Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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DEPARTMENT OF MATHEMATICS
Program: M. Sc. (Applied Mathematics)
Academic Year: 2020-2021

Course Code	Course Title	CO	Description of the Course Outcome
19AM1101	**Real Analysis**	CO1	Describe the fundamental properties of the real numbers that lead to the formaldevelopment of real analysis.
		CO2	Demonstrate an perceptive of limits and how they are used in sequences, series,differentiation and integration
		CO3	Describe and apply the important properties of the limit and continuity and the differentiation and integration of the sequences and series of functions. Explain thebasic properties of the Riemann integration
		CO4	Determine the Riemann integrability of a bounded or unbounded function andprove a selection of theorems concerning integrations.
19AM1102	**ORDINARY DIFFERENTIAL EQUATIONS**	CO1	Apply the existence and uniqueness conditions of solution of the homogeneous/non-homogeneous differential equation and the system ofdifferential equations.
		CO2	Apply the power series method of solution to second order ODE arising inmathematical physics- Gauss hypergeometric , Hermit and Chebyshev polynomials.
		CO3	Apply Green's function method to study behavior of the Boundary ValueProblems (BVP) for second order ODE.
		CO4	Determine the oscillatory solutions of BVP and illustrate their qualitative properties.
		CO5	Verify the solution of the ODE through MATLAB.

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19AM1103	**Numerical Methods**	CO1	Identify the difference between solutions of system linear and roots of non-linearequations by direct, bisection methods.
		CO2	Construct the interpolation forward and backward tables and find the Eigenvalues and vectors by using mat lab also.
		CO3	Apply Numerical differentiation and integration problems for different methodsand find the values and compare the values by using mat lab also.
		CO4	Construct numerical solutions of first and second order ordinary differentialequations and compare the numerical values with mat lab also.
		CO5	Verify the solution of the N.M. through MATLAB.
19AM1104	**Introduction to Computer Programmi ng**	CO1	Introduction to basic computer organization and computer fundamentals. Introduction to Programming language fundamentals. Illustrate and use Control FlowStatements in C++.
		CO2	Introduction to functions in C++ and Decomposition of programs through function.
		CO3	Interpret & Illustrate user defined C++ functions and different operations on list ofdata.
		CO4	Illustrate Object Oriented Concepts and implement linear data structures
		CO5	Develop the code for the algorithms in C++
19AM1105	**MATHEMATICAL STATISTICS**	CO1	Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expectedvalues and probabilities associated with the distributions of random variables
		CO2	Explain the concepts of independence, jointly distributed random variables andconditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
		CO3	..Explain the concepts of random sampling, statistical inference and samplingdistribution, and state and use basic sampling distributions. State the central limit theorem, and apply it.
		CO4	Construct the sampling distribution of mean and variance and calculation of meanand variance of sampling distribution of mean and variance.

19AM1201	**Soft Computing**	CO1	Apply A*, AO*, Branch and Bound search techniques for problem solving.
		CO2	Differentiate and classify traditional and non-additional optimization methods and Formulate optimization problem to solve complex problems.
		CO3	Apply Neural network methods for simple applications
		CO4	Apply GA, PSO and ACO algorithms for various optimization problems
19AM1202	**Data Structures**	CO1	Analyze and compare stack ADT and queue ADT implementations using linked list andapplications.
		CO2	Analyze the linked lists and types of Binary trees and their representations.
		CO3	Apply measures of efficiency on algorithms and Analyze different SortingAlgorithms, Analyze the linked implementation of Binary,Balanced Trees and different Hashing techniques.
		CO4	Analyze different representations, traversals, applications of Graphs and Heap organization.
		CO5	Develop and Evaluate common practical applications for linear and non-linear data structures.
19AM1203	**Statistical Inference**	CO1	Obtain estimates of parameters and identify the various methods to estimateit.
		CO2	Apply various principles for the data reduction and draw conclusion about the population based upon samples drawn from it
		CO3	Describe the tests of significance and draw conclusion about the population and sample using various tests.
		CO4	Testing the hypothesis to analyze the variance and also predict the linear relationship between the two variables
19AM1204	**Discrete Mathematics**	CO1	Apply the rules of Propositional logic to establish valid results and apply rules of valid inference and hence understand how to construct correct mathematicalarguments, Mathematical Induction
		CO2	Understand the concept of relations, functions and discrete structures , Count discrete event occurrences , lattices, to represent the Boolean functions by anexpression
		CO3	Formulate and solve recurrence relations of homogeneous and non homogeneous relations, understand some recursive algorithms.
		CO4	Use graph theory for various techniques to study and analyze different problems associated with computer design, logic design, Formal languages, Artificial Intelligence etc, Analysis of different traversal methods for trees and graphs.

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19AM1205	**Complex Analysis**	CO1	Explain the definition of continuity, differentiability, **apply** the concepts of analytic function and harmonic function to explain Cauchy-Riemann equations; Understganding Power Series.
		CO2	Apply the concept of conformal mapping, and describe the mapping properties ofMöbius transformations and how to apply them for conformal mappings in Fluid Dynamics,etc.
		CO3	Explain complex contour integrals; Understand simple sequences and series **apply** the convergence properties of a power series, and to determine the Taylorseries or the Laurent series of an analytic function.
		CO4	Explain properties of singularities and poles of analytic functions and **apply** to compute residues integrals by **applying** residue techniques.
19AM2101	**Partial Differentia lEquations**	CO1	Model the relevant phenomena as a Partial differential equations and obtain thesolutions
		CO2	Understand the Nature of the higher order Partial differential equation and obtain the solutions
		CO3	Express the Laplace equation in Various coordinate systems and solve by Fourierseries method
		CO4	Solve the Hyperbolic and Parabolic differential equations by Separation ofvariable method
19AM2102	**RELATIONAL ALGEBRAAND DBMS**	CO1	Illustrate the functional components of DBMS, importance of data modeling in design of a database.
		CO2	Build queries using SQL and concepts ofPL/SQL
		CO3	Apply normalization techniques and indexing to construct and access decent database.
		CO4	Identify the importance of transaction processing, concurrency control and recovery techniques
		CO5	Develop a good database and define SQL queries for data analysis
19AM2103	**Abstract Algebra**	CO1	Define group, subgroup and quotient group with examples, and proving some preliminary lemmas.
		CO2	Define homomorphism and automorphisim of groups .Explain Cayley's and Sylow's theorems of finite groups and demonstrate the problems.
		CO3	Define a ring, homomorphismof rings, ideal, quotient rings with examples. Explain principal ideal domain, unique factorization domain, modules over PID theorems and demonstrate the problems.
		CO4	Define field and Polynomial ring with examples. Explain the field of Quotients of an integral domain and Euclidean and polynomial rings with problems.

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19AM2104	**Transform Techniques**	CO1	Apply Laplace transform techniques to solve linear differential equations in system analysis where initial conditions can be easily included to give system response.
		CO2	Applying z- transform and Mellin transform to the analysis and characterization ofDiscrete Time systems.
		CO3	Apply Fourier series to analyze various signals.
		CO4	Apply Fourier transforms to analyze various signals.
		CO5	Verify the solution of the Transform techniques through MATLAB.
19AM2201	**Topology**	CO1	Explain the definition of Finite, countable, uncountable sets and **apply** the concepts of composite function and Axiom of choice to explain Zorn's Lemma.
		CO2	Explain the concept of open sets, closed sets and basis for a topology describe theproperties of product space and **apply** the concept of topological space and continuous function.
		CO3	Explain the definition of compact space and connected space and **apply** the concept of finite intersection property and Bolzano weierstrass property.
		CO4	Explain the properties of Hausdorff's space and normal space and **apply** the Urysohn's lemma to determine the urysohn's metrization theorem, Tietze extension theorem, and tychon off theorem.
19AM2202	**Mathematical Programming**	CO1	Apply different methods to find the optimal solution of linear programmingproblems and analyze the sensitivity of the solution.
		CO2	Different methods to find the optimal solution of Transportation and Assignment problems.
		CO3	Apply non-linear optimization methods to solve non- linear programming problems
		CO4	Apply Search methods to solve non-linear programming problems
19AM2106	**Crypto Analysis And Cyberdefense**	CO1	Understand the principles of cryptography by analyzing Various attacks and apply different classic encryption techniques.
		CO2	Understand the principles of block cipher and analyze algorithms like DES, AES.
		CO3	Understand and apply different algorithms of public key crypto system for ensuring secured communication.
		CO4	Apply Security engineering principles and respective algorithms to achieve authentication, integrity and digital certification.
		CO5	Implement various cryptographic algorithms so as to analyze the achievability of security goals like Confidentiality, integrity, authentication and also Justify thepossibility of Cryptanalysis attack with each algorithm.

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19AM2204	COMPUTER NETWORKS AND SECURITY	CO1	Understand network security issues and apply key distribution techniques.
		CO2	Apply user authentication and Transport layer Security techniques.
		CO3	Understanding Wireless Network Security
		CO4	Applying Email and IP Security concepts
		CO5	Implementing the various Network Security concepts and analyse their performance using various networking tools
19AM2205	Crypto currencies & Blockchain Technologies	CO1	Understand crypto currencies and Markets, Mining and Crypto currencies
		CO2	Understand block chain technology, Transactions, Blocks and Hashes
		CO3	Applying Hash cryptography, Encryption vs hashing. Analyzing Transactions , Digital signature, Information technology programs
		CO4	Analyzing Security and safeguards: protecting block chain from attackers.
		CO5	Creation of Merkle trees, block chain, Wallet structure, address structure
19AM2107	STATISTICS WITH R-PROGRAMMING	CO1	Understand the basic functions in R programming and identify the operators using in it.
		CO2	Simulating data using R
		CO3	Apply various probability distributions to the real world problems using R
		CO4	Analyze the data using various linear and nonlinear lines using R
19AM2206	Big DataAnalytics	CO1	Illustrate the concepts of big data, Initial exploration of analysis of data and Data visualization.
		CO2	Demonstrate Initial exploration of data and advanced data analytics by using R
		CO3	Examine advanced algorithms & Statistical modeling for big data using HDFS, HIVE, and PIG.
		CO4	Apply advanced SQL functions for in- database analytics by MADlib, Greenplum along with common deliverables of analytics life cycle project
		CO5	To implement Lab experiments using Hadoop
19AM2207	CLOUD COMPUTING	CO1	Identify the appropriate cloud services for a given application
		CO2	Understand authentication, confidentiality and privacy issues in Cloud computing environment.
		CO3	Justify financial and technological implications for selecting cloud computing platforms
		CO4	Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.
		CO5	Develop applications using Various Cloud Platforms

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19AM2108	**ContinuumMechanics-1**	CO1	Apply the basic concepts of generalized co-ordinates, unilateral and bilateral constraints; principle of virtual work, D'Alemberts principle.
		CO2	Apply the methods of variational principle, problems of calculus of variations, shortest distance, minimum surface of revolution, Brachistochrone problem iso- perimetric problem, geodesic.
		CO3	Analyze Lagranges equation of first kind and of second kind, uniqueness of solution, Energy equation of conservative fields, generalized equations
		CO4	Analyze the principle of least action, Routh's equation, Hamilton-canonical equation of Motion.
19AM2208	ContinuumMechanics-2	CO1	Apply various parameters such as Body force, Surface force, Cauchy's stress principle. Stress vector, State of stress at a point, relationship. These basics are essential for further analysis and to know the composition of fluid structure
		CO2	Analyze force and moment equilibrium, Stress tensor symmetry, Stress quadric ofCauchy, Stress transformation laws, Principal stress, Stress invariant, Stress ellipsoid.
		CO3	Analyze the concepts of deformation Gradients, Displacement Gradient, Deformation tensor, Finite strain tensors, Small deformation theory—
		CO4	Analyze finite strain interpretation, principal strains, strain invariant, cubical dilatation, Compatibility equation for linear strain, Strain energy function. Hook'sLaw. Methods and Solutions of Navier-Stocks Equations.
19AM2209	Computational Fluid Dynamics	CO1	Understand the concepts of Computational Fluid Dynamics and Principles of Conservation: Continuity Equation, Navier Stokes Equation, Energy Equation. and General Structure of Conservation Equations, Approximate Solutions of Differential Equations:
		CO2	Apply the concepts of steady state Diffusion Problems,Boundary Condition Implementation. Discretization of Unsteady State Problems, FTCS (Forward timecentral space) scheme,
		CO3	Apply the basic features of Finite Volume Discretization of 2-D unsteady State Diffusion type Problems, Solution of Systems of Methods, Iterative Methods, -Diffusion Equations:
		CO4	Analyze the nature of Navier Stokes Equations:Stream Function Vorticity approach and Primitive variable approach, SIMPLE Algorithm, SIMPLER Algorithm,
		CO5	To analyze the analytical solution and compare with that of numerical solution for a meaningful interpretation
19AM1106	Seminar-1	CO5	Organize mathematical concepts and results effectively in written and oral form
19AM1206	Seminar-2	CO5	Organize mathematical concepts and results effectively in written and oral form
19AM2105	Seminar-3	CO5	Organize mathematical concepts and results effectively in written and oral form
19AM2203	Dissertation	CO5	Performing Dissertation work and presentation

N. Srimannarayana
Academic Professor I/C

HOD-MATHEMATICS

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