2021-2022

21MAP01	Core : I **ADVANCED ALGEBRA**	**SEMESTER**	LEVEL
CO1	Recall the basic definitions in theory of Groups, Rings, Fields and linear transformations.	1	K1
CO2	identify the difference between algebraic and transcendental extensions and to find the minimal polynomial for algebraic elements over a field.		K2
CO3	apply the concept of Groups, Rings, Fields and linear transformations to find the dimensions.		K3
CO4	analyze the results in Groups, Rings, Fields and linear transformations.		K4
CO5	Evaluate the problems using permutations, polynomials and linear transformations		K5
CO6	Create some examples in Groups, Rings, Fields and linear transformations		
21MAP02	Core : II **REAL ANALYSIS**	**SEMESTER**	LEVEL
CO 1	Recall the definitions of lower and upper bound, Riemann Stieltjes Integral, point wise , uniform convergence, equi-continuous families of functions, dimension, vector space, invertible operators and determinants.	1	K 1
CO 2	demonstrate the basic concepts of the series of real numbers, necessary conditions of R.S. integral, uniform convergence, uniformly closed algebra, uniform closure, linear transformation and differentiation of integrals.		K 2
CO 3	apply the necessary conditions of R.S. Integral, the concepts of Uniform convergence, solution of integrals, linear transformations for finding the solution of integrals convergence criteria of a certain function and dimensions respectively.		K 3
CO 4	analyze the concept of Riemann Stieltjes Integral sequence and series of functions, functions of several variables.		K 4
CO 5	evaluate the problems based on Riemann Stieltjes integral, sequence and series of functions and Derivatives of Higher Order.		K 5
CO 6	construct the necessary conditions of R.S. Integral, Generalisation of Stone-Weierstrass theorem and functions of several variables.		K 6

21MAP03	Core : III **ORDINARY DIFFERENTIAL EQUATIONS**	SEMESTER	LEVEL
CO1	Recall the fundamental concepts of power series solution, existence and uniqueness of solutions of systems of linear differential equations and non linear IVPs.	1	K1
CO2	Explain series solutions, existence and uniqueness results, oscillations of equations.		K2
CO3	Apply the various methods to solve linear differential equations.		K3
CO4	Analyze the applicability of the results in systems of linear differential equations and the oscillations of second order differential equations.		K4
CO5	Determine the power series solutions, the solutions of systems of linear differential equations and oscillations of second order differential equations.		K5
CO6	formulate the research problem into a model by using differential equations.		K6
21MAP04	Core : IV **CLASSICAL MECHANICS**	**SEMESTER**	LEVEL
CO1	Recall the notions of configuration space, generalized co-ordinates, degrees of freedom, natural system, ignorable co-ordinates, stationary value, canonical transformation, Lagrange and Poisson brackets.	1	K1
CO2	Classify Hamilton's principle, Euler-Lagrange equations, Hamilton-Jacobi theory and different types of constraints, work, energy and momentum.		K2
CO3	Use Jacobi integral, Routhian procedure, Hamiltonian procedure, generating functions to find the differential equations of motion.		K3
CO4	Critique all the theoretical techniques.		K4
CO5	Evaluate the equations of Lagrange, Hamilton, Hamilton-Jacobi, linear, rotational and rolling motions and canonical tranformations		K5
CO6	Construct brachistochrone problem, geodesic problem , generating function and bilinear covaraint under the canonical transformation.		K6

21MAP05A	Core : V **ELECTIVE - I** **NUMERICAL ANALYSIS**	**SEMESTER**	LEVEL
CO1	recall the basic definitions of interpolation , numerical integration, Numerical Solution of Ordinary differential equations and Partial differential equations.	1	K1
CO2	explain the concepts of interpolation ,numerical integration, Euler methods and predictor –corrector methods		K2
CO3	apply the different method to solve the problems on interpolation ,numerical integration, Numerical Solution of Ordinary differential equations and Partial differential equations.		K3
CO4	analyze the numerical solution of Euler and modified Euler method and predictor –corrector methods.		K4
CO5	evaluate the problems based on interpolation , numerical integration, Euler methods and modified Euler method.		K5
CO6	Construct the problem and find the solution by using Gauss interpolation formulae.		K6
21MAP05B	Core : V **ELECTIVE – I** **OPTIMIZATION TECHNIQUES**	**SEMESTER**	LEVEL
CO1	Recall the definitions of Activities, Players, Payoff Matrix, Value of the Game, balanced and unbalanced transportation problems, Hungarian Assignment Method, Simulation Models, Network Scheduling and Entropy.	1	K1
CO2	Explain the concepts of Activities, Players, Payoff Matrix, Value of the Game, balanced and unbalanced transportation problems, Hungarian Assignment Method, Simulation Models, Network Scheduling and Entropy.		K2
CO3	Apply the concepts of the Maximin or Minimax Principles, tests of optimality, simulation models, Network scheduling, joint and conditional entropies.		K3
CO4	Compare the concepts of Pure Strategies, Mixed Strategies, Looping, Dangling, Joint and Conditional Entropies.		K4

CO5	Evaluate the problems based on Games and strategies, Value of the Game, Critical Path, Event – Type Simulation, MODI Method and Hungarian Assignment Method, Joint and Conditional Probability.		K5
CO6	Construct the Network and Critical Path		K6
21MAP06	Core : VI **PRACTICAL** **PROGRAMMING IN PYTHON - PRACTICAL**	**SEMESTER**	LEVEL
CO1	Recall the basic concepts of Python language to solve the mathematical problems	1	K1
CO2	Illustrate Python language to get the solution of mathematical concepts		K2
CO3	Applying Python programming to get the execation of mathematical problems		K3
CO4	Examine the coding of Python software in cheating the classes and objects, Correlation coefficient Probability Measres of Central tendency, temperature conversion, finding roots ,R-K method, Ordinary differential equations and distance calculation		K4
CO5	Assess the Python software to find the solution of mathematical problems		K5
CO6	Develop the Python software to solve the mathematical problems		K6
	VALUE ADDED COURSE: MATHEMATICS FOR COMPETITIVE EXAMINATIONS	**SEMESTER**	LEVEL
CO1	recall the fundamental concepts in sequence and series, Group Theory, Complex numbers , Analytic function.	1	K1
CO2	illustrate the contexts in sequence and series, Group Theory, Complex numbers , Analytic function		K2
CO3	apply the basic lemmas and theorems to solve the problems on sequence and series, Group Theory, Complex numbers , Analytic function		K3
CO4	analyze the various problems on sequence and series, Group Theory, Complex numbers , Analytic function		K4

CO5	evaluate the various methods and problems on sequence and series, Group Theory, Complex numbers , Analytic function		K5
CO6	Construct simple analytical and numerical examples in sequence and series, Group Theory, Complex numbers , Analytic function.		K6
21MAP07	Core : VII **COMPLEX ANALYSIS**	**SEMESTER**	LEVEL
CO1	Recall the results in conformal mapping, complex integration and series and product developments.	2	K1
CO2	explain the concepts of analytic functions, Cauchy's theorem, Cauchy's integral formula, power series expansion and mapping.		K2
CO3	apply the theorems and results to solve problems involving complex functions.		K3
CO4	analyze the local properties, zeros, power series expansion for analytic functions and conformal mapping.		K4
CO5	determine the power series expansion, convergence of infinite products of an analytic function and residues.		K5
CO6	construct the series and product development of complex functions.		K6
21MAP08	Core : VIII **PARTIAL DIFFERENTIAL EQUATIONS**	**SEMESTER**	LEVEL
CO1	Recall the basic concepts and various types of second order PDE.	2	K1
CO2	discuss the classification of second order PDE, Cauchy problem, existence and uniqueness results of initial boundary – value problems, methods to find Green's function.		K2
CO3	apply the method of separation of variables, method of characteristics, Green's function to solve initial boundary – value problems.		K3

CO4	analyze the general solutions, existence and uniqueness of solutions of initial boundary – value problems.		K4
CO5	determine the solutions of second order liner PDE.		K5
CO6	formulate physical problems as PDE and construct the solutions.		K6
21MAP09	Core : IX **MEASURE THEORY AND INTEGRATION**	**SEMESTER**	LEVEL
CO1	Recall the concepts of Lebesgue measure in integration, differentiation of measurable sets and product measures.	2	K1
CO2	Explain the properties of Lebesgue measurable sets and product measures.		K2
CO3	apply the Lebesgue measure, integration, differentiation, product measure in measurable sets.		K3
CO4	Analyze the integration and differentiation of measurable functions over general measure spaces, measurable sets and product measures.		K4
CO5	Evaluate the Lebesgue measure , Lebesgue Integration, Lebesgue Differentiation and product Measures.		K5
CO6	Construct the measurability of Lebesgue measure in integration, differentiation and in product measures.		K6
21MAP10	Core : X **DIFFERENTIAL GEOMETRY**	**SEMESTER**	LEVEL
CO1	recollect the basic concepts of theory of space curves and surfaces	2	K1
CO2	explain the fundamental ideas in differential geometry		K2
CO3	use the formulae and theoretical ideas of differential geometry in distinct curvatures.		K3
CO4	analyze the nature of space curves on various surfaces, intrinsic and non-intrinsic properties and Geodesics		K4

CO5	evaluate the problems on theory of space curve, Fundamental forms , intrinsic and non-intrinsic properties and Geodesics		K5
CO6	Construct the various cuve Equations ,Fundamental Equations of Surface Theory, Gauss quationsWeingarten equations and Mainardi-Codazzi equations		K6
21MAP11A	Core : XI **ELECTIVE – II MATHEMATICAL STATISTICS**	**SEMESTER**	LEVEL
CO1	Recall the definitions of Sample Spaces, Random Variables, Moments, Moment – Generating functions.	2	K1
CO2	Explain the concepts of Sample Spaces, Events, Random Variables, Moments, Moment – Generating functions.		K2
CO3	Apply the concepts of Sample Spaces, Random Variables, moments for solving problems based on it.		K3
CO4	Compare the concepts of Sample Spaces, Sample Points, Discrete Random Variables and Continuous Random Variables.		K4
CO5	Evaluate the Mean, Variance, Moment - Generating Functions for different kinds of distributions.		K5
CO6	Construct the examples for Sample Spaces, Random Variables and for different kinds of distributions like Uniform Distribution, Bernoulli Distribution, Binomial Distribution, Negative Binomial Distribution, Geometric Distribution, gamma Distribution, Exponential Distribution and Chi – Square Distribution.		K6
21MAP11B	Core : **XI ELECTIVE - II PROGRAMMING IN C++**	**SEMESTER**	LEVEL
CO1	recall the basic concepts of programming in C++	2	K1
CO2	discuss the concepts of Object Oriented Programming, Functions, Classes, Operators, Constructors and Destructors.		K2

CO3	identify the syntax of declaration of variable, reference variable, control structure, inline function, function prototyping, functions, operators, classes, Constructors and Destructors.		K3
CO4	analyze the concepts OOPs, functions, classes and object, operators, constructor and destructors.		K4
CO5	evaluate the values of mathematical function by using various functions, classes, constructor and destructors.		K5
CO6	construct the program by using inline function, friend function, control structure, functions, operators, classes, Constructors and Destructors.		K6
21MAP12A	Core : XII **ELECTIVE - II PRACTICAL MATHEMATICAL SOFTWARE – I (SPSS) - PRACTICAL**	**SEMESTER**	LEVEL
CO1	recognize the commands provided in the SPSS environment	2	K1
CO2	demonstrate the charts and diagrams in statistics		K2
CO3	classify the various kinds of distribution such as binomial distribution, Poisson distribution and normal distribution		K3
CO4	analyze the data which is used to find the mean, median, mode, standard deviation, variance and range		K4
CO5	estimate the probability distribution by using various types of distributions.		K5
CO6	create the SPSS database which is used to fit the straight line and plot the exponential curves.		K6
21MAP12B	Core : XII **ELECTIVE - II PRACTICAL PROGRAMMING IN C++**	**SEMESTER**	LEVEL
CO1	recognize the commands provided in the C++ environment	2	K1
CO2	demonstrate the data values		K2
CO3	classify the various kinds of function		K3

CO4	analyze the data which is used to find the different function values.		K4
CO5	estimate the data values by using different function		K5
CO6	create the C++ program which is used find values of data		K6
21AEPMA01	Core : **ABILITY ENHANCEMENT CYBER SECURITY**	**SEMESTER**	LEVEL
CO1	Recall the basic concepts of information security and its types	2	K1
CO2	Explain cyber space issues and cyber security measures		K2
CO3	Apply security measures to prevent ourselves from threats in social media		K3
CO4	Identify various risks and threats in cyber space		K4
CO5	Appraise the performance of social media, security issues and their measures		K5
CO6	Compose the real time examples using case studies		K6
21MAP13	Core : XIII **TOPOLOGY**	**SEMESTER**	LEVEL
CO1	recall the basic definitions of Topological spaces, connectedness, Compact Spaces, Countability and Completely regular spaces.	3	K1
CO2	explain the concepts of Topological spaces, connectedness, Compact Spaces, Countability and Completely regular spaces.		K2
CO3	apply the concepts of Continuous Functions, Compact Spaces, Urysohn Metrization Theorem and Tychonoff Theorem in topological spaces.		K3
CO4	analyze the separation properties, convergent sequence, metric space in the general theory of topological space.		K4
CO5	justify the relationship between compact spaces, connected spaces and regular spaces.		K5
CO6	construct the examples for Topological spaces, connectedness, Compact Spaces, and Countability.		K6

21MAP14	Core - XIV **THEORY OF NUMBERS**	**SEMESTER**	LEVEL
CO1	bring back all the concepts in theory of numbers	3	K1
CO2	demonstrate Congruences,Quadratic reciprocity and Arithmetic functions.		K2
CO3	apply conceptual knowledge and formulae in number theory to solve the problems.		K3
CO4	critique the proof and context of theorems in Divisibility,Primes, Congruences,Quadratic reciprocity and Arithmetic functions.		K4
CO5	evaluate the solutions of congruences ,Jacobi symbol problems and Arithmetic functions.		K5
CO6	manipulate simple research problems on Divisibility,Primes, Congruences,Quadratic reciprocity and Arithmetic functions		K6
21MAP15	Core : XV **OPERATOR THEORY**	**SEMESTER**	LEVEL
CO1	recall the basic definitions of Spectral theory , infinite dimensional spectral theory,Banach Algebra, Hilbert spaces and operators.	3	K1
CO2	explain the basic concepts of Spectral theory, infinite dimensional spectral theory, Banach Algebra, Hilbert spaces and operators.		K2
CO3	apply the concepts of operator theory in Hilbert space and operator, spectral theory, Infinite Dimensional Spectral Theory and banach algebra.		K3
CO4	examine the properties Hilbert space and operator, spectral theory, Infinite Dimensional Spectral Theory and banach algebra.		K4
CO5	establish the adjoint Operator-Self adjoint operator, The adjoint Operator-Self adjoint operator, Spectrum of an Operator on a finite dimensional Hilbert Space		K5
CO6	construct the examples for Hilbert space, the adjoint Operator-Self adjoint operator and Normal operator		K6

21MAP16	Core : XVI **PRACTICAL** **MATHEMATICAL SOFTWARE – II** **(R SOFTWARE)- PRACTICAL**	**SEMESTER**	LEVEL
CO1	Recognize the commands provided in R Software	3	K1
CO2	Demonstrate the graphs and diagrams inn statistics		K2
CO3	Classify statistical methods using numerical data		K3
CO4	Analyze the data using various statistical methods		K4
CO5	Estimate measures of central tendency, probabiliy distributions, standard deviation, variance, correlation, regression and one and two sample 't' test.		K5
CO6	Formulate functions, data frames, diagrams and graphs.		K6
21PEPMA01	**PROFICIENCY ENHANCEMENT** **(SELF STUDY) INDUSTRIAL MATHEMATICS** **(SELF STUDY)**	**SEMESTER**	LEVEL
CO1	understand the meaning, purpose, and tools of operations research.	3	K1
CO2	gain the knowledge about simulation, Inventory control and Numerical Methods.		K2
CO3	apply the concepts of Inventories to find EOQ.		K3
CO4	Analyze the concept of Interpolation with equal and unequal integrals and find the solution to the problems by using various methods.		K4
CO5	evaluatethe problems based on types of inventory control.		K5
CO6	evaluatethe problems based on types of inventory control.		K6

21MAP17A	CORE – XVIII ELECTIVE - III :GRAPH THEORY	SEMESTER	LEVEL
CO1	recall the basic concepts of graph theory.	3	K1
CO2	illustrate various types of graph,matchings,coverings and colourings.		K2
CO3	apply the preliminaries of graph theory in well – named theorems and Conjectures.		K3
CO4	analyze the proof of theorems on graphs,matchings,coverings and colourings.		K4
CO5	determine the path ,cycle, Chromatic Number,.		K5
CO6	construct graphs with Euler tours, Hamiltonian cycles, and four and five Colour concepts.		K6
21MAP17B	**CORE – XVIII ELECTIVE – III: INTEGRAL TRANSFORMS**	**SEMESTER**	LEVEL
CO1	recall the concepts based on Fourier Sine and Cosine transforms, Hankel transforms.	3	K1
CO2	Explain the concepts of Fourier Transforms, Hankel transforms and diffusion equations.		K2
CO3	apply the Fourier Transforms, Hankel transforms in Laplace Equation and PDE.		K3
CO4	analyze the properties on Fourier and Hankel Transforms.		K4
CO5	evaluate the problems based on Fourier Cosine and sine Transforms and Hankel Transforms.		K5
CO6	construct the solution of Laplace and linear diffusion equations.		K6
	VALUE ADDED COURSE :TYPE SETTING IN LATEX	**SEMESTER**	LEVEL
CO1	recall the commands and environments in LATEX.	3	K1
CO2	interpret document class, index, page style, changing font size, boxes.		K2
CO3	Identify the tables, figures, bibliography, picture objects and page style parameters.		K3
CO4	show mathematical symbols, foot notes, slides, picture objects and page breaking in LATEX.		K4
CO5	sketch boxes, tables and pictures in LATEX.		K5
CO6	design a document or an article in LATEX.		K6

21MAP19	CORE - XX : MATHEMATICAL METHODS	SEMESTER	LEVEL
CO1	recall the concepts based on Various types of integral equations and Calculus of Variations.	4	K1
CO2	explain various types of integral equations, extremals, Euler equations, Euler – Poisson equation, and Ostrogradsky equation.		K2
CO3	apply various methods for finding the solutions of Fredhlom Integral Equation, Volterra Integral equation and Calculus of Variation.		K3
CO4	analyze the concepts of Fredhlom Integral Equation and Volterra Integral equation, Calculus of Variation.		K4
CO5	evaluate the problems based on Fredhlom Integral Equation, Volterra Integral equation and Calculus of Variation.		K5
CO6	Construct initial, boundary value problems, minimum surface of revolution problem, Brachistochrome problem, problem on geodesics.		K6

21MAP18	CORE - XIX :FUNCTIONAL ANALYSIS	SEMESTER	LEVEL
CO1	Recall the basic concept of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.	4	K1
CO2	Explain the concepts of linear space, normed linear space and banach space.		K2
CO3	apply the knowledge of functional analysis in linear space, normed linear space and in banach space.		K3
CO4	analyze the properties of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.		K4
CO5	Evaluate the properties of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.		K5
CO6	Construct the vector space in Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and in Bounded linear operators.		K6

21MAP20	CORE - XXI :FLUID DYNAMICS	SEMESTER	LEVEL
CO1	recall the concepts based on stream lines, path lines, energy equation, two dimensional motion, Navier stokes equations and boundary layer equations.	4	K1
CO2	illustrate stream lines, path lines, energy equation, two dimensional motion, Navier stokes equations and boundary layer equations.		K2
CO3	apply the concepts of fluid dynamics in equations of continuity , momentum theorem, Blasius theorem, Navier Strokes equations and boundary layer equations.		K3
CO4	analyze the solutions of energy equations Navier Strokes equations and boundary layer equations.		K4
CO5	evaluate the problems based on stream lines, path lines and two – dimensional motion.		K5
CO6	construct the energy equations, Navier Strokes equations and boundary layer equations.		K6
21MAP21	**CORE - XXII :PROJECT WORK AND VIVA - VOCE**	**SEMESTER**	LEVEL
CO1	recall the fundamental disciplinary concepts and methods appropriate to their principal areas of study.	4	K1
CO2	illustrate the depth knowledge about their principal areas of study		K2
CO3	apply the knowledge of principles, theories, and concepts to project situations.		K3
CO4	analyze the problems creatively through sustained critical investigation		K4
CO5	evaluate the consequences of project and their implications for project objectives.		K5
CO6	construct the solutions of contemporary issues in their chosen field of research.		K6

21MAP22A	CORE – XXIII ELECTIVE - IV :FUZZY LOGIC AND FUZZY SETS	SEMESTER	LEVEL
CO1	recall the basic concepts of the crisp sets theory, types of crisp sets, standard operations of the crisp sets, crisp relations, representation of uncertainty and measures of uncertainty in real life.	4	K1
CO2	express the basic concepts of fuzzy set theory with fuzzy logic, fuzzy relations, fuzzy measures, measures of fuzziness, types of uncertainty and classical measures of uncertainty.		K2
CO3	apply the concepts of fuzzy sets, fuzzy relations, fuzzy measures, measures of uncertainty in real life situations.		K3
CO4	analyze the standard fuzzy operations, types of fuzzy relations, different fuzzy measures, types of uncertainty and information.		K4
CO5	evaluate fuzzy set, fuzzy relations, fuzzy measures, measures of fuzziness in real life		K5
CO6	design fuzzy models in real life situations.		K6
21MAP22B	**CORE – XXIII ELECTIVE - IV :ACTUARIAL MATHEMATICS**	**SEMESTER**	LEVEL
CO1	recall the basic concepts of probability, Annuities, premiums, present value and reserves	4	K1
CO2	Classify interest, life tables, premium calculation and insurance		K2
CO3	apply probability, Annuities, premiums, present value and reserves to improve the financial decision making		K3
CO4	Illustrate mortgage refinancing, life tables, premiums and reserves		K4
CO5	evaluate life tables, reserves, annuities and premiums		K5
CO6	Prepare life tables and mortality tables		K6