KONERU LAKSMAIAH EDUCATION FOUNDATION (KLEF)
DEPARTMENT OF MATHEMATICS
PROGRAM DEVELOPMENT DOCUMENT
M.Sc.(Applied Mathematics)
2018

PROGRAME EDUCATIONAL OBJECTIVES:

The Program Educational Objectives (PEOs) are as follows:

PEO-1: Apply mathematics and technology tools (MATLAB) to solve problems.

PEO-2: Understand the use of mathematical tools and concepts in other fields.

PEO-3: Communicate, and work, with people of diverse backgrounds in individual and group settings, in an ethical and professional manner.

PEO-4: Critically analyze information and concepts to adapt to advances in knowledge and technology in the workplace.

PROGRAMME OUT COMES: (PO :)

Programme Outcomes

a. Understand and analyze real life problems using modern mathematical concepts.

b. Apply Advanced Mathematical Techniques to formulate, solve and analyze mathematical models of real life problems.

c. Identify and apply suitable computational mathematical tools and techniques to solve various complex Engineering problems

d. Use knowledge and skills necessary for immediate employment or excellent foundation for planning to a Ph.D program in mathematics.

e. Maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for life long learning.

Programme Specific Outcomes

PSO1: Global level research opportunities to pursue Ph.D programme targeted approach of CSIR – NET examination, Discipline specific competitive exams conducted by service commission

PSO2: Apply knowledge of Mathematics, science and Engineering to solve complex Engineering problems.

MAPPING OF PEOs with MISSION OF THE DEPARTMENT:

S.No	Description of PEOs	Key Components of Mission		
		M 1	M 2	M 3
		To create an ambience of Mathematical thinking and applying the same to solve complex engineering problems.	To Develop Mathematical model to solve problems at global level	To collaborate with other campus entities, individuals, professional associations and local community organizations.
PEO 1	Apply mathematics and technology tools (MATLAB) to solve problems.	.✓.		.
PEO 2	Understand the use of mathematical tools and concepts in other fields.			✓
PEO 3	Communicate, and work, with people of diverse backgrounds in individual and group settings, in an ethical and professional manner.			✓
PEO 4	Critically analyze information and concepts to adapt to advances in knowledge and technology in the workplace	✓	✓	

MAPPING OF POs/PSOs with PEOs:

S No.	Key Components of POs and PSOs	Description of PEO			
		Apply mathematics and technology tools (MATLAB) to solve problems.	Understand the use of mathematical tools and concepts in other fields.	Communicate, and work, with people of diverse backgrounds in individual and group settings, in an ethical and professional manner.	Critically analyze information and concepts to adapt to advances in knowledge and technology in the workplace
		PEO 1	PEO 2	PEO 3	PEO 4
PO1	Understand and analyze real life problems using modern mathematical concepts.	✓	✓		✓
PO2	Apply Advanced Mathematical Techniques to formulate, solve and analyze mathematical models of real life problems.	✓	✓		✓

PO3	Identify and apply suitable computational mathematical tools and techniques to solve various complex Engineering problems	✓	✓		✓
PO4	Use knowledge and skills necessary for immediate employment or excellent foundation for planning to a Ph.D program in mathematics	✓	✓		✓
PO5	Maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for life long learning	✓	✓		✓

K L UNIVERSITY

DEPARTMENT OF MATHEMATICS

2018-2019 M.Sc.(App.Mathematics) BATCH Course Outcomes vs Program Outcomes

Course Articulation Matrix

S No	Course Code	Course Title	LTP	Credits	CO NO	Description of the Course Outcome	Program Outcomes						Course Rationale
							1	2	3	4	5	6	
1	18AM1101	**Real Analysis**	*4-0-0*	*4*	CO1	Define the real numbers, least upper bounds, and the triangle inequality.Define functions between sets; equivalent sets; finite, countable and uncountable sets. Summarize sequences and their limits, limit theorems, monotone sequences, sub-sequences, open and closed sets. Analyze the Cauchy criterion and the Bolzano-Weierstrass theorem	1						For the students to develop a strong foundation in Real Analysis and the theory of integration
					CO2	Recognize convergent, divergent, bounded, Cauchy and monotone sequences. Calculate the limit superior, limit inferior, and the limit of a sequence.	1						
					CO3	Recognize alternating, convergent, conditionally and absolutely convergent series. Apply the ratio, root, limit and limit comparison tests.	1						
					CO4	Give an account of the basic properties of singularities of analytic functions and be able to determine the order of zeros and poles, to compute residues and to evaluate integrals using residue techniques; Determine the number of	1						

						roots in a given area for simple equations; Formulate important results and theorems covered by the course and describe the main features of their proofs.							
2	18AM1102	**ORDINARY DIFFERENTIAL EQUATIONS**	*3-0-2*	*4*	CO1	Apply the existence and uniqueness conditions of solution of the homogeneous/non-homogeneous differential equation and the system of differential equations.	1						This course intends to highlight basic concepts, principles and procedure of ODE as a tool to analyze practical problems and as such it lays down foundation for the understanding of basic science and Engineering problems. Our emphasis is on principles rather than routine calculations and our approach is a compromise between diversity and depth. The students acquire the knowledge on usage of ODE with MATLAB.
					CO2	Apply the power series method of solution to second order ODE arising in mathematical physics- Gauss hypergeometric , Hermit and Chebyshev polynomials.	1						
					CO3	Apply Green's function method to study behavior of the Boundary Value Problems (BVP) for second order ODE.	1						
					CO4	Determine the oscillatory solutions of BVP and illustrate their qualitative properties.	1						
					CO5	Verify the solution of the ODE through MATLAB.		2					
3	**18AM1103**	**Numerical Methods**	*3-0-2*	*4*	CO1	Identify the difference between solutions of system linear and roots of non-linear equations by direct, bisection methods.	1						The skills will be developed to identify the solution for different types of differential equations

					CO2	Construct the interpolation forward and backward tables and find the Eigen values and vectors by using mat lab also.	1						using Numerical Techniques and MATLAB
					CO3	Apply Numerical differentiation and integration problems for different methods and find the values and compare the values by using mat lab also..	1						
					CO4	Construct numerical solutions of first and second order ordinary differential equations and compare the numerical values with mat lab also.	1						
					CO5	Verify the solution of the ODE through MATLAB.		2					
4	18AM1104	**Complex Analysis**	*4-0-0*	*4*	CO1	State the definition of continuity , state the definition of differentiable, give an account of the concepts of analytic function and harmonic function and to explain the role of the Cauchy-Riemann equations; Gives an explanation of Power Series	1					1	The students should learn the basic techniques of contemporary complex analysis as well as use methods of complex analysis in various applications such as harmonic analysis, differential equations as well as in the applied disciplines which are mentioned above. The second half of the course extends these ideas to complex functions of a complex variable. It turns out that complex differentiability is a very strong condition and differentiable functions behave very well. Integration is along paths in the complex plane. The central result of this spectacularly beautiful part of mathematics is Cauchy's Theorem guaranteeing that certain integrals along closed paths are zero. This striking result leads to useful techniques for evaluating real integrals based on the 'calculus of residues'
					CO2	Explain the concept of conformal mapping, describe its relation to analytic functions, and know the mapping properties of the elementary functions; describe the mapping properties of Möbius transformations and know how to use them for conformal mappings; Explain the application of mapping in Fluid Dynamics,etc.	1						
					CO3	Define and evaluate complex contour integrals; Give an account of and use the Cauchy integral theorem, the Cauchy integral formula and some of their consequences; Analyse simple sequences and series of functions with respect to uniform convergence, describe the convergence properties of a power series, and determine the Taylor series or the Laurent series of an analytic function	1						

						in a given region							
					CO4	Give an account of the basic properties of singularities of analytic functions and be able to determine the order of zeros and poles, to compute residues and to evaluate integrals using residue techniques; Determine the number of roots in a given area for simple equations; Formulate important results and theorems covered by the course and describe the main features of their proofs.	1						
5	**18AM1105**	**MATHEMATICAL STATISTICS**	*4-0-0*	*4*	CO1	Identify the types of random variables and also apply discrete distributions to analyze various real world situations.	1						To apply statistics to real time problems
					CO2	Construct the probability distribution of a discrete and continuous random variable based on a real-world problems, and also predict the linear and non-linear relationship between two variables.	2						
					CO3	Apply statistical tests for large and small samples to test the hypothesis.	1						
					CO4	Construct the Joint probability distribution of a discrete and ncontinuous random variable based on real-world problems.	2						
6	**18AM1106**	*Seminar-1*	*0-0-2*	*1*									

6	18AM1206	**Topology**	*4-0-0*	*4*	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.	1						
					CO2	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.	1						
					CO3	Explain the definition of compact space and connected space and apply the concept of finite intersection property and Bolzano weierstrass property	1						
					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 tychonoff theorem.	1						
7	18AM1207	**Abstract Algebra**	*4-0-0*	*4*	CO1	Define group, subgroup and quotient group with examples, and proving some preliminary lemmas.	3						
					CO2	Define homomorphism and automorphisim of groups .Explain Cayley's and Sylow's theorems of finite groups and demonstrate the problems.	1						
					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.	2						
					CO4	Define field and Polynomial ring with examples. Explain the field of Quotients of an integral domain and Euclidean and polynomial rings with problems.	4						

8	18AM1208	**Transform Techniques**	*3-0-2*	*4*	CO1	Apply Laplace transform techniques to solve linear differential equations in system analysis where initial conditions can be easily included to give system response.	1					
					CO2	Applying z- transform and Mellin transform to the analysis and characterization of Discrete Time systems.	1					
					CO3	Apply Fourier series to analyze various signals.	4					
					CO4	Apply Fourier transforms to analyze various signals.	6					
					CO5	Verify the solution of the Transform techniques through MATLAB.						

9	18AM1209	**Discrete Mathematics**	*4-0-0*	*4*	CO1	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	3,6,7					
					CO2	Understand the concept of relations, functions and discrete structures , Count discrete event occurrences , lattices, to represent the Boolean functions by an expression	2,3,6,7					
					CO3	Formulate and solve recurrence relations of homogeneous and non homogeneous relations, understand some recursive algorithms.	2,3,6,7					

					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.	2,3,5,6,7					
10	18AM1210	**Introduction to Computer Programming**	*3-0-2*	*4*	CO1	Introduction to basic computer organization and computer fundamentals. Introduction to Programming language fundamentals. Illustrate and use Control Flow Statements in C++.	1					
					CO2	Introduction to functions in C++ and Decomposition of programs through function.	1					
					CO3	Interpret & Illustrate user defined C++ functions and different operations on list of data.	1					
					CO4	Illustrate Object Oriented Concepts and implement linear data structures	1					
					CO5	Develop the code for the algorithms in C++	8					
11	18AM2111	**Partial Differential Equations**	*4-0-0*	*4*	CO1	Model the relevant phenomena as a Partial differential equations and obtain the solutions	2					
					CO2	Understand the Nature of the higher order Partial differential equation and obtain the solutions	3					
					CO3	Express the Laplace equation in Various coordinate systems and solve by Fourier series method	1,5					
					CO4	Solve the Hyperbolic and Parabolic differential equations by Separation of variable method	1,5					

12	18AM2112	**Continuum Mechanics**	*4-0-0*	*4*	CO1	Concept of fluids, Continum Hypothesis, Density, Specific etc Equation of State, First and Second Law of Thermodynamics and Clausius Inequality	2					
					CO2	Eulerian and Lagranges methods of Description of Fluids, Newtonian Fluids, Non Newtonian Fluids, Visco elastic fluids	3					
					CO3	Equation of conservation of Mass, Equation for the conservation of momentum, Equation for energy, Basic equations in different coordinate systems, Boundary conditions Voretex motion, velocity potential due to a vortex, velocity potential due to a vortex	1,5					
					CO4	Flow between two parallel plates, Plane ciutte flow, Plane poiseuille flow, Flow over an inclined plane, Flow through circular pipe,Flow through an annulus, Flow between two porous plates, Unsteady flows, Unsteady flow over a flat plate, Unsteady flow between two parallel plates.	1,5					
13	18AM2113	**Data Structures**	*3-0-2*	*4*	CO1	Analyze and compare stack ADT and queue ADT implementations using linked list andapplications.	1,4					
					CO2	Analyze the linked lists and types of Binary trees and their representations.	1,4					
					CO3	Apply measures of efficiency on algorithms and Analyze different Sorting Algorithms, Analyze the linked implementation of Binary,Balanced Trees and different Hashing techniques.	1,2					
					CO4	Analyze different representations, traversals, applications of Graphs and Heap organization.	2,4					
					CO5	Develop and Evaluate common practical applications for linear and non-linear data structures.	1,2					
14	18AM2114	**Functional**	*4-0-0*	*4*	CO1	Understand the concepts of Banach and Hilbert spaces and to learn to classify the standard examples. In particular, spaces of sequences and	2					

		Analysis				functions						
					CO2	learn to use properly the specific techniques for bounded operators over normed and Hilbert spaces	3					
					CO3	Eplain the fundamental results in the theory with accuracy and proper formalism.	1,5					
					CO4	Apply the spectral analysis of compact self-adjoint operators to the resolution of integral equations	1,5					
15	18AM2101	**Technical Skill**	*0-0-0-2*	*4*	CO1	Apply MATLAB operators and functions for symbolic processing and solving equations	1,2					
					CO2	Apply MATLAB functions and codes to fit discrete and continuous probability distributions and use statistical plots to evaluate goodness of fit.	1,2					
					CO3	Apply MATLAB tools and codes for regression analysis and interpolation.	1,2					
					CO4	Apply MATLAB tools and codes for solving linear and nonlinear programming problems.	2,2					
16	18AM2215	**Fluid Dynamics**	*4-0-0*	*4*	CO1	Under stand irrotational flows, boundary surface, streamlines, path lines, streak lines, vorticity.	1,2					

					CO2	Explain General equations of motion, in viscid case, Bernoulli's theorem,	1,2					
					CO3	Develop energy equation, Dynamical similarity.	1,2					
					CO4	Solve Momentum integral equations by Karman- Pohlhausen	1,2					
17	18AM2216	**Operations Research**	*4-0-0*	*4*	CO1	Solving LPP by Simplex Method, Big – M Method, Two Phase Method, Revised Simplex Method.	1,2					
					CO2	Solve parametric LPP	1,2					
					CO3	Solve Transportation and Assignment Problems	1,2					
					CO4	Find the solution of non linear LPP	2,2					
18	18AM2011	**Mathematical Control**	*4-0-0*	*4*	CO1	Develop conditions for the controllability and observability of the linear control systems and validate with suitable example.	1,2					
					CO2	Obtain conditions for the controllability and observability for the nonlinear control systems and illustrate with suitable example.	1					

		theory			CO3	Determine the stability for the linear and nonlinear control systems.	1					
					CO4	Solve the optimal control problems for linear and nonlinear control systems.	1					
18	18AM2012	**Statistical Inference**	*4-0-0*	*4*	CO1	Obtain estimates of parameters and identify the various methods to estimateit.	1					
					CO2	Apply various principles for the data reduction and draw conclusion about the population based upon samples drawn from it	2					
					CO3	Describe the tests of significance and draw conclusion about the population and sample using various tests.	3					
					CO4	Testing the hypothesis to analyze the variance and also predict the linear relationship between the two variables	3					
19	18AM2013	**Data Base Management systems**	*4-0-0*	*4*	CO1	Illustrate the functional components of DBMS, importance of data modelling in design of a database.	1					
					CO2	Build queries using SQL and concepts of PL/SQL	2					
					CO3	Apply normalization techniques and indexing to construct and access decent database.	3					
					CO4	Identify the importance of transaction processing, concurrency control and recovery techniques						
					CO5	Develop a good database and define SQL queries for data analysis	3					

20	18AM2021	**Fuzzy mathematics and applications**	*4-0-0*	*4*	CO1	Understand cartesian Product of Crisp Sets Crisp Relations on Sets.	1,2					
					CO2	Explain Concept on a Fuzzy Set.	1					
					CO3	Apply Projections of Fuzzy Relations and sets	1					
					CO4	Apply fuzzy methods in control theory	1					
21	18AM2022	**Advanced Numerical Analysis**	*3-0-2*	*4*	CO1	Find of Eigen Values of a Matrix by using poer and Jacobi methods.	1,2					
					CO2	Solve initial value problems.	1					
					CO3	Classify and solve PDE.	1					
					CO4	Apply Galerkins, Rayleigh-Ritz methods and their compatibility.	1					
					CO5		1					
22	18AM2023	**Design and Analysis**	*3-0-2*	*4*	CO1	Understand notions of algorithm, pseudo code conventions, Performance analysis, Time and space .	1,2					
					CO2	Solve the recurrence relations	1					

		of Algorithms			CO3	Develop the search algorithms.	1					
					CO4	Apply naive string matching algorithm, The Rabin-Karp algorithm.	1					
23	18AM2031	**Dynamical Systems**	*4-0-0*	*4*	CO1	Understand Periodic points, Itineraries , Invariant sets of one dimensional maps.	1,2					
					CO2	Explain the functions with several variables	1					
					CO3	Apply limit sets, Chaotic Attractors, Lyapunov Exponents	1					
					CO4	Apply Periodic points of Higher Dimensional maps.	1					
24	18AM2032	**Number Theory**	*4-0-0*	*4*	CO1	Under stand divisibility, Euclidean algorithm,, Fundamental theorem of arithmetic, Congruences, Chinese Remainder Theorem, Euler's totient function, Euler-Fermat theorem, Wilson's theorem.	1,2					
					CO2	Identify the residue systems, Quadratic residues, quadratic reciprocity, the Jacobi symbols.	1					
					CO3	Develop the Mobius function and Mobius inversion formula, finite and infinite continued fractions.	1					

					CO4	Explain the concepts of cryptography, public key cryptography, RSA.	1						

25	18AM2033	**Mathematical Modeling**	*3-0-2*	*4*	CO1	Understand the Merits and Demerits of Mathematical Modeling.	1,2						
					CO2	Solve linear , Non-linear Difference equations.	1						
					C03	Identify various mathematical models and solve them.							
					CO4	Solve the wave equation, Vibrating string, Traffic flow problems	1						