Programme Outcomes - Department of Mathematics (PG)

GPO No.	Programme Outcomes
PO1	To provide the students with knowledge, abilities and insight of Mathematics and computational techniques for getting employability in any field.
PO2	To impart qualitative inputs to the students for CSIR – JRF, GATE and Competitive Examinations.
PO3	To acquire advanced knowledge to pursue higher studies and research.
PO4	To inculcate the students with the knowledge of handling technologies with secure.
PO5	To apply mathematical concept, knowledge and practice in Scientific Research.
PO6	To be academically honest and spiritually inspiring citizens.
PO7	To teach and share Mathematics effectively using various instructional strategies.

Programme Specific Outcomes - Department of Mathematics (PG)

PSO No.	Intended Programme Specific Outcomes
PSO1	To acquire Mathematical and Statistical skills which will enable them to have successful career.
PSO2	To formulate complete, concise, correct Mathematical proofs and theoretical ideas in their relevant areas of Mathematical research.
PSO3	To strengthen the students logical and analytical ability to deal with the generality and abstraction of Mathematical principles.

Course Outcome – Department of Mathematics

M.Sc., Mathematics

First Semester

Core – 1 **Group Theory (P21MA101)**

CO No.	Course Outcome
CO1	remember and understand the concept of Groups, homomorphism, automorphism, permutation groups, Sylow's theorem and direct products
CO2	Demonstrate normal subgroups, quotient groups, automorphism, permutation groups, Sylow's theorem, direct product
CO3	analyze the properties of homomorphism, automorphism, counting principle, Sylow's subgroups and finite abelian group
CO4	Argue Cauchy's theorem, Sylow's theorem for Abelian groups, solvable group, Sylow's theorems, in variants. Evaluate class equation of finite groups
CO5	solve the different types of problems using class equations and Sylow's theorems. Solve the problems in Solvable groups, Permutation group and finite abelian groups

Core – 2 **Analysis-I (P21MA102)**

CO No.	Course Outcome
CO1	remember and understand the basic concepts metric spaces, numerical sequences and series, continuity and differentiability
CO2	demonstrate the knowledge of compact sets, limits of sequences, tests of convergence of series, properties of continuous and differentiable functions
CO3	Analyze Weier strass theorem, perfect sets, series of non negative terms, absolute convergence, power series, characterization of continuity and Mean value theorems
CO4	Determine the structure of connected subsets, the series expansion of e, additional, multiplication and Cauchy product of series, discontinuities, monotone functions, rules of differentiability
CO5	Derived derivative of higher order, finding solutions of problems in metric spaces, sequences, series and continuous functions

Core – 3 Ordinary Differential Equations (P21MA103)

CO No.	Course Outcome
CO1	remember and understand the concepts of linear equations, power series solutions, singular points and some special functions the system of first order equations
CO2	demonstrate general solution of homogenous equation and Bessel function, power series solutions, regular and singular points, linear systems
CO3	analyze the solution of homogenous equation, power series solution of first order and second order equation, Legendre polynomials, properties of some special functions, homogeneous linear system
CO4	evaluate different types of solutions for second order linear homogenous equations, singular points, regular points and some special functions and homogenous linear systems
CO5	find the solution for Homogeneous linear differential equations, homogeneous linear system, series solution of first and second order

Core – 4 **Probability and Statistics (P21MA104)**

CO No.	Course Outcome
CO1	remember and understand the basic concept of probability and statistics and some special distributions, transformation of variables, distributions of functions of random variables
CO2	Illustrate conditional probability, change of variable techniques, binomial and poission distribution, transformation of variable of discrete type and change of variable technique
CO3	Analyze conditional distribution, gamma and chi-square distribution, transformation of variable of continuous type, distribution of order statistics
CO4	determine limiting distributions, correlation coefficient, normal distributions, t and F distribution, m.g.f.
CO5	solve the problems using various types of distributions

Core – 5 **Number Theory (P21MA105)**

CO No.	Course Outcome
CO1	remember and understand the concept of theory of numbers, some special functions and congruences
CO2	apply the concept inDivisibility, multiplicative functions, prime number theorem, residue classes, Lagrange's theorem and Chinese remainder theorem
CO3	analyze Euclidean algorithm, Bell series, Relations connecting $\vartheta(x)$and π(x), linear congruences and polynomial congruences
CO4	evaluate the Dirichelet product of arithmetic functions, Dirichlet inverses and Mobius inversion formula. Also a product formula for ϕ(n), some equivalent forms of the prime number theorem and polynomial congruence with prime power moduli
CO5	solve the problems in Divisibility, Some Special functions**,** Chebyshev's Functions , Congruences and polynomial congruences

Second Semester

Core - 6 **Ring Theory (P21MA206)**

CO No.	Course Outcome
CO1	Remember the basic concepts of Ring theory and understand rings, ideals, Euclidean rings, polynomial rings, radicals of a ring, direct sum of rings
CO2	demonstrate fundamental theorem of homomorphism, Fermat's theorem, Gauss lemma, Eisenstein criterion. Present certain radical of a ring, Jordan radical of a ring, semi simple ring, nil radical ring, primary ring, quasi regular, J. Semi simple
CO3	analyze the concept ofrings, ideal, Euclidean ring, polynomial rings, radicals of a ring, direct sum of rings
CO4	argue ideals, quotient ring, the field of quotient of an integral domain, Euclidean ring, polynomial rings, radical of a ring, direct sum of rings
CO5	solve the problems in rings, ideals, Euclidean rings, polynomial rings, radicals of a ring, direct sum of rings

Core – 7 **Analysis-II (P21MA207)**

CO No.	Course Outcome
CO1	remember and understand the concepts of Riemann Stieltjes integrals, integration and differentiation, uniform convergence, some special functions and fourier series
CO2	Demonstrate Riemann Stieltjes integrals, criterion for uniform convergence, Stone Weirstrass theorem, Abel's theorem, orthogonal system of functions
CO3	analyze the concept of Riemann Stieltjes integrals, integration and differentiation, uniform convergence, some special functions and fourier series
CO4	Determine the properties of Riemann Stieltjes integrals, criterion for uniform convergence, equicontinuous families of functions. Evaluate the solution for some special functions and series
CO5	solve the problems in Riemann Stieltjes integrals, integration and differentiation, uniform convergence, some special functions and fourier series

Core – 8 **Graph Theory(P21MA208)**

CO No.	Course Outcome
CO1	remember the concepts of graphs, trees, blocks, cliques, matching and colouring
CO2	demonstrate graph isomorphism, adjacency matrices, bonds, connectivity, matching and colouring, covering, Vizing's theorem, Ramsey's theorem, Turan's theorem, Brooks theorem and Hajos conjecture
CO3	Analyze path, connection, trees, cut vertices, blocks, matching, covering, independent sets, cliques, vertex and edge colouring
CO4	determine graph isomorphism, adjacency matrices, bonds, connectivity, matching and colouring, covering,
CO5	Find the solutions of real life problems using graph theory concepts

Core – 9 **Combinatorics (P21MA209)**

CO No.	Course Outcome
CO1	remember and understand the concept of counting Principles, distributions, generating functions, recurrence relation, inclusion and exclusion formula
CO2	Apply counting Principles, distribution of distinct objects. Demonstrate generating functions , recurrence relation models and inclusion-exclusion formula
CO3	Analyze simple arrangements and selections, distribution of identical objects, partitions, divided and conquer relations and derangement
CO4	Determine arrangement and selection with repetitions, rook polynomial. Evaluate binomial identities, exponential generating functions, solutions of linear recurrence relations
CO5	formulate recurrence relation for counting problems and solve them using known techniques including the generating functions

Core - 10 **Operations Research (P21MA210)**

CO No.	Course Outcome
CO1	Remember and understand the concepts of transportation models, network analysis, integer linear programming, inventory theory and queuing theory
CO2	apply transportation algorithm, minimal spanning tree algorithm, algorithms in integer linear programming, network analysis, inventory model, birth and death models
CO3	Analyze transportations models, maximum flow model, integer linear programming solutions inventory models and queuing models
CO4	evaluate transportation problem, shortest route problems , Integer programming problem, shortest path problem, problems in inventory theory and Queuing model
CO5	solve the problems in Transportation model, integer linear programming, network analysis, inventory theory and Queuing Theory

Core Elective – I **LATEX (P21MA2E1A)**

CO No.	Course Outcome
CO1	remember and understand the concepts of LATEX software while preparing a Document and the Mathematical formulas
CO2	use of LATEX and various templates acquired from the course to compose Mathematical documents, Presentation and reports.
CO3	analyze various templates acquired from the course to compose Mathematical documents
CO4	elucidate boxes, tables, document layout, article formation, basics of LATEX file
CO5	create an article and construct a table using LATEX

Core Elective – I **Python Language (P21MA2E1B)**

CO No.	Course Outcome
CO1	to implement basic concepts of operators and functions.
CO2	to Review various string, list, tuple and dictionaries.
CO3	To analyze the concept of classes and objects.
CO4	to evaluate the functionality of an exception handling.
CO5	

Core Elective – I **C ++ Programming (P21MA2E1C)**

CO No.	Course Outcome
CO1	write a psudo code for a given problem and convert the same to a C++ program that works
CO2	discover errors in a C++ program and to fix them using proper tools and methodology .
CO3	critique a C++ program and describe ways to improve it
CO4	Choose the required Linux commands to develop C++ programs in a command-line environment
CO5	

Core Elective Lab – I **LATEX Lab (P21MA2EPA)**

CO No.	Course Outcome
CO1	remember the basic concepts of LATEX and write programs to display paragraph format and definition
CO2	apply the concepts of document layout and organization to execute programs to display figure and theorem with proof
CO3	analyze the boxes types and use it to display the table content
CO4	execute LATEX program to display body of the letter and matrices
CO5	compose a LATEX program to prepare an article

Core Elective Lab – I **Python Lab (P21MA2EPB)**

CO No.	Course Outcome
CO1	remembering the basic concepts of python and write programs to calculate area of triangle, print prime numbers and find HCF
CO2	apply string methods and built in list methods to execute programs
CO3	generate Fibonacci sequence using recursion
CO4	assess exception handling
CO5	develop pythons program for simple calculator and cube of numbers between 1 and 10.

Core Elective Lab - I **C ++ Programming Lab (P21MA2EPC)**

CO No.	Course Outcome
CO1	understand the basic operations of C++ and execute simple programs using functions, classes and objects
CO2	apply the various concepts of functions and execute programs using friend function, in-line function, virtual functions
CO3	analyze operator overloading and develop programs to add complex numbers and multiply matrices
CO4	illustrate the use of arrays of objects
CO5	develop C++ programs to implement pay bill application, Mark list application using files

Third Semester

Core – 09 **Topology (P20MA309)**

CO No.	Course Outcome
CO1	remember and understand the concepts of closed sets and limit points, continuous functions, connected spaces, compact and local compact spaces, normal spaces, Urysohn Metrization theorem
CO2	apply the concepts of topological spaces, closed sets and limit points, continuous functions, product topology, connected and compact spaces, normal spaces and Urysohn Metrization theorem
CO3	analyze the concepts of topological spaces, closed sets and limit points, continuous functions, product topology, connected and compact spaces, normal spaces and Urysohn Metrization theorem
CO4	evaluate the problems in topological spaces, closed sets and limit points, continuous functions, product topology, connected and compact spaces, countability axioms, separation axioms, normal spaces, local compactness and Urysohn Metrization theorem
CO5	develop the creative thinking in closed sets and limit points, continuous functions, product topology, compact and local compact spaces, connected spaces, normal spaces, product topology, Urysohn Metrization Theorem and Tietze extension theorem using Urysohn lemma

Core – 10 Measure and Integration (P20MA310)

CO No.	Course Outcome
CO1	remember the concept of set functions and their properties and understand the concepts of outer measure and the Lebesgue measure
CO2	apply the theory of the course to solve a variety of problems at an appropriate level of difficulty
CO3	analyze the concept of general Lebesgue measure, measurable functions, Lebesgue integration and differentiability, absolutely continuous functions and signed measures
CO4	evaluate the problems regarding Lebesgue measure, measurable functions, Lebesgue integration and differentiability, absolutely continuous functions and signed measures
CO5	construct different measure using outer measure

Core 11 Linear Algebra (P20MA311)

CO No.	Course Outcome
CO1	remember and understanding the essential aspects of vector spaces, linear transformations and matrix algebra
CO2	apply the principles of matrix algebra to find properties of linear transformations and demonstrate the Hermitian, Unitary and normal transformations
CO3	analyze vector spaces, linear transformations, canonical forms, matrices and transformations
CO4	determine characteristic roots, trace, transpose, determinant of matrices, canonical forms, hermitian, unitary and normal transformations
CO5	solve the problems in matrix algebra and vector spaces

Core - 12 **Partial Differential Equations (P20MA312)**

CO No.	Course Outcome
CO1	remember and understand the concepts of partial differential equations
CO2	solve differential equations, apply charpit's method, cauchy's method, find the first order differential equations, linear partial differential equations and separation of variables
CO3	analyze the partial differential equations using separation of variable techniques, Compatible systems of First order Equations, linear partial differential equations and separation of variables
CO4	evaluate the solution of partial differential equations using different method
CO5	find the solutions for partial differential equations

Employability Enhancement: Mathematics for Competitive Examinations(P20MA3EE)

CO No.	Course Outcome
CO1	acquisition of Knowledge
CO2	bring desired changes in students attitude
CO3	improve the learning skills of the students
CO4	develop creativity and efficient thinking
CO5	

SEC – II **MATLAB (P20MA3S2)**

CO No.	Course Outcome
CO1	understand and remember the concept of matrices, vectors and basic comments of MATLAB
CO2	perform input output file types. Apply the concept of linear algebra, script files and function files. Determine plotting and solution of system of linear equations
CO3	analyze platform dependence, language specific features. Illustrate matrices, vectors, eigen values, eigen vectors and two dimensional plots
CO4	determine general commands, matrix and array operations, advanced data objects, matrix factorization, three dimensional plots
CO5	develop programme skills in MATLAB

SEC – II **MATLAB Lab (P20MA3SP)**

CO No.	Course Outcome
CO1	remember and understand Vector spaces, Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO2	apply Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO3	analyze the concepts of Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO4	evaluate the problems in Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO5	find the solutions of various types of problems in Banach spaces, Hilbert spaces and conjugate spaces

Core – 13 **Functional Analysis (P20MA413)**

CO No.	Course Outcome
CO1	remember and understand Vector spaces, Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO2	apply Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO3	analyze the concepts of Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO4	evaluate the problems in Banach spaces, imbedding, Hilbert spaces, conjugate space and Spectral theory
CO5	find the solutions of various types of problems in Banach spaces, Hilbert spaces and conjugate spaces

Core – 14 **Complex Analysis (P20MA414)**

CO No.	Course Outcome
CO1	remember and understand analytic functions, conformal mapping, complex integration, highest derivatives residues
CO2	demonstrate polynomials, linear transformations, Cauchy's theorem, zeros and poles, Residue theorem
CO3	analyze power series, cross ratio, Cauchy's theorem in a disc, local mapping theorem, argument principle
CO4	determine the limit of an analytic function, properties of line integrals. Evaluate the value of an analytic function using Cauchy's integral formula and evaluate definite integrals
CO5	develop further properties of analytic function using complex integration

Core – 15 **Field Theory (P20MA415)**

CO No.	Course Outcome
CO1	remember the extensions of a given field and understand the concept of splitting field and Galois theory
CO2	demonstrate the concept of extension fields, finite fields, root of polynomials, elements of Galois theory, finite fields and some special theorems
CO3	analyze the concept of the extension fields, finite fields, root of polynomials, elements of Galois theory, finite fields and some special theorems
CO4	determine the roots of polynomials and splitting fields of a polynomial and some special theorems
CO5	construct various types of splitting fields with its example

Core – 16 **Numerical Analysis (P20MA416)**

CO No.	Course Outcome
CO1	remember and understand the concepts of interpolation, numerical differentiation and integration, numerical solutions of ODE and predictor corrector methods
CO2	demonstrate different formulas and methods
CO3	analyze interpolation, numerical differentiation and integration, numerical solutions of ODE and various methods
CO4	evaluate the problems on interpolation, numerical differentiation and integration using various methods
CO5	develop the practical knowledge on solving problems using numerical methods