

**KONERU LAKSHMAIAH EDUCATION FOUNDATION (KLEF)**  
**DEPARTMENT OF MATHEMATICS**  
**PROGRAM DEVELOPMENT DOCUMENT**  
**M. Sc. (Applied Mathematics)**  
**Y20-Batch**

**Vision of University:**

To be a globally renowned university.

**Mission of University:**

To impart quality higher education and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all-round development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.

**Goals of the University:**

1. To offer academic flexibility by means of Choice based credit systems and the like.
2. To identify and introduce new specializations and offer programs in emerging areas therein.
3. To incorporate into the curriculum the Application orientation and use high standards of competence for academic delivery
4. To design and implement educational system adhering to outcome based International models.
5. To introduce and implement innovation in teaching and learning process to strengthen academic delivery.
6. To offer academic programs at UG, PG, doctoral, Post-Doctoral which are industry focused, and incorporates Trans-discipline, inter-discipline aspects of the education system.

To deliver higher education that includes technologies and meeting the global requirements.

**VISION OF THE DEPARTMENT:**

Department of Mathematics strives to be internationally recognised for academic excellence.

**MISSION OF THE DEPARTMENT:**

**M1.** To create an ambience of Mathematical thinking and applying the same to solve complex engineering problems.

**M2.** To Develop Mathematical model to solve problems at global level.

**M3.** To collaborate with other campus entities, individuals, professional associations and local community organizations.

#### A. Program Outcomes

- PO1.** Ability to assimilate and understand a large body of complex concepts and their interrelationships.
- 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.** Ability to communicate, and work, with people of diverse backgrounds in individual and group settings, in an ethical and professional manner.
- PO5.** To maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for life long learning.
- PO6.** Ability to apply Mathematics as a language in a wide range of situations relevant to research and industry.
- PO7.** Promote interdisciplinary research among allied subjects related to applied mathematics
- PO8.** Use symbolic and numerical software as part of practical computation.

#### B. Program Specific Outcomes for M.Sc., Applied Mathematics

- PSO1.** An ability to identify, formulate, abstract, and solve mathematical problems that use tools from a variety of mathematical areas, including algebra, analysis, probability, numerical analysis and differential equations
- PSO2.** The program prepares students for a variety of mathematical careers. The current program has three identified tracks: Cryptography, Data analysis, Applied Mechanics, and Ph.D preparation. Students should be prepared for employment requiring mathematical skill and sophistication at the Master's level.
- PSO3.** Apply mathematics and technology tools (MATLAB, R, MINITAB) to solve problems.
- PSO4.** Ability to do research in a particular topic agreed with a Supervisor, on which the student publish a research paper in an indexed journal.

## **PROGRAMME 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.

**C. Outcomes -Competencies – Performance Indicators**

<b>PO 1: Ability to assimilate and understand a large body of complex concepts and their interrelationships</b>		
<b>Competency</b>	<b>Indicators</b>	
1.1 To develop mathematical competency to visualize the problem for practical applications with a possible meaningful solution.	1.1.1	To identify the problem and understand the importance of participating parameters in the field equations, there by identifying the objectives of the problem.
	1.1.2	To identify the real life problems, variables and parameters to solve the problem. Further mathematical tools to be identified.
1.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering systems.	1.2.1	A suitable mathematical model need to be developed there by inter connecting various participating parameters and obtain their relationships and then to correlate the terms. Problems identified , assembled and evaluated based on the characteristic features of the vital terms involved.
	1.2.2	The solution applied with the better tested tools and with the experimental data wherever it is applicable.
<b>PO 2: Apply Advanced Mathematical Techniques to formulate, solve and analyze mathematical models of real life problems</b>		
<b>Competency</b>	<b>Indicators</b>	
2.1 Demonstrate an ability to identify and formulate complex analytical systems coupled with engineering real life applications.	2.1.1	The course is basically aimed to train the students to pursue their career in several areas of cyber security and network analysis /protection. The cyber security and cryptology are mainly focused at big data analysis and transfer of files in the encrypted form and there by encoded to decryption by the end user. This makes the data transfer more secure and safe.
	2.1.2	
	2.1.3	The basic concepts of applied mathematics leads the students to pursue their higher studies in applied mechanics and Ph.D programs. The concepts learned by the students will enable them to design and develop aero dynamical and fuel efficient systems.

2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.1  2.2.2	<p>The study involves a comprehensive analysis and design of cyber security and full proof system security. The methods studied will enable the students to apply their knowledge for safe secured transfer of confidential files and more so in the financial sector.</p> <p>The procedures and techniques studied by the students will enable them to apply their knowledge in mathematical modeling of aerodynamic vehicles and structures in civil engineering with higher stability.</p>
2.3 Demonstrate an ability to formulate and interpret a model	2.3.1	The concepts studied by the candidates enable them to apply engineering mathematics and complex computational techniques there by producing and validating results through contemporary engineering tools and models.

**PO 3 Identify and apply suitable computational mathematical tools and techniques to solve various complex Engineering problems**

Competency	Indicators	
3.1 Demonstrate an ability to define a complex / open-ended problem in engineering terms	3.1.1	The complex problems existing the hither to not been aerodynamically designed for better utilization and optimality. The mathematical tools studied by the students will enable the engineers to design a competitive and comprehensive designs viz. as theory of plates and shells and aerodynamic and fire resistance structure for better living conditions.

**PO 4 Ability to communicate, and work, with people of diverse backgrounds in individual and group settings, in an ethical and professional manner.**

Competency	Indicators	
4.1 The ability to demonstrate and conduct investigations of technical issues with the understand of technical importance.	<p>The scope and importance of the project will be discussed in consultation with the qualified and competent technical man power available in the field further the relevant methods, tools, design and system calibration long with data acquisition will be implemented with the compitenent technical man power.</p> <p>A strong rapport with the local and non local people will be established for the successful implementation of the project.</p>	

4.2 Demonstrate an ability to design experiments to solve open ended problems	Design and develop experimental approach, specify appropriate equipment and procedures Understand the importance of statistical design of experiments and choose an appropriate experimental design plan based on the study objectives
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**PO 5: To maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for life long learning.**

Competency	Indicators
5.1 Demonstrate an ability to identify / create modern engineering tools, techniques and resources	Apart from the class room teaching the candidates shall acquire the knowledge of modern tools and computer aided drafting and practical modeling analysis for the successful implementation of the undertaken job. It is also expected that create/adopt modify understand implement and exhibit the latest techniques to understand engineering problems.

**PO 6: Ability to apply Mathematics as a language in a wide range of situations relevant to research and industry.**

Competency	Indicators
6.1 Demonstrate an ability to describe engineering roles in a broader context, e.g. pertaining to the environment, health, safety, legal and public welfare	6.1.1 Identify and describe various engineering roles; particularly as pertains to protection of the public and public interest at global, regional and local level
6.2 Demonstrate an understanding of professional engineering regulations, legislation and standards	6.2.1 Interpret legislation, regulations, codes, and standards relevant to your discipline and explain its contribution to the protection of the public

**PO 7 Promote interdisciplinary research among allied subjects related to applied mathematics**

Competency	Indicators
7.1 Demonstrate an understanding of the impact of engineering and industrial practices	Understand the risk/ impact the life cycle of an engineering/ financial project for the better utility of the social economic community. It is expected that the relation between technical and socio economic relation coupled with the environmental balance will be

on social, environmental and in economic contexts	the need of hour,
<b>PO 8: Use symbolic and numerical software as part of practical computation.</b>	
<b>Competency</b>	<b>Indicators</b>
8.1 Demonstration of the latest software techniques and numerical methods for the real life situations.	8.1.1 A gap between the theoretical knowledge by applying the numerical methods and software techniques will be studied and the gap will be try to fill depending up on the naturalconsequences

### D. Program Articulation Matrix

S.No	Course Code	Course Name	Categor	L	T	P/S	Credits	PO								PSO			
								1	2	3	4	5	6	7	8	1	2	3	4
1	19AM1101	Real Analysis		4	0	0	4	2	2										
2	19AM1102	Ordinary Differential Equations		3	0	2	4			2		3		2	2	1	4	1	4
3	19AM1103	Numerical Methods		3	0	2	4					3	3	2	2	1	4	1	4
4	19AM1104	Introduction to Computer Programming		3	0	2	4					3	3	2		2	2	2	2
5	19AM1105	Mathematical Statistics		4	0	0	4	2		2				2		2	1	2	2
6	19AM1106	Seminar-1		0	0	2	1						2						
7	19AM1201	Soft computing		4	0	0	4					3	3	2		2	2	2	2



S.No	Course Code	Course Name	Category	L	T	P/S	Credits	P O											
								1	2	3	4	5	6	7	8	1	2	3	4
8	19AM1202	Data Structures		3	0	2	4	2	2							1	2	1	2
9	19AM1203	Statistical Inference		4	0	0	4		2					2		2	2	2	2
10	19AM1204	Discrete Mathematics		4	0	0	4		2							2	3	3	3
11	19AM1205	Complex Analysis		4	0	0	4					3	3			1	4	4	4
12	19AM1206	Seminar-2		0	0	2	1												
13	19AM2101	Partial Differential Equations		3	0	2	4					3	3			1	4	1	1
14	19AM2102	Data Base Management system		3	0	2	4		2	2				2		2	2	1	4
15	19AM2103	Abstract Algebra		4	0	0	4			2	2				2	2	1	1	2
16	19AM2104	Transform Techniques		3	0	2	4					3	3		2	3	3	3	3
17	19AM2105	Seminar-3		0	0	2	1												
18	19AM2106	Cryptanalysis and Cyber Defense		3	0	2	4					3	3	2	2	1	1	1	1
19	19AM2107	statistics with R Programming		3	0	2	4					3	3	2	2	3	3	2	2

S.No	Course Code	Course Name	Category	L	T	P/S	Credits	P O											
								1	2	3	4	5	6	7	8	1	2	3	4
20	19AM2108	Continuum Mechanics-I		4	0	0	4					3	3		2	2	2	2	2
21	19AM2201	Topology		4	0	0	4				3	3				2	2	2	2
22	19AM2202	Mathematical Programming		4	0	0	4					3	3	2		1	1	1	1
23	19AM2203	Dissertation with research Publications		0	0	24	12					3	3	3					
24	19AM2204	Computer networks and Security		3	0	2	4					3	3	3	2	2	2	2	2
25	19AM2205	Crypto currencies & Block chain Technologies		3	0	2	4					3	3	2	2	2	2	2	2
26	19AM2206	Big Data Analytics		3	0	2	4				3	3		2	2	2	2	1	1
27	19AM2207	Cloud Computing		3	0	2	4					3	3	2	2				

28	19AM2208	Continuum Mechanics-II		4	0	0	4					3	3		2	3	3	4	3
29	19AM2209	Computational Fluid Dynamics		3	0	2	4					3	3		2	2	2	2	3

**K L UNIVERSITY**

**DEPARTMENT OF MATHEMATICS**

**2020-2021 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	19AM1101	Real Analysis	4-0-0	4	CO1	Describe the fundamental properties of the real numbers that lead to the formal development of real analysis.		2			5	6,7	For the students to develop a strong foundation in Real Analysis and the theory of integration
					CO2	Demonstrate an perceptive of limits and how they are used in sequences, series, differentiation and integration		2			5	6,7	
					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 the basic properties of the Riemann integration		2			5	6,7	
					CO4	Determine the Riemann integrability of a bounded or unbounded function and prove a selection of theorems concerning integrations.		2			5	6,7	

2	19AM1102	<b>ORDINARY DIFFERENTIAL EQUATIONS</b>	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.	2	3				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	2				
					CO3	Apply Green's function method to study behavior of the Boundary Value Problems (BVP) for second order ODE.		2				
					CO4	Determine the oscillatory solutions of BVP and illustrate their qualitative properties.		2				
					CO5	Verify the solution of the ODE through MATLAB.		2				
3	19AM1103	<b>Numerical Methods</b>	3-0-2	4	CO1	Identify the difference between solutions of system linear and roots of non-linear equations by direct, bisection methods.	2	3				The skills will be developed to identify the solution for different types of differential

					CO2	Construct the interpolation forward and backward tables and find the Eigen values and vectors by using mat lab also.	1	2										equations 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.		2										
					CO4	Construct numerical solutions of first and second order ordinary differential equations and compare the numerical values with mat lab also.		2										
					CO5	Verify the solution of the N.M. through MATLAB.		2										
4	19AM1104	<b>Introduction to Computer Programming</b>	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.												
					CO4	Illustrate Object Oriented Concepts and implement linear data structures	1											
					CO5	Develop the code for the algorithms in C++	8											