Programme: M. Sc. Mathematics

Semester I			
Core I	**Groups and Rings**		
Course Code: 21PMAC11	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	illustrate the orbit for a set and make use of the counting principle technique to find algebraic descriptions for the size of each equivalence class.	2	Un
CO-2	describe all abelian groups generated by a finite set of elements and to find the root of unity for each element of a group.	1,2	Re
CO-3	analyze and demonstrate the examples of Ideals and Quotient Rings.	5	An
CO-4	evaluate the properties implied by the definition of Euclidean Rings and to illustrate and apply the concepts of Polynomial Rings.	6	Ev
CO-5	recall procedural fluency with polynomial expressions including basic factoring.	4	Re
CO-6	write the definitions of matrix multiplication that corresponds to composition of linear transformations.	2	Re

Semester I			
Core II	**Real Analysis**		
Course Code: 21PMAC12	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	recall the basic properties of real numbers.	5,6	Re
CO-2	demonstrate the knowledge of real functions, limit of functions and their properties	2,5	Ap
CO-3	evaluate the continuity, differentiability and integrability of functions defined on the real line.	2,5	Ev
CO-4	analyse the concepts of continuous functions and their properties	6	An
CO-5	explain the concepts of axioms of real number systems, uniform convergence of sequences and series of functions, equicontinuity, compact and complete metric spaces, the Stone-Weierstrass theorem.	1,5	Un
CO-6	apply the concept of the series of real numbers and convergence.	2,5	Ap

Semester I			
Core III	**Ordinary Differential Equations**		
Course Code: 21PMAC13	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	solve the solution of second order differential equations by variation of parameters.	2	Ap
CO-2	solve the method of Frobenius to solve differential equations about regular singular points.	5	Ap
CO-3	construct Legendre and Bessel equations.	2	Cr
CO-4	solve scientific and engineering problems	8	Ap
CO-5	compare the Euler equation, Bessel equation and Regular singular points.	2	An
CO-6	understand the Homogenous linear system with constant co-efficient	2,5	Un

Semester I			
Core IV	**Mathematical Statistics**		
Course Code: 21PMAC14	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO.NO.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	explain the concepts of distributions and apply them.	2,8	Un
CO-2	examine the method used for analysis, including a discussion of advantages, disadvantages and necessary assumptions.	1,2	An
CO-3	apply discrete and continuous probability to evaluate the probability of real world events.	2,7	Ap
CO-4	compare the distribution with one another.	2,8	An
CO-5	apply the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables	2,7,8	Ap
CO-6	define a probability generating function, a moment generating function and derive them in simple cases.	5,8	Re

Semester I			
Elective I A	**Combinatorics**		
Course Code:21PMAE11	**Hrs/week: 6**	**Hrs/Sem:90**	**Credits: 4**

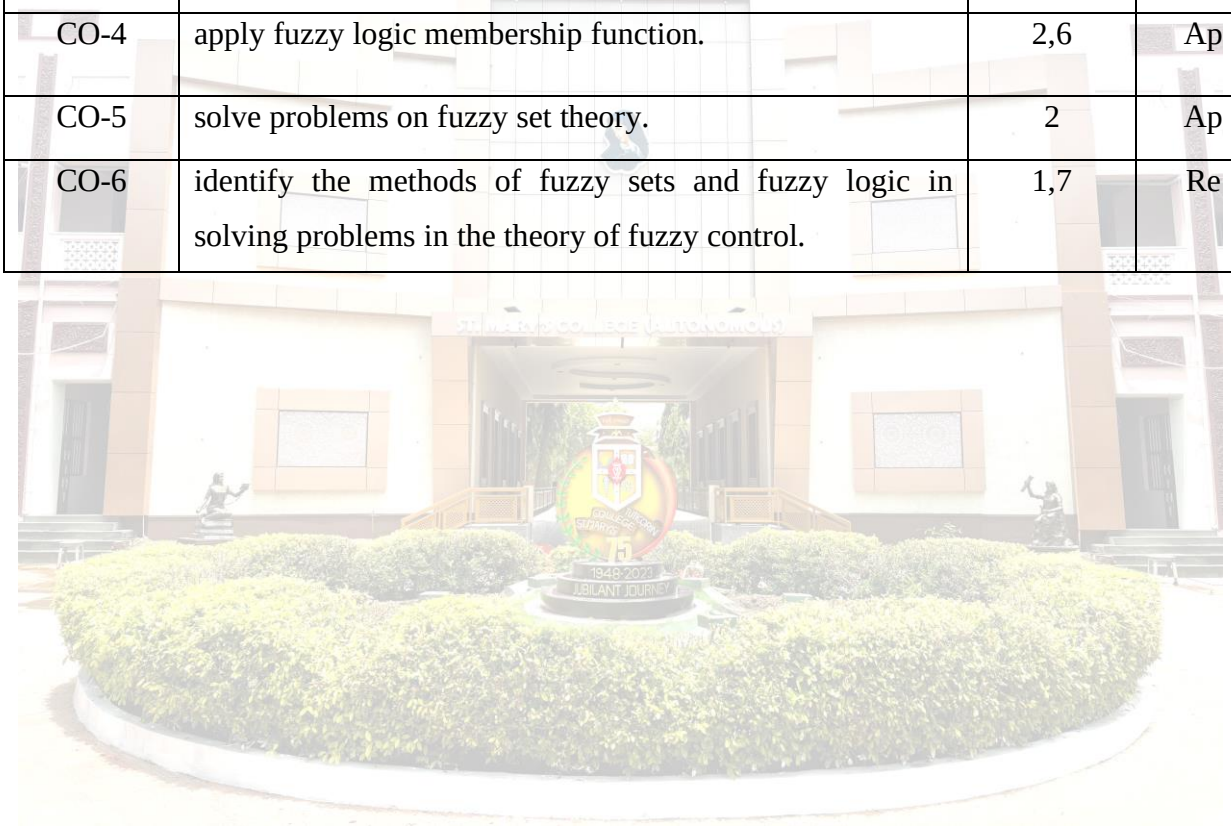
Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	explain the properties and behaviour of permutations and combinations.	1, 6	Un
CO-2	solve problems involving strings, combinations, distributions and partitions.	2	Ap
CO-3	understand the ideas of permutations and combinations.	1,6	Un
CO-4	apply, implement and interpret the theory of combinatorics to relevant probability and statistics problems.	2	Ap
CO-5	evaluate the addition and multiplication principles of counting.	3	Ev
CO-6	apply diverse counting strategies to solve varied problems involving combinations and distributions	2,3	Ap

Semester I			
Elective I B	**Fuzzy Sets**		
Course Code :21PMAE12	**Hrs/week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

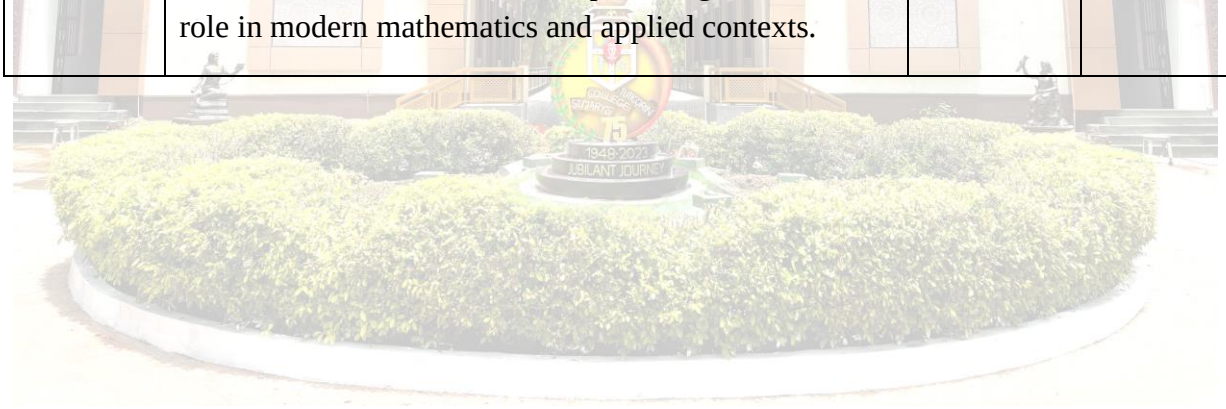
CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	differentiate crisp sets and fuzzy sets.	6	An
CO-2	apply the fuzzy set theory on statistical methods.	7	Ap
CO-3	compare statistical methods against fuzzy logic methods.	1,7	An
CO-4	apply fuzzy logic membership function.	2,6	Ap
CO-5	solve problems on fuzzy set theory.	2	Ap
CO-6	identify the methods of fuzzy sets and fuzzy logic in solving problems in the theory of fuzzy control.	1,7	Re



Semester II			
Core V	**Linear Algebra**		
Course Code: 21PMAC21	**Hrs/Week: 6**	**Hrs/Semester: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	define inner products and determine orthogonality on vector spaces including Gram Schmidt orthogonalization.	5,6	Re
CO-2	explain the concepts of field extensions and apply it to diverse situations in mathematical contexts.	7	Un
CO-3	demonstrate accurate and efficient use of field extension and Galois Theory.	5,6	Ap
CO-4	understand Polynomial Rings and its effect in Galois Theory.	6	Un
CO-5	understand the significance of various canonical forms.	5	Un
CO-6	evaluate the fundamental concepts of algebra and their role in modern mathematics and applied contexts.	2	Ev



Semester II			
Core VI	**Mathematical Analysis**		
Course Code: 21PMAC22	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	differentiate the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function and able to prove theorems concerning integration.	4	An
CO-2	distinguish pointwise and uniform convergence of a sequence of functions.	2,6	Un
CO-3	illustrate the convergent properties of power series.	2	Un
CO-4	analyze the concepts of Fourier Series and Beta, Gamma functions.	2	An
CO-5	compare differentiability of functions and relate to the integrability of functions.	6	An
CO-6	describe fundamental properties of the real numbers that lead to the formal development of real analysis.	1	Un

Semester II			
Core VII	**Classical Mechanics**		
Course Code:21PMAC23	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

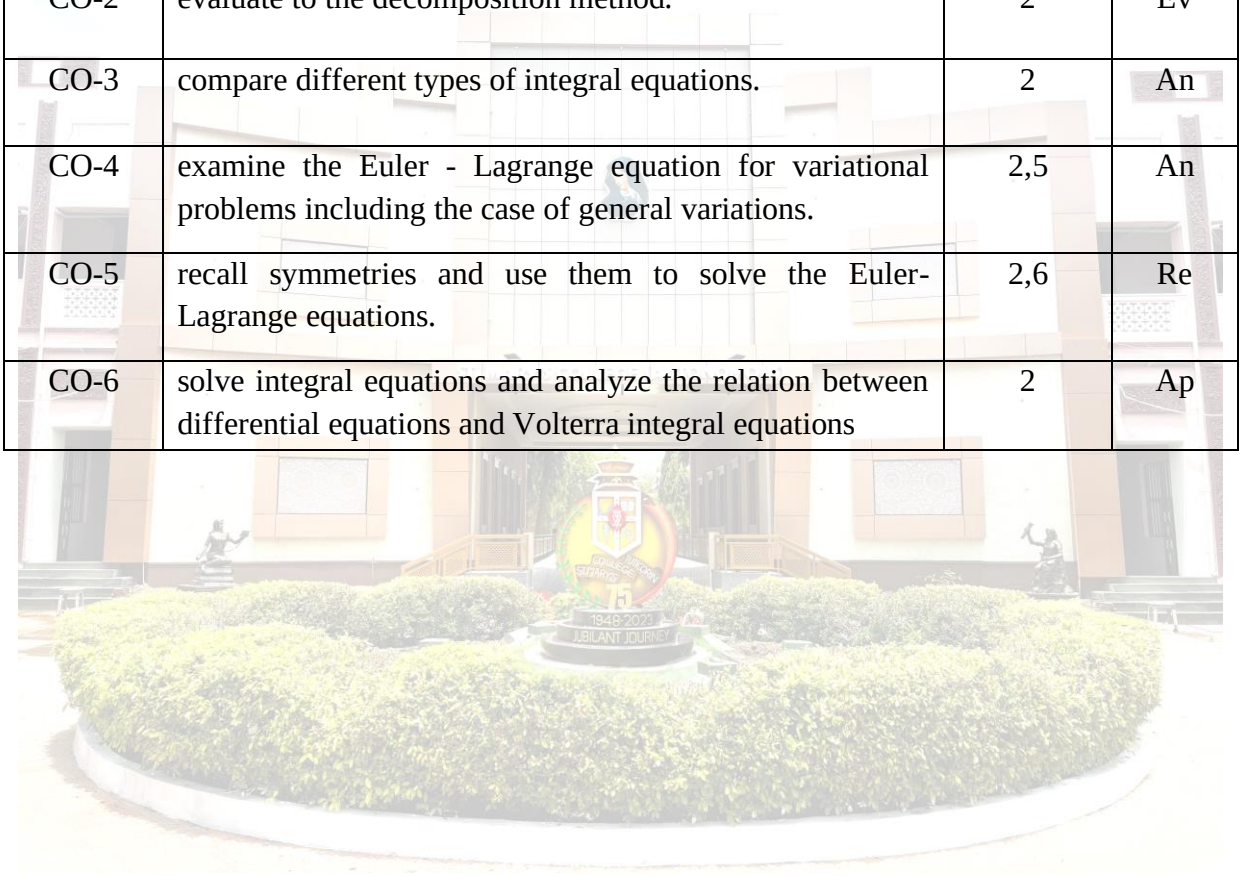
Course Outcome

Co. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	analyze the dynamics of system near equilibrium and find the normal modes of oscillation.	2	An
CO-2	understand D' Alembert's Principle and simple applications of the Lagrangian formulation.	2,6	Un
CO-3	compute the principle co-ordinates and the principle moment of inertia for arbitrary rigid body.	2	Ap
CO-4	explain Hamiltonian principles and establish the Hamiltonian equations.	2,5	Un
CO-5	write the magnitude of selected mechanical properties of materials.	2	Cr
CO-6	distinguish the concept of Hamilton equation of motion and lagrange's equations.	6	An

Semester II			
Core VIII	**Calculus of Variations and Integral Equations**		
Course Code:21PMAC24	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the properties of geometrical problems	2	Un
CO-2	evaluate to the decomposition method.	2	Ev
CO-3	compare different types of integral equations.	2	An
CO-4	examine the Euler - Lagrange equation for variational problems including the case of general variations.	2,5	An
CO-5	recall symmetries and use them to solve the Euler-Lagrange equations.	2,6	Re
CO-6	solve integral equations and analyze the relation between differential equations and Volterra integral equations	2	Ap



Semester - II			
Core IX	**Stochastic Processes**		
Course Code: 21PMAC25	**Hrs/week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	illustrate the stochastic model.	8	Un
CO-2	explain the well known models like birth-death and queueing to reorient their knowledge of stochastic analysis.	7	Un
CO-3	analyze the transition probabilities and its classifications.	2	An
CO-4	compare the different stochastic models.	1,8	An
CO-5	understand the notions of stochastic process.	5	Un
CO-6	apply markov chains to practical problems	4	Ap

Semester II			
Elective II A	**Operations Research**		
Course Code: 21PMAE21	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	classify and formulate integer programming problems and solve them with Cutting Plane Algorithm, Branch and Bound Algorithm.	2,4	Ap
CO-2	solve classical dynamic programming problems.	2,6	Ap
CO-3	compare inventory models and other related models.	2	An
CO-4	analyze a network of queues with Poisson external arrival, exponential service requirements and independent routing.	1,6	An
CO-5	evaluate the concept of complementary slackness and its role in solving prime and dual problems	2	Ev
CO-6	define probabilistic inventory models that accounts for all variations in real systems.	2	Re

Semester II			
Elective II B	**Applied Algebra**		
Course Code: 21PMAE22	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand some fundamental mathematical concepts and terminology.	2,4	Un
CO-2	analyse recursive definitions.	2,6	An
CO-3	compare the different techniques for constructing mathematical proofs, illustrated by discrete mathematics examples	2	An
CO-4	solve linear codes and cyclic codes.	1,6	Ap
CO-5	understand the concepts of Boolean Algebra and lattices.	2	Un
CO-6	apply basic and advanced principles of codes	2,6	Ap

Semester III			
Core X	**Topology**		
Course Code: 21PMAC31	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	define and illustrate the concepts of topological spaces and product topology.	5	Re
CO-2	explain the concepts concerned with properties that are preserved under continuous deformation of objects.	5,6	Un
CO-3	apply the knowledge general topology to formulate and solve problems of a topological nature in mathematics and other fields where topological issues arise.	2	Ap
CO-4	analyse Connectedness and Compactness and prove the related theorems.	5	An
CO-5	understand the separation axioms in different spaces.	5	Un
CO-6	explain the relation between the three types of compactness in general topological spaces and in metric spaces.	5	An

Semester III			
Core XI	**Graph Theory**		
Course Code: 21PMAC32	**Hrs/Week: 6**	**Hrs/Sem:90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the basic concepts of graphs, directed graphs and present the graph by matrices.	7	Un
CO-2	solve the problems involving edge and vertex connectivity, Planarity and crossing number and to determine the Eulerian and Hamiltonian graphs.	2,7	Ap
CO-3	analyze the properties of Trees and Connectivity	5,7	An
CO-4	solve the problems involving vertex and edge coloring.	2,7	Ap
CO-5	understand and apply the fundamental concepts of independent sets.	2	Un
CO-6	show a series of graph theoretical problems which have real world applications	1	Re

Semester III			
Core XII	**Measure Theory**		
Course Code: 219MAC33	**Hrs/Week:5**	**Hrs/Sem: 75**	**Credits: 4**

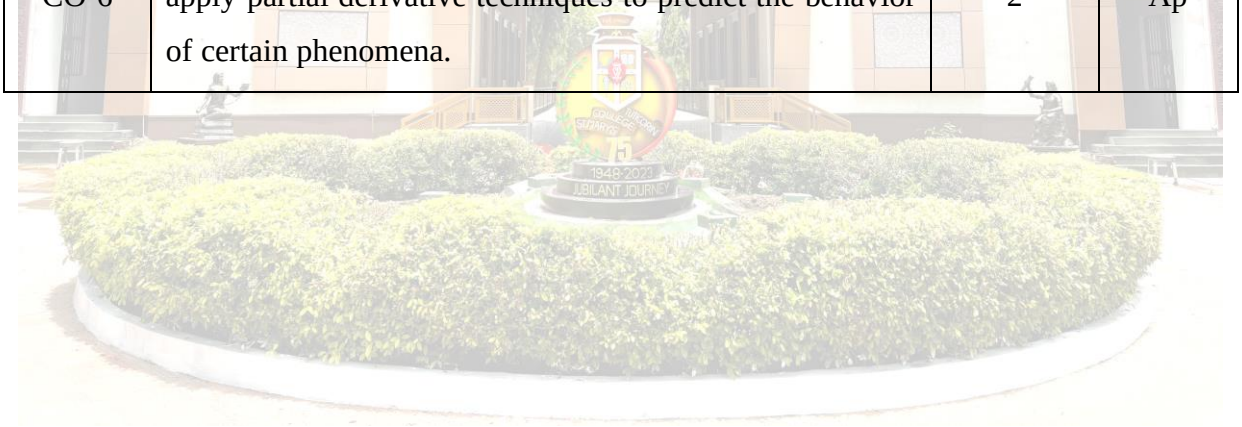
Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the basic definitions and the properties of Lebesgue measure of measurable sets.	1	Un
CO-2	define Lebesgue integral and discuss its properties.	6	Re
CO-3	analyze the concept of bounded variation.	1,2	An
CO-4	explain the concept of simple functions and Lebesgue integral of nonnegative integral functions.	6	Un
CO-5	summarize and discuss the properties of outer measure.	2	Un
CO-6	develop a basic knowledge of measure theory needed to understand probability theory and functional analysis	7	Cr

Semester III			
Core XIII	**Partial Differential Equations**		
Course Code: 21PMAC34	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution.	2	Ap
CO-2	demonstrate accurate and sufficient use of Laplace's equation and their applications in the theory of PDE.	2,6	Ap
CO-3	investigate the behavior of second order partial differential equations.	1,2	Un
CO-4	analyze the Partial Differential Equations using separation of variables techniques.	6	An
CO-5	solve the differential equations using Laplace Equation.	2	Ap
CO-6	apply partial derivative techniques to predict the behavior of certain phenomena.	2	Ap



Semester III			
Elective III A	**Fluid Mechanics**		
Course Code: 21PMAE31	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 3**

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	explain fundamentals of fluid mechanics, which is used in the applications of Hydraulics.	1,8	Un
CO-2	classify hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.	2	Ap
CO-3	examine stability of submerged and floating bodies.	6	An
CO-4	differentiate horizontal motion and vertical motion.	1	An
CO-5	describe methods of implementing fluid mechanics laws and phenomena.	5,6	Re
CO-6	calculate and optimize operational parameters of hydraulic problems, systems and machines	2	Ap

Semester - III			
Elective III B	**Wavelet Analysis**		
Course Code: 21PMAE32	**Hrs/week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand wavelet basis and characterize continuous and discrete wavelet transform	2	Un
CO-2	understand multi resolution analysis and identify various wavelets and evaluate their time frequency resolution properties	3	Un
CO-3	discuss and explain the main merits and limitations of wavelet analysis	2	An
CO-4	explain the properties and applications of wavelet transform	1	Un
CO-5	explain brief features and strength of transform beyond wavelet.	2	Un
CO-6	analyse the basis of the application of wavelet transforms to different fields	1,6	An

Semester IV			
Core XV	**Complex Analysis**		
Course Code: 21PMAC41	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	define and analyze limits and continuity for complex functions as well as consequences of continuity.	1,6	Re
CO-2	evaluate the complex contour integral directly and by the fundamental theorem.	6	Re
CO-3	represent functions as Taylor, power and Laurent series, classify singularities and poles, find the residues and evaluate complex integrals using the residue theorem.	6	Un
CO-4	apply the concept and consequences of analyticity and the Cauchy-Riemann equations and of results on Harmonic and entire functions including the fundamental theorem of algebra.	2,6	Ap
CO-5	demonstrate accurate and efficient use of complex analysis techniques	6	An
CO-6	apply the methods of complex analysis to evaluate definite integrals.	1,2	Ap

Semester IV			
Core XVI	**Functional Analysis**		
Course Code: 21PMAC42	**Hrs/Week: 6**	**Hrs/Semester: 90**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	apply the spectral theorem for compact self- adjoint operators and decide which properties an operator has.	5	Ap
CO-2	understand the various concepts of Banach Spaces.	5	Un
CO-3	attain a detailed knowledge about Hilbert Spaces.	2,5	Re
CO-4	understand the Operator theory in Hilbert Spaces.	1,5	Un
CO-5	explain the concepts of different operators.	5	Un
CO-6	understand the statements and proof of important theorems and explain the key steps in proofs sometimes with variation	1	Un

Semester IV			
Core XVII	**Number Theory and Cryptography**		
Course Code:21PMAC43	**Hrs/week: 5**	**Hrs/Sem:75**	**Credits: 4**

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	define the key notions of algebraic number theory and outline their interrelation.	5	Re
CO-2	calculate the most important number theoretical quantities introduced during the course.	5	Re
CO-3	calculate and solve the system of linear congruences and warning problem.	2,6	Re
CO-4	differentiate the greatest integer functions and arithmetic function.	1,6	An
CO-5	explains the notions of public key encryption and digital signatures.	6	Un
CO-6	describe and implement the specifics of some of the prominent techniques for public key crypto systems and digital signature schemes	6	Re

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