO3: Know about Hamilton's Principle and deduce Lagrange's Equations from Hamilton's Principle.
CO4: Demonstrate the knowledge of central-force motion problem.
CO5: Interpret an idea about the Kinematics of rigid body motion.

Optimization Techniques-I

CO1: Understanding deeply the theoretical background of operation research

CO2: Describe the applications of Operation research in real-world problems.

CO3: Apply Linear Programming models to analyze real world systems.

CO4: Solve multi-level decision problems using Linear programming method.

CO5: Set up and solve Linear optimization problems both analytically and numerically and demonstrate their working by hand.

The Theory of Linear operators

CO1: Understand Spectral theory in Normed linear spacesbounded linear operator, Spectral mapping theorem for polynomials,Elementary theory of BanachAlgebras.

CO2: UndersatandSpectral properties of compact linear operators on normed spacebounded self-adjoint linear operators on a complex Hilbert space. Positive operators, Fredholm type theorems.

CO3: Differentiate between Banach Space and Hilbert Space

CO4: Apply Spectral Techniques for the study of the Theory of Linear Operators.

Algebraic Coding Theory

CO1: Understand the basic techniques of coding theory liked Error detecting and correcting codes, Matrix encoding ,Polynomial encoding, Maximum likelihood decoding,Nearest Neighbourhood decoding and syndrome decoding.
CO2: Understand the usefulness of coding theory in real life problems
CO3: Classify different types of codes and bounds on the parameters of codes.
CO4: Identify role of Linear algebra and Field Theory in coding theory.
CO5: Solve problems of encoding and decoding in real life using coding techniques.
CO6: Apply the knowledge of Coding theory in Cryptography and Error control.

Commutative Algebra

CO1: Classify and explain Nill Radicals, Jacobson radical, Tensor product of modules, Primary ideals and prime ideals.

CO2: Interpret and use previous knowledge of algebra in Rings and Modules of Fractions.

CO3: Apply Advanced Core Concepts of algebra in real-life situations.

CO4: The students should be able to participate in scientific discussions and begin with own research in commutative algebra

Operations Research

CO1: Describe the importance of stocks in an organization and the reasons for holding stock.

CO2: Understand and compute quantitative metrics of performance for queueing systems.

CO3: Apply inventory models and queueing models to analyze real world systems.

CO4:Deal with replacement & maintenance problems.

CO5: Formulate and solve problems as networks using CPM and PERT techniques, to plan, schedule, and control project activities.

Mathematical Methods

CO1: Understand the relation between linear differential equation and Volterra's equation and convert one type into another.

CO2: Understand the difference between Volterra and Fredholm Integral Equations, First kind and Second kind.

CO3: Apply to analyze the safety and stability of the dam during an earthquake.

CO4: Give the Solution to the brachistochrone and isoperimetric problem

CO5: Understand the fundamental concepts of the space of admissible variations for fixed points.