CRITERION I **POs and COs**

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) (2019-2020 Onwards)

DEPARTMENT OF MATHEMATICS

B. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of B. Sc Mathematics Programme, the students will be able to
PO1	Demonstrate basic manipulative skills in algebra, geometry and trigonometry.
PO2	Communicate mathematical principles and ideas with clarity and coherence, both written and verbally, demonstrating communication skills to be used in any future career.
PO3	Demonstrate proficiency in linear algebra, real and complex analysis as well as areas of modern, proof-based Mathematics.
PO4	Compute limits and derivatives using their definitions, and use the fundamental theorem of calculus to compute definite and indefinite integrals.
PO5	Construct counter examples to mathematical statements and understand the importance of hypotheses into a viable career path.

COURSE OUTCOMES (COs)

Course Title: DIFFERENTIAL CALCULUS AND TRIGONOMETRY **Course Code: 19UMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of differentiation, extreme functions of two variables.	**K2**
CO2	Apply the concept of differentiation for explaining curvature.	**K3**
CO3	Explore the solution of problems from a mathematical perspective.	**K3**
CO4	Associate various types of hyperbolic and inverse hyperbolic functions and Solve problems in summation of trigonometric series.	**K4**
CO5	Examine the conceptual understanding and fluency with trigonometric functions, techniques and manipulations necessary for success in calculus.	**K4**

Course Title: INTEGRAL CALCULUS AND FOURIER SERIES **Course Code: 19UMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of double, triple integrals.	**K3**
CO2	Distinguish the concepts of Beta and Gamma functions.	**K3**
CO3	Apply the concepts of half range Fourier series for solving problems necessary for success in calculus.	**K3**
CO4	Associate various types of Fourier series for solving problems.	**K3**
CO5	Evaluate the types of integration**.**	**K4**

CRITERION I **POs and COs**

Course Title: MATHEMATICAL STATISTICS – I **Course Code: 19UMA1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the concept of probability theory and identify its applications in real situations.	**K2**
CO2	Explain the derivation of moment generating function, characteristic function, probability generating function and the proof of Chebychev's inequality with its applications.	**K2**
CO3	Compute the index numbers by different types of methods.	**K3**
CO4	Define and Classify the two dimensional random variables.	**K3**
CO5	Interpret the various properties of expectation, variance and the concept of covariance.	**K3**
CO6	Distinguish between a discrete and a continuous random variable.	**K4**

Course Title: MATHEMATICS-I **Course Code: 19UPH1AC1/19UCH1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of successive differentiation and Leibnitz theorem	**K2**
CO2	Describe curvature, radius of curvature in Cartesians	**K2**
CO3	Compute integrals of various types	**K3**
CO4	Solve integrals by trigonometric substitution and by parts.	**K3**
CO5	Interpret the properties of definite integrals and evaluate them.	**K2**
CO6	Apply reduction formula and evaluate the integrals.	**K3**
CO7	Compute double and triple integrals.	**K3**
CO8	Classify Fourier series for full range, half range and odd & even functions.	**K3**

CRITERION I **POs and COs**

Course Title: MATHEMATICS – II **Course Code: 19UPH1AC2/19UCH1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define matrices and various procedures for solving matrices.	**K1**
CO2	Explain Binomial, Logarithmic and Exponential series.	**K2**
CO3	Describe skew lines, co planarity, sphere and several concepts on sphere.	**K3**
CO4	Classify series expansion of sine, cosines, and tangents in all manners.	**K3**
CO5	Compute using hyperbolic and inverse hyperbolic functions.	**K3**

Course Title: ESSENTIAL MATHEMATICS **Course Code: 19UCS1AC1/19UCA1AC1/19UIT1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the basic concepts of graph theory.	**K1**
CO2	Explain the concepts of Matrices and its types.	**K2**
CO3	Compute characteristic equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO4	Apply Differentiation to find the solutions of Ordinary and Partial Differentiation.	**K3**
CO5	Classify the various types of integrals.	**K3**
CO6	Solve different types of ordinary differential equation.	**K3**
CO7	Classify the characteristics of graph theory.	**K3**

Course Title: NUMERICAL ANALYSIS AND STATISTICS Course Code: 19UCS1AC2/19UCA1AC2/19UIT1AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations and Interpolation.	**K3**
CO2	Solve numerical integration and system of linear equation by appropriate methods.	**K3**
CO3	Compute the numerical solution of ordinary differential equation by various method.	**K3**
CO4	Explain the concept of measures of central tendency and dispersion.	**K2**
CO5	Explain correlation and regression and solve the numerical problems.	**K3**

Course Title: ANALYTICAL GEOMETRY AND VECTOR CALCULUS Course Code: 19UMA2CC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the coordinates in space, equation of a plane.	**K3**
CO2	Describe the concepts of straight lines and coplanar lines.	**K3**
CO3	Classify the equation of a sphere and tangent planes.	**K3**
CO4	Solve the problems of Gauss Divergence Theorem, Stokes Theorem- Green's Theorem.	**K3**
CO5	Examine the concepts of vector integration for finding scalar potential.	**K4**

Course Title: MATHEMATICAL STATISTICS – II (PRACTICAL) Course Code: 19UMA2AC1P		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the discrete and continuous data and find average through the Measures of Central Tendency and Measures of Dispersion.	**K1**
CO2	Solve the problems in joint, Marginal and Conditional Probability distributions involving two random variables.	**K2**
CO3	Explain the various methods of finding Correlation and Regression co-efficient between two data sets and their applications.	**K2**
CO4	Describe and illustrate the concepts of fitting probability distributions.	**K2**
CO5	Analyze the concepts of testing of hypothesis and apply the test to the real life problems.	**K3**

Course Title: MATHEMATICAL STATISTICS III Course Code: 19UMA2AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the chi square Distribution and discuss the applications of chi square Distribution to conduct tests of goodness of fit and independence of attributes.	**K2**
CO2	Explain Student's t, Fisher's t and F statistics and derive their probability Distribution.	**K2**
CO3	Identify the concepts of a discrete probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a discrete probability Distribution and its applications.	**K3**
CO4	Describe the concepts of a continuous probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a continuous probability Distribution and its applications.	**K3**
CO5	Classify the various properties of the correlation and regression co- efficient and their applications.	**K3**

Course Title: MATHEMATICS – III Course Code: 19UPH2AC3/19UCH2AC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transforms and solve.	**K1**
CO2	Rephrase the partial differential equations by eliminating constants and arbitrary functions and solve various types of PDE's.	**K2**
CO3	Solve ordinary differential equations under several methods.	**K3**
CO4	Apply inverse Laplace transforms and solve second order ODE.	**K3**
CO5	Classify vectors and vector differentiation.	**K3**

Course Title: OPERATIONS RESEARCH Course Code: 19UCS2AC3/19UCA2AC3/19UIT2AC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the applications of Operations research.	**K2**
CO2	Illustrate the formulations of Linear Programming Problem and Solve them by graphical method.	**K3**
CO3	Classify the different types of Simplex methods.	**K3**
CO4	Describe the concepts of Transportation Problem and Assignment Problem and compute the solution by various methods.	**K3**
CO5	Determine the solution of Sequencing Problem.	**K4**
CO6	Compute PERT and CPM in Network Analysis.	**K3**

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) (2020-2021 Onwards)

DEPARTMENT OF MATHEMATICS

B. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of B. Sc Mathematics Programme, the students will be able to
PO1	Demonstrate basic manipulative skills in algebra, geometry and trigonometry.
PO2	Communicate mathematical principles and ideas with clarity and coherence, both written and verbally, demonstrating communication skills to be used in any future career.
PO3	Demonstrate proficiency in linear algebra, real and complex analysis as well as areas of modern, proof-based Mathematics.
PO4	Compute limits and derivatives using their definitions, and use the fundamental theorem of calculus to compute definite and indefinite integrals.
PO5	Construct counter examples to mathematical statements and understand the importance of hypotheses into a viable career path.

COURSE OUTCOMES (Cos)

Course Title: DIFFERENTIAL CALCULUS AND TRIGONOMETRY **Course Code: 19UMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of differentiation, extreme functions of two variables.	**K2**
CO2	Apply the concept of differentiation for explaining curvature.	**K3**
CO3	Explore the solution of problems from a mathematical perspective.	**K3**
CO4	Associate various types of hyperbolic and inverse hyperbolic functions and Solve problems in summation of trigonometric series.	**K4**
CO5	Examine the conceptual understanding and fluency with trigonometric functions, techniques and manipulations necessary for success in calculus.	**K4**

Course Title: INTEGRAL CALCULUS AND FOURIER SERIES **Course Code: 19UMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of double, triple integrals.	**K3**
CO2	Distinguish the concepts of Beta and Gamma functions.	**K3**
CO3	Apply the concepts of half range Fourier series for solving problems necessary for success in calculus.	**K3**
CO4	Associate various types of Fourier series for solving problems.	**K3**
CO5	Evaluate the types of integration**.**	**K4**

Course Title: MATHEMATICAL STATISTICS – I Course Code: 19UMA1AC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the concept of probability theory and identify its applications in real situations.	**K2**
CO2	Explain the derivation of moment generating function, characteristic function, probability generating function and the proof of Chebychev's inequality with its applications.	**K2**
CO3	Compute the index numbers by different types of methods.	**K3**
CO4	Define and Classify the two dimensional random variables.	**K3**
CO5	Interpret the various properties of expectation, variance and the concept of covariance.	**K3**
CO6	Distinguish between a discrete and a continuous random variable.	**K4**

Course Title: MATHEMATICS-I Course Code: 19UPH1AC1/19UCH1AC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of successive differentiation and Leibnitz theorem	**K2**
CO2	Describe curvature, radius of curvature in Cartesians	**K2**
CO3	Compute integrals of various types	**K3**
CO4	Solve integrals by trigonometric substitution and by parts.	**K3**
CO5	Interpret the properties of definite integrals and evaluate them.	**K2**
CO6	Apply reduction formula and evaluate the integrals.	**K3**
CO7	Compute double and triple integrals.	**K3**
CO8	Classify Fourier series for full range, half range and odd & even functions.	**K3**

CRITERION I **POs and COs**

Course Title: MATHEMATICS – II **Course Code: 19UPH1AC2/19UCH1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define matrices and various procedures for solving matrices.	**K1**
CO2	Explain Binomial, Logarithmic and Exponential series.	**K2**
CO3	Describe skew lines, co planarity, sphere and several concepts on sphere.	**K3**
CO4	Classify series expansion of sine, cosines, and tangents in all manners.	**K3**
CO5	Compute using hyperbolic and inverse hyperbolic functions.	**K3**

Course Title: ESSENTIAL MATHEMATICS **Course Code: 19UCS1AC1/19UCA1AC1/19UIT1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the basic concepts of graph theory.	**K1**
CO2	Explain the concepts of Matrices and its types.	**K2**
CO3	Compute characteristic equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO4	Apply Differentiation to find the solutions of Ordinary and Partial Differentiation.	**K3**
CO5	Classify the various types of integrals.	**K3**
CO6	Solve different types of ordinary differential equation.	**K3**
CO7	Classify the characteristics of graph theory.	**K3**

Course Title: NUMERICAL ANALYSIS AND STATISTICS Course Code: 19UCS1AC2/19UCA1AC2/19UIT1AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations and Interpolation.	**K3**
CO2	Solve numerical integration and system of linear equation by appropriate methods.	**K3**
CO3	Compute the numerical solution of ordinary differential equation by various method.	**K3**
CO4	Explain the concept of measures of central tendency and dispersion.	**K2**
CO5	Explain correlation and regression and solve the numerical problems.	**K3**

Course Title: ANALYTICAL GEOMETRY AND VECTOR CALCULUS Course Code: 20UMA2CC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the coordinates in space, equation of a plane.	**K3**
CO2	Describe the concepts of straight lines and coplanar lines.	**K3**
CO3	Classify the equation of a sphere and tangent planes.	**K3**
CO4	Solve the problems of Gauss Divergence Theorem, Stokes Theorem- Green's Theorem.	**K3**
CO5	Examine the concepts of vector integration for finding scalar potential.	**K4**

Course Title: MATHEMATICAL STATISTICS – II (PRACTICAL) Course Code: 19UMA2AC1P		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the discrete and continuous data and find average through the Measures of Central Tendency and Measures of Dispersion.	**K1**
CO2	Solve the problems in joint, Marginal and Conditional Probability distributions involving two random variables.	**K2**
CO3	Explain the various methods of finding Correlation and Regression co-efficient between two data sets and their applications.	**K2**
CO4	Describe and illustrate the concepts of fitting probability distributions.	**K2**
CO5	Analyze the concepts of testing of hypothesis and apply the test to the real life problems.	**K3**

Course Title: MATHEMATICAL STATISTICS III Course Code: 19UMA2AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the chi square Distribution and discuss the applications of chi square Distribution to conduct tests of goodness of fit and independence of attributes.	**K2**
CO2	Explain Student's t, Fisher's t and F statistics and derive their probability Distribution.	**K2**
CO3	Identify the concepts of a discrete probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a discrete probability Distribution and its applications.	**K3**
CO4	Describe the concepts of a continuous probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a continuous probability Distribution and its applications.	**K3**
CO5	Classify the various properties of the correlation and regression co- efficient and their applications.	**K3**

Course Title: MATHEMATICS – III **Course Code: 19UPH2AC3/19UCH2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transforms and solve.	**K1**
CO2	Rephrase the partial differential equations by eliminating constants and arbitrary functions and solve various types of PDE's.	**K2**
CO3	Solve ordinary differential equations under several methods.	**K3**
CO4	Apply inverse Laplace transforms and solve second order ODE.	**K3**
CO5	Classify vectors and vector differentiation.	**K3**

Course Title: OPERATIONS RESEARCH **Course Code: 19UCS2AC3/19UCA2AC3/19UIT2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the applications of Operations research.	**K2**
CO2	Illustrate the formulations of Linear Programming Problem and Solve them by graphical method.	**K3**
CO3	Classify the different types of Simplex methods.	**K3**
CO4	Describe the concepts of Transportation Problem and Assignment Problem and compute the solution by various methods.	**K3**
CO5	Determine the solution of Sequencing Problem.	**K4**
CO6	Compute PERT and CPM in Network Analysis.	**K3**

Course Title: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS Course Code: 19UMA3CC4		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transform & its inverse.	**K1**
CO2	Illustrate the notion of order & degree of the ordinary differential equations.	**K2**
CO3	Rephrase the partial differential equations by eliminating constants and arbitrary functions.	**K2**
CO4	Apply the method of variation of parameters for finding the solutions of second order ordinary differential equations.	**K3**
CO5	Compute general, singular & particular integrals for standard forms.	**K3**
CO6	Solve the ordinary differential equations by Laplace Transforms and inverse Laplace transforms.	**K3**

Course Title: CLASSICAL ALGEBRA AND THEORY OF EQUATIONS Course Code: 19UMA3CC5		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain relation between roots and co-efficient of Polynomial equations.	**K2**
CO2	Apply symmetric functions in solving equations and find sum of r^{th} power of roots.	**K3**
CO3	Compute transformation of equations and solve Reciprocal equations.	**K3**
CO4	Interpret the quotient and remainder, Find removal of terms and form an equation whose roots are any power.	**K2**
CO5	Describe transformation in general with Descarte's rule of signs.	**K2**
CO6	Classify inequalities in all manners.	**K3**
CO7	Explain theory of numbers with its applications.	**K2**

CRITERION I **POs and COs**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-I **Course Code: 19UMA3NME1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve the Problems on Numbers and Problems on Ages.	**K2**
CO2	Explain the concept of time and distance, Calendar and Clock.	**K2**
CO3	Apply the concept of Data Interpretation in various types of Graphs.	**K3**
CO4	Distinguish the concept of Series Codes, Relationships, Analogy and Classification.	**K3**
CO5	Explain the concept of Logical Reasoning.	**K3**

Course Title: Biostatistics **Course Code: 19UMB3AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations.	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of dispersion.	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems.	**K4**
CO5	Examine the various testing of hypothesis.	**K4**

Course Title: SEQUENCES AND SERIES Course Code: 19UMA4CC6		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of convergent sequences, divergent sequences and series.	**K2**
CO2	Apply the ideas of sequences in Algebra of limits.	**K3**
CO3	Compute the behavior of monotonic functions.	**K3**
CO4	Apply the theory of Cauchy's condensation test and Cauchy's root test on series.	**K3**
CO5	Solve the problems based on binomial, logarithmic and exponential series.	**K3**
CO6	Examine infinite series using D' Alembert's ratio test.	**K4**

Course Title: DISCRETE MATHEMATICS Course Code: 19UMA4MBE1A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Illustrate the concepts on statements and truth tables.	**K2**
CO2	Describe the properties of lattices and some special lattices.	**K2**
CO3	Apply the ideas of tautology in statements.	**K3**
CO4	Relate the notion of normal forms and its types.	**K3**
CO5	Apply the theory of Boolean Algebra and its functions.	**K3**
CO6	Compute the inference theory of predicate calculus and its characteristics.	**K3**

Course Title: AUTOMATA THEORY Course Code: 19UMA4MBE1B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Study Deterministic and Nondeterministic Finite state automata.	**K1**
CO2	Outline the Chomsky classification of languages.	**K1**
CO3	Understand the concepts of Regular Expressions.	**K2**
CO4	Impart knowledge in Pumping lemma for Regular sets.	**K3**
CO5	Apply the simplification of context free grammars.	**K3**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-II Course Code: 19UMA4NME2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve decimal fractions and simplification.	**K2**
CO2	Explain the concept of square roots, cube roots, Average, profit and loss.	**K2**
CO3	Apply the concept of Ratio & Proportion and Problems on Trains.	**K3**
CO4	Distinguish the concept of Simple Interest and Compound Interest.	**K3**
CO5	Apply the concept of Permutations &Combinations, Odd Man Out & Series.	**K3**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 10:43:48

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) (2021-2022 Onwards)

DEPARTMENT OF MATHEMATICS

B. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of B. Sc Mathematics Programme, the students will be able to
PO1	Demonstrate basic manipulative skills in algebra, geometry and trigonometry.
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PO4	Compute limits and derivatives using their definitions, and use the fundamental theorem of calculus to compute definite and indefinite integrals.
PO5	Construct counter examples to mathematical statements and understand the importance of hypotheses into a viable career path.

COURSE OUTCOMES (COs)

Course Title: DIFFERENTIAL CALCULUS AND TRIGONOMETRY **Course Code: 19UMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of differentiation, extreme functions of two variables.	**K2**
CO2	Apply the concept of differentiation for explaining curvature.	**K3**
CO3	Explore the solution of problems from a mathematical perspective.	**K3**
CO4	Associate various types of hyperbolic and inverse hyperbolic functions and Solve problems in summation of trigonometric series.	**K4**
CO5	Examine the conceptual understanding and fluency with trigonometric functions, techniques and manipulations necessary for success in calculus.	**K4**

Course Title: INTEGRAL CALCULUS AND FOURIER SERIES **Course Code: 19UMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of double, triple integrals.	**K3**
CO2	Distinguish the concepts of Beta and Gamma functions.	**K3**
CO3	Apply the concepts of half range Fourier series for solving problems necessary for success in calculus.	**K3**
CO4	Associate various types of Fourier series for solving problems.	**K3**
CO5	Evaluate the types of integration**.**	**K4**

CRITERION I **POs and COs**

Course Title: MATHEMATICAL STATISTICS – I **Course Code: 19UMA1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the concept of probability theory and identify its applications in real situations.	**K2**
CO2	Explain the derivation of moment generating function, characteristic function, probability generating function and the proof of Chebychev's inequality with its applications.	**K2**
CO3	Compute the index numbers by different types of methods.	**K3**
CO4	Define and Classify the two dimensional random variables.	**K3**
CO5	Interpret the various properties of expectation, variance and the concept of covariance.	**K3**
CO6	Distinguish between a discrete and a continuous random variable.	**K4**

Course Title: MATHEMATICS-I **Course Code: 19UPH1AC1/19UCH1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of successive differentiation and Leibnitz theorem	**K2**
CO2	Describe curvature, radius of curvature in Cartesians	**K2**
CO3	Compute integrals of various types	**K3**
CO4	Solve integrals by trigonometric substitution and by parts.	**K3**
CO5	Interpret the properties of definite integrals and evaluate them.	**K2**
CO6	Apply reduction formula and evaluate the integrals.	**K3**
CO7	Compute double and triple integrals.	**K3**
CO8	Classify Fourier series for full range, half range and odd & even functions.	**K3**

CRITERION I **POs and COs**

Course Title: MATHEMATICS – II **Course Code: 19UPH1AC2/19UCH1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define matrices and various procedures for solving matrices.	**K1**
CO2	Explain Binomial, Logarithmic and Exponential series.	**K2**
CO3	Describe skew lines, co planarity, sphere and several concepts on sphere.	**K3**
CO4	Classify series expansion of sine, cosines, and tangents in all manners.	**K3**
CO5	Compute using hyperbolic and inverse hyperbolic functions.	**K3**

Course Title: ESSENTIAL MATHEMATICS **Course Code: 19UCS1AC1/19UCA1AC1/19UIT1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the basic concepts of graph theory.	**K1**
CO2	Explain the concepts of Matrices and its types.	**K2**
CO3	Compute characteristic equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO4	Apply Differentiation to find the solutions of Ordinary and Partial Differentiation.	**K3**
CO5	Classify the various types of integrals.	**K3**
CO6	Solve different types of ordinary differential equation.	**K3**
CO7	Classify the characteristics of graph theory.	**K3**

Course Title: NUMERICAL ANALYSIS AND STATISTICS Course Code: 19UCS1AC2/19UCA1AC2/19UIT1AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations and Interpolation.	**K3**
CO2	Solve numerical integration and system of linear equation by appropriate methods.	**K3**
CO3	Compute the numerical solution of ordinary differential equation by various method.	**K3**
CO4	Explain the concept of measures of central tendency and dispersion.	**K2**
CO5	Explain correlation and regression and solve the numerical problems.	**K3**

Course Title: ANALYTICAL GEOMETRY AND VECTOR CALCULUS Course Code: 20UMA2CC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the coordinates in space, equation of a plane.	**K3**
CO2	Describe the concepts of straight lines and coplanar lines.	**K3**
CO3	Classify the equation of a sphere and tangent planes.	**K3**
CO4	Solve the problems of Gauss Divergence Theorem, Stokes Theorem- Green's Theorem.	**K3**
CO5	Examine the concepts of vector integration for finding scalar potential.	**K4**

Course Title: MATHEMATICAL STATISTICS – II (PRACTICAL) Course Code: 19UMA2AC1P		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the discrete and continuous data and find average through the Measures of Central Tendency and Measures of Dispersion.	**K1**
CO2	Solve the problems in joint, Marginal and Conditional Probability distributions involving two random variables.	**K2**
CO3	Explain the various methods of finding Correlation and Regression co-efficient between two data sets and their applications.	**K2**
CO4	Describe and illustrate the concepts of fitting probability distributions.	**K2**
CO5	Analyze the concepts of testing of hypothesis and apply the test to the real life problems.	**K3**

Course Title: MATHEMATICAL STATISTICS III Course Code: 19UMA2AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the chi square Distribution and discuss the applications of chi square Distribution to conduct tests of goodness of fit and independence of attributes.	**K2**
CO2	Explain Student's t, Fisher's t and F statistics and derive their probability Distribution.	**K2**
CO3	Identify the concepts of a discrete probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a discrete probability Distribution and its applications.	**K3**
CO4	Describe the concepts of a continuous probability Distribution and compute the moments, Cumulants, m.g.f and various constants of a continuous probability Distribution and its applications.	**K3**
CO5	Classify the various properties of the correlation and regression co- efficient and their applications.	**K3**

Course Title: MATHEMATICS – III Course Code: 19UPH2AC3/19UCH2AC3		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transforms and solve.	**K1**
CO2	Rephrase the partial differential equations by eliminating constants and arbitrary functions and solve various types of PDE's.	**K2**
CO3	Solve ordinary differential equations under several methods.	**K3**
CO4	Apply inverse Laplace transforms and solve second order ODE.	**K3**
CO5	Classify vectors and vector differentiation.	**K3**

Course Title: OPERATIONS RESEARCH Course Code: 19UCS2AC3/19UCA2AC3/19UIT2AC3		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the applications of Operations research.	**K2**
CO2	Illustrate the formulations of Linear Programming Problem and Solve them by graphical method.	**K3**
CO3	Classify the different types of Simplex methods.	**K3**
CO4	Describe the concepts of Transportation Problem and Assignment Problem and compute the solution by various methods.	**K3**
CO5	Determine the solution of Sequencing Problem.	**K4**
CO6	Compute PERT and CPM in Network Analysis.	**K3**

Course Title: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS Course Code: 19UMA3CC4		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transform & its inverse.	**K1**
CO2	Illustrate the notion of order & degree of the ordinary differential equations.	**K2**
CO3	Rephrase the partial differential equations by eliminating constants and arbitrary functions.	**K2**
CO4	Apply the method of variation of parameters for finding the solutions of second order ordinary differential equations.	**K3**
CO5	Compute general, singular & particular integrals for standard forms.	**K3**
CO6	Solve the ordinary differential equations by Laplace Transforms and inverse Laplace transforms.	**K3**

Course Title: CLASSICAL ALGEBRA AND THEORY OF EQUATIONS Course Code: 19UMA3CC5		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain relation between roots and co-efficients of Polynomial equations.	**K2**
CO2	Apply symmetric functions in solving equations and find sum of r^{th} power of roots.	**K3**
CO3	Compute transformation of equations and solve Reciprocal equations.	**K3**
CO4	Interpret the quotient and remainder, Find removal of terms and form an equation whose roots are any power.	**K2**
CO5	Describe transformation in general with Descarte's rule of signs.	**K2**
CO6	Classify inequalities in all manners.	**K3**
CO7	Explain theory of numbers with its applications.	**K2**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-I Course Code: 19UMA3NME1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve the Problems on Numbers and Problems on Ages.	**K2**
CO2	Explain the concept of time and distance, Calendar and Clock.	**K2**
CO3	Apply the concept of Data Interpretation in various types of Graphs.	**K3**
CO4	Distinguish the concept of Series Codes, Relationships, Analogy and Classification.	**K3**
CO5	Explain the concept of Logical Reasoning.	**K3**

Course Title: Biostatistics Course Code: 19UMB3AC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations.	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of dispersion.	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems.	**K4**
CO5	Examine the various testing of hypothesis.	**K4**

Course Title: SEQUENCES AND SERIES **Course Code: 19UMA4CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of convergent sequences, divergent sequences and series.	**K2**
CO2	Apply the ideas of sequences in Algebra of limits.	**K3**
CO3	Compute the behavior of monotonic functions.	**K3**
CO4	Apply the theory of Cauchy's condensation test and Cauchy's root test on series.	**K3**
CO5	Solve the problems based on binomial, logarithmic and exponential series.	**K3**
CO6	Examine infinite series using D' Alembert's ratio test.	**K4**

Course Title: DISCRETE MATHEMATICS **Course Code: 19UMA4MBE1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Illustrate the concepts on statements and truth tables.	**K2**
CO2	Describe the properties of lattices and some special lattices.	**K2**
CO3	Apply the ideas of tautology in statements.	**K3**
CO4	Relate the notion of normal forms and its types.	**K3**
CO5	Apply the theory of Boolean Algebra and its functions.	**K3**
CO6	Compute the inference theory of predicate calculus and its characteristics.	**K3**

Course Title: AUTOMATA THEORY Course Code: 19UMA4MBE1B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Study Deterministic and Nondeterministic Finite state automata.	**K1**
CO2	Outline the Chomsky classification of languages.	**K1**
CO3	Understand the concepts of Regular Expressions.	**K2**
CO4	Impart knowledge in Pumping lemma for Regular sets.	**K3**
CO5	Apply the simplification of context free grammars.	**K3**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-II Course Code: 19UMA4NME2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve decimal fractions and simplification.	**K2**
CO2	Explain the concept of square roots, cube roots, Average, profit and loss.	**K2**
CO3	Apply the concept of Ratio & Proportion and Problems on Trains.	**K3**
CO4	Distinguish the concept of Simple Interest and Compound Interest.	**K3**
CO5	Apply the concept of Permutations &Combinations, Odd Man Out & Series.	**K3**

CRITERION I **POs and COs**

Course Title: ABSTRACT ALGEBRA **Course Code: 19UMA5CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concept of Abstract Algebra and give examples.	**K2**
CO2	Describe the concept of cyclic subgroups.	**K2**
CO3	Apply properties of normal subgroups and quotient groups, finite groups and Cayley tables.	**K3**
CO4	Compose clear and accurate points using the concept of rings.	**K5**
CO5	Assess the impact of unique factorization domain, Euclidean domain.	**K6**

Course Title: REAL ANALYSIS **Course Code: 19UMA5CC8**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the fundamental properties of real numbers that lead to the formal development of real analysis.	**K2**
CO2	Understand the concept of limit of a function on the real line R and metric space.	**K2**
CO3	Describe the continuous and discontinuous functions on metric spaces.	**K2**
CO4	Explain the concept of connectedness, completeness and compactness.	**K2**
CO5	Classify the basic concepts of Riemann integration.	**K3**

Course Title: STATICS **Course Code: 19UMA5CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of force, equilibrium and the resultant of two forces.	**K2**
CO2	Classify friction and relate limiting equilibrium on a rough inclined plane.	**K3**
CO3	Compute moment of a force.	**K3**
CO4	Reduce coplanar force into a couple and a force.	**K4**
CO5	Ascertain the different aspects of strings and application of common catenary.	**K4**
CO6	Determine the principle of Virtual Work for applying the system of bodies in equilibrium.	**K4**

Course Title: METHODS IN NUMERICAL ANALYSIS **Course Code: 19UMA5CC10**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations.	**K2**
CO2	Explain and solve the numerical techniques of interpolation in various intervals.	**K2**
CO3	Solve numerical integration and differentiation.	**K3**
CO4	Solve the system of linear equation with understanding by appropriate methods.	**K3**
CO5	Compute the numerical solution of ordinary differential equation by various methods.	**K3**

Course Title: NUMERICAL METHODS WITH MATLAB PROGRAMMING (PRACTICAL) **Course Code: 19UMA5CC1P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the use of fundamental data structures.	**K2**
CO2	Apply MATLAB effectively to analyze and visualize data.	**K3**
CO3	Solve scientific and mathematical problems.	**K3**
CO4	Apply basic functions for numerical integration, differentiation, and curve fitting.	**K3**
CO5	Compute simple programs in MATLAB	**K3**

Course Title: INTRODUCTION TO R **Course Code: 19UMA5SBE1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Explain concepts of matrices and arrays.	**K3**
CO3	Discuss about List and data frames.	**K3**
CO4	Apply R effectively to analyze and visualize data.	**K3**
CO5	Classify various testing of hypothesis.	**K2**

Course Title: INTRODUCTION TO STATISTICAL TOOLS AND TECHNIQUES - SPSS **Course Code: 19UMA5SBE1B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the objectives of SPSS.	**K2**
CO2	Apply SPSS for data interpretation.	**K3**
CO3	Compute various test using SPSS.	**K3**
CO4	Interpretation of several graphs in SPSS.	**K2**
CO5	Classify Data View, Variable View and Output View Screens.	**K2**

Course Title: STATISTICAL TOOLS AND TECHNIQUES – R PROGRAMMING (PRACTICAL) Course Code: 19UMA5SBE2AP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Apply the Statistical Programming Software.	**K2**
CO3	Explain concepts related to Statistical datas.	**K3**
CO4	Explain the terms of constructs, control statements, string functions.	**K3**
CO5	Compute R programming from a statistical Perspective.	**K3**

Course Title: STATISTICAL TOOLS AND TECHNIQUES – SPSS (PRACTICAL) Course Code: 19UMA5SBE2BP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the built in functions for data manipulation.	**K2**
CO2	Explain the ideas and concepts of various charts and Box plots.	**K2**
CO3	Classify the given data for various tests.	**K2**
CO4	Solve Measures of Central Tendency and Dispersion.	**K3**
CO5	Compute Correlation and Regression.	**K3**

Course Title: BIOSTATISTICS **Course Code: 19UBT5CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of Dispersion	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems	**K4**
CO5	Examine the various testing of hypothesis and also analysis of variance based on one-way classification and two-way classification	**K4**

Course Title: LINEAR ALGEBRA **Course Code: 19UMA6CC11**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the ideas of Vector Spaces, Linear Independence and Bases.	**K3**
CO2	Distinguish the concepts of Roots of a Polynomial and the Algebra of Linear Transformations.	**K3**
CO3	Explain the concepts of matrix and Elementary transformation.	**K3**
CO4	Compute Characteristic Equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO5	Solve the problems related to Eigen Values and Eigen Vectors	**K3**
CO6	Describe Inner Product Space and Modules.	**K3**

Course Title: COMPLEX ANALYSIS **Course Code: 19UMA6CC12**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the functions of Complex variables, continuity and differentiation of complex variable functions, C – R equations of analytic functions.	**K2**
CO2	Explain about Elementary transformations in Complex variables.	**K2**
CO3	Compute Complex Integration through Cauchy's theorem.	**K3**
CO4	Determine the Power series expansions for Taylor's and Laurent's series.	**K4**
CO5	Diagnose the singularity concept and residues, solving definite integrals using residues.	**K4**

Course Title: DYNAMICS **Course Code: 19UMA6CC13**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the motion under the action of central force.	**K2**
CO2	Compute motion of a straight line using relative velocity and acceleration.	**K3**
CO3	Apply the concepts of impulsive forces and impact of spheres.	**K3**
CO4	Ascertain the various aspect of projectile.	**K4**
CO5	Examine simple harmonic motions and its characteristics.	**K4**
CO6	Determine differential equation and pedal equation of a central orbit.	**K4**

Course Title: OPERATIONS RESEARCH **Course Code: 19UMA6CC14**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the Game theory problems	**K2**
CO2	Illustrate the Network Problems.	**K2**
CO3	Describe the Inventory Models.	**K2**
CO4	Solve the given LPP under various methods.	**K3**
CO5	Compute solutions to Transportation and Assignment Problem.	**K3**

Course Title: GRAPH THEORY **Course Code: 19UMA6MBE2A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define basic definitions of graphs	**K1**
CO2	Explain the notion of Eulerian Graphs.	**K2**
CO3	Describe the concepts of Hamiltonian Graphs and Characterization of Trees.	**K2**
CO4	Compute the properties of Planar Graphs.	**K3**
CO5	Apply the concepts of Directed Graphs for solving Kruskal's and Dijkstra's Algorithms.	**K3**

Course Title: NUMBER THEORY **Course Code: 19UMA6MBE2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concept of divisibility and the linear Diophantine equations.	**K2**
CO2	Explain permutations and combinations in Fermat's little theorem and Wilson's theorem.	**K2**
CO3	Describe the basic properties of congruences.	**K2**
CO4	Solve the congruences using Chinese Remainder theorem and Polynomial congruences.	**K3**
CO5	Compute the theory of multiplicative arithmetic function and the Mobius inversion formula.	**K3**

Course Title: FUZZY SETS AND SYSTEMS **Course Code: 19UMA6MBE3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Explain the basic concepts of arithmetic fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy logic and propositions.	**K6**
CO5	Develop Fuzzy concepts to design fuzzy control system models.	**K6**

Course Title: ASTRONOMY **Course Code: 19UMA6MBE3B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Celestial sphere, diurnal motion, Celestial coordinates and sidereal time.	**K2**
CO2	Classify circumpolar stars, zones of earth, perpetual day, dip of horizon and twilight.	**K3**
CO3	Derive refraction, laws of refraction, tangent formula, Cassini's formula, horizontal refraction, geocentric parallax and horizontal parallax.	**K3**
CO4	Discuss lunar and solar eclipses and ecliptic limits.	**K3**
CO5	Ascertain Kepler's laws, verification of 1^{st} and 2^{nd} laws in the case of earth, Anomalies, Kepler's equation, Seasons, causes and kinds of years.	**K4**

Course Title: LaTeX (PRACTICAL) **Course Code: 19UMA6SBE3AP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define and use new commands within LaTeX.	**K1**
CO2	Apply mathematical formulae using LaTeX.	**K2**
CO3	Create a table using LaTeX.	**K3**
CO4	Classify various types of formulae, equations, matrix etc. by using LaTeX.	**K3**
CO5	Prepare a bibliography for a particular document.	**K3**

Course Title: PYTHON PROGRAMMING (PRACTICAL) Course Code: 19UMA6SBE3BP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Interpret the fundamental Python syntax and the use of Python input statements.	**K2**
CO2	Classify various control structures of Python in simple programs.	**K3**
CO3	Compute simple programs using input statements of Python programming language.	**K3**
CO4	Infer the usage of Dictionaries, Sets and Object-Oriented programming concepts in Python.	**K4**
CO5	Explain the need for working with functions in Python.	**K2**

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) (2022-2023 Onwards)

DEPARTMENT OF MATHEMATICS

B. Sc-Mathematics

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosenfields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of B. Sc Mathematics Programme, the students will be able to
PO1	**DOMAIN KNOWLEDGE** Analyse, design and develop solutions by applying from fundamental concepts of basic sciences and expertise in discipline.
PO2	**PROBLEM SOLVING** Ability to think abstractly, to evaluate and concentrates effectively on problem-solving, as well as knowledge of global challenges.
PO3	**CREATIVE THINKING AND TEAM WORK** Develop prudent decision-making skills and mobility to work in teams to solve multifaceted problems.
PO4	**EMPLOYABILITY** Self-study acclimatize them to observe effective interactive practices for practical learning enabling them to be a successful science graduate.
PO5	**LIFE LONG LEARNING** Assure consistent improvement in the performance and arouse interest to pursue higher studies in premium institutions.

COURSE OUTCOMES (Cos)

Course Title: DIFFERENTIAL CALCULUS AND TRIGONOMETRY
Course Code: 22UMA1CC1

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Explain the basic concepts of differentiation, extreme functions of two variables.	K2
CO2	Apply the concept of differentiation for explaining curvature.	K3
CO3	Explore the solution of problems from a mathematical perspective.	K3
CO4	Associate various types of hyperbolic and inverse hyperbolic functions and Solve problems in summation of trigonometric series.	K4
CO5	Examine the conceptual understanding and fluency with trigonometric functions, techniques and manipulations necessary for success in calculus.	K4

Course Title: INTEGRAL CALCULUS Course Code: 22UMA1CC2		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of double, triple integrals.	K3
CO2	Distinguish the concepts of Beta and Gamma functions.	K3
CO3	Apply the concept of definite integral to solve various problems.	K3
CO4	Interpret the definite integral geometrically as the area under a plane curve.	K3
CO5	Evaluate the types of integration**.**	K5

Course Title: MATHEMATICAL STATISTICS I Course Code: 22UMA1AC1		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply Student's t, Fisher's t and F statistics to derive their probability Distribution.	**K3**
CO2	Analyze how correlation is used to identify the relationships between variables and how regression analysis is used to predict outcomes.	**K3**
CO3	Solving mean, median, mode, moments and moment generating functions of discrete and continuous distributions.	**K3**
CO4	Distinguish between a discrete and a continuous random variable.	**K4**
CO5	Examine the various properties of expectation, variance and the concept of covariance.	**K4**

Course Title: MATHEMATICAL STATISTICS (P) Course Code: 22UMA1AC2P		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explore various statistical concepts in Excel.	**K3**
CO2	Solve the Measures of Central Tendency and Measures of Dispersion using Excel.	**K3**
CO3	Compute Correlation and Regression co-efficient between two data sets and their applications.	**K3**
CO4	Analyze the concepts of testing the hypothesis and apply the test to the real-life problems.	**K4**
CO5	Make use of formulas, including the use of built-in functions.	**K3**

CRITERION I **POs and COs**

Course Title: CALCULUS AND FOURIER SERIES **Course Code: 22UPH1AC1/ 22UCH1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Calculus and Fourier series.	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Solve various types of problems in the corresponding stream.	**K3**
CO4	Identify the properties of solutions in the core area.	**K3**
CO5	Discover the applications of Calculus and Fourier series.	**K4**

Course Title: ALGEBRA, ANALYTICAL GEOMETRY OF 3D & TRIGONOMETRY **Course Code: 22UPH1AC2/ 22UCH1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in Algebra, Analytical Geometry of 3D & Trigonometry.	**K1,K2**
CO2	Identify the problem models.	**K3**
CO3	Apply the concepts of Algebra, Analytical Geometry of 3D & Trigonometry.	**K3**
CO4	Solve the given problems in the respective stream.	**K3**
CO5	Analyze the applications of the core area	**K4**

Course Title: ESSENTIAL MATHEMATICS **Course Code: 22UCS1AC1/ 22UCA1AC1/ 22UIT1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concept of essential mathematics.	**K1**
CO2	Illustrate the various notions in the respective streams.	**K2**
CO3	Apply the different terminologies of essential mathematics.	**K3**
CO4	Classify the solution of mathematical problems using various techniques.	**K4**
CO5	Examine the solution of mathematical problems.	**K4**

CRITERION I **POs and COs**

Course Title: NUMERICAL ANALYSIS AND STATISTICS **Course Code: 22UCS1AC2/ 22UCA1AC2/ 22UIT1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the list of basic ideas of Numerical Methods and Statistics.	**K1,K2**
CO2	Solve the problems using various methods and also classify the given datas.	**K2,K3**
CO3	Identify the conceptual collection and classification of variables.	**K3**
CO4	Analyze the accuracy and graphical representation of statistical datas.	**K4**
CO5	Support the implementation of numerical methods and statistical datas.	**K4**

Course Title: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS **Course Code: 22UMA2CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, PDE, Laplace transforms.	**K1, K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the field of mathematics.	**K3**
CO4	Solve various types of problems involving differential equations.	**K3**
CO5	Analyze the applications of the Differential equations in practical life.	**K4**

CRITERION I **POs and COs**

Course Title: VECTOR CALCULUS AND FOURIER SERIES **Course Code: 22UMA2CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the concepts of Vector Calculus and Fourier Series.	**K1**
CO2	Solve various types of problems in the Core area.	**K3**
CO3	Explain the concepts of odd and even functions.	**K3**
CO4	Describe the development of series.	**K3**
CO5	Examine the concepts of integration for finding solution.	**K4**

Course Title: MATLAB PROGRAMMING (P) **Course Code: 22UMA2CC1P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain fundamental concepts of MATLAB.	**K2**
CO2	Illustrate a great numbers of MATLAB commands and how to use them in programming and in many applications in Mathematics.	**K2**
CO3	Compute simple program for a given problem in MATLAB coding.	**K3**
CO4	Determine the result and the outcome of any command or script.	**K4**
CO5	Deduce Mathematical solutions using MATLAB tools.	**K5**

Course Title: MATHEMATICAL STATISTICS II **Course Code: 22UMA2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the basic concepts in probability, some special distributions, and sampling distributions.	**K1**
CO2	Explain the properties of probability, special distributions and the theory of sampling distributions to find solutions of real-life problems.	**K2**
CO3	Solve problems in probability, some special distributions and sampling distributions.	**K3**
CO4	Examine the given data and interpret the results	**K4**
CO5	Analyze probability, and various distributions in the case of solid conclusions about the values of the population parameter.	**K4**

Course Title: ODE, PDE, LAPLACE TRANSFORMS AND VECTOR ANALYSIS **Course Code: 22UPH2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, PDE, Laplace transforms & Vector Analysis.	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the core area.	**K3**
CO4	Solve various types of problems in the corresponding stream.	**K3**
CO5	Analyze the applications of the core area.	**K4**

Course Title: ODE, LAPLACE TRANSFORMS AND STATISTICS **Course Code: 22UCH2AC3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, Laplace transforms & Statistics.	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the core area.	**K3**
CO4	Solve various types of problems in the corresponding stream.	**K3**
CO5	Analyze the applications of the core area.	**K4**

Course Title: OPERATIONS RESEARCH **Course Code: 22UCS2AC3/22UCG2AC3/22UCA2AC3/22UIT2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the various techniques of Operations research.	**K1**
CO2	Illustrate the various notions in the respective streams	**K2**
CO3	Identify the different terminologies of Operations research.	**K3**
CO4	Analyze the solutions of mathematical problem using specific techniques.	**K4**
CO5	Simplify the optimum solutions of a mathematical problem.	**K4**

Course Title: STATISTICS **Course Code: 22UCG2AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concepts of statistics.	**K1**
CO2	Illustrate the various notions in the respective stream.	**K2**
CO3	Apply the different terminologies of statistics.	**K3**
CO4	Classify the solution of statistical methods using various techniques.	**K4**
CO5	Explain the solution of statistical problems.	**K4**

Course Title: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS **Course Code: 19UMA3CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define Laplace transform & its inverse.	**K1**
CO2	Illustrate the notion of order & degree of the ordinary differential equations.	**K2**
CO3	Rephrase the partial differential equations by eliminating constants and arbitrary functions.	**K2**
CO4	Apply the method of variation of parameters for finding the solutions of second order ordinary differential equations.	**K3**
CO5	Compute general, singular & particular integrals for standard forms.	**K3**
CO6	Solve the ordinary differential equations by Laplace Transforms and inverse Laplace transforms.	**K3**

Course Title: CLASSICAL ALGEBRA AND THEORY OF EQUATIONS **Course Code: 19UMA3CC5**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain relation between roots and co-efficients of Polynomial equations.	**K2**
CO2	Apply symmetric functions in solving equations and find sum of r^{th} power of roots.	**K3**
CO3	Compute transformation of equations and solve Reciprocal equations.	**K3**
CO4	Interpret the quotient and remainder, Find removal of terms and form an equation whose roots are any power.	**K2**
CO5	Describe transformation in general with Descarte's rule of signs.	**K2**
CO6	Classify inequalities in all manners.	**K3**
CO7	Explain theory of numbers with its applications.	**K2**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-I **Course Code: 19UMA3NME1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve the Problems on Numbers and Problems on Ages.	**K2**
CO2	Explain the concept of time and distance, Calendar and Clock.	**K2**
CO3	Apply the concept of Data Interpretation in various types of Graphs.	**K3**
CO4	Distinguish the concept of Series Codes, Relationships, Analogy and Classification.	**K3**
CO5	Explain the concept of Logical Reasoning.	**K3**

Course Title: Biostatistics **Course Code: 19UMB3AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations.	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of dispersion.	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems.	**K4**
CO5	Examine the various testing of hypothesis.	**K4**

Course Title: SEQUENCES AND SERIES **Course Code: 19UMA4CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of convergent sequences, divergent sequences and series.	**K2**
CO2	Apply the ideas of sequences in Algebra of limits.	**K3**
CO3	Compute the behavior of monotonic functions.	**K3**
CO4	Apply the theory of Cauchy's condensation test and Cauchy's root test on series.	**K3**
CO5	Solve the problems based on binomial, logarithmic and exponential series.	**K3**
CO6	Examine infinite series using D' Alembert's ratio test.	**K4**

Course Title: METHODS IN NUMERICAL ANALYSIS **Course Code: 21UMA4CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations.	**K2**
CO2	Explain and solve the numerical techniques of interpolation in various intervals.	**K2**
CO3	Solve numerical integration and differentiation.	**K3**
CO4	Solve the system of linear equation with understanding by appropriate methods.	**K3**
CO5	Compute the numerical solution of ordinary differential equation by various methods.	**K3**

Course Title: INTRODUCTION TO R **Course Code: 21UMA4SBE1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Explain concepts of matrices and arrays.	**K3**
CO3	Discuss about List and data frames.	**K3**
CO4	Apply R effectively to analyze and visualize data.	**K3**
CO5	Classify various testing of hypothesis.	**K2**

Course Title: INTRODUCTION TO STATISTICAL TOOLS AND TECHNIQUES – SPSS **Course Code: 21UMA4SBE1B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the objectives of SPSS.	**K2**
CO2	Apply SPSS for data interpretation.	**K3**
CO3	Compute various test using SPSS.	**K3**
CO4	Interpretation of several graphs in SPSS.	**K2**
CO5	Classify Data View, Variable View and Output View Screens.	**K2**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-II Course Code: 19UMA4NME2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve decimal fractions and simplification.	**K2**
CO2	Explain the concept of square roots, cube roots, Average, profit and loss.	**K2**
CO3	Apply the concept of Ratio & Proportion and Problems on Trains.	**K3**
CO4	Distinguish the concept of Simple Interest and Compound Interest.	**K3**
CO5	Apply the concept of Permutations &Combinations, Odd Man Out & Series.	**K3**

Course Title: ABSTRACT ALGEBRA Course Code: 19UMA5CC7		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concept of Abstract Algebra and give examples.	**K2**
CO2	Describe the concept of cyclic subgroups.	**K2**
CO3	Apply properties of normal subgroups and quotient groups, finite groups and Cayley tables.	**K3**
CO4	Compose clear and accurate points using the concept of rings.	**K5**
CO5	Assess the impact of unique factorization domain, Euclidean domain.	**K6**

Course Title: REAL ANALYSIS **Course Code: 19UMA5CC8**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the fundamental properties of real numbers that lead to the formal development of real analysis.	**K2**
CO2	Understand the concept of limit of a function on the real line R and metric space.	**K2**
CO3	Describe the continuous and discontinuous functions on metric spaces.	**K2**
CO4	Explain the concept of connectedness, completeness and compactness.	**K2**
CO5	Classify the basic concepts of Riemann integration.	**K3**

Course Title: STATICS **Course Code: 19UMA5CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of force, equilibrium and the resultant of two forces.	**K2**
CO2	Classify friction and relate limiting equilibrium on a rough inclined plane.	**K3**
CO3	Compute moment of a force.	**K3**
CO4	Reduce coplanar force into a couple and a force.	**K4**
CO5	Ascertain the different aspects of strings and application of common catenary.	**K4**
CO6	Determine the principle of Virtual Work for applying the system of bodies in equilibrium.	**K4**

Course Title: METHODS IN NUMERICAL ANALYSIS **Course Code: 19UMA5CC10**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations.	**K2**
CO2	Explain and solve the numerical techniques of interpolation in various intervals.	**K2**
CO3	Solve numerical integration and differentiation.	**K3**
CO4	Solve the system of linear equation with understanding by appropriate methods.	**K3**
CO5	Compute the numerical solution of ordinary differential equation by various methods.	**K3**

Course Title: NUMERICAL METHODS WITH MATLAB PROGRAMMING (PRACTICAL) **Course Code: 19UMA5CC1P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the use of fundamental data structures.	**K2**
CO2	Apply MATLAB effectively to analyze and visualize data.	**K3**
CO3	Solve scientific and mathematical problems.	**K3**
CO4	Apply basic functions for numerical integration, differentiation, and curve fitting.	**K3**
CO5	Compute simple programs in MATLAB	**K3**

Course Title: INTRODUCTION TO R Course Code: 19UMA5SBE1A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Explain concepts of matrices and arrays.	**K3**
CO3	Discuss about List and data frames.	**K3**
CO4	Apply R effectively to analyze and visualize data.	**K3**
CO5	Classify various testing of hypothesis.	**K2**

Course Title: INTRODUCTION TO STATISTICAL TOOLS AND TECHNIQUES - SPSS Course Code: 19UMA5SBE1B		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the objectives of SPSS.	**K2**
CO2	Apply SPSS for data interpretation.	**K3**
CO3	Compute various test using SPSS.	**K3**
CO4	Interpretation of several graphs in SPSS.	**K2**
CO5	Classify Data View, Variable View and Output View Screens.	**K2**

Course Title: STATISTICAL TOOLS AND TECHNIQUES – R PROGRAMMING (PRACTICAL) Course Code: 19UMA5SBE2AP		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Apply the Statistical Programming Software.	**K2**
CO3	Explain concepts related to Statistical datas.	**K3**
CO4	Explain the terms of constructs, control statements, string functions.	**K3**
CO5	Compute R programming from a statistical Perspective.	**K3**

Course Title: STATISTICAL TOOLS AND TECHNIQUES – SPSS (PRACTICAL) **Course Code: 19UMA5SBE2BP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the built in functions for data manipulation.	**K2**
CO2	Explain the ideas and concepts of various charts and Box plots.	**K2**
CO3	Classify the given data for various tests.	**K2**
CO4	Solve Measures of Central Tendency and Dispersion.	**K3**
CO5	Compute Correlation and Regression.	**K3**

Course Title: BIOSTATISTICS **Course Code: 19UBT5CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of Dispersion	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems	**K4**
CO5	Examine the various testing of hypothesis and also analysis of variance based on one-way classification and two-way classification	**K4**

Course Title: LINEAR ALGEBRA **Course Code: 19UMA6CC11**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the ideas of Vector Spaces, Linear Independence and Bases.	**K3**
CO2	Distinguish the concepts of Roots of a Polynomial and the Algebra of Linear Transformations.	**K3**
CO3	Explain the concepts of matrix and Elementary transformation.	**K3**
CO4	Compute Characteristic Equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO5	Solve the problems related to Eigen Values and Eigen Vectors	**K3**
CO6	Describe Inner Product Space and Modules.	**K3**

Course Title: COMPLEX ANALYSIS **Course Code: 19UMA6CC12**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the functions of Complex variables, continuity and differentiation of complex variable functions, C – R equations of analytic functions.	**K2**
CO2	Explain about Elementary transformations in Complex variables.	**K2**
CO3	Compute Complex Integration through Cauchy's theorem.	**K3**
CO4	Determine the Power series expansions for Taylor's and Laurent's series.	**K4**
CO5	Diagnose the singularity concept and residues, solving definite integrals using residues.	**K4**

Course Title: DYNAMICS **Course Code: 19UMA6CC13**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the motion under the action of central force.	**K2**
CO2	Compute motion of a straight line using relative velocity and acceleration.	**K3**
CO3	Apply the concepts of impulsive forces and impact of spheres.	**K3**
CO4	Ascertain the various aspect of projectile.	**K4**
CO5	Examine simple harmonic motions and its characteristics.	**K4**
CO6	Determine differential equation and pedal equation of a central orbit.	**K4**

Course Title: OPERATIONS RESEARCH **Course Code: 19UMA6CC14**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the Game theory problems	**K2**
CO2	Illustrate the Network Problems.	**K2**
CO3	Describe the Inventory Models.	**K2**
CO4	Solve the given LPP under various methods.	**K3**
CO5	Compute solutions to Transportation and Assignment Problem.	**K3**

Course Title: GRAPH THEORY **Course Code: 19UMA6MBE2A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define basic definitions of graphs	**K1**
CO2	Explain the notion of Eulerian Graphs.	**K2**
CO3	Describe the concepts of Hamiltonian Graphs and Characterization of Trees.	**K2**
CO4	Compute the properties of Planar Graphs.	**K3**
CO5	Apply the concepts of Directed Graphs for solving Kruskal's and Dijkstra's Algorithms.	**K3**

Course Title: NUMBER THEORY **Course Code: 19UMA6MBE2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concept of divisibility and the linear Diophantine equations.	**K2**
CO2	Explain permutations and combinations in Fermat's little theorem and Wilson's theorem.	**K2**
CO3	Describe the basic properties of congruences.	**K2**
CO4	Solve the congruences using Chinese Remainder theorem and Polynomial congruences.	**K3**
CO5	Compute the theory of multiplicative arithmetic function and the Mobius inversion formula.	**K3**

Course Title: FUZZY SETS AND SYSTEMS **Course Code: 19UMA6MBE3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Explain the basic concepts of arithmetic fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy logic and propositions.	**K6**
CO5	Develop Fuzzy concepts to design fuzzy control system models.	**K6**

Course Title: ASTRONOMY **Course Code: 19UMA6MBE3B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Celestial sphere, diurnal motion, Celestial coordinates and sidereal time.	**K2**
CO2	Classify circumpolar stars, zones of earth, perpetual day, dip of horizon and twilight.	**K3**
CO3	Derive refraction, laws of refraction, tangent formula, Cassini's formula, horizontal refraction, geocentric parallax and horizontal parallax.	**K3**
CO4	Discuss lunar and solar eclipses and ecliptic limits.	**K3**
CO5	Ascertain Kepler's laws, verification of 1^{st} and 2^{nd} laws in the case of earth, Anomalies, Kepler's equation, Seasons, causes and kinds of years.	**K4**

Course Title: LaTeX (PRACTICAL) **Course Code: 19UMA6SBE3AP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define and use new commands within LaTeX.	**K1**
CO2	Apply mathematical formulae using LaTeX.	**K2**
CO3	Create a table using LaTeX.	**K3**
CO4	Classify various types of formulae, equations, matrix etc. by using LaTeX.	**K3**
CO5	Prepare a bibliography for a particular document.	**K3**

Course Title: PYTHON PROGRAMMING (PRACTICAL) **Course Code: 19UMA6SBE3BP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Interpret the fundamental Python syntax and the use of Python input statements.	**K2**
CO2	Classify various control structures of Python in simple programs.	**K3**
CO3	Compute simple programs using input statements of Python programming language.	**K3**
CO4	Infer the usage of Dictionaries, Sets and Object-Oriented programming concepts in Python.	**K4**
CO5	Explain the need for working with functions in Python.	**K2**

Signature Not Verified
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Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 10:43:49

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) (2023-2024 Onwards)

DEPARTMENT OF MATHEMATICS

B. Sc-Mathematics

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosenfields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents andto nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES (POs)

Pos	Programme Outcome On completion of B. Sc Mathematics Programme, the students will be able to
PO1	**DOMAIN KNOWLEDGE** Analyse, design and develop solutions by applying from fundamental concepts of basic sciences and expertise in discipline.
PO2	**PROBLEM SOLVING** Ability to think abstractly, to evaluate and concentrates effectively on problem-solving, as well as knowledge of global challenges.
PO3	**CREATIVE THINKING AND TEAM WORK** Develop prudent decision-making skills and mobility to work in teams to solve multifaceted problems.
PO4	**EMPLOYABILITY** Self-study acclimatize them to observe effective interactive practices for practical learning enabling them to be a successful science graduate.
PO5	**LIFE LONG LEARNING** Assure consistent improvement in the performance and arouse interest to pursue higher studies in premium institutions.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Programme Specific Outcomes Students of B. Sc Mathematics will be able to	POs Addressed
PSO1	Procure a precise understanding of the mathematical concepts.	**PO1, PO3**
PSO2	Excel by enhancing interpersonal skills, overcoming procedural challenges and intending career paths.	**PO3, PO4**
PSO3	Recognize, strengthen and analyse mathematical problems in order to acquire better conclusion.	**PO4, PO5**
PSO4	Manipulate numerical abilities across a variety of domains.	**PO2, PO5**
PSO5	Develop and desire to learn more about advanced mathematics and its applications.	**PO5**

COURSE OUTCOMES (COs)

Course Title: ALGEBRA AND TRIGONOMETRY Course Code: 23UMA1CC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define and interpret on reciprocal equations	**K1, K2**
CO2	Illustrate the sum of binomial, exponential and logarithmic series	**K3**
CO3	Compute Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix.	**K3**
CO4	Determine the powers and multiples of trigonometric functions in terms of sine and cosine.	**K4**
CO5	Evaluate the relationship between circular and hyperbolic functions and the summation of trigonometric series.	**K5**

Course Title: DIFFERENTIAL CALCULUS Course Code: 23UMA1CC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Calculus.	**K1, K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Solve various types of problems in the corresponding stream.	**K3**
CO4	Identify the properties of solutions in the core area.	**K3**
CO5	Discover the applications of Calculus.	**K4**

Course Title: MATHEMATICAL STATISTICS Course Code: 23UMA1AC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the basic concepts in probability, some special distributions, and sampling distributions.	**K1**
CO2	Explain the properties of probability and the theory of sampling distributions to find solutions of real-life problems.	**K2**
CO3	Solve problems in probability, some special distributions and sampling distributions.	**K3**
CO4	Examine the given data and interpret the results	**K4**
CO5	Analyze probability, and various distributions in the case of solid conclusions about the values of the population parameter.	**K4**

Course Title: PROGRAMMING LANGUAGE USING MATLAB (P) Course Code: 23UMA1AC2P		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain fundamental concepts of MATLAB.	**K2**
CO2	Illustrate a great numbers of MATLAB commands and how to use them in programming and in many applications of Mathematics.	**K2**
CO3	Compute simple program for a given problem in MATLAB coding.	**K3**
CO4	Determine the result and the outcome of any command or script.	**K4**
CO5	Deduce Mathematical solutions using MATLAB tools.	**K5**

Course Title: CALCULUS AND FOURIER SERIES Course Code: 22UPH1AC1/ 22UCH1AC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Calculus and Fourier series	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Solve various types of problems in the corresponding stream.	**K3**
CO4	Identify the properties of solutions in the core area.	**K3**
CO5	Discover the applications of Calculus and Fourier series.	**K4**

Course Title: ALGEBRA, ANALYTICAL GEOMETRY OF 3D & TRIGONOMETRY Course Code: 22UPH1AC2/ 22UCH1AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in Algebra, Analytical Geometry of 3D & Trigonometry.	**K1,K2**
CO2	Identify the problem models.	**K3**
CO3	Apply the concepts of Algebra, Analytical Geometry of 3D & Trigonometry.	**K3**
CO4	Solve the given problems in the respective stream.	**K3**
CO5	Analyze the applications of the core area	**K4**

CRITERION I **POs and COs**

Course Title: NUMERICAL METHODS **Course Code: 23UCG1AC1/ 23UCS1AC1/ 23UCA1AC1/ 23UIT1AC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember the basic concepts of numerical methods.	**K1**
CO2	Illustrate the various notions of computational numerical streams.	**K2**
CO3	Apply the different techniques of numerical problems	**K3**
CO4	Classify the methods of numerical techniques.	**K4**
CO5	Examine the solutions of numerical problems.	**K4**

Course Title: GRAPH THEORY AND ITS APPLICATIONS **Course Code: 23UCS1AC2/ 23UIT1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define basic definitions of graphs.	**K1**
CO2	Describe the concepts and Characterization of Graphs.	**K2**
CO3	Explain the notion of Spanning Trees.	**K2**
CO4	Compute the properties of Planar Graphs.	**K3**
CO5	Analyze the concept of graphs in Matrix Representation.	**K4**

Course Title: Statistical Methods and its Application-I **Course Code: 23UCA1AC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concepts of statistics.	**K1**
CO2	Illustrate the various notions in the respective stream.	**K2**
CO3	Apply the different terminologies of statistics.	**K2**
CO4	Classify the solution of statistical methods using various techniques.	**K3**
CO5	Explain the solution of statistical problems.	**K4**

CRITERION I **POs and COs**

Course Title: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS **Course Code: 23UMA2CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, PDE, Laplace transforms.	**K1, K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the field of mathematics.	**K3**
CO4	Solve various types of problems involving differential equations.	**K3**
CO5	Analyze the applications of the Differential equations in practical life.	**K4**

Course Title: INTEGRAL CALCULUS **Course Code: 23UMA2CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.	**K1, K2**
CO2	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.	**K3**
CO3	Evaluate double and triple integrals and problems using change of order of integration.	**K4**
CO4	Explain beta and gamma functions and to use them in solving problems of integration.	**K5**
CO5	Discover the applications of Integral Calculus.	**K5**

Course Title: STATISTICS WITH EXCEL (P) **Course Code: 23UMA2CC1P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explore various statistical concepts in Excel.	**K3**
CO2	Solve the different types of statistical problems using Excel.	**K3**
CO3	Make use of formulas, including the use of built-in functions.	**K3**
CO4	Compute Statistical data's using Excel.	**K3**
CO5	Analyze the concepts of statistical methods and apply it to the real-life problems.	**K4**

Course Title: APPLIED STATISTICS **Course Code: 23UMA2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define measures of central tendency, correlation, regression, measures of dispersion, large and small sample tests.	**K1**
CO2	Explain the basic concepts of measures of central tendency, measures of dispersion, correlation, regression, large and small sample tests.	**K2**
CO3	Apply the various concepts of correlation, regression, measures of central tendency & dispersion and sampling tests for solving the problems.	**K3**
CO4	Solve the problems using measures of central tendency and dispersion, correlation, regression, large and small sample tests.	**K3**
CO5	Examine the given data and interpret the results.	**K4**

Course Title: ODE, PDE, LAPLACE TRANSFORMS AND VECTOR ANALYSIS **Course Code: 22UPH2AC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, PDE, Laplace transforms & Vector Analysis.	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the core area.	**K3**
CO4	Solve various types of problems in the corresponding stream.	**K3**
CO5	Analyze the applications of the core area.	**K4**

Course Title: ODE, LAPLACE TRANSFORMS AND STATISTICS **Course Code: 22UCH2AC3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain various notions in ODE, Laplace transforms & Statistics.	**K1,K2**
CO2	Classify the problem models in the respective area.	**K3**
CO3	Identify the properties of solutions in the core area.	**K3**
CO4	Solve various types of problems in the corresponding stream.	**K3**
CO5	Analyze the applications of the core area.	**K4**

Course Title: OPERATIONS RESEARCH Course Code: 22UCS2AC3/22UCG2AC3/22UCA2AC3/22UIT2AC3		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the various techniques of Operations research.	**K1**
CO2	Illustrate the various notions in the respective streams	**K2**
CO3	Identify the different terminologies of Operations research.	**K3**
CO4	Analyze the solutions of mathematical problem using specific techniques.	**K4**
CO5	Simplify the optimum solutions of a mathematical problem.	**K4**

Course Title: STATISTICS Course Code: 22UCG2AC2		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concepts of statistics.	**K1**
CO2	Illustrate the various notions in the respective stream.	**K2**
CO3	Apply the different terminologies of statistics.	**K3**
CO4	Classify the solution of statistical methods using various techniques.	**K4**
CO5	Explain the solution of statistical problems.	**K4**

Course Title: ANALYTICAL GEOMETRY (3D) Course Code: 22UMA3CC5		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember the basic concepts of Straight Line, Plane, the Sphere and the Cone.	**K1**
CO2	Understand the aspects of Modern Mathematics through Straight Line, Plane, the Sphere and the Cone.	**K2**
CO3	Relate the Various forms of equation of a plane, Straight line, Sphere and Cone.	**K3**
CO4	Determine the angle between the plane, the line and infer about coplanar lines and Shortest distance between two lines.	**K4**
CO5	Evaluate the Problems based on Properties of the Coordinate system of equations.	**K5**

CRITERION I **POs and COs**

Course Title: CLASSICAL ALGEBRA AND THEORY OF NUMBERS **Course Code: 22UMA3CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember the relation between roots and co-efficients of Polynomial equations.	**K1**
CO2	Understand the symmetric functions in solving equations and find sum of r^{th} power of roots.	**K2**
CO3	Compute transformation of equations and solve Reciprocal equations.	**K3**
CO4	Determine the inequalities in all manners.	**K4**
CO5	Evaluate the Problems based on the applications of the theory of numbers	**K5**

Course Title: Biostatistics **Course Code: 22UMB3AC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concepts of biostatistics	**K1**
CO2	Illustrate the various notions in the respective stream.	**K2**
CO3	Apply the different terminologies of biostatistics.	**K3**
CO4	Classify the solution of statistical methods using various techniques.	**K4**
CO5	Explain the solution of bio statistical problems.	**K4**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-I **Course Code: 22UMA3GEC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the knowledge of the various techniques of Quantitative Aptitude and Reasoning.	**K1, K2**
CO2	Apply the concepts in solving mathematical problems to succeed in various Competitive examinations.	**K3**
CO3	Examine various types of Problems using Arithmetic and Reasoning test.	**K3**
CO4	Apply the different concepts of Arithmetic and Reasoning test to solve the problems.	**K3**
CO5	Analyze real life problems and finding solutions.	**K4**

Course Title: SEQUENCES AND SERIES Course Code: 22UMA4CC7		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of convergent sequences, divergent sequences and series.	**K2**
CO2	Apply the ideas of sequences in Algebra of limits and Compute the behavior of monotonic functions.	**K3**
CO3	Apply the theory of Cauchy's condensation test and Cauchy's root test on series.	**K3**
CO4	Solve the problems based on binomial, logarithmic and exponential series.	**K3**
CO5	Examine infinite series using D' Alembert's ratio test.	**K4**

Course Title: METHODS IN NUMERICAL ANALYSIS Course Code: 22UMA4CC8		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply numerical methods to solve Algebraic, Transcendental equations.	**K1, K2**
CO2	Classify and solve the numerical techniques of interpolation in various intervals.	**K2, K4**
CO3	Solve numerical integration and differentiation problems.	**K3**
CO4	Determine the system of algebraic equations by various methods.	**K5**
CO5	Compute the numerical solution of ordinary differential equation Using different methods.	**K3**

Course Title: STATISTICAL TOOLS AND TECHNIQUES - R PROGRAMMING (P) Course Code: 22UMA4SEC1P		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Calculate simple arithmetic and statistical operations in R.	**K1**
CO2	Interpret the R programming language and its programming Environment.	**K2**
CO3	Apply the Statistical Programming Software.	**K3**
CO4	Manipulate data within R and to create simple graphs and charts.	**K3**
CO5	Compute R programming from a statistical Perspective.	**K4**

Course Title: MATHEMATICS FOR COMPETITIVE EXAMINATION-II Course Code: 22UMA4GEC2		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the knowledge of the various techniques of Quantitative Aptitude and Reasoning.	**K1, K2**
CO2	Apply the concepts in solving mathematical problems to succeed in various Competitive examinations.	**K3**
CO3	Examine various types of Problems using Arithmetic and Reasoning test.	**K3**
CO4	Apply the different concepts of Arithmetic and Reasoning test to solve the problems.	**K3**
CO5	Analyze real life problems and finding solutions.	**K4**

Course Title: BIOSTATISTICS (P) Course Code: 22UMB3AC5P		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify and collect various data for representation using biological materials.	**K1**
CO2	Illustrate 'chi' square test, standard Deviation using SPSS programme.	**K2**
CO3	Interpret results of commonly used statistical analyses in SPSS Package	**K2**
CO4	Apply basic statistical concepts commonly used in public health and health Sciences	**K3**
CO5	Discriminate the basic analytical techniques to generate results	**K4**

Course Title: ABSTRACT ALGEBRA Course Code: 21UMA5CC8		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concept of Abstract Algebra and give examples.	**K2**
CO2	Describe the concept of cyclic subgroups.	**K2**
CO3	Apply properties of normal subgroups and quotient groups, finite groups and Cayley tables.	**K3**
CO4	Compose clear and accurate points using the concept of rings.	**K5**
CO5	Assess the impact of unique factorization domain, Euclidean domain.	**K6**

CRITERION I **POs and COs**

Course Title: REAL ANALYSIS **Course Code: 21UMA5CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the fundamental properties of real numbers that lead to the formal development of real analysis.	**K2**
CO2	Understand the concept of limit of a function on the real line R and metric space.	**K2**
CO3	Describe the continuous and discontinuous functions on metric spaces.	**K2**
CO4	Explain the concept of connectedness, completeness and compactness.	**K2**
CO5	Classify the basic concepts of Riemann integration.	**K3**

Course Title: STATICS **Course Code: 21UMA5CC10**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of force, equilibrium and the resultant of two forces.	**K2**
CO2	Classify friction and relate limiting equilibrium on a rough inclined plane.	**K3**
CO3	Compute moment of a force.	**K3**
CO4	Reduce coplanar force into a couple and a force.	**K4**
CO5	Ascertain the different aspects of strings and application of common catenary.	**K4**
CO6	Determine the principle of Virtual Work for applying the system of bodies in equilibrium.	**K4**

Course Title: DISCRETE MATHEMATICS **Course Code: 21UMA5CC11**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Illustrate the concepts on statements and truth tables.	**K2**
CO2	Describe the properties of lattices and some special lattices.	**K2**
CO3	Apply the ideas of tautology in statements.	**K3**
CO4	Relate the notion of normal forms and its types.	**K3**
CO5	Apply the theory of Boolean Algebra and its functions.	**K3**
CO6	Compute the inference theory of predicate calculus and its characteristics.	**K3**

Course Title: FUZZY SET THEORY AND ITS APPLICATIONS Course Code: 21UMA5MBE1A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Explain the basic concepts of arithmetic fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy logic and propositions.	**K6**
CO5	Develop Fuzzy concepts to design fuzzy control system models.	**K6**

Course Title: ASTRONOMY Course Code: 21UMA5MBE1B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Celestial sphere, diurnal motion, Celestial coordinates and sidereal time.	**K2**
CO2	Classify circumpolar stars, zones of earth, perpetual day, dip of horizon and twilight.	**K3**
CO3	Derive refraction, laws of refraction, tangent formula, Cassini's formula, horizontal refraction, geocentric parallax and horizontal parallax.	**K3**
CO4	Discuss lunar and solar eclipses and ecliptic limits.	**K3**
CO5	Ascertain Kepler's laws, verification of 1^{st} and 2^{nd} laws in the case of earth, Anomalies, Kepler's equation, Seasons, causes and kinds of years.	**K4**

Course Title: ARTIFICIAL INTELLIGENCE Course Code: 21UMA5MBE1C		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the basic principles, models, and algorithms used in Artificial Intelligence.	K1
CO2	Understand knowledge representation	K2
CO3	Describe knowledge on various reasoning techniques	K2
CO4	Apply AI techniques to predict solution to the real world problems	K3
CO5	Explore the concepts of Logic programming and Prolong	K4

Course Title: STATISTICAL TOOLS AND TECHNIQUES – R PROGRAMMING (PRACTICAL) Course Code: 19UMA5SBE2AP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Navigate in the R Studio interface.	**K2**
CO2	Apply the Statistical Programming Software.	**K2**
CO3	Explain concepts related to Statistical datas.	**K3**
CO4	Explain the terms of constructs, control statements, string functions.	**K3**
CO5	Compute R programming from a statistical Perspective.	**K3**

Course Title: STATISTICAL TOOLS AND TECHNIQUES – SPSS (PRACTICAL) Course Code: 19UMA5SBE2BP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the built in functions for data manipulation.	**K2**
CO2	Explain the ideas and concepts of various charts and Box plots.	**K2**
CO3	Classify the given data for various tests.	**K2**
CO4	Solve Measures of Central Tendency and Dispersion.	**K3**
CO5	Compute Correlation and Regression.	**K3**

Course Title: LaTeX (PRACTICAL) Course Code: 21UMA5SBE3AP		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define and use new commands within LaTeX.	**K1**
CO2	Apply mathematical formulae using LaTeX.	**K2**
CO3	Create a table using LaTeX.	**K3**
CO4	Classify various types of formulae, equations, matrix etc. by using LaTeX.	**K3**
CO5	Prepare a bibliography for a particular document.	**K3**

Course Title: NUMERICAL METHODS WITH MATLAB PROGRAMMING (PRACTICAL) **Course Code: 21UMA5SBE3BP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the use of fundamental data structures.	**K2**
CO2	Apply MATLAB effectively to analyze and visualize data.	**K3**
CO3	Solve scientific and mathematical problems.	**K3**
CO4	Apply basic functions for numerical integration, differentiation, and curve fitting.	**K3**
CO5	Compute simple programs in MATLAB	**K3**

Course Title: BIOSTATISTICS **Course Code: 19UBT5CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of biostatistics, functions and limitations	**K3**
CO2	Classify the data and sampling deign	**K3**
CO3	Compute the measures of central tendency and measures of Dispersion	**K3**
CO4	Apply the concepts of skewness, moments, kurtosis, correlation and regression to solve the problems	**K4**
CO5	Examine the various testing of hypothesis and also analysis of variance based on one-way classification and two-way classification	**K4**

Course Title: LINEAR ALGEBRA **Course Code: 21UMA6CC12**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the ideas of Vector Spaces, Linear Independence and Bases.	**K3**
CO2	Distinguish the concepts of Roots of a Polynomial and the Algebra of Linear Transformations.	**K3**
CO3	Explain the concepts of matrix and Elementary transformation.	**K3**
CO4	Compute Characteristic Equation of a matrix and its inverse by Cayley Hamilton theorem.	**K3**
CO5	Solve the problems related to Eigen Values and Eigen Vectors	**K3**

CRITERION I **POs and COs**

CO6	Describe Inner Product Space and Modules.	**K3**

Course Title: COMPLEX ANALYSIS **Course Code: 21UMA6CC13**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the functions of Complex variables, continuity and differentiation of complex variable functions, C – R equations of analytic functions.	**K2**
CO2	Explain about Elementary transformations in Complex variables.	**K2**
CO3	Compute Complex Integration through Cauchy's theorem.	**K3**
CO4	Determine the Power series expansions for Taylor's and Laurent's series.	**K4**
CO5	Diagnose the singularity concept and residues, solving definite integrals using residues.	**K4**

Course Title: DYNAMICS **Course Code: 21UMA6CC14**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the motion under the action of central force.	**K2**
CO2	Compute motion of a straight line using relative velocity and acceleration.	**K3**
CO3	Apply the concepts of impulsive forces and impact of spheres.	**K3**
CO4	Ascertain the various aspect of projectile.	**K4**
CO5	Examine simple harmonic motions and its characteristics.	**K4**
CO6	Determine differential equation and pedal equation of a central orbit.	**K4**

Course Title: OPERATIONS RESEARCH **Course Code: 21UMA6CC15**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the Game theory problems	**K2**
CO2	Illustrate the Network Problems.	**K2**
CO3	Describe the Inventory Models.	**K2**
CO4	Solve the given LPP under various methods.	**K3**
CO5	Compute solutions to Transportation and Assignment Problem.	**K3**

Course Title: GRAPH THEORY **Course Code: 21UMA6MBE2A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define basic definitions of graphs	**K1**
CO2	Explain the notion of Eulerian Graphs.	**K2**
CO3	Describe the concepts of Hamiltonian Graphs and Characterization of Trees.	**K2**
CO4	Compute the properties of Planar Graphs.	**K3**
CO5	Apply the concepts of Directed Graphs for solving Kruskal's and Dijkstra's Algorithms.	**K3**

Course Title: MATHEMATICAL MODELLING **Course Code: 21UMA6MBE2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the basics of mathematical model and its process	**K 1**
CO2	Explain the different classifications of mathematical models	**K 2**
CO3	Predict the essential features and discuss the benefits of using a mathematical model	**K 3**
CO4	Examine the applications of mathematical modelling to solve problems in Engineering, Physics, Biological and Social sciences	**K 4**
CO5	Associate and interpret the results to real world problems.	**K4**

Course Title: FUNDAMENTALS OF BIG DATA ANALYTICS **Course Code: 21UMA6MBE2C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the Big Data phenomenon.	**K2**
CO2	Explain the various Big Data tools.	**K2**
CO3	Classify the use of predictive analytics on big data.	**K2**
CO4	Identify the potential use of Big Data in corporate environment.	**K4**
CO5	Analyze large scale data.	**K4**

Course Title: PROBABILITY AND QUEUEING THEORY **Course Code: 21UMA6MBE3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the fundamental concepts of Probability and Acquire Knowledge of Standard distribution which can describe real life phenomena.	**K1**
CO2	Identify various distribution functions and acquire skills in handling situations involving more than one variable	**K2**
CO3	Apply the basic characteristics features of a queueing system and acquire skills in analyzing queueing models	**K3**
CO4	Analyze the various Classifications of Random Processes and Characterized phenomena which evolve with respect to time in Probabilistic manner	**K4**
CO5	Deduce the different queueing models and its applications	**K5**

Course Title: NUMBER THEORY **Course Code: 21UMA6MBE3B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concept of divisibility and the linear Diophantine equations.	**K2**
CO2	Explain permutations and combinations in Fermat's little theorem and Wilson's theorem.	**K2**
CO3	Describe the basic properties of congruences.	**K2**
CO4	Solve the congruences using Chinese Remainder theorem and Polynomial congruences.	**K3**
CO5	Compute the theory of multiplicative arithmetic function and the Mobius inversion formula.	**K3**

CRITERION I **POs and COs**

Course Title: WEB TECHNOLOGY **Course Code: 21UMA6MBE3C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Discover the basic concepts of web technology	**K1**
CO2	Summarize the components of web design	**K2**
CO3	Identify the different type of tags and styles to create web pages	**K3**
CO4	Apply scripting language concepts	**K4**
CO5	Construct websites using HTML and Cascading Style Sheets	**K5**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 10:43:49

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) – (2019-2020 Onwards)

DEPARTMENT OF MATHEMATICS

M. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of M. Sc Mathematics Programme, the students will be able to
PO1	Apply the ideas of mathematics to solve the scientific issues and problems being faced in society.
PO2	Utilize the knowledge of pure and applied mathematics to solve complex mathematical Problems.
PO3	Use mathematical models to relate mathematical sciences in real world problems.
PO4	Communicate effectively in the field of expertise on their activities, and write effective reports and make effective presentations.
PO5	Prepare themselves completely to the demands of the growing field of mathematics.
PO6	Plan to crack lectureship and fellowship exams approved by UGC like CSIR-NET and SET.

COURSE OUTCOMES (COs)

Course Title: ALGEBRA- I **Course Code: 19PMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Gain expertise in the basic concepts of group theory with the help of numerous examples	**K4**
CO2	Examine in detail about Permutation Groups and Normal Groups and discuss in counting tricks in algebra	**K4**
CO3	Illustrate Jordan holder theorem with examples	**K2**
CO4	To classify groups of finite order upto 120 using Sylow's theorems	**K3**
CO5	To evaluate the Field of Quotients of an integral domain	**K5**
CO6	Determine various forms of Polynomial rings, Further they will be able to discuss Euclidean domain	**K4**

Course Title: ORDINARY DIFFERENTIAL EQUATIONS **Course Code: 19PMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the Solutions of First Order Homogeneous Equations by using Different Methods.	**K3**
CO2	Solve the Linear System Of Homogeneous Equations And Compute the Solutions Of Initial Value Problems using Picard's Method Of Successive Approximations.	**K3**
CO3	Diagnose the Functions of Gauss Hyper Geometric, Bessel's and Legendre Polynomials.	**K4**
CO4	Discriminate the Qualitative Properties of Solutions for Boundary Value Problems by Using Sturm Theorems.	**K4**
CO5	Analyze the Stability Nature Of Linear and Non-Linear System	**K4**

CRITERION I **POs and COs**

Course Title: INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS **Course Code: 19PMA1CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of calculus of variations to find the maxima and minima of quantities defined as integrals containing unknown functions.	**K3**
CO2	Classify various kinds of Fourier sine and cosine transforms with their properties and simple problems.	**K3**
CO3	Explain the concept of Fourier transform, Hankel transform and its inverse transform.	**K3**
CO4	Recognize and solve particular cases of Fredholm and Volterra integral equations and variational problem	**K4**
CO5	Evaluate the integral equations by the method of successive approximations.	**K5**

Course Title: ALGEBRAIC NUMBER THEORY **Course Code: 19PMA1CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of divisibility, congruences, primes, primitive roots, quadratic residues, greatest integer functions and linear equations.	**K3**
CO2	Explore the concepts of arithmetic functions, prime modulus and congruences of Degree two.	**K3**
CO3	Relate the ideas of Chinese remainder theorem, quadratic reciprocity and The Mobius Inversion formula.	**K3**
CO4	Determine the solutions of congruences, techniques of numerical calculations, Jacobi symbol, recurrence functions and simultaneous linear equations.	**K4**
CO5	Examine the conceptual understanding in Pythagorean triangles, Legendre Symbol and related problems.	**K4**

Course Title: DISCRETE MATHEMATICS Course Code: 19PMA1CC5		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify grammars and languages with its types.	**K3**
CO2	Classify the various types of graphs.	**K3**
CO3	Compute the Graph Colourings and related theorems.	**K3**
CO4	Ascertain the meaning of Vertex Cuts, Edge Cuts, Connectivity and related theorems.	**K4**
CO5	Access the details of Planar and Non-Planar graphs, Dual of a Plane graph.	**K5**
CO6	Apply the concepts of cryptography using matrices.	**K3**
CO7	Develop the idea of Public key cryptography by RSA cryptosystem.	**K6**

Course Title: MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE Course Code: 19PCS1CC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Permutation.	**K2**
CO2	Apply the concepts of connectives, theory of inference for the statement calculus and fuzzy set theory.	**K3**
CO3	Examine basic terminologies in graph to draw various kinds of graphs.	**K4**
CO4	Differentiate the theory of Boolean Algebra and Lattices.	**K4**
CO5	Develop the concepts of trees.	**K6**

Course Title: ALGEBRA – II Course Code: 19PMA2CC6		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Analyse the important concepts of Prime ideal and maximal ideal and identify them in various examples.	**K4**
CO2	Predict the notions principal ideal domain and unique factorization domains and their connections with Euclidean domain.	**K3**
CO3	Examine the proof of solvability by Radicals.	**K4**
CO4	Evaluate clear cut idea in the notions of Galois groups, normal extensions and separable extensions and illustrate them with various examples.	**K5**
CO5	Learn Galois correspondence and give a proof of fundamental theorem of algebra. Able to conclude the proof of Fundamental theorem of Galois theory.	**K5**

Course Title: REAL ANALYSIS – I Course Code: 19PMA2CC7		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the fundamental concepts such as sets and functions in various problems.	**K3**
CO2	Discriminate the basic concepts in metric spaces geometrically.	**K4**
CO3	Ascertain the notion of convergence of sequences and some related theorems.	**K4**
CO4	Distinguish the concept of continuity of functions and uniform continuity.	**K4**
CO5	Diagnose the ideas of metric topology connecting compactness and continuity and connectedness and continuity.	**K4**
CO6	Evaluate various important problems using the Banach contraction principle.	**K5**

Course Title: LINEAR ALGEBRA **Course Code: 19PMA2CC8**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic terminologies, principles and methods in Vector Spaces.	**K3**
CO2	Apply algebra of linear transformation, Linear Functionals, the Double Dual and Transpose of Linear Transformation.	**K3**
CO3	Analyze mathematical proof techniques to prove or disprove certain claims in determinant functions and Modules.	**K4**
CO4	Assess Characteristic Values with triangulation Diagonalization, Direct sum decomposition and Primary decomposition.	**K5**
CO5	Integrate Lagrange's Interpolation, polynomial ideals and prime factorization of a polynomial.	**K6**

Course Title: TOPOLOGY **Course Code: 19PMA2CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the topological spaces.	**K3**
CO2	Apply the concept of Continuous functions in Product Topology and Metric Topology.	**K3**
CO3	Prepare the consequences of Connected Spaces of the real line.	**K3**
CO4	Assess the details of Compact Spaces of the real line.	**K5**
CO5	Compose a study of Countability and Separation Axioms.	**K6**

Course Title: PARTIAL DIFFERENTIAL EQUATIONS Course Code: 19PMA2EC1A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the solutions of linear and non-linear partial differential equations using various Methods.	**K3**
CO2	Determine the solutions of first order equations using the methods of Cauchy's, Charpit's and Jacobi's.	**K4**
CO3	Diagnose the characteristics of the second order partial differential equations with constant and variable coefficients.	**K4**
CO4	Discriminate the solutions of linear hyperbolic equations in three variables and non-linear equations of the second order.	**K4**
CO5	Ascertain the concepts of Laplace equation to find the solution of boundary value problems.	**K4**

Course Title: DIFFERENCE EQUATIONS Course Code: 19PMA2EC1B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Examine linear difference equations of high order.	**K4**
CO2	Prepare to deal with systems of two or more dependent variables.	**K3**
CO3	Reduce the study of a linear difference or differential equation to examination of an associated complex function.	**K4**
CO4	Criticize the solutions oscillate around zero or eventually positive or eventually negative.	**K5**
CO5	Compile the basic results of oscillation for three-term linear difference equations.	**K6**
CO6	Extend at these results to nonlinear difference equations.	**K6**
CO7	Modify to oscillation theory for self-adjoint equations.	**K6**

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) – (2020-2021 Onwards)

DEPARTMENT OF MATHEMATICS

M. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of M. Sc Mathematics Programme, the students will be able to
PO1	Apply the ideas of mathematics to solve the scientific issues and problems being faced in society.
PO2	Utilize the knowledge of pure and applied mathematics to solve complex mathematical Problems.
PO3	Use mathematical models to relate mathematical sciences in real world problems.
PO4	Communicate effectively in the field of expertise on their activities, and write effective reports and make effective presentations.
PO5	Prepare themselves completely to the demands of the growing field of mathematics.
PO6	Plan to crack lectureship and fellowship exams approved by UGC like CSIR-NET and SET.

COURSE OUTCOMES (COs)

Course Title: ALGEBRA- I **Course Code: 19PMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Gain expertise in the basic concepts of group theory with the help of numerous examples	**K4**
CO2	Examine in detail about Permutation Groups and Normal Groups and discuss in counting tricks in algebra	**K4**
CO3	Illustrate Jordan holder theorem with examples	**K2**
CO4	To classify groups of finite order upto 120 using Sylow's theorems	**K3**
CO5	To evaluate the Field of Quotients of an integral domain	**K5**
CO6	Determine various forms of Polynomial rings, Further they will be able to discuss Euclidean domain	**K4**

Course Title: ORDINARY DIFFERENTIAL EQUATIONS **Course Code: 19PMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the Solutions of First Order Homogeneous Equations by using Different Methods.	**K3**
CO2	Solve the Linear System Of Homogeneous Equations And Compute the Solutions Of Initial Value Problems using Picard's Method Of Successive Approximations.	**K3**
CO3	Diagnose the Functions of Gauss Hyper Geometric, Bessel's and Legendre Polynomials.	**K4**
CO4	Discriminate the Qualitative Properties of Solutions for Boundary Value Problems by Using Sturm Theorems.	**K4**
CO5	Analyze the Stability Nature Of Linear and Non-Linear System	**K4**

Course Title: INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS **Course Code: 19PMA1CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of calculus of variations to find the maxima and minima of quantities defined as integrals containing unknown functions.	**K3**
CO2	Classify various kinds of Fourier sine and cosine transforms with their properties and simple problems.	**K3**
CO3	Explain the concept of Fourier transform, Hankel transform and its inverse transform.	**K3**
CO4	Recognize and solve particular cases of Fredholm and Volterra integral equations and variational problem	**K4**
CO5	Evaluate the integral equations by the method of successive approximations.	**K5**

Course Title: ALGEBRAIC NUMBER THEORY **Course Code: 19PMA1CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of divisibility, congruences, primes, primitive roots, quadratic residues, greatest integer functions and linear equations.	**K3**
CO2	Explore the concepts of arithmetic functions, prime modulus and congruences of Degree two.	**K3**
CO3	Relate the ideas of Chinese remainder theorem, quadratic reciprocity and The Mobius Inversion formula.	**K3**
CO4	Determine the solutions of congruences, techniques of numerical calculations, Jacobi symbol, recurrence functions and simultaneous linear equations.	**K4**
CO5	Examine the conceptual understanding in Pythagorean triangles, Legendre Symbol and related problems.	**K4**

Course Title: DISCRETE MATHEMATICS Course Code: 19PMA1CC5		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify grammars and languages with its types.	**K3**
CO2	Classify the various types of graphs.	**K3**
CO3	Compute the Graph Colourings and related theorems.	**K3**
CO4	Ascertain the meaning of Vertex Cuts, Edge Cuts, Connectivity and related theorems.	**K4**
CO5	Access the details of Planar and Non-Planar graphs, Dual of a Plane graph.	**K5**
CO6	Apply the concepts of cryptography using matrices.	**K3**
CO7	Develop the idea of Public key cryptography by RSA cryptosystem.	**K6**

Course Title: MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE Course Code: 19PCS1CC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Permutation.	**K2**
CO2	Apply the concepts of connectives, theory of inference for the statement calculus and fuzzy set theory.	**K3**
CO3	Examine basic terminologies in graph to draw various kinds of graphs.	**K4**
CO4	Differentiate the theory of Boolean Algebra and Lattices.	**K4**
CO5	Develop the concepts of trees.	**K6**

Course Title: ALGEBRA – II **Course Code: 19PMA2CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Analyse the important concepts of Prime ideal and maximal ideal and identify them in various examples.	**K4**
CO2	Predict the notions principal ideal domain and unique factorization domains and their connections with Euclidean domain.	**K3**
CO3	Examine the proof of solvability by Radicals.	**K4**
CO4	Evaluate clear cut idea in the notions of Galois groups, normal extensions and separable extensions and illustrate them with various examples.	**K5**
CO5	Learn Galois correspondence and give a proof of fundamental theorem of algebra. Able to conclude the proof of Fundamental theorem of Galois theory.	**K5**

Course Title: REAL ANALYSIS – I **Course Code: 19PMA2CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the fundamental concepts such as sets and functions in various problems.	**K3**
CO2	Discriminate the basic concepts in metric spaces geometrically.	**K4**
CO3	Ascertain the notion of convergence of sequences and some related theorems.	**K4**
CO4	Distinguish the concept of continuity of functions and uniform continuity.	**K4**
CO5	Diagnose the ideas of metric topology connecting compactness and continuity and connectedness and continuity.	**K4**
CO6	Evaluate various important problems using the Banach contraction principle.	**K5**

Course Title: LINEAR ALGEBRA **Course Code: 19PMA2CC8**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic terminologies, principles and methods in Vector Spaces.	**K3**
CO2	Apply algebra of linear transformation, Linear Functionals, the Double Dual and Transpose of Linear Transformation.	**K3**
CO3	Analyze mathematical proof techniques to prove or disprove certain claims in determinant functions and Modules.	**K4**
CO4	Assess Characteristic Values with triangulation Diagonalization, Direct sum decomposition and Primary decomposition.	**K5**
CO5	Integrate Lagrange's Interpolation, polynomial ideals and prime factorization of a polynomial.	**K6**

Course Title: TOPOLOGY **Course Code: 19PMA2CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the topological spaces.	**K3**
CO2	Apply the concept of Continuous functions in Product Topology and Metric Topology.	**K3**
CO3	Prepare the consequences of Connected Spaces of the real line.	**K3**
CO4	Assess the details of Compact Spaces of the real line.	**K5**
CO5	Compose a study of Countability and Separation Axioms.	**K6**

Course Title: PARTIAL DIFFERENTIAL EQUATIONS Course Code: 19PMA2EC1A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the solutions of linear and non-linear partial differential equations using various Methods.	**K3**
CO2	Determine the solutions of first order equations using the methods of Cauchy's, Charpit's and Jacobi's.	**K4**
CO3	Diagnose the characteristics of the second order partial differential equations with constant and variable coefficients.	**K4**
CO4	Discriminate the solutions of linear hyperbolic equations in three variables and non-linear equations of the second order.	**K4**
CO5	Ascertain the concepts of Laplace equation to find the solution of boundary value problems.	**K4**

Course Title: DIFFERENCE EQUATIONS Course Code: 19PMA2EC1B		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Examine linear difference equations of high order.	**K4**
CO2	Prepare to deal with systems of two or more dependent variables.	**K3**
CO3	Reduce the study of a linear difference or differential equation to examination of an associated complex function.	**K4**
CO4	Criticize the solutions oscillate around zero or eventually positive or eventually negative.	**K5**
CO5	Compile the basic results of oscillation for three-term linear difference equations.	**K6**
CO6	Extend at these results to nonlinear difference equations.	**K6**
CO7	Modify to oscillation theory for self-adjoint equations.	**K6**

Course Title: REAL ANALYSIS – II Course Code: 19PMA3CC10		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of derivatives, the mean-value theorem in various problems.	**K3**
CO2	Classify the functions of bounded variations and rectifiable paths.	**K3**
CO3	Ascertain the notion of Riemann-Stieltjes integral.	**K4**
CO4	Diagnose the concept of convergence of sequences and series of functions.	**K4**
CO5	Discriminate the fundamentals of multivariable calculus, directional derivative, total derivative of functions and jacobian matrix.	**K4**
CO6	Evaluate extremum problems using implicit function theorem.	**K5**

Course Title: MEASURE AND INTEGRATION Course Code: 19PMA3CC11		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the convergence in measures.	**K3**
CO2	Ascertain the various aspects of Lebesgue measure.	**K4**
CO3	Distinguish the relation between Riemann and Lebesgue integral.	**K4**
CO4	Examine about measure space and compute the integration with respect to the measure.	**K4**
CO5	Diagnose the measurability in product space.	**K4**
CO6	Evaluate the integration of non-negative functions and series.	**K5**
CO7	Appraise the signed measures by decomposition.	**K5**

Course Title: ANALYTICAL SKILLS FOR COMPETITIVE EXAMINATIONS Course Code: 19PMA3CC12		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the vector spaces.	**K3**
CO2	Apply the concept of linear transformations.	**K3**
CO3	Prepare the consequences of Matrices.	**K3**
CO4	Explain the Diagonalizability and Canonical Forms.	**K4**
CO5	Choose the basis in inner product space.	**K5**

Course Title: COMPUTATIONAL NUMERICAL ANALYSIS Course Code: 19PMA3EC2A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply various methods to solve transcendental and polynomial equations	**K3**
CO2	Solve system of linear algebraic equations and Eigen value problems	**K3**
CO3	Classify the various techniques of interpolation and approximation	**K3**
CO4	Compute the integration and differentiation problems	**K4**
CO5	Determine the various methods to solve ordinary differential equations.	**K5**

Course Title: FLUID DYNAMICS **Course Code: 19PMA3EC2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.	**K3**
CO2	Apply Laplace equation and its relation to elementary plane flows of inviscid fluids: sinks, sources, vortex flows, and superposition of these flows.	**K3**
CO3	Compute the Navier - Stokes equations of Motion of a Viscous Fluid.	**K3**
CO4	Solve problems in Viscous Flow.	**K3**
CO5	Distinguish the concepts of rotational and irrotational flows of stream functions & velocity potentials.	**K4**
CO6	Analyze a variety of practical fluid-flow problems and utilize fluid dynamics principles.	**K4**

Course Title: PROBABILITY THEORY AND MACHINE LEARNING **Course Code: 19PMA3EC3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute functions, Inverse functions, Random variables	**K3**
CO2	Classify discrete probability space, General probability space, Induced probability space	**K3**
CO3	Examine the various distribution functions	**K4**
CO4	Determine expectations and Moments	**K4**
CO5	Evaluate the convergence of Random Variables	**K5**

Course Title: STOCHASTIC PROCESSES **Course Code: 19PMA3EC3B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic concepts of Stochastic Processes.	**K3**
CO2	Classify the various states space and chains of the Stochastic Processes.	**K3**
CO3	Describe the birth and death process of Markovian	**K3**
CO4	Apply the renewal processes in continuous time.	**K4**
CO5	Determine the steady state behavior and transient behavior of M/M/1 model and GI/M/1 model.	**K4**

Course Title: FUNCTIONAL ANALYSIS **Course Code: 19PMA4CC13**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of groups, rings and linear transformation	**K3**
CO2	Apply general principle of Banach Algebra to define the regular and singular elements of topological divisors and prove spectral radius formula.	**K3**
CO3	Determine the concepts of Hilbert Space and discriminate different types of operators.	**K4**
CO4	Analyze the structure of Commutative Banach Algebras to prove the Gelfand Neumark theorem.	**K4**
CO5	Compose clear, accurate proof of Hahn Banach Theorem, Open Mapping Theorem using continuous linear transformation and Conjugate of an operator.	**K6**
CO6	Generalize finite dimensional spectral theory for different types of operators.	**K6**

Course Title: COMPLEX ANALYSIS Course Code: 19PMA4CC14		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the basic concepts of Elementary Point Set Topology and Conformality.	**K3**
CO2	Ascertain the basic properties of Harmonic function and theorem and series.	**K4**
CO3	Examine the Local Properties and theorems of Analytic functions.	**K4**
CO4	Evaluate definite integral by Cauchy's theorem and Residue theorem.	**K5**
CO5	Evaluate line integral, Cauchy's integral formula for higher derivatives.	**K5**

Course Title: OPTIMIZATION TECHNIQUES Course Code: 19PMA4EC4A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve Integer Programming by various types.	**K3**
CO2	Classify several Dynamic Programming problems.	**K3**
CO3	Compute Decision Theory problems and solve problems on games.	**K3**
CO4	Predict Inventory models and solve them accordingly.	**K3**
CO5	Diagnose Non-linear Programming problems.	**K4**

Course Title: FUZZY SETS AND THEIR APPLICATIONS Course Code: 19PMA4EC4B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Relate type-2 Fuzzy sets with Fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy relations and Fuzzy graphs.	**K6**
CO5	Develop Fuzzy concepts to compute Fuzzy decision, Fuzzy Linear Programming Program, Dynamic Programming.	**K6**

Course Title: DIFFERENTIAL GEOMETRY Course Code: 19PMA4EC5A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define space curves and the concepts of fundamental existence theorem	**K2**
CO2	Explain the notion of surfaces and their intrinsic properties.	**K2**
CO3	Ascertain various concepts on geodesics.	**K4**
CO4	Deduce non intrinsic properties of a surface.	**K3**
CO5	Classify Differential Geometry of several surfaces.	**K3**

Course Title: AUTOMATA THEORY Course Code: 19PMA4EC5B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of Deterministic and Nondeterministic Finite Automata and Grammars.	**K3**
CO2	Determine the implementation of Lexical analyzers.	**K4**
CO3	Compare Pushdown Automaton with Context free languages.	**K5**
CO4	Develop the concepts of Lexical analyzers.	**K6**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 12:00:05

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) – (2021-2022 Onwards)

DEPARTMENT OF MATHEMATICS

M. Sc-Mathematics

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of M. Sc Mathematics Programme, the students will be able to
PO1	Apply the ideas of mathematics to solve the scientific issues and problems being faced in society.
PO2	Utilize the knowledge of pure and applied mathematics to solve complex mathematical Problems.
PO3	Use mathematical models to relate mathematical sciences in real world problems.
PO4	Communicate effectively in the field of expertise on their activities, and write effective reports and make effective presentations.
PO5	Prepare themselves completely to the demands of the growing field of mathematics.
PO6	Plan to crack lectureship and fellowship exams approved by UGC like CSIR-NET and SET.

COURSE OUTCOMES (COs)

Course Title: ALGEBRA- I **Course Code: 19PMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Gain expertise in the basic concepts of group theory with the help of numerous examples	**K4**
CO2	Examine in detail about Permutation Groups and Normal Groups and discuss in counting tricks in algebra	**K4**
CO3	Illustrate Jordan holder theorem with examples	**K2**
CO4	To classify groups of finite order upto 120 using Sylow's theorems	**K3**
CO5	To evaluate the Field of Quotients of an integral domain	**K5**
CO6	Determine various forms of Polynomial rings, Further they will be able to discuss Euclidean domain	**K4**

Course Title: ORDINARY DIFFERENTIAL EQUATIONS **Course Code: 19PMA1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the Solutions of First Order Homogeneous Equations by using Different Methods.	**K3**
CO2	Solve the Linear System Of Homogeneous Equations And Compute the Solutions Of Initial Value Problems using Picard's Method Of Successive Approximations.	**K3**
CO3	Diagnose the Functions of Gauss Hyper Geometric, Bessel's and Legendre Polynomials.	**K4**
CO4	Discriminate the Qualitative Properties of Solutions for Boundary Value Problems by Using Sturm Theorems.	**K4**
CO5	Analyze the Stability Nature Of Linear and Non-Linear System	**K4**

CRITERION I **POs and COs**

Course Title: INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS **Course Code: 19PMA1CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of calculus of variations to find the maxima and minima of quantities defined as integrals containing unknown functions.	**K3**
CO2	Classify various kinds of Fourier sine and cosine transforms with their properties and simple problems.	**K3**
CO3	Explain the concept of Fourier transform, Hankel transform and its inverse transform.	**K3**
CO4	Recognize and solve particular cases of Fredholm and Volterra integral equations and variational problem	**K4**
CO5	Evaluate the integral equations by the method of successive approximations.	**K5**

Course Title: ALGEBRAIC NUMBER THEORY **Course Code: 19PMA1CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of divisibility, congruences, primes, primitive roots, quadratic residues, greatest integer functions and linear equations.	**K3**
CO2	Explore the concepts of arithmetic functions, prime modulus and congruences of Degree two.	**K3**
CO3	Relate the ideas of Chinese remainder theorem, quadratic reciprocity and The Mobius Inversion formula.	**K3**
CO4	Determine the solutions of congruences, techniques of numerical calculations, Jacobi symbol, recurrence functions and simultaneous linear equations.	**K4**
CO5	Examine the conceptual understanding in Pythagorean triangles, Legendre Symbol and related problems.	**K4**

CRITERION I **POs and COs**

Course Title: DISCRETE MATHEMATICS **Course Code: 19PMA1CC5**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify grammars and languages with its types.	**K3**
CO2	Classify the various types of graphs.	**K3**
CO3	Compute the Graph Colourings and related theorems.	**K3**
CO4	Ascertain the meaning of Vertex Cuts, Edge Cuts, Connectivity and related theorems.	**K4**
CO5	Access the details of Planar and Non-Planar graphs, Dual of a Plane graph.	**K5**
CO6	Apply the concepts of cryptography using matrices.	**K3**
CO7	Develop the idea of Public key cryptography by RSA cryptosystem.	**K6**

Course Title: MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE **Course Code: 19PCS1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the concepts of Permutation.	**K2**
CO2	Apply the concepts of connectives, theory of inference for the statement calculus and fuzzy set theory.	**K3**
CO3	Examine basic terminologies in graph to draw various kinds of graphs.	**K4**
CO4	Differentiate the theory of Boolean Algebra and Lattices.	**K4**
CO5	Develop the concepts of trees.	**K6**

CRITERION I **POs and COs**

Course Title: ALGEBRA – II **Course Code: 19PMA2CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Analyse the important concepts of Prime ideal and maximal ideal and identify them in various examples.	**K4**
CO2	Predict the notions principal ideal domain and unique factorization domains and their connections with Euclidean domain.	**K3**
CO3	Examine the proof of solvability by Radicals.	**K4**
CO4	Evaluate clear cut idea in the notions of Galois groups, normal extensions and separable extensions and illustrate them with various examples.	**K5**
CO5	Learn Galois correspondence and give a proof of fundamental theorem of algebra. Able to conclude the proof of Fundamental theorem of Galois theory.	**K5**

Course Title: REAL ANALYSIS – I **Course Code: 19PMA2CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the fundamental concepts such as sets and functions in various problems.	**K3**
CO2	Discriminate the basic concepts in metric spaces geometrically.	**K4**
CO3	Ascertain the notion of convergence of sequences and some related theorems.	**K4**
CO4	Distinguish the concept of continuity of functions and uniform continuity.	**K4**
CO5	Diagnose the ideas of metric topology connecting compactness and continuity and connectedness and continuity.	**K4**
CO6	Evaluate various important problems using the Banach contraction principle.	**K5**

Course Title: LINEAR ALGEBRA **Course Code: 19PMA2CC8**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic terminologies, principles and methods in Vector Spaces.	**K3**
CO2	Apply algebra of linear transformation, Linear Functionals, the Double Dual and Transpose of Linear Transformation.	**K3**
CO3	Analyze mathematical proof techniques to prove or disprove certain claims in determinant functions and Modules.	**K4**
CO4	Assess Characteristic Values with triangulation Diagonalization, Direct sum decomposition and Primary decomposition.	**K5**
CO5	Integrate Lagrange's Interpolation, polynomial ideals and prime factorization of a polynomial.	**K6**

Course Title: TOPOLOGY **Course Code: 19PMA2CC9**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the topological spaces.	**K3**
CO2	Apply the concept of Continuous functions in Product Topology and Metric Topology.	**K3**
CO3	Prepare the consequences of Connected Spaces of the real line.	**K3**
CO4	Assess the details of Compact Spaces of the real line.	**K5**
CO5	Compose a study of Countability and Separation Axioms.	**K6**

Course Title: PARTIAL DIFFERENTIAL EQUATIONS Course Code: 19PMA2EC1A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute the solutions of linear and non-linear partial differential equations using various Methods.	**K3**
CO2	Determine the solutions of first order equations using the methods of Cauchy's, Charpit's and Jacobi's.	**K4**
CO3	Diagnose the characteristics of the second order partial differential equations with constant and variable coefficients.	**K4**
CO4	Discriminate the solutions of linear hyperbolic equations in three variables and non-linear equations of the second order.	**K4**
CO5	Ascertain the concepts of Laplace equation to find the solution of boundary value problems.	**K4**

Course Title: DIFFERENCE EQUATIONS Course Code: 19PMA2EC1B		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Examine linear difference equations of high order.	**K4**
CO2	Prepare to deal with systems of two or more dependent variables.	**K3**
CO3	Reduce the study of a linear difference or differential equation to examination of an associated complex function.	**K4**
CO4	Criticize the solutions oscillate around zero or eventually positive or eventually negative.	**K5**
CO5	Compile the basic results of oscillation for three-term linear difference equations.	**K6**
CO6	Extend at these results to nonlinear difference equations.	**K6**
CO7	Modify to oscillation theory for self-adjoint equations.	**K6**

Course Title: REAL ANALYSIS – II Course Code: 19PMA3CC10		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of derivatives, the mean-value theorem in various problems.	**K3**
CO2	Classify the functions of bounded variations and rectifiable paths.	**K3**
CO3	Ascertain the notion of Riemann-Stieltjes integral.	**K4**
CO4	Diagnose the concept of convergence of sequences and series of functions.	**K4**
CO5	Discriminate the fundamentals of multivariable calculus, directional derivative, total derivative of functions and jacobian matrix.	**K4**
CO6	Evaluate extremum problems using implicit function theorem.	**K5**

Course Title: MEASURE AND INTEGRATION Course Code: 19PMA3CC11		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the convergence in measures.	**K3**
CO2	Ascertain the various aspects of Lebesgue measure.	**K4**
CO3	Distinguish the relation between Riemann and Lebesgue integral.	**K4**
CO4	Examine about measure space and compute the integration with respect to the measure.	**K4**
CO5	Diagnose the measurability in product space.	**K4**
CO6	Evaluate the integration of non-negative functions and series.	**K5**
CO7	Appraise the signed measures by decomposition.	**K5**

Course Title: ANALYTICAL SKILLS FOR COMPETITIVE EXAMINATIONS Course Code: 19PMA3CC12		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the vector spaces .	**K3**
CO2	Apply the concept of linear transformations.	**K3**
CO3	Prepare the consequences of Matrices.	**K3**
CO4	Explain the Diagonalizability and Canonical Forms.	**K4**
CO5	Choose the basis in inner product space.	**K5**

Course Title: COMPUTATIONAL NUMERICAL ANALYSIS Course Code: 19PMA3EC2A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply various methods to solve transcendental and polynomial equations	**K3**
CO2	Solve system of linear algebraic equations and Eigen value problems	**K3**
CO3	Classify the various techniques of interpolation and approximation	**K3**
CO4	Compute the integration and differentiation problems	**K4**
CO5	Determine the various methods to solve ordinary differential equations.	**K5**

Course Title: FLUID DYNAMICS Course Code: 19PMA3EC2B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.	**K3**
CO2	Apply Laplace equation and its relation to elementary plane flows of inviscid fluids: sinks, sources, vortex flows, and superposition of these flows.	**K3**
CO3	Compute the Navier - Stokes equations of Motion of a Viscous Fluid.	**K3**
CO4	Solve problems in Viscous Flow.	**K3**
CO5	Distinguish the concepts of rotational and irrotational flows of stream functions & velocity potentials.	**K4**
CO6	Analyze a variety of practical fluid-flow problems and utilize fluid dynamics principles.	**K4**

Course Title: PROBABILITY THEORY AND MACHINE LEARNING Course Code: 19PMA3EC3A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute functions, Inverse functions, Random variables	**K3**
CO2	Classify discrete probability space, General probability space, Induced probability space	**K3**
CO3	Examine the various distribution functions	**K4**
CO4	Determine expectations and Moments	**K4**
CO5	Evaluate the convergence of Random Variables	**K5**

Course Title: STOCHASTIC PROCESSES Course Code: 19PMA3EC3B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic concepts of Stochastic Processes.	**K3**
CO2	Classify the various states space and chains of the Stochastic Processes.	**K3**
CO3	Describe the birth and death process of Markovian	**K3**
CO4	Apply the renewal processes in continuous time.	**K4**
CO5	Determine the steady state behavior and transient behavior of M/M/1 model and GI/M/1 model.	**K4**

Course Title: FUNCTIONAL ANALYSIS Course Code: 19PMA4CC13		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of groups, rings and linear transformation	**K3**
CO2	Apply general principle of Banach Algebra to define the regular and singular elements of topological divisors and prove spectral radius formula.	**K3**
CO3	Determine the concepts of Hilbert Space and discriminate different types of operators.	**K4**
CO4	Analyze the structure of Commutative Banach Algebras to prove the Gelfand Neumark theorem.	**K4**
CO5	Compose clear, accurate proof of Hahn Banach Theorem, Open Mapping Theorem using continuous linear transformation and Conjugate of an operator.	**K6**
CO6	Generalize finite dimensional spectral theory for different types of operators.	**K6**

Course Title: COMPLEX ANALYSIS Course Code: 19PMA4CC14		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the basic concepts of Elementary Point Set Topology and Conformality.	**K3**
CO2	Ascertain the basic properties of Harmonic function and theorem and series.	**K4**
CO3	Examine the Local Properties and theorems of Analytic functions.	**K4**
CO4	Evaluate definite integral by Cauchy's theorem and Residue theorem.	**K5**
CO5	Evaluate line integral, Cauchy's integral formula for higher derivatives.	**K5**

Course Title: OPTIMIZATION TECHNIQUES Course Code: 19PMA4EC4A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve Integer Programming by various types.	**K3**
CO2	Classify several Dynamic Programming problems.	**K3**
CO3	Compute Decision Theory problems and solve problems on games.	**K3**
CO4	Predict Inventory models and solve them accordingly.	**K3**
CO5	Diagnose Non-linear Programming problems.	**K4**

CRITERION I **POs and COs**

Course Title: FUZZY SETS AND THEIR APPLICATIONS **Course Code: 19PMA4EC4B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Relate type-2 Fuzzy sets with Fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy relations and Fuzzy graphs.	**K6**
CO5	Develop Fuzzy concepts to compute Fuzzy decision, Fuzzy Linear Programming Program, Dynamic Programming.	**K6**

Course Title: DIFFERENTIAL GEOMETRY **Course Code: 19PMA4EC5A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define space curves and the concepts of fundamental existence theorem	**K2**
CO2	Explain the notion of surfaces and their intrinsic properties.	**K2**
CO3	Ascertain various concepts on geodesics.	**K4**
CO4	Deduce non intrinsic properties of a surface.	**K3**
CO5	Classify Differential Geometry of several surfaces.	**K3**

Course Title: AUTOMATA THEORY **Course Code: 19PMA4EC5B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of Deterministic and Nondeterministic Finite Automata and Grammars.	**K3**
CO2	Determine the implementation of Lexical analyzers.	**K4**
CO3	Compare Pushdown Automaton with Context free languages.	**K5**
CO4	Develop the concepts of Lexical analyzers.	**K6**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 12:00:05

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) – (2022-2023 Onwards)

DEPARTMENT OF MATHEMATICS

M. Sc-Mathematics

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosenfields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents andto nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to thechanging global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of M. Sc Mathematics Programme, the students will be able to
PO1	Problem Analysis Provide opportunities to develop innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.
PO2	Scientific Skills Create and apply advanced techniques and tools to solve the societal environmental issues.
PO3	Environment and Sustainability Ascertain eco-friendly approach for sustainable development and inculcate scientific temper in the society.
PO4	Ethics Imbibe ethical and social values aiming towards holistic development of learners.
PO5	Lifelong learning Instill critical thinking, communicative knowledge which potentially leads to higher rate of employment and also for higher educational studies.

COURSE OUTCOMES (COs)

Course Title: ALGEBRA- I **Course Code: 22PMA1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the basic concepts of group theory with the help of numerous examples	**K3**
CO2	Examine in detail about Permutation Groups and Normal Groups and discuss about counting tricks in algebra	**K4**
CO3	Solve problems related to theorems	**K3**
CO4	Classify groups of finite order using Sylow's theorems	**K4**
CO5	Analyze the Field of Quotients of an integral domain	**K4**

Course Title: ORDINARY DIFFERENTIAL EQUATIONS Course Code: 22PMA1CC2		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	**Define** linear, non-linear, homogeneous and autonomous system of ordinary differential equations.	**K1**
CO2	**Understand** the Qualitative properties of solutions by Sturm separation and Sturm comparison theorems.	**K2**
CO3	**Diagnose** the power series solution for ordinary differential equations such as Gauss Hyper Geometric, Bessel's and Legendre equations.	**K4**
CO4	**Discriminate** the Qualitative properties of solutions for Boundary value problems by using Sturm theorems.	**K4**
CO5	**Analyze** the Stability nature of Linear and Non-Linear system for various methods.	**K4**

Course Title: INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS Course Code: 22PMA1CC3		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of calculus of variations to find the maxima and minima of quantities defined as integrals containing unknown functions.	**K3**
CO2	Classify various kinds of Fourier sine and cosine transforms with their properties and simple problems.	**K3**
CO3	Explain the concept of Fourier transform, Hankel transform and its inverse transform.	**K3**
CO4	Recognize and solve particular cases of Fredholm and Volterra integral equations and variational problem	**K4**
CO5	Evaluate the integral equations by the method of successive approximations.	**K5**

CRITERION I **POs and COs**

Course Title: ALGEBRAIC NUMBER THEORY **Course Code: 22PMA1CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of divisibility, congruences, primes, primitive roots, quadratic residues, greatest integer functions and linear equations.	**K3**
CO2	Explore the concepts of arithmetic functions, prime modulus and congruences of Degree two.	**K3**
CO3	Relate the ideas of Chinese remainder theorem, quadratic reciprocity and The Mobius Inversion formula.	**K3**
CO4	Determine the solutions of congruences, techniques of numerical calculations, Jacobi symbol, recurrence functions and simultaneous linear equations.	**K4**
CO5	Examine the conceptual understanding in Pythagorean triangles, Legendre Symbol and related problems.	**K4**

Course Title: ADVANCED NUMERICAL ANALYSIS **Course Code: 22PMA1DSE1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply various methods to solve transcendental and polynomial equations	**K3**
CO2	Use the concepts of interpolation analyze Eigen value problem with Techniques for Mathematical Problems arising in various fields	**K4**
CO3	Classify the various techniques of interpolation and approximation	**K3**
CO4	Compute the numerical differentiation problems	**K3**
CO5	Apply the knowledge of various methods to solve numerical integration problems	**K3**

Course Title: MATHEMATICAL MODELLING **Course Code: 22PMA1DSE1B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the models through Ordinary Differential equations.	**K3**
CO2	Evaluate the systems of Ordinary Differential equations for various models.	**K4**
CO3	Examine the Planetary motions through Ordinary Differential equations of second order.	**K4**
CO4	Explain the basic concepts of Difference equation.	**K4**
CO5	Compute various types of models through Difference equation.	**K3**

Course Title: BOUNDARY VALUE PROBLEMS **Course Code: 22PMA1DSE1C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply real world scenarios in order to solve the problems using multiple approaches.	**K3**
CO2	Classify Boundary value problems and learn their distinguishing qualitative properties.	**K3**
CO3	Relate the applications of Laplace and Poisson Equations	**K3**
CO4	Determine the understanding of Fourier Bessel Series	**K4**
CO5	Analyze Dirichlet Problems and its solutions in various Regions.	**K4**

Course Title: MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE Course Code: 22PCS1CC1		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the various concepts in Discrete Mathematics and Fuzzy Set Theory.	**K1**
CO2	Understand the different terminologies of Discrete Mathematics and Fuzzy set theory.	**K2**
CO3	Analyze the problems in different aspects and give solutions in their respective streams.	**K3**
CO4	Examine some methodologies for the related area in an effective manner.	**K4**
CO5	Apply the notions to distinct problems and get solutions in a easy way.	**K5**

Course Title: ALGEBRA – II Course Code: 22PMA2CC5		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Analyse the important concepts of Galois theory and identify through various examples	**K1, K2, K3**
CO2	Predict the notions and their connections of Galois theory	**K3**
CO3	Examine the proof of solvability by Galois theory	**K4**
CO4	Evaluate clear cut idea in Galois theory extensions and illustrate through examples	**K5**
CO5	Learn and conclude Galois theory correspondence theorem of algebra	**K5**

Course Title: REAL ANALYSIS **Course Code: 22PMA2CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.	**K2**
CO2	Construct the important concepts of real analysis.	**K3**
CO3	Ascertain the concepts of basic topology, continuity, differentiation, The Riemann-Stieltjes Integral, sequences and series of functions, functions of several variables.	**K4**
CO4	Explain various mathematical proofs of basic results in real analysis.	**K5**
CO5	Develop the abstract ideas and various methods in mathematical analysis that can be applied to important practical problems.	**K6**

Course Title: LINEAR ALGEBRA **Course Code: 22PMA2CC7**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember and recall the basic concepts of vector space	**K1**
CO2	Illustrate the various techniques of problem solving in respective stream	**K2**
CO3	Apply different terminologies of linear algebra	**K3**
CO4	Classify the various properties in transformation	**K4**
CO5	Interpret the problems involved in vector spaces	**K5**

CRITERION I **POs and COs**

Course Title: PARTIAL DIFFERENTIAL EQUATIONS **Course Code: 22PMA2CCC1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	**Interpret** the solutions of hyperbolic, linear and second order partial differential equations, Exterior, Interior and boundary value problems using various Methods.	**K2**
CO2	**Develop** the various type of first and second order equations, Interior and Exterior value problems and **Determine** the higher order equations in physics, **C**haracteristics of Equations in Three Variables, Linear Hyperbolic Equations and Elementary Solutions of Laplace's Equation.	**K3**
CO3	**Diagnose** the orthogonally, compatibility and characteristics of the partial differential equations with constant and variable coefficients, method of Integral transforms and Families of Equipotential Surfaces.	**K3**
CO4	**Discriminate** the solutions of first, second order and hyperbolic equations, Integral Surfaces Passing through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces, **C**haracteristics of Equations in Three Variables, The Solution of Linear Hyperbolic Equations, Separation of Variables	**K4**
CO5	**Ascertain** the concepts of Laplace equation to find the solution of boundary value problems, Special Types of First-Order Equations, Linear Partial Differential Equations with Constant Coefficients, Equations with Variable Coefficients, the Method of Integral Transforms, Families of Equipotential Surfaces.	**K4**

Course Title: MATHEMATICAL PROGRAMMING Course Code: 22PMA2CCC1B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry	**K1, K2**
CO2	Know how to use variables for formulating complex mathematical models in management science, industrial engineering and Transportation science and in real life.	**K3**
CO3	Analyze a managerial decision problem and formulate into a mathematical model	**K4**
CO4	To design, improve and operate complex systems in the best possible way	**K4, K5**
CO5	Determine the solution of NonLinear Programming based on Various Method.	**K5**

Course Title : DIFFERENCE EQUATION Course Code: 22PMA2CCC1C		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recall and Classify the models through linear difference equations of high- order.	**K1, K2**
CO2	Interpret the systems of two or more dependent variables for various models.	**K2**
CO3	Solve the Planetary motions through the study of a linear difference or differential equations to examination of an associated complex function.	**K3**
CO4	Analyze the basic concepts of Difference equations.	**K4**
CO5	Determine various types of models through the solutions oscillate around zero or eventually positive or eventually negative and also oscillation theory for self-adjoint equations	**K5**

CRITERION I **POs and COs**

Course Title: COMPUTATIONAL MATHEMATICS USING MATLAB(P) **Course Code: 22PMA2DSE2AP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Remember the concepts of Algebra, Geometry, Numerical Analysis, Calculus, etc.	**K1**
CO2	Understand the calculation by reading documented source code	**K2**
CO3	Relate the mathematical thinking that is applicable to daily life	**K3**
CO4	Associate technological tools for graphical visualization	**K4**
CO5	Develop skills with core elements of MATLAB and gain an appreciation of social scientific work	**K6**

Course Title: MATHEMATICAL MODELLING USING MATLAB(P) **Course Code: 22PMA2DSE2BP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the importance of Mathematical Modelling in the real world using MATLAB.	**K2**
CO2	Apply Mathematical concepts to identify the appropriate mathematics to realize a solution using MATLAB.	**K3**
CO3	Make use of formulas, familiar with memory and file management in MATLAB.	**K4**
CO4	Determine various types of models through Difference equation.	**K5**
CO5	Formulate, Analyse and simulate mathematical models using MATLAB.	**K6**

Course Title: ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS USING MATLAB (P) **Course Code: 22PMA2DSE2CP**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Describe the use of fundamental data structures	**K3**
CO2	Apply MATLAB effectively to analyze and visualize data	**K4**
CO3	Solve scientific and mathematical problems	**K4**
CO4	Apply basic functions for ordinary and partial differential equations	**K3**
CO5	Compute programs in MATLAB	**K5**

Course Title: Business Analytics **Course Code: 22PCO2CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the advanced analytical tools to analyse complex problems under uncertainty	**K2**
CO2	Compare business processes using analytical and management tools	**K3**
CO3	Apply appropriate analytical methods to find solutions to business problems using SAS, Excel and SPSS	**K3**
CO4	Identify and describe complex business problems in terms of analytical models	**K3, K4**
CO5	Extract and manipulate data sets from various sources to meet organizational needs	**K5**

Course Title: REAL ANALYSIS – II Course Code: 19PMA3CC10		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the concepts of derivatives, the mean-value theorem in various problems.	**K3**
CO2	Classify the functions of bounded variations and rectifiable paths.	**K3**
CO3	Ascertain the notion of Riemann-Stieltjes integral.	**K4**
CO4	Diagnose the concept of convergence of sequences and series of functions.	**K4**
CO5	Discriminate the fundamentals of multivariable calculus, directional derivative, total derivative of functions and jacobian matrix.	**K4**
CO6	Evaluate extremum problems using implicit function theorem.	**K5**

Course Title: MEASURE AND INTEGRATION Course Code: 19PMA3CC11		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the convergence in measures.	**K3**
CO2	Ascertain the various aspects of Lebesgue measure.	**K4**
CO3	Distinguish the relation between Riemann and Lebesgue integral.	**K4**
CO4	Examine about measure space and compute the integration with respect to the measure.	**K4**
CO5	Diagnose the measurability in product space.	**K4**
CO6	Evaluate the integration of non-negative functions and series.	**K5**
CO7	Appraise the signed measures by decomposition.	**K5**

Course Title: ANALYTICAL SKILLS FOR COMPETITIVE EXAMINATIONS Course Code: 19PMA3CC12		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Classify the vector spaces.	**K3**
CO2	Apply the concept of linear transformations.	**K3**
CO3	Prepare the consequences of Matrices.	**K3**
CO4	Explain the Diagonalizability and Canonical Forms.	**K4**
CO5	Choose the basis in inner product space.	**K5**

Course Title: COMPUTATIONAL NUMERICAL ANALYSIS Course Code: 19PMA3EC2A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply various methods to solve transcendental and polynomial equations	**K3**
CO2	Solve system of linear algebraic equations and Eigen value problems	**K3**
CO3	Classify the various techniques of interpolation and approximation	**K3**
CO4	Compute the integration and differentiation problems	**K4**
CO5	Determine the various methods to solve ordinary differential equations.	**K5**

Course Title: FLUID DYNAMICS Course Code: 19PMA3EC2B		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.	**K3**
CO2	Apply Laplace equation and its relation to elementary plane flows of inviscid fluids: sinks, sources, vortex flows, and superposition of these flows.	**K3**
CO3	Compute the Navier - Stokes equations of Motion of a Viscous Fluid.	**K3**
CO4	Solve problems in Viscous Flow.	**K3**
CO5	Distinguish the concepts of rotational and irrotational flows of stream functions & velocity potentials.	**K4**
CO6	Analyze a variety of practical fluid-flow problems and utilize fluid dynamics principles.	**K4**

Course Title: PROBABILITY THEORY AND MACHINE LEARNING Course Code: 19PMA3EC3A		
CO Number	**CO Statement On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Compute functions, Inverse functions, Random variables	**K3**
CO2	Classify discrete probability space, General probability space, Induced probability space	**K3**
CO3	Examine the various distribution functions	**K4**
CO4	Determine expectations and Moments	**K4**
CO5	Evaluate the convergence of Random Variables	**K5**

Course Title: STOCHASTIC PROCESSES Course Code: 19PMA3EC3B		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the basic concepts of Stochastic Processes.	**K3**
CO2	Classify the various states space and chains of the Stochastic Processes.	**K3**
CO3	Describe the birth and death process of Markovian	**K3**
CO4	Apply the renewal processes in continuous time.	**K4**
CO5	Determine the steady state behavior and transient behavior of M/M/1 model and GI/M/1 model.	**K4**

Course Title: FUNCTIONAL ANALYSIS Course Code: 19PMA4CC13		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of groups, rings and linear transformation	**K3**
CO2	Apply general principle of Banach Algebra to define the regular and singular elements of topological divisors and prove spectral radius formula.	**K3**
CO3	Determine the concepts of Hilbert Space and discriminate different types of operators.	**K4**
CO4	Analyze the structure of Commutative Banach Algebras to prove the Gelfand Neumark theorem.	**K4**
CO5	Compose clear, accurate proof of Hahn Banach Theorem, Open Mapping Theorem using continuous linear transformation and Conjugate of an operator.	**K6**
CO6	Generalize finite dimensional spectral theory for different types of operators.	**K6**

Course Title: COMPLEX ANALYSIS Course Code: 19PMA4CC14		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Apply the basic concepts of Elementary Point Set Topology and Conformality.	**K3**
CO2	Ascertain the basic properties of Harmonic function and theorem and series.	**K4**
CO3	Examine the Local Properties and theorems of Analytic functions.	**K4**
CO4	Evaluate definite integral by Cauchy's theorem and Residue theorem.	**K5**
CO5	Evaluate line integral, Cauchy's integral formula for higher derivatives.	**K5**

Course Title: OPTIMIZATION TECHNIQUES Course Code: 19PMA4EC4A		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Solve Integer Programming by various types.	**K3**
CO2	Classify several Dynamic Programming problems.	**K3**
CO3	Compute Decision Theory problems and solve problems on games.	**K3**
CO4	Predict Inventory models and solve them accordingly.	**K3**
CO5	Diagnose Non-linear Programming problems.	**K4**

CRITERION I **POs and COs**

Course Title: FUZZY SETS AND THEIR APPLICATIONS **Course Code: 19PMA4EC4B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Explain the basic concepts of Fuzzy set theory.	**K2**
CO2	Classify the operations on Fuzzy sets and Fuzzy measures and give examples.	**K3**
CO3	Relate type-2 Fuzzy sets with Fuzzy numbers.	**K3**
CO4	Compose clear and accurate proofs using the concepts of Fuzzy relations and Fuzzy graphs.	**K6**
CO5	Develop Fuzzy concepts to compute Fuzzy decision, Fuzzy Linear Programming Program, Dynamic Programming.	**K6**

Course Title: DIFFERENTIAL GEOMETRY **Course Code: 19PMA4EC5A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define space curves and the concepts of fundamental existence theorem	**K2**
CO2	Explain the notion of surfaces and their intrinsic properties.	**K2**
CO3	Ascertain various concepts on geodesics.	**K4**
CO4	Deduce non intrinsic properties of a surface.	**K3**
CO5	Classify Differential Geometry of several surfaces.	**K3**

Course Title: AUTOMATA THEORY **Course Code: 19PMA4EC5B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Relate the concepts of Deterministic and Nondeterministic Finite Automata and Grammars.	**K3**
CO2	Determine the implementation of Lexical analyzers.	**K4**
CO3	Compare Pushdown Automaton with Context free languages.	**K5**
CO4	Develop the concepts of Lexical analyzers.	**K6**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 12:00:05

CRITERION I **POs and COs**

Key Indicator - 1.1 Curriculum Design and Development

1.1.1 Curricula developed and implemented have relevance to the local, regional, national and global developmental needs, which is reflected in the Programme outcomes (POs) and Course Outcomes (COs) of the Programmes offered by the institution

Programme Outcomes (POs) and Course Outcomes (COs) – (2023-2024 Onwards)

DEPARTMENT OF FOOD SERVICE MANAGEMENT AND DIETETICS

M. Sc FOOD SERVICE MANAGEMENT AND DIETETICS

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

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CRITERION I **POs and COs**

PROGRAMME OUTCOMES (POs)

POs	Programme Outcome On completion of M. Sc Food Service Management and Dietetics Programme, the students will be able to,
PO1	**SCIENTIFIC MANAGEMENT AND CAREER OPPORTUNITIES** Master the scientific and applied aspects of the subject for employment opportunities.
PO2	**EXPLORE CREATIVITY AND INTELLIGENCE** Employ novel ideas with conceptual thinking to secure self-discipline and independence to foster scientific attitude by exploration of science.
PO3	**TEAM BUILDING AND SCIENTIFIC TEMPERAMENT** Inculcate training, internships and team spirit with leadership skills through academic projects and transmit complex scientific and technical information and contribute to the scientific community.
PO4	**INNOVATIVE LEARNING AND TECHNOLOGICAL ADVANCEMENT** Perceive research in the specialized areas and to engage in life-long learning to keep pace with emerging trends in academics, research and technology
PO5	**PERSONALITY DEVELOPMENT WITH SOCIAL RESPONSIBILITY** Achieve ethical, social and holistic values with social responsibility to develop a healthy life

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSOs	Programme Specific Outcomes Students of M. Sc Nutrition and Dietetics will be able to	POs Addressed
PSO1	Analyze scientific concepts in the area of Nutrition, Food Service Management and Dietetics.	**PO1**
PSO2	Apply critical thinking, technical skills and collaborative approach in food and nutrition, dietetics and managerial practices.	**PO2, PO3**
PSO3	Develop core competency skills through experimental work, internship and projects to support actions that promote social development	**PO3, PO5**
PSO4	Utilize local, national and global trends, emerging techniques and changes of legislation to enhance work performance.	**PO4**
PSO5	Utilize local, national and global trends, emerging techniques and changes of legislation to enhance work performance.	**PO2, PO5**

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CRITERION I **POs and COs**

COURSE OUTCOMES (COs)

Course Title: Food Service Management **Course Code: 23PFS1CC1**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recall the classification of food services, distinguish between different food service systems, relate the food production systems to the relevant food service operations, explain current trends in food service facility design and regulations for specific food service types.	**K1, K2**
CO2	Define the different types of organization; Explain the approaches, principles, functions and tools of management, apply the tools of management to the various management functions.	**K1,K2, K3**
CO3	Classify equipment based on type and order of use, explain the different finishes, design and construction features of equipment, develop SOP for selection, operation and care of major equipment.	**K2, K3,**
CO4	Ascertain the principles of cleaning and sanitation, create a checklist to ensure personal hygiene of food handlers, evaluate the causes of food hazards and suggest solutions based on principles of HACCP	**K4, K5**
CO5	Identify the causes for accidents and suggest methods for prevention; Analyze methods of conserving energy, conserving resources and ensure zero waste. Evaluate strategies for conserving natural resources, energy saving and facility waste assessment and management.	**K1, K3, K5**

Course Title: Food Science **Course Code: 23PFS1CC2**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Understand the basic nutrition facts of different food groups and state the best cooking practices to retain the nutrients	**K1, K2**
CO2	Illustrate the chemistry of foods	**K2**
CO3	Apply the scientific principles underlying food preparation, processing, storage and assess innovative practices to retain the quality of food	**K3, K5**
CO4	Identify and apply the appropriate subjective and objective methods while evaluating food quality	**K3,**
CO5	Analyze the role of nutraceuticals, functional foods and alternative protein sources and evaluate their potential as indispensable future foods	**K4, K5**

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CRITERION I **POs and COs**

Course Title: Human Physiology **Course Code: 23PFS1CC3**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Label composition and functions of blood and physiology of cell	**K1**
CO2	Interpret physiological of circulatory and respiratory system	**K2**
CO3	Predict various homeostasis of human body.	**K3**
CO4	Ascertain regulation of digestive and excretory system	**K4**
CO5	Evaluate structure and function of endocrine and reproductive system	**K5**

Course Title: Food Science (P) **Course Code: 23PFS1CC1P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the common food adulterants and additives	**K1**
CO2	Explain the factors affecting cooking quality of foods	**K2**
CO3	Prepare various food items by applying innovative practices	**K3**
CO4	Determine the suitable cooking practices to retain the nutrients	**K4**
CO5	Evaluate the scientific principles involved in food preparation, processing and storage	**K5**

Course Title: Food Microbiology, Safety and Quality Control **Course Code: 23PFS1DSE1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recall the important genera of microorganisms associated with food. Understand the Scope of food microbiology and food safety.	**K1**
CO2	Explain the suitable techniques for enumeration of microbes and methods (traditional to advanced) for preserving food	**K2**
CO3	Compute the role of different microorganisms in food spoilage, food fermentation and food-borne diseases and suggest ways to prevent food spoilage and food borne diseases	**K3**
CO4	Determine and recommend methods for microbiological quality control. Create investigation procedures for ensuring food safety and Hygiene	**K4**
CO5	Assess the food safety rules and regulations, Comprehend the use of Food Safety Management System (FSMS), and conduct Microbiological Risk Assessment.	**K5**

CRITERION I **POs and COs**

Course Title: Nutrition Through Life Cycle **Course Code: 23PFS1DSE1B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify national nutritional guidelines for various life stages	**K1**
CO2	Interpret nutritional care plan for all age groups	**K2**
CO3	Predict physiological changes in various stages of life cycle	**K3**
CO4	Ascertain nutritional strategies to combat the infections, deficiencies and disorders	**K4**
CO5	Conclude menu and develop diet charts according to nutritional requirements of different age groups	**K5**

Course Title: Front Office Operations **Course Code: 23PFS1DSE1C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Illustrate operations of hospitality sector	**K2**
CO2	Classify hotels on the basis of various criteria	**K3**
CO3	Predict functionalities of all departments in the industry	**K3**
CO4	Devise strategies for the profitability of the hotel	**K4**
CO5	Plan check in and check out of guest	**K5**

Course Title: Public Health Nutrition **Course Code: 23PFS2CC4**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State basic sciences relevant to nutrition and apply public health principles to current public health related issues	**K1**
CO2	Interpret the nutritional status of the population making use of the different evidence- based scientific assessment methods and protocols	**K2**
CO3	Predict the impact of nutrition policies on the health of individual as well as population	**K3**
CO4	Differentiate the health and nutritional challenges encountered in different regions and understand the various strategies employed to address them	**K4**
CO5	Assess Nutrition Education programs for a target population using appropriate aids	**K5**

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CRITERION I **POs and COs**

Course Title: Advanced Dietetics **Course Code: 23PFS2CC5**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	List the causes, symptoms and complications of various diseases	**K1**
CO2	Describe the importance and principles of dietetics as a modified therapy for various diseases	**K2**
CO3	Apply the nutritional requirements and menu plans for therapeutic conditions.	**K3**
CO4	Point out the role of dietitian in the hospitals and interpret the importance of computer in nutrition practice	**K4**
CO5	Evaluate special feeding methods and psychology of the patients	**K5**

Course Title: Biochemistry and Metabolic Disorders **Course Code: 22PFS2CCC1A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the parameters of biochemistry in disease condition	**K1**
CO2	Interpret inborn diseases associated with carbohydrate, protein and fat disorder	**K2**
CO3	Relate importance of hormones and enzymes with diseases	**K3**
CO4	Associate compensatory mechanism in disease condition	**K4**
CO5	Appraise appropriate technique to evaluate various organ functions	**K5**

Course Title: Food Quality Control and Regulations **Course Code: 22PFSCCCIB**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recite basic laws and regulations followed in various food industries relevant to food quality	**K1**
CO2	Restate the safety operations involved in food systems	**K2**
CO3	Apply various regulations and quality control involved in food industries	**K3**
CO4	Ascertain the steps of food regulation involved in the process of operations in food industries	**K4**
CO5	Appraise adequate safety regulations and control at different food sectors	**K5**

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CRITERION I **POs and COs**

Course Title: Nutrition in Clinical Critical Care **Course Code: 23PFS2CCC1C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Label the nutritional assessment methods	**K1**
CO2	Explain the principles of nutritional care	**K2**
CO3	Predict the nutritional status of critically ill patients	**K3**
CO4	Associate importance of enteral and parenteral nutrition	**K4**
CO5	Determine role of nutrients in critical care	**K5**

Course Title: Advanced Dietetics (P) **Course Code: 22PFS2CC2P**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Recall the importance of therapeutic nutrition	**K1**
CO2	Illustrate foods to be included and avoided in the treatment of diseases	**K2**
CO3	Predict the dietary principles in the management of diseases	**K3**
CO4	Analyse the various disease conditions and prepare menu according to it	**K4**
CO5	Appraise the developed tools for diet counselling of all conditions.	**K5**

Course Title: Functional Foods, Nutraceuticals and Nutrigenomics **Course Code: 22PFS2DSE2A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define and classify functional foods and nutraceuticals and its regulatory aspects	**K1**
CO2	Explain the techniques used for extracting functional food components from food sources	**K2**
CO3	Classify the isolated component derived from the functional food	**K3**
CO4	Ascertain mechanism of action of functional foods and nutraceuticals on health and disease	**K4**
CO5	Contrast the interactions between functional foods and nutrigenomics	**K5**

Course Title: Housekeeping and Interior Designing **Course Code: 22PFS2DSE2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the concept, scope and importance of housekeeping and interior design in food service establishments	**K1**
CO2	Illustrate the layout of establishment and styles of interior design	**K2**
CO3	Apply the functions of housekeeping and interior design	**K3**
CO4	Examine the selection and maintenance of cleaning equipment	**K4**
CO5	Appraise skill in the field of housekeeping and interior design	**K5**

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CRITERION I **POs and COs**

Course Title: Food Packaging **Course Code: 22PFS2DSE2C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State basics in relevant to food packaging, materials and equipment	**K1**
CO2	Describe the different types and properties of the food packaging materials and equipment	**K2**
CO3	Relate packaging properties, rules and packaging techniques	**K3**
CO4	Associate the packaging materials and effective packaging processes	**K4**
CO5	Conclude food standard and laws to emphasize the importance of food safety with packaging aspects	**K5**

Course Title: Internship **Course Code: 22PFS2INT**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Label functions of dietary department in hospitals	**K1**
CO2	Illustrate the organization pattern of dietary department	**K2**
CO3	Prepare routine hospital diets	**K3**
CO4	Predict modified diet according to special condition	**K4**
CO5	Compare role tools for patient education	**K5**

Course Title: Food Product Development and Entrepreneurship **Course Code: 22PFS3CC6**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Define the principles and sketch appropriate processing technology to create a new food product	**K1**
CO2	Explain the evaluation procedures involved in food product development	**K2**
CO3	Relate the role of food packaging and importance of labeling on developed food product	**K3**
CO4	Determine financial sources for entrepreneurial ventures for a new product development	**K4**
CO5	Evaluate commercialization of a new food product	**K5**

Course Title: Research Methods, Statistical Techniques and Computer Applications

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CRITERION I **POs and COs**

Course Code: 22PFS3CC7		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the problem and select appropriate type of research	**K1**
CO2	Illustrate the data processing using diagrammatic and graphical representation	**K2**
CO3	Apply sampling techniques and apply the same for thesis and report writing	**K3**
CO4	Analyze statistical distribution and apply it for tests of significance using Statistical Package for the Social Sciences (SPSS) software	**K4**
CO5	Assess central tendency variation and relate the results	**K5**

Course Title: Food Microbiology and Sanitation **Course Code: 22PFS3CCC2B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the types and morphology of microorganisms	**K1**
CO2	Describe the beneficial effects of microorganisms in food products.	**K2**
CO3	Predict the risk factors of microorganisms in food products	**K3**
CO4	Infer the hygiene and sanitary practices	**K4**
CO5	Appraise the various food standards to maintain the quality of foods	**K5**

Course Title: Food Service Facilities **Course Code: 22PFS3CCC2C**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State space allocation and layout in commercial and non-commercial establishments	**K1**
CO2	Illustrate classification, selection, care and maintenance of equipment and furnishing	**K2**
CO3	Predict menu planning and different types of food service systems using computers	**K3**
CO4	Infer and apply computer techniques in purchase, storage, production of foods and housekeeping requirements	**K4**
CO5	Assess cost control and accounting	**K5**

Course Title: Research Methods, Statistical Techniques and Computer Applications (P)

CRITERION I **POs and COs**

Course Code: 22PFS3CC3P		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the role of questionnaire and interview schedule for major and minor projects.	K1
CO2	Design effective visual representations of data using various graphical tools.	K2
CO3	Apply various statistical methods to analyze and interpret data using operating system and application software.	K3
CO4	Examine instances of plagiarism in research articles and understand the ethical implications.	K4
CO5	Evaluate research studies that utilize different statistical methods, including bivariate correction, non -parametric tests and multiple regression analysis.	K5

Course Title: Competitive Examinations in Home Science for Professional Development **Course Code: 22PFS3DSE3A**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	State the principles involved in food science, food standards and diet therapy	**K1**
CO2	Illustrate malnutrition, ecological factors, nutritional problems and their management	**K2**
CO3	Apply resource management, consumer issues, fundamentals of design in housing and apparel designing	**K3**
CO4	Associate appropriate communication tools with extension education	**K4**
CO5	Evaluate physical and physiological human development with respect to family relationship	**K5**

Course Title: Waste Management in Food Industries **Course Code: 22PFS3DSE3B**		
CO Number	**CO Statement** **On the successful completion of the course, students will be able to,**	**Knowledge Level**
CO1	Identify the basic principles of waste in food industries	K1
CO2	Describe the types of waste generated in various food industries	K2
CO3	Predict the methods of various waste treatment	K3
CO4	Determine the methods of utilizing wastes to make value added product	K4
CO5	Evaluate the recent trends in managing the waste food industries	K5

Course Title: Child Development **Course Code: 22PFS3DSE3C**

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CRITERION I **POs and COs**

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Label the stages and growth of child development	K1
CO2	Describe the theories of child development	K2
CO3	Apply assessment and techniques in child growth and cognitive	K3
CO4	Analyze the nutritional programmes associated with adolescence	K4
CO5	Evaluate cognitive language, social and emotional development of child	K5

Course Title: Fundamentals Of Nutrition
Course Code: 22PFS3GEC1

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Identify the interrelationship between nutrition and health	K1
CO2	Describe basic five food groups, balanced diet, factors affecting RDA and BMR	K2
CO3	Predict the role of nutrients in human nutrition	K3
CO4	Determine the excess and deficiency effects of nutrients	K4
CO5	Assess knowledge on functions of water, distribution of water and regulation of water balance and acid base and electrolyte balance	K5

Course Title: Quantity Food Production and Service
Course Code: 22PFS4CC8

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Define menu planning, standardization, purchase, inventory, storage and food service.	K1
CO2	Illustrate menu, styles of food service, food service systems and kitchen organization.	K2
CO3	Compute the principles of purchasing, receiving, storage and techniques in pre-preparations.	K3
CO4	Infer standardization of recipes, portioning, production, work simplification and sanitation.	K4
CO5	Assess the techniques in food storage, management of food production, réchauffé, fuel, and maintenance of equipments.	K5

Course Title: Management and Accounting in Hospitality Industry
Course Code: 22PFS4CCC3A

CO	CO Statement	Knowledge

CRITERION I **POs and COs**

Number	On the successful completion of the course, students will be able to,	Level
CO1	Define the management and importance of hospitality management	**K1**
CO2	Explain the scope of hospitality industry	**K2**
CO3	Apply the basic strategies involved in marketing	**K3**
CO4	Analyse financial statements by using basic accounting techniques	**K4**
CO5	Assess the types of various records used in front office area	**K5**

Course Title: Techniques in Food Analysis
Course Code: 22PFS4CCC3B

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Identify the knowledge obtained to choose the appropriate instrument and technique for food analysis	**K1**
CO2	Explain the role of chromatography and spectrometry in food analysis	**K2**
CO3	Predict the importance of advanced chromatography and electrophoresis techniques	**K3**
CO4	Infer the usage of various analytical techniques for quality of food analysis.	**K4**
CO5	Evaluate the methods and types of radioactive isotopes and their functions.	**K5**

Course Title: Dietary Compliance and Counselling Skills
Course Code: 22PFS4CCC3C

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Identify the psychology and nutritional status of client	**K1**
CO2	Explain communication skills for various groups	**K2**
CO3	Apply counselling techniques as per the needs of various groups	**K3**
CO4	Determine the sources of counselling data	**K4**
CO5	Evaluate the impact of counselling	**K5**

Course Title: Quantity Food Production and Service (P)
Course Code: 22PFS4CC4P

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level

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CO1	Identify the menu, table setting and napkin folding and production area.	**K1**
CO2	Explain standardization of recipes, portion control and napkin folding.	**K2**
CO3	Illustrate the courses of menu, napkin folding and layout.	**K3**
CO4	Infer the role of ingredients in various regional cuisines	**K4**
CO5	Evaluate different cuisines and techniques in layout for different production area.	**K5**

Course Title: Community Nutrition
Course Code: 22PFS4GEC2

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	State the strategies for Improving nutritional status and health status of the community.	**K1**
CO2	llustrate the consequences of deficiency diseases and nutrition intervention programmes	**K2**
CO3	Apply the role organization and schemes in combating malnutrition	**K3**
CO4	Determine the nutritional problems and develop nutrition programmes and strategies to overcome.	**K4**
CO5	Assess the nutrition education for the community.	**K5**

Course Title: Project Work
Course Code: 22PFS4PW

CO Number	CO Statement On the successful completion of the course, students will be able to,	Knowledge Level
CO1	Define the research design	**K1**
CO2	Describe research problem	**K2**
CO3	Classify collected data	**K3**
CO4	Examine collected data and associate with statistical tool	**K4**
CO5	Assess and publish papers in reputed research journals	**K5**

Signature Not Verified
Digitally Signed
Signed by: Sujatha.V
Designation: Principal
Reason: NAAC
Location: Tiruchirappalli, Tamil Nadu, India
Date: 30-Sep-2024 12:00:04

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