Name of the Department : Mathematics
Programme : PG

S.No	Course Code	Course Name	Course Outcome
SEMESTER - I			
1.	15PMAC11	Algebra I	• Learn the concepts and develop the working knowledge on Groups, Normal Subgroups, Automorphism groups, Finite groups and Rings. • Understand the concepts and develop the working knowledge on class equation, solvability of groups and finite abelian groups. • Knowledge about Group Theory and Ring Theory mainly, the Sylow's theorems and polynomials rings. • Understand the concepts of group, ring, field, homomorphism, isomorphism, and quotient structure, and to apply some of these concepts to real world problems. • Knowledge about direct product of groups, Structure of finite abelian groups. • Knowledge about Ring of polynomials, prime, irreducible elements and their properties, UFD, PID and Euclidean domains. prime ideal, maximal ideals. • Knowledge about various algebraic structures. • Establish the algebraic concept to apply in other disciplines.
2.	15PMAC12	Analysis I	• Learn the basic ingredients of reals. • Study the properties of functions defined on the Real line. • Exhibit knowledge of relevant definitions, techniques and mathematical results. • Develop a sound knowledge and appreciation of the ideas and concepts related to metric spaces • Give a strong foundation to take up advanced level courses in analysis. • Make the student knowledgeable in the area of infinite series and their convergence so that he/

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			she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling. • Demonstrate compactness, Completeness, limits, continuity. • Get the analytical skill about continuity and derivability. • Inculcate the basic knowledge of differentiation, expansion of functions and their applications.
3.	15PMAC13	Graph Theory I	• Write precise and accurate mathematical definitions of objects in graph theory • Able to formulate problems in terms of graphs, solve graph theoretic problems and apply algorithms taught in the course • Know when a connected graph is a tree and how trees arise in applications • Prove Euler's result on Eulerian graphs • Able to formulate Dual graphs • Explain basic terminology of a graph • Identify Euler and Hamiltonian cycle • Represent graphs using adjacency matrices • Know about many different coloring problems for graphs. • Able to study the graph concepts in directed graphs
4.	15PMAC14	Statistics	• Apply the specialised knowledge in set theory and probability set function. • Demonstrate ability to use formal mathematical argument in the context of conditional distributions and expectations • Understand the binomial and related distributions • Gain knowledge about various distributions like the Gamma and Chi-square distributions ,the normal distribution ,the bivariate normal distribution. • Introduce the concept of sampling theory.

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			• Present the ideas about the Beta, t, and F distributions • Evaluate the concept of moment generating function technique • Learn the concept of Limiting moment generating functions • Formulate and analyze mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions using various discrete distributions and estimation theory techniques. • Use statistical techniques to solve well-defined problems and present their mathematical work, both in oral and written format.
5.	15PMAO11	Combinatorial Mathematics	• Learn about the use of generating functions for enumeration of combinatorial structures, including partitions of numbers, permutations with restricted conditions. • Study the solution of recurrence relations; methods of enumeration with restricted conditions. • Comprehend the features characterizing problems in combinatorial mathematics; • Develop skills required to analyze and solve problems in combinatorial mathematics; • Appreciate the overlap between mathematics and other areas of applied and pure mathematics. • An improved ability to communicate mathematical ideas. • Describe and explain theories, design principles and empirical results in the area of specialization. • Apply the ideas in real life situations. • Know to classify the counting.
6.	15PMAO12	Differential Geometry	• Explain the concepts and language of differential geometry and its role in modern mathematics.

S.No	Course Code	Course Name	Course Outcome
			• Demonstrate the contact between curves and surfaces. • Know about the surfaces of revolution. • Parametrize a plane and a space curve and to calculate its curvatures and Frenet-Serret apparatus and arc-length • Gain knowledge of families of curves. • Present the concept of Geodesic and their properties. • Identify the principle of curvature of a curve. • Understand the developable associated with space curves • Able to know the minimal and ruled surfaces.
7.	15PMAO13	Automata and Formal Languages	• Prove properties of languages, grammars and automata with rigorously formal mathematical methods. • Design automata, regular expressions and context-free grammars accepting or generating a certain language. • Describe the language accepted by automata or generated by a regular expression or a context-free grammar. • Acquire a fundamental understanding of the core concepts in automata theory and formal languages. • An ability to design grammars and automata (recognizers) for different language classes. • An ability to identify formal language classes and prove language membership properties. • An ability to prove and disprove theorems establishing key properties of formal languages and automata. • Identify different formal language classes and their relationships. • Design grammars and recognizers for different formal languages.
8.	15PMAO14	Modern Applied Algebra	• Demonstrate accurate and efficient use of advanced algebraic techniques

S.No	Course Code	Course Name	Course Outcome
			• Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra • Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts • Demonstrate accurate and efficient use of advanced algebraic techniques • Demonstrate capacity for mathematical reasoning through analyzing, proving and explaining concepts from advanced algebra • Apply problem-solving using advanced algebraic techniques applied to diverse situations in physics, engineering and other mathematical contexts • Analyze an application using a function developed from data • Use the outputs of a Johnson shift counter to generate specialized waveforms utilizing various combinations of the five basic gates. • Develop a comparison of the Boolean equations and truth tables for the five basic gates.
SEMESTER - II			
1.	15PMAC21	Algebra II	• Inculcate an insight into algebraic structures. • Demonstrate the vector spaces and the concept of linearity. • Develop some important algebraic systems like Inner product Spaces. • Develop an analytic thinking in the concept of linear transformation. • Learn the Canonical form and Jordan form. • Provide an introduction to the concept of matrices. • Give a thorough knowledge of the various aspects of Trace and Transposes. • Provide the concept of determinants using the

S.No	Course Code	Course Name	Course Outcome
			operation of matrices. • Inculcate the basic knowledge of Hermitian and Unitary transformations. • Illustrate the real and quadratic forms of a matrix.
2.	15PMAC22	Analysis II	• Inculcate an insight into Riemann integration • Understand the basic concepts underlying the definition of the Riemann integral. • Understand the statement and proof of the fundamental integral convergence theorems, and their applications. • Demonstrate the main results on integration and an ability to apply these in examples • Find the domain, derivatives, and integral of power series and express known functions as power series. • Identify uniformly and non-uniformly convergent sequences of functions, and apply results related to uniform convergence • Inculcate the basic knowledge of differentiation, expansion of functions and their applications. • Provide a good background on advanced analysis
3.	15PMAC23	Differential Equations	• Appreciate ODE and system of ODEs concepts that are encountered in the real world • Work with Differential Equations and systems of Differential Equations in various situations and use correct mathematical terminology, Notation, and symbolic processes in order to engage in work, study, and conversation on topics involving Differential equations. • Solve exact differential equations, linear differential equations and understand the basics of non -linear differential equations. • Learn the concepts of series solution of differential equation and solution of Bessel's,

S.No	Course Code	Course Name	Course Outcome
			Legendre's equations and their properties; • Formulate and solve partial differential equations arising in a number of practical problems • Identify an ordinary differential equation and its order and degree • Determine the general solution of higher order linear equations with constant coefficients • Determine whether a system of functions is linearly independent using the Wronksian
4.	15PMAC24	Mechanics	• Analyse mechanical behaviour of particle. • Obtain simple mathematical and physical relationships between mechanics and materials. • Achieve mastery in moments and products of Inertia, Equimomental systems. • Ability to study generalized coordinates, Scleronomic and Rheonomic systems. • Able to study Lagrange's equations for various systems • Solve orbit problems using the conservation of angular momentum and total energy. • Recognize the principles written in form of mathematical equations. • Able to work out the centre of gravity and moment of inertia of various plane areas.
5.	15PMAO21	Numerical Analysis	• Demonstrate understanding of common Numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems. • Apply various mathematical operations and tasks, such as interpolation, differentiation, integration, the solutions of linear equations and the solutions of differential equations and partial differential equations. • Examine approximate solutions to mathematical problems. • Understand basics of finite precision arithmetic, conditioning of problems and

S.No	Course Code	Course Name	Course Outcome
			stability of numerical algorithms. • Solve dense systems of linear equations and least squares problems and have a working knowledge of LU and QR factorizations for these problems. • Understand and apply appropriate techniques for numerical differentiation and integration. • Solve initial value problem ordinary differential equations with explicit or implicit methods as appropriate solution. • Compute eigen values and eigenvectors of matrices numerically. • Increase the accuracy of numerical approximations by extrapolation.
6.	15PMAO22	Graph Theory II	• Have increased ability in graph theoretic problem solving. • Able to formulate applied problems as coloring problems. • Calculate the chromatic number and chromatic index of a given graph • Apply the Planarity Algorithm • Calculate the chromatic polynomial of a graph using the algorithm • Able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems. • Able to solve Turan's problem
7.	15PMAO23	Fuzzy Analysis	• Gain knowledge about constructing the appropriate fuzzy numbers corresponding to uncertain and imprecise collected data. • Gain knowledge about finding the optimal solution of mathematical programming problems having uncertain and imprecise data. • Knowledge about fuzzy cluster analysis and how to solve basic problems using fuzzy cluster analysis • Distinguish between the crisp set and fuzzy set

S.No	Course Code	Course Name	Course Outcome
			concepts through the learned differences between the crisp set characteristic function and the fuzzyset membership function • Draw a parallelism between crisp set operations and fuzzy set operations through the use of characteristic and membership functions respectively. • Able to define fuzzy sets using linguistic words and represent these sets by membership functions. • Know fuzzy-set-related notions; such as α-level sets, convexity, normality, support, etc.
8.	15PMAO24	Stochastic Processes	• Apply the specialised knowledge in probability theory and random processes to solve practical problems. • Gain advanced and integrated understanding of the fundamentals of and interrelationship between discrete and continuous random variables and between deterministic and stochastic processes. • Analyse the performance in terms of probabilities and distributions achieved by the determined solutions. • Demonstrate essential stochastic modelling tools like Markov chains . • Evaluate the n-step transition probability. • Learn about renewal theory. • Demonstrate the transition function • Know about the Birth – Death and Yule process • Study the properties of Poission process and their characterization. • Understand the relationship between the purpose of a model and the appropriate level of complexity and accuracy.
SEMESTER - III			
1.	15PMAC31	Field Theory and Lattices	• Inculcate the basic knowledge of extension fields.

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			• Learn the concept of splitting field and its properties. • Develop the famous theory of field extension, the Galois Theory of polynomial equations. • Gain knowledge of solvable group by radicals. • Understand the relation between symmetric roots of a polynomial and its solvability. • Study about finite fields and its properties. • Gain an in-depth knowledge of finite fields using general theorems like wedderburns theorem, Jacobson theorem and square theorem. • Introduce a new algebraic structure namely Lattices using partially ordered sets. • Study the types of lattices and the concept of Boolean algebras.
2.	15PMAC32	Measure Theory	• Learn the concept and properties of measure starting with outer measure and then the Lebesgue measure. • Study measurable sets and measurable functions and their properties. • Understand the basic concepts underlying the definition of the general Lebesgue integral • Study spaces of measurable Lebesgue integrable functions. • Understand Lebesgue integral and its relation with Riemann integral • Apply the theory of the course to solve a variety of problems at an appropriate level of difficulty. • Build a good background for more advanced analysis • Exhibit knowledge of relevant definitions, techniques and mathematical results.
3.	15PMAC33	Functional Analysis	• Gain an insight into normed space. • Understand the concept of continuity and boundedness of linear maps • Study the characterization of Hahn – Banach

S.No	Course Code	Course Name	Course Outcome
			Theorem. • Gain knowledge of central concepts of the open mapping and closed graph theorems. • Demonstrate the Bounded Linear maps on Banach spaces • Present the uniform boundedness principle on Banach spaces. • Learn about Spectrum of a bounded operator • Evaluate the spectral radius formula • Demonstrate the concept of weak and weak* convergence • Able to get idea of reflexivity using Helly's theorem and Milman theorem
4.	15PMAC34	Topology	• Learn the basic concepts of topology • Become competent in writing proofs • Gain knowledge about the fundamental groups and covering spaces. • Able to work new ideas with Mathematics. • Gain knowledge about topological examples and counterexamples • Establish an introduction to the field of topology, with emphasis on those aspects of the subject that are basic to higher mathematics.
5.	15PMAN31	Bio Statistics	• Demonstrate an understanding of the properties of probability and probability distributions and their role as the foundation for statistical inference. • Demonstrate an ability to use formal mathematical argument in the context of probability and statistics. • Understand sampling distributions of sample means and sample proportions • Estimate a population mean and a population proportion from a sample • Evaluate the accuracy of sample estimates using standard errors • Evaluate interpret margins of error for both

S.No	Course Code	Course Name	Course Outcome
			qualitative and quantitative data • Identify the use of confidence intervals and hypothesis tests • Gain knowledge about statistical significance. • Distinguish marginal, joint, and conditional probabilities • Understand and apply the concept of independence of events.
6.	15PMAN32	Business Statistics	• Enhance the knowledge of statistics in business management. • Develop analytical skills in both private and public business organics in the country. • Build a culture of informed decision making using statistical models • Describe data with descriptive statistics • Perform statistical analyses • Interpret the results of statistical analyses • Make inferences about the population from sample data. • Calculate and apply measures of location and measures of dispersion --grouped and ungrouped data cases. • Apply discrete and continuous probability distributions to various business problems. • Analyze and understand the meaning of the measures of central tendency: mean, median and mode
7.	15PMAN33	Quantitative Aptitude	• Be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems. • Understand the properties of proportion and how to use them. • Be able to add, subtract, multiply and divide whole numbers, decimal numbers and fractions. • Manipulate equations and formulas in order to solve for the desired variable. • Be able to perform operations with surds and

S.No	Course Code	Course Name	Course Outcome
			indices. • Determine the square roots, cube roots of positive whole numbers, decimals and common fractions.
SEMESTER - IV			
9.	15PMAC41	Complex Analysis	• Introduce the concept of Analytic Function, rational function etc., • Inculcate an insight into the characterization of some special series • Describe and parameterize curves and regions in two-dimensional space • Study about the families of circles • Evaluate fundamental theorem of calculus and Cauchy's integral formula • Find the Taylor series of a function and determine its circle or annulus of convergence • compute the residue of a function and use the residue theory to evaluate a integral over the real line • Understand the concept of reflection principle • Learn about Partial fractions. • Demonstrate the concept of Infinite products-Canonical products
10.	15PMAC42	Number Theory and Cryptography	• Solve problems in elementary number theory • Able to effectively express the concepts and results of Number Theory. • Apply elementary number theory to cryptography • Understand the mathematical ideas underlying the theory of error- detection and error-correction using linear codes. • Apply the theory of error-detecting and error-correcting codes. • Understand the mathematical ideas underlying the theory of cryptography. • Apply the theory of cryptography. • Able to understand the logic and methods behind the major proofs in Number Theory.

S.No	Course Code	Course Name	Course Outcome
			• Able to understand the principles and theory of error-correcting codes, and the various methods for constructing them.
11.	15PMAC43	Operations Research	• Learn the applications of shortest route algorithm • Gain knowledge of Queuing model. • Relate the exponential and Poisson distribution • Present the idea of servicing models • Demonstrate the Aspiration Level Model. • Learn the necessary and Sufficient Conditions of Unconstrained problems • Understand the concept of Direct Search Method of Quadratic Programming. • Able to know Linear Combinations method and SUMT Algorithm.
12.	15PMAO41	Microsoft Visual Basic	• Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic. • Load, modify, and save changes made to forms and projects in the Visual Basic environment • Write syntactically correct statements using local and global variables, sub procedures, forms, and Windows environment calls. • Define and implement form objects including data arrays, control arrays, text boxes, message boxes, dialog boxes, labels, controls, menus, frames, picture boxes, pull-down menus, and combo boxes • Manipulate strings using various String functions • Identify the difference between Random Access files and Sequential files • Use one dimensional array in your applications • Create applications that use ADO. NET • Identify and perform the steps necessary to convert Visual Basic programs to executable files that will run in the Windows environment.

S.No	Course Code	Course Name	Course Outcome
13.	15PMAO42	Advanced Functional Analysis	• Gain an insight into the compact linear maps. • Understand the concept of Spectrum of a compact operator • Study the characterization of approximate solutions. • Gain knowledge of central concepts of inner product spaces • Demonstrate the concept of orthonormal sets • Represent the projection using Riesz representation theorems. • Present the ideas of bounded operators and Adjoints. • Learn about Normal, Unitary and self-adjoint operators • Able to get idea of Compact self-Adjoint operators.
14.	15PMAO43	Advanced Statistics	• Inculcate an insight into Confidence intervals for means and their differences. • Understand the concept of Chi-Square tests • Study the characterization of sufficient statistic. • Demonstrate the concept of Fisher information and the Rao-Cramer inequality. • Present the idea of Limiting distributions of maximum likelihood estimators . • Understand the ideas of the sequential probability ratio test • Evaluate the Noncentral χ^2 and noncentral F. • Able to get idea of a regression problem.
15.	15PMAO44	Advanced Topology	• Demonstrate an understanding of the concepts of metric spaces and topological spaces, and their role in mathematics. • Prove basic results about operators on Hilbert the properties of bounded spaces. • Prove basic results about completeness, compactness, connectedness and convergence • these structures. • Able to find various fundamental constructions

S.No	Course Code	Course Name	Course Outcome
			in General Topology, such as the Stone-Cech compactifications. • Gain knowledge about fundamental concepts as compactness, compactifications, paracompactness, • Connectedness and disconnectedness. • Gain knowledge about the handling of several topological techniques. • Able to apply Tychonoff's theorem, fundamental metrization theorems to construct several mathematical objects. • Use ideas and methods of coverings to prove fundamental results related with metrisabilty and characterizations of Paracompactness. • Analyse basic techniques related with coverings of topological spaces.