PG AND RESEARCH DEPARTMENT OF MATHEMATICS
JAMAL MOHAMED COLLEGE (Autonomous)
Tiruchirappalli-620020

B.Sc., MATHEMATICS

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: Technical Proficiency:

Provide a degree course, suitable for students of high ability, combining and relating mathematics, statistics, and the social sciences.

PEO2: Professional Growth:

Prepare students for further study, or for professional and managerial careers, particularly in areas requiring the application of quantitative skills.

PEO3: Management Skills:

Provide students with knowledge of mathematics, Management and the interaction between the two.

PROGRAMME OUTCOMES (PO)

POs describe what students are expected to know or to be able to do by the time of graduation from the programme. The Program Outcomes of UG in Mathematics are: At the end of the programme, the students will be able to:

1. Think in a critical manner.
2. Know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.
3. Formulate and develop mathematical arguments in a logical manner.
4. Acquire good knowledge and understanding in advanced areas of mathematics and statistics, chosen by the student from the given courses.
5. Understand, formulate and use quantitative models arising in social science, business and other contexts.
6. Apply the concepts studied, in real life situations.

UG Programme – Course Learning Outcomes (2017-2018)

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
I	17UMA1C1	III	**Core – I**	Differential Calculus and Trigonometry	• Find successive differentiation of the nth derivatives of Standard result, trigonometrical transformation of functions and Leibnitz formula for the nth derivative of a product. • Find maxima and minima of function of two variables and Lagrange's method of undetermined multipliers. • Find curvature, circle, radius and centre of curvature. • Expansion of sin nq, cos nq, tan nq and powers of sines and cosines in terms of functions of multiples of q. • Define and illustrate the concept of hyperbolic functions and logarithms of complex numbers.
	17UMA1C2		**Core – II**	Solid Geometry	• Find direction cosines, ratios and angle between two planes. • Evaluate Length of the perpendicular and bisecting the angle between two planes. • Describe the equation of a straight line passing through two given points and Shortest distance between two skew lines. • Finding centre, radius and length of the tangent plan to a sphere.
II	17UMA2C3	III	**Core – III**	Integral Calculus	• Revision of all the basic concept of integral models. • Solving technique of integrals, Integration by parts and Bernoulli's formula • Verify geometric Application of integration to length, area, volume and change of integral. • Discuss Beta & Gamma functions.
	17UMA2C4		**Core – IV**	Classical Algebra	• Understanding the concept of Inequalities. • Prove and illustrate Cauchy - Schwarz inequality. • Find relation between the roots and coefficients of equations and Symmetric function of the roots. • Describe transformation of equation and Reciprocal equation. • Use Descarte's rule, Newton's method of divisors and Horner's method to Nature of roots.
III	17UMA3C5	III	**Core– V**	Ordinary and Partial Differential Equations	• Define Linear equation and Bernoulli's equation . • Equations solvable for dy/dx, x and y. • Discuss and demonstrate the Linear Equations with constant coefficients, Complementary function and Particular integrals. • Discuss and demonstrate the Linear equations with variable co-efficients and Variation of parameters. • Define and illustrate Partial Differential Equations of the first order and Classification of integrals • Verify Lagrange's method of solving the linear equation and Standard forms I, II, III and IV (Clairaut's form).
	17UMA3C6		**Core– VI**	Vector Calculus	• Define a vector differentiation • Find and interpret of vector differential operator, Gradient, Direction and magnitude of gradient. • Describe the Divergence and curl. • Define and illustrate the vector integration, Line, Surface and Volume integral. • Evaluate Gauss divergence theorem, Stoke's theorem and Green's theorem.
	17UMA3A5:1		**Allied–V**	Mathematical Statistics I	• Calculate Arithmetic Mean, Weighted mean, Median, Mode, Geometric mean, Harmonic mean and graphical location of the partition values. • Illustrate the dispersion, Range, Q.D, M.D, S.D, and coefficient of dispersion. • Calculate Moments Pearson's β and γ Co-efficient, Skewness and Kurtosis. • Demonstrate the fitting of a Straight, second degree parabola and change of origin. • Solve most plausible solution of a system of linear equations. • Find conversion of data to linear and fitting of a power curve and exponential curves.
	17UMA3A6:1		**Allied–VI**	Mathematical Statistics II	• Discuss classical probability, empirical probability and axiomatic approach towards probability. • Prove addition and multiplication theorems. • Solve Conditional probability for Baye's theorem. • Define and illustrate the random variable and distribution function. • Discuss and illustrate the properties of Probability mass function, Probability density function. • Discuss and illustrate the Mathematical Expectation for addition and Multiplication theorem. • Find moment generating function and cumulant generating function.

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
IV	17UMA4C7	III	**Core– VII**	Sequences and Series	• Define and illustrate the intervals in R, Bounded sets, lub and glb, sequence. • Prove properties of Convergent, Divergent and oscillating sequences. • Verify the given Sequences in Convergent and Divergent by using behaviour of monotonic sequences. • Find Limit points and Upper and lower limits of a sequence. Prove theorems on different test of convergence and divergence of series.
	17UMA4C8		**Core - VIII**	Laplace Transform and Fourier Series	• Define Laplace transforms and discuss the Properties of Laplace transforms • Define and illustrate the inverse Laplace transforms. • Discuss the Application of Laplace transforms with Solution of ODE's. • Define Fourier series and Finding Fourier expansion of a periodic function with period 2π. • Find Odd and Even function, Half range Fourier series.
	17UMA4A7:1		**Allied– VII**	Mathematical Statistics III	• Discuss Theoretical discrete distributions. • Understand the Binomial and Poisson distributions of Moments and Moment generating Function . • Discuss Theoretical continuous distribution • Describe Normal, Gamma and Beta Distribution of Moment generating Function. • Understand the concept of Bivariate distribution of Correlation and Regression.
	17UMA4A8:1		**Allied–VIII**	Mathematical Statistics IV	• Compute types of sampling parameter and statistics,Tests of significance and Null Hypothesis. • Understand Chi-Square variate and independence of attributes. • Understand Student's t-test of Difference of means. • Define F-Statistic definition and F-test for equality of population Variance.
V	17UMA5C9	III	**Core – IX**	Mechanics	• Define Force and Newton's Laws of motion and Forces on a rigid body. • Explain Types of forces and Equilibrium of a uniform homogeneous string. • Define Kinematics of Velocity, Impact and law of impact
	17UMA5C10		**Core – X**	Real Analysis	• Define Countable and Uncountable sets. • Define Neighbourhoods, Open sets, Closed sets and Limit points of a set. • Determine the Continuous functions, Uniform continuous and Types of discontinuities. • Define and recognize the concept Derivability of a function. • Write Mean Value Theorems, Taylor's Theorem and Power series expansion. • Define and illustrate the concept of Riemann integration.
	17UMA5C11		**Core – XI**	Modern Algebra	• Define and discuss the concept of Groups, Cyclic Group, Normal subgroups and Quotient group • Find cycles and transpositions of a given permutations. • Prove Lagranges's theorem. • Define Rings, Subrings, Ideals, Quotient rings Field of quotients of an integral domain. • Discuss the Unique Factorization Domain, Euclidean domain, PID. • Define Polynomial rings.
	17UMA5C12		**Core - XII**	Numerical Methods	• Compute the Solution of Algebraic and Transcendental equation using Bisection, Iteration, Method of false position and Newton-Raphson Method. • Solve Interpolation of Finite differences – Newton's Forward, Central and Backward differences • Obtain the Numerical differentiation and integration. • Derive Trapezoidal and Simpson's Rule**.** • Find the solution of linear system of equation by Gaussian Elimination, Method of Factorization, Gauss Jacobi, Gauss Seidel Methods**.** • Calculate the Numerical solution of ordinary differential equations. • Derive and compute the solution of Taylor series, Picard's and Euler method and Runge–Kutta Methods.

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
	17UMA5M1		Major Based Elective – I**		• Describe the Origin and development of OR. • Illustrate General Linear Programming Problem by Graphical Solution Method. • Compute Simplex Algorithm, Two Phase Method and Big-M Method of LPP. • Demonstrate Primal and Dual LPP. • Find Initial Basic Feasible Solution to the Transportation Problem by using North West Corner Rule, Least Cost Entry Method and VAM – MODI Method • Illustrate Assignment Problem and Hungarian method. • Define Basic Components of network and critical paths. • Define CPM and PERT.
	17UMA5EC1		**Extra Credit Course - I**	Astronomy	• Understand Celestial sphere and diurnal motion. • Study morning and evening stars, Zones of earth and Perpetual day. • Study laws of refraction, geocentric and horizontal • Distinguish Kepler's laws . • Understand the concept of Lunar, solar eclipses , Maximum and minimum number of eclipses in a year.
VI	17UMA6C13	III	**Core– XIII**	Complex Analysis	• Understanding and significance of Limits, Continuous functions and Differentiability for complex function and be familiar with the CR-equation. • Define Conformal Mapping, Bilinear transformations, Cross ratio and Fixed points. • Use Cauchy's integral Theorem and formula to compute line integral. • Represent functions as Taylor's series and Laurent's series. • Find Residues and evaluate complex integral using Cauchy's Residue Theorem.
	17UMA6C14		**Core– XIV**	Number Theory	• Describe the Division Algorithm and the Diophantine Equation ax+by=c. • Define Primes and Their Distribution and prove Eratosthenes. • Discuss the properties of Congruence and prove the Chinese Remainder Theorem. • Write Fermat's Theorems, Wilson's Theorem and the Fermat-Kraitchik Factorization Method. • Evaluate Sum and Number of Divisors.
	17UMA6C15		**Core - XV**	Discrete Mathematics	• Understand Logic and properties. • Derived Permutations, Combinations, Pigeonhole principle and Recurrence relations. • Describe Order relations and structures. • Define and illustrate the concept of Lattices and Boolean Algebras. • Define Languages Grammars. • Describe Finite and State Machines.
	17UMA6C16		**Core XVI**	Graph Theory	• Describe the origin of graph theory • Illustrate different types of graph. • Discuss Operations on Graphs on Hamiltonian Paths and circuits • Define Trees, fundamental circuits, cut sets, Connectivity and Separability. • Derive some properties on Planar and dual graphs. • Demonstrate Matrix Representation of graphs.
	17UMA6M2		Major Based Elective II**		• Describe Constants, Variables and Data Types, Character set, C tokens • Define Operators and character • Discuss Loop statements. • Define Strings and Arrays. • Define Functions and Recursion. • Demonstrate File Management.
	17UMA6M3		Major Based Elective III**		• Define and illustrate Vector Spaces, Subspaces, Linear Transformations. • Define Linear independence, Basis and dimension • Fine the Rank and nullity. • Define Inner Product Space and Orthogonality. • Describe Theory of Matrices. • Find the Characteristic equation , Eigen values and vectors. • Prove Cayley Hamilton theorem .
	17UMA6EC2		**Extra Credit Course - II**	Replacement and Sequencing Models	• Distinguish the concept of Replacement and maintenance models. • Identify replacement policy and general cost function . • Study equipment renewal problem. • Understating the concept of processing n jobs through two, three and m machines.

@ Skill Based Electives Courses offered to our Department:

SEM	Elective No.	COURSE CODE	COURSE TITLE	COURSE LEARNING OUTCOMES
V	II	17UMA5S2A	Quantitative Aptitude	1. Solve the problems based on Numbers. 2. Solve the problems based on Surds, Indices, Percentage, Profit, Loss, Ratio and Proportion. 3. Solve the problems based on Chain Rule, Time , work, Pipes and Cistern 4. Understand problems on trains and streams. 5. Solve the problems based on Allegations or Mixture, Simple Interest and Compound Interest
		17UMA5S2BP	SPSS	• Create the programs on Mean, Standard deviation, Variance. • Create the programs on Write the programs on Co efficient of correlation. • Create the programs on Write the programs on Regression equation of X on Y and Regression equation of Y on X. • Create the programs on t-test for testing the significance of Correlation Coefficient problems. • Create the programs on Application of analysis of variance.
		17UMA5S2CP	PageMaker	• Make to create a brochure for seminar, workshop and visiting card Wedding Card / New year Greeting Card. • Make to create a resume, Newspaper Report • Convert Word Document into a PageMaker document. • Make to create a book works, building booklets, completing the book.
V	III	17UMA5S3A	Reasoning	• Understand the concept of number and alphabet series and analogy. • Solving problems on coding and blood relations. • Solving puzzles problems. • Solving problems on sequential output tracing and direction sense test. • Solving problems on logical Venn diagrams, logical deduction
		17UMA5S3BP	MatLab	1. Based on the programs for higher degrees and solving Linear programming problems. 2. Solving equation of higher degrees using Bisection method. 3. Solving system of equations by matrix method and find the eigen values, eigen vectors of a matrix of order 4 by 4 and system of non-linear equations and Gauss Jacobi iteration Method. 4. Creating and plotting 2-D and 3-D graphs. 5. Find the integration using Simpsons 3/8 rule. 6. Solving ordinary differential equations using Runge– Kutta Fourth order method.
		17UMA5S3CP	CorelDraw	• Introduce Coreldraw. • Create case study programs for visiting card, sticker, letterhead with logo • Create case study programs for wedding card, flex banner. • Create case study programs for brochure, product box package, book cover.

** Major Based Electives Courses offered to our Department:

SEM	Major Based Elective No.	COURSE CODE	COURSE TITLE	COURSE LEARNING OUTCOMES
V	I	17UMA5M1A	Operations Research	• Describe the Origin and development of OR. • Illustrate General Linear Programming Problem by Graphical Solution Method. • Compute Simplex Algorithm, Two Phase Method and Big-M Method of LPP. • Demonstrate Primal and Dual LPP. • Find Initial Basic Feasible Solution to the Transportation Problem by using North West Corner Rule, Least Cost Entry Method and VAM – MODI Method • Illustrate Assignment Problem and Hungarian method. • Define Basic Components of network and critical paths. • Define CPM and PERT.
		17UMA5M1B	Combinatorics	• Study Euler's pentagonal number • Obtain the solution of the power series and generating functions. • Discuss the different type of generating function. • Understand the concept of structure of permutations. • Distinguish the concept of unimodality and concavity
VI	II	17UMA6M2AT	C Programming	• Describe Constants, Variables and Data Types, Character set, C tokens • Define Operators and character • Discuss Loop statements. • Define Strings and Arrays. • Define Functions and Recursion. • Demonstrate File Management.
		17UMA6M2AP	C Programming - Practical	
		17UMA6M2B	Data Structures and Algorithms	1. Identify the concept of basic terminologies and complexity of algorithms. 2. Distinguish the concept of arrays and stacks. 3. Understand the concept of queues and linked lists. 4. Study the graphs and sequential representation of graph. 5. Distinguish the concept of sorting and searching.
VI	III	17UMA6M3A	Linear Algebra	• Define and illustrate Vector Spaces, Subspaces, Linear Transformations. • Define Linear independence, Basis and dimension • Fine the Rank and nullity. • Define Inner Product Space and Orthogonality. • Describe Theory of Matrices. • Find the Characteristic equation , Eigen values and vectors. • Prove Cayley Hamilton theorem .
		17UMA6M3B	Z and Fourier Transform	1. Understanding the concept of Z-transform and solution of difference equation. 2. Study the concept of Fourier integral theorem complex form of the Fourier integral. 3. Deep study for Properties of Fourier Transformation, Convolution Theorem for and Dirac-Delta function. 4. Solve the cosine and sine transformation and Parseval's Identities. 5. Discuss application of Fourier transforms.

Allied Mathematics for B.Sc Computer Science

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
I	17UMA1A1	III	**Allied –I**	Calculus	• Understand the concept of successive Differentiation with examples. • Known concept of properties of definite Integrals, integration by parts andreduction formulae • Learn differential equations of the first order with higher degree. • Know about the method of finding solving Linear Differential Equations with constant coefficients and particular integral • Solve the standard type of first order partial differential equations and Lagrange's equations.
	17UMA1A2		**Allied –II**	Numerical Methods	• Solving concept of solution of Algebraic equations by using bisection method, the iteration method, the method of false positionand Newton- Raphson Method. • Learn finite differences forward and backward methods. • Obtain the solution of system of linear equation by using Direct and Iteration methods. • Find the solution of numerical integral problems. • Calculate numerical solution of ordinary differential equations.
II	17UMA2A3	III	**Allied – III**	Operations Research	• Study the concept of Operations Research and Mathematical Formulation of the Problems • Solving a LPP by Graphical Method and Simplex Method. • Obtain Initial Basic Feasible Solution (IBFS) Transportation Problems. • Find Optimum Solution for the Transportation Problem and Assignment Problem (Balanced and unbalanced). • Study the concept of Network scheduling by CPM.
	17UMA2A4		**Allied –IV**	Statistics	• Calculate Measures of Central Tendency for the given data. • Obtain the solutions of Measures of Dispersion with simple problems. • Understand the concept of Correlation in Bivariate distribution. • Study the concept of Regression and Properties of correlation and regression coefficients.

Allied Mathematics for B.Sc (Physics)

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
III	17UMA3A5:2	III	**Allied–V**	Algebra and Trigonometry	• Calculate Binomial Series, Exponential Series and the Logarithmic Series • Finding the solution of Theory of equations. • Study the concept of Matrices and Cayley-Hamilton theorem • Evaluate Expansions of cos nθ and sin nθ • Obtain the solution of Hyperbolic functions and Logarithm of complex numbers
	17UMA3A6:2		**Allied–VI**	Calculus	• Understand the concept of successive Differentiation with examples. • Find the solution of Circle, radius and centre of curvature • Known concept of properties of definite Integrals, integration by parts and reduction formulae • Evaluation of the double integral • Apply the concept of multiple integrals in practical problems.
IV	17UMA4A7:2	III	**Allied– VII**	Differential Equations	• Know about the method of finding solving Linear Differential Equations with constant coefficients and particular integral. • Understand the concept of partial differential equations with examples • Solve the standard type of first order partial differential equations and Lagrange's equations. • Study the concept of Laplace Transforms with examples. • Solving ordinary differential equations with constant coefficients using Laplace transforms.
	17UMA4A8:2		**Allied–VIII**	Vector Calculus and Fourier series	• Understand the concept of vector differential operators. • Finding solution of Line integral, volume integral and surface integral. • Understand the concept of Gauss Divergence and Stokes Theorem. • Obtain the solution of even and odd functions and half range Fourier. • Understand the concept of Sine Series and change of interval.

Allied Mathematics for B.Sc (Chemistry)

SEM	COURSE CODE	PART	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
III	17UMA3A5:3	III	**Allied–V**	Algebra and Trigonometry	• Calculate Binomial Series, Exponential Series and the Logarithmic Series • Finding the solution of Theory of equations. • Study the concept of Matrices and Cayley-Hamilton theorem • Evaluate Expansions of cos nθ and sin nθ • Obtain the solution of Hyperbolic functions and Logarithm of complex numbers
	17UMA3A6:3		**Allied–VI**	Calculus and Finite Differences	• Obtain the solution of Newton's forward and Newton's backward interpolation formula • Understand the concept of successive Differentiation with examples. • Find the solution of Circle, radius and centre of curvature • Known concept of properties of definite Integrals, integration by parts and reduction formulae • Evaluation of the double integral • Apply the concept of multiple integrals in practical problems.
IV	17UMA4A7:3	III	**Allied– VII**	Differential Equations	• Know about the method of finding solving Linear Differential Equations with constant coefficients and particular integral. • Understand the concept of partial differential equations with examples • Solve the standard type of first order partial differential equations and Lagrange's equations. • Study the concept of Laplace Transforms with examples. • Solving ordinary differential equations with constant coefficients using Laplace transforms.
	17UMA4A8:3		**Allied–VIII**	Statistics and Vector Calculus	• Calculate Measures of Central Tendency for the given data. • Obtain the solutions of Measures of Dispersion with simple problems. • Understand the concept of Correlation in Bivariate distribution • Study the concept of Regression and Properties of correlation and regression coefficients. • Understand the concept of vector differential operators.

M.Sc., MATHEMATICS

PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

PEO 1: Technical Proficiency:

Victorious in getting employment in different areas, such as industries, laboratories,Banks, Insurance Companies, Educational/Research institutions, Administrative positions, sincethe impact of the subject concerned is very wide.

PEO 2: Professional Growth:

Keep on discovering new avenues in the chosen field and exploring areas that remainconducive for research and development.

PEO 3: Management Skills:

Encourage personality development skills like time management, crisis management,stress interviews and working as a team.

PROGRAMME OUTCOMES (PO):

POs describe what students are expected to know or be able to do by the time of graduation. TheProgram Outcomes of PG in Mathematics are:At the end of the programme, the students will be able to:

1. Apply knowledge of Mathematics, in all the fields of learning including higher research and its extensions.
2. Innovate, invent and solve complex mathematical problems using the knowledge of pure and applied mathematics.
3. To solve one dimensional Wave and Heat equations employing the methods in Partial Differential equations.
4. Utilize Number Theory in the field of Cryptography that helps in hiding information and maintaining secrecy in Military information transmission, computer password and electronic commerce.
5. Facilitate in the study of crystallographic groups in chemistry and Lie symmetry groups in physics.
6. Demonstrate risk assessment in Financial markets, Disease spread in Biology and Ecology.
7. Identify Simulation of ground freezing and water evaporation, Heat transfer analysis due to solar radiation, Calculation of temperatures and heat flow under steady-state or transient boundary conditions.
8. Explain the knowledge of contemporary issues in the field of Mathematics and applied sciences.
9. Work effectively as an individual, and also as a member or leader in multi-linguistic and multi-disciplinary teams.

10. Adjust themselves completely to the demands of the growing field of Mathematics by lifelong learning.

11. 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

12. Crack lectureship and fellowship exams approved by UGC like CSIR – NET and SET.

PG Programme – Course Learning Outcomes (2017-2018)

SEM	Course Code	Course	Course Title	Course Learning Outcomes
I	17PMA1C1	Core– I	Real Analysis	• Describe basic topology of Metric spaces, Compact sets Perfect sets, Connected sets. • Define continuous functions and discuss Continuity and connectedness, Discontinuities. • Define differentiation and derive Mean value theorems, L'Hospital's rule, Taylor's Theorem. • Derive the existence of the Riemann - Stieltjes integral, explain the properties of Integration and differentiation and rectifiable Curves. • Explain Uniform convergence of continuity, integration and differentiation for sequences and series of functions. • State and prove Stone -Weierstrass theorem.
	17PMA1C2	Core –II	Algebra	• Discuss the basic properties on groups and sub groups, Automorphisms on a group. • State and prove Cayley's theorem. • State and proveSylow's theorems. • Discuss the properties Polynomial Rings over the rationals,, Properties on Primitive polynomials and Polynomial rings over commutative rings • Explain the fields, Extension fields, algebraic extension and its properties. • State and prove the elements of Galois theory.
	17PMA1C3	Core– III	Ordinary Differential Equations	• Discuss the second order linear Equations, The Homogeneous equation with constant coefficients and calculate the method of variation of parameters. • Explain the oscillations and the sturm separation theorem and prove sturm comparison theorem. • Find the regular singular points and derive Gauss's Hypergeometric equation. • Discus the Properties of Legendre Polynomials and Bessel functions. • Solve Homogeneous linear systems with constant coefficients and state and prove Picard's theorem.
	17PMA1C4	Core– IV	Numerical Analysis	• Apply Chebyshev Method, Multipoint, Iteration Methods, Bridge VietaMethod ,Baristow Method, Graeffe's root Squaring Method to Calculate the Iteration method based on Second degree equations. • Use Iteration Methods to solve Jacobi Method, Guass Seidel Method, Successive Over Relaxation Method and power method. • Finding solution of Interpolation use to Hermite Interpolation, Piecewise cubic Interpolation and cubic Spline interpolation and Lagrange and Newton's and Bivariate interpolation • Finding solution of Approximation Gram-Schmidt Orthogonalizing Process. • Calculate the numerical differentiation, partial differentiation, Integration • Solving numerical methods for using Euler, Mid-Point Method, Runge-kutta Methods, Implicit Runge-Kutta Methods and Predictor – Corrector Methods.
II	17PMA2C5	Core– V	Topology	• Define topological spaces and explain the properties of order topology, product topology, subspace topology, continuous functions. • Describe the properties on metric topology, connected spaces and compact space. • State and prove Tychonoff theorem, Urysohn Metrization theorem and Baire Spaces theorem.
	17PMA2C6	Core– VI	Complex Analysis	• Prove that Cauchy's theorem for a rectangle and disk. • Use Cauchy's integral theorem and formula to compute line intergrals. • Classify Removable singularities, Zeros and poles. • Describe the local mapping and Homology and prove general form of Cauchy theorem. • Describe the harmonic functions and represent functions as Poisson's formula, Schwartz's theorem, Weierstrass's theorem, Taylor series and Laurent series. • Compute partial fractions, factorization, Infinite products, Canonical products and Gamma functions
	17PMA2C7	Core– VII	Linear Algebra	• Define Matrices and vector spaces, Subspaces, Bases and Dimension. • Describe the basic properties on elementary Row operations, Row-Reduced echelon Matrices • Understand the signification of linear transformations and linear Functional.

SEM	Course Code	Course	Course Title	Course Learning Outcomes
				• Define and illustrate the Polynomials and Inverse of an invertible matrix using determinants. • Define basic properties on Characteristic values, Annihilating polynomials, Simultaneous triangulation and simultaneous diagonalization. • Prove the sum Decompositions, Invariant Direct sums, Primary Decomposition theorem.
	17PMA2C8	Core– VIII	Partial Differential Equations	• Define Curves and Surfaces • Define genesis of First Order P.D.E and Prove the Pfaffian Differential Equations. • Prove the Jacobi's Method-Integral Surfaces Through a given Curve • Find Quasi-Linear Equations and Charpit's method. • Define Genesis of Second Order P.D.E and Classification of Second order P.D.E • Describe One Dimensional Wave Equations and Heat Conduction Problem.
III	17PMA3C9	Core– IX	Measure theory and integration	• Define the basic properties on sets in real line and Measure on a real line, Outer measure, measurable sets and measurable functions. • Define the Borel set and Lebesgue measurability. • Understand the signification of abstract measure space. • Prove Hahn Decomposition and Jordan Decomposition. • State and prove Radon Nikodym theorem and Fubini's theorem.
	17PMA3C10	Core– X	Fuzzy Sets and their Applications	• From Classical Sets to fuzzy sets and operator. • Define fuzzy arithmetic, fuzzy numbers, Linguistic variables, fuzzy equations. • Define fuzzy logic, fuzzy propositions and linguistic Hedges. • Demonstrate the fuzzy decision making, fuzzy ranking methods and fuzzy linear programming. • Illustrate fuzzy relations, composition of fuzzy relations.
	17PMA3C11	Core– XI	Fluid Dynamics	• Define Real fluids and ideal fluids and Streamlines, pathlines steady, unsteady flows, velocity potential and vorticity vector. Prove velocity of a fluid at a point equation of continuity and acceleration of a point of a fluid. • Discus the pressure at a point in a fluid at rest and moving fluid and prove Euler's equations of motion - Bernoulli's equation. • Describe some three dimensional flows as Sources, sinks, doublets, Axis-symmetric flows and prove Stokes stream • Apply complex velocity potential for standard two-dimensional flows to Uniform stream, line sources and line sinks, line doublets, line vortices. • Prove Milne-Thomson circle theorem and Theorem of Blasius.
	17PMA3C12	Core– XII	Advanced Graph Theory	• Explain connectivity and edge-connectivity, 2-connected graphs and prove Menger's theorem. • Define and illustrate the matching, system of distinct representatives and Marriage problem, covering. • Explain Independent sets and edge-colourings • Prove Vizing's theorem. • Discus the predecessor and successor • Explain basic perfect graphs.
	17PMA3EC1	Extra Credit Course - I	Discrete Mathematics	• Understanding the concept of computability and Formal Languages. • Study the concept of finite state machines and Finite state languages • Understand the rules of sum and product of Permutations and Combinations. • Identify solutions by the Discrete numeric functions and generating functions. • Understanding the concept of recurrence relations and recursive algorithms.
IV	17PMA4C13	Core– XIII	Functional Analysis	• Define and illustrate Banach Space • State and Prove Hahn Banach theorem and open mapping theorem. • Define and illustrate Hilbert spaces and orthogonal • Prove Spectral theorem.
	17PMA4C14	Core– XIV	Advanced Operations Research	• Describe Integer Linear Programming and Gomory's all integer cutting plane method. • Illustrate Goal Programming • Demonstrate decision making process. • Discuss theory of Games. • Explain deterministic inventory control models

SEM	Course Code	Course	Course Title	Course Learning Outcomes
				• Describe Model I(a): EOQ model with constant rate of demand, Model I(c): Economic production quantity model when supply is gradual, Model II (a): EOQ model with constant rate of demand and variable order cycle time. • Illustrate dynamic programming and optimal decision policy.
	17PMA4C15	Core– XV	Integral Equations and Calculus of Variations	• Discuss regularity conditions and prove Fredholm alternative. • Describe method of successive approximations and Volterra Integral. • Explain applications to ordinary differential equations of Initial value boundary value problems. • Illustrate and discuss singular integral equations to Abel integral equation. • Describe calculus of variations and applications • Illustrative problems on maxima and minima. • Find the natural boundary and transition conditions, constraints and Lagrange multipliers.
	17PMA4EC2	Extra Credit Course - II	Differential Geometry	• Understand the concept of Arc length , Tangent, Normal, Binormal, Curvature and torsion • Study the concept of local Intrinsic properties of a surface, families of curves and Isometric correspondence . • Study Canonical geodesic equations, Gauss-Bonnet theorem and Gaussian curvature • Study the concept of the Second fundamental form and Developables • Analyze the developables associated with curves on surfaces , Minimal surfaces , Ruled surfaces and Parallel Surfaces.

SEMESTER	Course Code	CORE BASED ELECTIVE	Course Learning Outcomes
I	17PMA1CE1AT	C++ Programming	• Describe the object-oriented programming paradigm. • Explain functions in C++, function prototyping, return by reference, lnline functions and function overloading. • Discuss the constructors and destructors. • Discuss the working with files and random access.
	17PMA1CE1AP	C++ Programming - Practical	
II	17PMA2CE2A	Classical Dynamics	• Define mechanical system, Generalized Co-ordinates, Constraints and Virtual work. • Derive the Lagrange's Equation and illustrate the mechanical Examples • State Rayleigh's Dissipation Function. • Write Hamilton's principle function and Jacobi equation, Separability.
III	17PMA3CE3A	Mathematical Statistics	• Define probability and axiomatic. • Prove and illustrate the basic concept of Boole's inequality. • Define the distribution function of a Random Variable. Prove decomposition of D.F's-Jordan decomposition theorem, correspondence theorem, Holder's inequality-Schwartz's inequality, Minkowski's inequality. • State and prove Fatou's theorem and dominated convergence theorem. • Prove Kolmogorov three-series theorem, Kronecker's Lemma • Describe central limit theorem, Lindeberg-Levy theorem, Liapounov's theorem-Lindeberg-Feller theorem.
IV	17PMA4CE4A	Stochastic Processes	• Define Stationary processes and transition matrix. • Classification of States and Chains and Communication Relations • Describe stability of a Markov System, limiting behavior. • Define poisson processes, renewal processes and density - renewal Equation. • Classify queueing processes and prove Little's formula. • Demonstrate queueing Model M/M/1.

M.Phil., PROGRAMME EDUCATIONAL OBJECTIVES (PEO):

PEO 1: Technical Proficiency:

Victorious in getting employment in different areas, such as industries, laboratories, Banks, Insurance Companies, Educational/Research institutions, Administrative positions, since the impact of the subject concerned is very wide.

PEO 2: Professional Growth:

Keep on discovering new avenues in the chosen field and exploring areas that remain conducive for research and development.

PEO 3: Management Skills:

Encourage personality development skills like time management, crisis management, stress interviews and working as a team.

PROGRAM SPECIFIC OUTCOMES (PSO):

PSO 1: To develop research level thinking in the field of pure and applied mathematics.

PSO 2: To assimilate complex mathematical ideas and arguments.

PSO 3: To improve your own learning and performance.

PSO 4: To develop abstract mathematical thinking.

M.Phil., PG Programme – Course Learning Outcomes (2017-2018)

SEM	SUB. CODE	COURSE	COURSE TITLE	COURSE LEARNING OUTCOMES
I	18MPMA1C1	Core - I	Research Methodology	• To develop understanding of research problem of research design. • Identify the concept of Noetherian modules, Primary decomposition and Artinian modules • Provide information on topological preliminaries and regularity properties of Borel measures. • Concentrate on atotal variation, Consequences of the Random Nikodym theorem and Riesz representation Theorem. • Discuss the Fundamental group and Covering spaces
	18MPMA1C2	Core - II	Analysis and Applied Mathematics	• Discuss the Gelfand mapping theorem and Gelfand – Neumark theorem • Analyse the concepts of Linear and Non-Linear systems differential Equations. • Concentrate on the domination number of graph, Exploration and Stratification. • Obtain solution of MOSPP by usingalgorithms. • Fuzzy Graph: Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees.
	18MPMA1C3	Core - III	**Area of Research**	
	18MPMA1C4	Core - IV	Educational Technology in Mathematics and MATLAB	• Discuss the learning, Teaching Technology, Instructional Designsand Instructional Designsin higher education • Distinguish teaching technology for Lecture, Seminar, Symposium, Panel Discussion, Team Teaching, Project and workshop. • Focus on class room management with effective teaching methods. • Focus of character formation and interpersonal skills. • Exposure on MATLAB software's.
II	18MPMA2PW	Project Work	Dissertation	