Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.
Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

DEPARTMENT OF MATHEMATICS

Program: M. Sc. (Applied Mathematics)

Academic Year: 2021-2022

S.No.	Course Code	Course Title	CO	Description of the Course Outcome
1	21AM1101	**Real Analysis**	CO-1	Describe the fundamental properties of the real numbers that lead to the formal development of real analysis.
			CO-2	Demonstrate an perceptive of limits and how they are used in sequences, series, differentiation and integration
			CO-3	Describe and apply the important properties of the limit and continuity and the differentiation and integration of the sequences and series of functions. Explain the basic properties of the Riemann integration
			CO-4	Determine the Riemann integrability of a bounded or unbounded function and prove a selection of theorems concerning integrations.
2	21AM1102	**ORDINARY DIFFERENTIAL EQUATIONS**	CO-1	Apply the existence and uniqueness conditions of solution of the homogeneous/non-homogeneous differential equation and the system of differential equations.
			CO-2	Apply the power series method of solution to second order ODE arising in mathematical physics- Gauss hypergeometric , Hermit and Chebyshev polynomials.
			CO-3	Apply Green's function method to study behavior of the Boundary Value Problems (BVP) for second order ODE.
			CO-4	Determine the oscillatory solutions of BVP and illustrate their qualitative properties

Dr. B.V. APPA RAO
Professor & Head Dept. of Mathematics
KLEF, (Deemed to be University)
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			CO-5	Verify the solution of the ODE through MATLAB.
3	21AM1103	**Discrete Mathematics**	CO-1	Apply the rules of Propositional logic to establish valid results and apply rules of valid inference and hence understand how to construct correct mathematical arguments, Mathematical Induction
			CO-2	Understand the concept of relations, functions and discrete structures , Count discrete event occurrences , lattices, to represent the Boolean functions by an expression Formulate and solve recurrence relations of homogeneous and non homogeneous relations, understand some recursive algorithms.
			CO-3	Formulate and solve recurrence relations of homogeneous and non homogeneous relations, understand some recursive algorithms.
			CO-4	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.
4	21AM1104	**Introduction to Computer Programming**	CO-1	Introduction to basic computer organization and computer fundamentals. Introduction to Programming language fundamentals. Illustrate and use Control Flow Statements in C++.
			CO-2	AIntroduction to functions in C++ and Decomposition of programs through function.
			CO-3	Interpret & Illustrate user defined C++ functions and different operations on list of data.
			CO-4	Illustrate Object Oriented Concepts and implement linear data structures.
			CO-5	Develop the code for the algorithms in C++

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5	21AM1105	**MATHEMATICAL STATISTICS**	CO-1	Explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables
			CO-2	Explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
			CO-3	Explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.State the central limit theorem, and apply it.
			CO-4	Construct the sampling distribution of mean and variance and calculation of mean and variance of sampling distribution of mean and variance..
6	21AM1106	Seminar-1	CO-5	CO5 This course prepares students for how to organize mathematical presentations. An emphasis will be placed on communication skills, both oral and written. Students will be required to give both oral and written presentations
7	21AM1105	**Communication and Logical Skills**	CO-1	Relating grammar concepts and receptive skills for documenting and editing
			CO-2	Able to set goals through SWOT and present themselves effectively during the Interview.
			CO-3	Apply and formulate the concepts of mathematical principles besides logic and basic mathematical formulae to solve word based situational problems.
			CO-4	Estimate inductive reasoning, to categorize the rules-set from a given list of observations and relate them to predict the conclusions according to the given conditions

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8	21AM1201	**Abstract Algebra**	CO-1	Define group, subgroup and quotient group with examples, and proving some preliminary lemmas
			CO-2	Define homomorphism and automorphisim of groups .Explain Cayley's and Sylow's theorems of finite groups and demonstrate the problems
			CO-3	Define a ring, homomorphism of rings, ideal, quotient rings with Examples. Explain principal ideal domain, unique factorization domain, modules over PID theorems and demonstrate the problems.
			CO-4	Define field and Polynomial ring with examples. Explain the field of Quotients of an integral domain and Euclidean and polynomial rings with problems
9	21AM1202	**Data Structures**	CO-1	Analyze and compare stack ADT and queue ADT implementations using linked list and applications
			CO-2	Analyze the linked lists and types of Binary trees and their representations
			CO-3	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms, Analyze the linked implementation of Binary, Balanced Trees and different Hashing techniques
			CO-4	Analyze different representations, traversals, applications of Graphs and Heap organization
			CO-5	Develop and Evaluate common practical applications for linear and non-linear data structures
10	21AM1203	**Statistical Inference**	CO-1	Obtain estimates of parameters and identify the various methods to estimate it.
			CO-2	Apply various principles for the data reduction and draw conclusion about the population based upon samples drawn from it
			CO-3	Describe the tests of significance and draw conclusion about the population and sample using various tests

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			CO-4	Testing the hypothesis to analyze the variance and also predict the linear relationship between the two variables
11	21AM1204	**Numerical Analysis**	CO-1	Apply analytical and numerical methods to solve algebraic and transcendental equations
			CO-2	Apply interpolating polynomials for interpolation and extrapolation
			CO-3	Apply Numerical differentiation and integration techniques
			CO-4	Apply numerical methods to solve Ordinary Differential Equations
			CO-5	Compute the numerical solutions through MATLAB
12	21AM1205	**Complex Analysis**	CO-1	Explain the definition of continuity, differentiability, apply the concepts of analytic function and harmonic function to explain Cauchy-Riemann equations; Understanding Power Series.
			CO-2	Apply the concept of conformal mapping, and describe the mapping properties of Möbius transformations and how to apply them for conformal mappings in Fluid Dynamics ,etc.
			CO-3	Explain complex contour integrals; Understand simple sequences and series apply the convergence properties of a power series, and to determine the Taylor series or the Laurent series of an analytic function
			CO-4	Explain properties of singularities and poles of analytic functions and apply to compute residues integrals by applying residue techniques.
13	21AM1206	**Technical Skills**	CO-1	Analyze MATLAB tools to solve Mathematical Problems
			CO-2	Test for statistical distribution to the given experimental data by software tools Dynamics ,etc.
			CO-3	Inference regression curves and hypothesis testing by software tools

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			CO-4	Analyze MATLAB functions to find the optimal solution for Mathematical Programming Problems
14	21AM1207	Seminar-2	CO-5	This course prepares students for how to organize mathematical presentations. An emphasis will be placed on communication skills, both oral and written. Students will be required to give both oral and written presentations
15	20UC1102	**Design Thinking and Innovation**	CO-1	Understand the basics of design thinking and its implications in product or service development
			CO-2	Understand and Analyse the requirements of a typical problem
			CO-3	Plan the necessary activities towards solving the problem through ideation and prototyping
			CO-4	Evaluate the solution and refine them based on the customer feedback
16	21AM2101	**Topology**	CO-1	Explain the definition of Finite, countable, uncountable sets and apply the concepts of composite function and Axiom of choice to explain Zorn's Lemma.
			CO-2	Explain the concept of open sets, closed sets and basis for a topology describe the properties of product space and apply the concept of topological space and continuous function.
			CO-3	Explain the definition of compact space and connected space and apply the concept of finite intersection property and Bolzano weier strass property.
			CO-4	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 tychonoff theorem.
17	21AM2102	**Partial Differential Equations**	CO-1	Model the relevant phenomena as a Partial differential equations and obtain the solutions
			CO-2	Understand the Nature of the higher order Partial differential equation and obtain the solutions function.
			CO-3	Express the Laplace equation in Various coordinate systems and solve by Fourier series method

			CO-4	Solve the Hyperbolic and Parabolic differential equations by Separation of variable method
18	21AM2103	**Continuum Mechanics**	CO-1	Apply the basic concepts of generalized co-ordinates, Physical Properties of Fluids:Concept of fluids, Continuum Hypothesis, Kinematics of Fluids:Eulerian and Lagranges methods of Description of Fluids, Equvalence of Lagrangian and Eulerian Methods
			CO-2	Deformation of Fluid Elements, Analytical Approach to Deformation, Stress - strain relations, Steady and unsteady flows, Stream Lines, Path Lines and Streak Lines
			CO-3	Stress in Fluids and Constitutive Equations:Stress tensor, Normal Stresses, Shear Stresses, Symmetry of Shear of Stress tensor, newtonian Fluids, Non Newtonian Fluids, Purely viscous fluids, Reiner Rivlin Fluids, Power Law Fluids, Visco elastic fluids Viscous Fluid Flows: Flow between two parallel plates, Plane ciutte flow, Plane poiseuille flow, Flow over an inclined plane,
			CO-4	Flow of two immissible fluids, Flow through circular pipe. Flow through an annulus, Flow between two porous plates, Planecouette flow, Flow through convergent and divergent channels, Stagnent point, Unsteady flows. Unsteady flow over a flat plate, Unsteady flow between two parallel plates
19	21AM2104	**Statistics with R Programming**	CO-1	Understand the basic functions in R programming and identify the operators using in it.
			CO-2	Simulating data using R
			CO-3	Apply various probability distributions to the real world problems using R flow, Flow over an inclined plane.
			CO-4	Analyze the data using various linear and nonlinear lines using R

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20	21AM2105	Seminar-3	CO-5	This course prepares students for how to organize mathematical presentations. An emphasis will be placed on communication skills, both oral and written. Students will be required to give both oral and written presentations
21	21AM2201	**Fluid Dynamics**	CO-1	Illustrate 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:
			CO-2	Apply the concepts of steady state Diffusion Problems, Boundary Condition Implementation. Discretization of Unsteady State Problems, FTCS (Forward time central space) scheme
			CO-3	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
			CO-4	Demonstrate the nature of Navier Stokes Equations: Stream Function Vorticity approach and Primitive variable approach, SIMPLE Algorithm, SIMPLER Algorithm
			CO-5	Analyze theoretical concepts of fluid flows to formulate and conduct numerical experiments using MATLAB software and coding.
22	21AM2202	**Transform Techniques**	CO-1	Apply Laplace transform techniques to solve linear differential equations in system analysis where initial conditions can be easily included to give system response.
			CO-2	Applying z- transform and Mellin transform to the analysis and characterization of Discrete Time systems.
			CO-3	Apply Fourier series to analyze various signals
			CO-4	Apply Fourier transforms to analyze various signals.
			CO-5	Verify the solution of the Transform techniques through MATLAB
23	21AM2203	Dissertation with Research Publication	CO-5	Performing dissertation work and presentation

ELECTIVE-1

24	21AM2106	**Operations Research**	CO-1	Apply the concept of Linear Programming to formulate and find the optimal solution of linear programming problems
			CO-2	Apply other methods to solve Linear Programming Problem and study the sensitivity of the solution
			CO-3	Apply different methods to solve Transportation and Assignment problems
			CO-4	Apply different methods to solve integer programming and game problems.
25	21AM2107	**Functional Analysis**	CO-1	Illustrate basic concepts of metric spaces, results on inequalities, spaces of sequences and functions.
			CO-2	Demonstrate bounded linear operators over normed and Hilbert spaces
			CO-3	Illustrate the results on various operators on Banach and Hilbert Spaces.
			CO-4	Apply fixed point results to solve integral equations
26	21AM2108	**Fuzzy mathematics and applications**	CO-1	Describe the relationship between the crisp sets and fuzzy sets.
			CO-2	Demonstrate fuzzy operations and relations on fuzzy sets.
			CO-3	Illustrate fuzzy logic, switching functions and circuits.
			CO-4	Apply fuzzy sets and fuzzy logic in control systems.

ELECTIVE-2

27	21AM2204	**Mathematical Modelling**	CO-1	Model and solve real life problems through difference equations and describe mathematical models using proportionality and geometric similarity.
			CO-2	Determine best fitting models
			CO-3	Interpret real life problems using simulation modeLling.
			CO-4	Apply mathematical modelling through differential equations
28	21AM2205	**Mathematical Control Theory**	CO-1	Develop conditions for the controllability and observability of the linear control systems and validate with suitable example.
			CO-2	Obtain conditions for the controllability and observability for the nonlinear control systems and illustrate with suitable example.

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			CO-3	Determine the stability for the linear and nonlinear control systems.
			CO-4	Solve the optimal control problems for linear and nonlinear control systems.
29	21AM2206	**Dynamical Systems**	CO-1	Describe Periodic points, graphs, stability and bifurcation.
			CO-2	Illustrate itineraries, transition graphs, contor sets and their applications.
			CO-3	Demonstrate invariant sets, Chaotic Attractors, Lyapunov Exponents and their applications.
			CO-4	Apply periodic points of higher dimensional maps to dynamical systems.

ELECTIVE-3

30	21AM2207	**Advanced Numerical Analysis**	CO-1	Find of Eigen Values of a Matrix by using poer and Jacobi methods.
			CO-2	Solve initial value problems
			CO-3	Classify and solve PDE.
			CO-4	Apply Galerkins, Rayleigh-Ritz methods and their compatibility.
			CO-5	Verify the solutions of PDE through MATLAB
31	21AM2208	**Number Theory**	CO-1	Describe various fundamental results of number theory
			CO-2	Demonstrate Residue systems and Quadratic residues.
			CO-3	Illustrate Mobius function, finite and infinite continued fractions.
			CO-4	Demonstrate the concepts of cryptography, public key cryptography, RSA and their applications.
32	21AM2209	**Applied Stochastic Processes**	CO-1	Describe the concept of Markov process and Discre time Markov models.
			CO-2	Demonstrate Poisson Process and continuous Markov models.
			CO-3	Illustrate generalized Markov models and Queueing models.
			CO-4	Demonstrate the concepts of Brownian motions and applications

N. Srinivasarayana
Academic Professor I/C

HOD-MATHEMATICS
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Green Fields, Vaddeswaram-522 302,
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