



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### COURSE STRUCTURE

#### I SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / IDC/DSE/ SEC/OEC/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22 AMT 101	Ordinary Differential Equations	4	0	0	Core	30	70	4
22 AMT 102	Real Analysis	4	0	0	Core	30	70	4
22 AMT 103	Probability & Statistics	4	0	0	Core	30	70	4
22 AMT 104	Linear Algebra	4	0	0	Core	30	70	4
22 AMT 105	C-Programming	4	0	0	Core	30	70	4
22 AMT 106 (Compulsory)	Personality Development through Life Enlightenment Skills	3	1	0	Core	30	70	3
22AMTLAB101	C-Programming Lab	0	6	0	Core	30	70	3
<b>TOTAL FOR FIRST SEMESTER</b>						<b>210</b>	<b>490</b>	<b>26</b>

#### II SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / IDC/DSE/ SEC/OEC/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22 AMT 201	Complex Analysis	4	0	0	Core	30	70	4
22 AMT 202	Partial Differential Equations	4	0	0	Core	30	70	4
22 AMT 203	Algebra	4	0	0	Core	30	70	4
22 AMT 204	Numerical Analysis	4	0	0	Core	30	70	4
22 AMT 205 (Compulsory)	Research Methodology & IPR	3	1	0	SEC	30	70	3
<b>DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)</b>								
22AMTDSE 201	Discrete Mathematical Structures	4	0	0	DSE	30	70	4
22AMTDSE 202	Lebesgue Theory	4	0	0	DSE	30	70	4
22AMTDSE 203	Bio-Mechanics	4	0	0	DSE	30	70	4



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

LAB PRACTICALS								
22AMTLAB 201	Numerical Methods Lab	0	6	0	Core	30	70	3
<b>TOTAL FOR SECOND SEMESTER</b>						<b>210</b>	<b>490</b>	<b>26</b>
At the end of 2 <sup>nd</sup> semester, every student must undergo summer Internship/ Apprenticeship/Project work/Industrial training/Research based Project work for Six weeks and must prepare a report concerned as per approved project guidelines, and submit the same to the University 14 days before the commencement of third semester end examinations.								

### III SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / IDC/DSE/ SEC/OEC/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22 AMT 301	Mathematical Methods	4	0	0	Core	30	70	4
22 AMT 302	Linear Programming	4	0	0	Core	30	70	4
<b>DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)</b>								
22AMTDSE 301	Integral Equations & Transforms	4	0	0	DSE	30	70	4
22AMTDSE 302	Boundary Value Problems	4	0	0	DSE	30	70	4
22AMTDSE 303	Fuzzy Sets & Fuzzy Logic	4	0	0	DSE	30	70	4
22AMTDSE 304	Data Mining	4	0	0	DSE	30	70	4
22AMTDSE 305	Operator Theory	4	0	0	DSE	30	70	4
22AMTDSE 306	Topology	4	0	0	DSE	30	70	4
<b>LAB PRACTICALS</b>								
22AMTLAB 301	MSOFFICE/ SCILAB	0	6	0	Core	30	70	3
<b>OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)</b>								
22AMTOEC 301	Matrix Theory	3	0	0	OEC	30	70	3
22AMTOEC 302	Numerical Methods	3	0	0	OEC	30	70	3



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

22AMTOEC 303	Quantitative Aptitude and Logical Reasoning	3	0	0	OEC	30	70	3
22AMTOEC 304	Fundamentals of Mathematics for Sciences	3	0	0	OEC	30	70	3
22AMTOEC 305	Fundamentals of Mathematics for Arts Courses	3	0	0	OEC	30	70	3
<b>TOTAL FOR III SEMESTER</b>						<b>210</b>	<b>490</b>	<b>26</b>

### IV SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / IDC/DSE/ SEC/OEC/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22 AMT 401	Operations Research	4	0	0	Core	30	70	4
<b>DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)</b>								
22 AMT DSE401	Numerical Solutions of Differential Equations	4	0	0	DSE	30	70	4
22 AMT DSE402	Finite Element Methods	4	0	0	DSE	30	70	4
22 AMT DSE403	Graph Theory	4	0	0	DSE	30	70	4
22 AMT DSE404	Computer Graphics	4	0	0	DSE	30	70	4
22 AMT DSE405	Functional Analysis	4	0	0	DSE	30	70	4
22 AMT DSE406	Fluid Dynamics	4	0	0	DSE	30	70	4
<b>LAB PRACTICALS</b>								
22 AMT LAB401	MATLAB/Python Lab	0	6	0	Core	30	70	3
<b>ENTREPRENEURIAL &amp; INNOVATION/IT SKILL RELATED TO DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)</b>								
22 AMT SEC401	Cryptography and Network Security	3	0	0	SEC	30	70	3
22 AMT SEC402	Mathematical Modelling	3	0	0	SEC	30	70	3
22 AMT SEC403	Introduction to Industrial Mathematics	3	0	0	SEC	30	70	3
<b>* CHOOSE MOOCS FROM SWAYAM/NPTEL SOURCES</b>								
MOOCS								4
<b>PROJECT WORK EVALUATION AND VIVA-VOCE</b>							<b>100</b>	<b>4</b>
<b>TOTAL FOR IV SEMESTER</b>						<b>180</b>	<b>520</b>	<b>30</b>

**\*\*L : Lecture, P: Practical, T:Tutorial**

**Note:** Students may be allowed to register and appear for MOOCS from the third semester itself. However, students are to complete the MOOCS successfully and submit pass certificate of the same to the University through the Principal of the College concerned for approval and endorsement of the same on grade cards and PCs and ODs as per the regulations of the University.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### Instructions for evaluation:

1. Each theory subject is evaluated for 100 Marks out of which 70 Marks through end examination and internal assessment would be for 30 Marks. The minimum marks for qualifying in theory subject shall be 40% subject to securing minimum of 40% in the end examination.
2. End Examination Question Paper Pattern is as follows:

Sl. No.	Questions	Units of the Syllabus	Marks
Section-A (Short Answers Questions)			
1	Questions 1 ( Eight short answer Questions (a) to (h) each of 4 Marks, at least ONE from each unit)	From UNIT-I to UNIT-V	5x4=20
Section-B(Essay Questions)			
2	Question (2) Or (3)	Form UNIT-I	10
3	Question (4) Or (5)	From UNIT-II	10
4	Question (6) Or (7)	From UNIT-III	10
5	Question (8) Or (9)	From UNIT-IV	10
6	Question (10) Or (11)	From UNIT-V	10
Total:			70



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

Procedure to evaluate midterm examinations:

Theory:

Question paper pattern:

Answer any Three questions out of Five, each question carries 10 marks,  $3 \times 10 = 30M$

Practical: One mid can be conducted for 30Marks

Midterm Examinations –I & II	30 marks
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**Note:** Final mid semester marks shall be awarded as average of two mid examinations.

**Example:**

**Marks obtained in first mid: 30**

**Marks obtained in second mid: 20**

**Final mid semester Marks:  $(30+20) = 50/2 = 25$**

**Project work** and Evaluation is External evaluation: 100Marks



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### ORDINARY DIFFERENTIAL EQUATIONS-22AMT101

Course Name	Ordinary Differential Equations	L	T	P	C	IM	EM	TM
Course Code	22AMT101	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course provides the knowledge to the students to understand the differential equations of second and higher order with special attention to the existence and uniqueness of solutions and the theory. It also enhance the knowledge of the students about the different methods of solving ODE and its applications.

#### Course Objectives:

- The goal of this course is to provide the students with an understanding of the solutions of second and higher order linear ordinary differential equations
- They learn the applications of ordinary differential equations.

#### Course Learning Outcomes:

- From this course students will be able to learn the differential equations of second and higher order with a special attention to the existence and uniqueness of solutions and the theory.
- Also they learn different methods of solving and applications.

#### Course Content:

##### UNIT-I:

Linear Differential Equations of higher order: Higher order equations- A modelling problem- Linear Independence- Equations with constant coefficients- Equations with variable coefficients- Wronskian- Variation of parameters.

[Topics from Chapter 2 of Text book]

##### UNIT-II:

Solutions of Differential Equations in Power series: Preliminaries – Second order Linear Equations with Ordinary points – Legendre equations with Legendre Polynomials.

[Topics from Chapter 3 of Text Book(2)]

##### UNIT-III:

Second Order equations with regular singular points – Bessel functions- Recurrence relations- Generating function- Orthogonality property.

[Topics from Chapter 3 of Text Book(2)]



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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#### UNIT-IV:

**Systems of Linear Differential Equations:** Preliminaries - Systems of first order equations - Model of arms competitions between two nations - Existence and uniqueness theorem - Fundamental Matrix - Non homogeneous linear systems - Linear systems with constant coefficients.[Topics from Chapter 4 of Text Book(2)]

#### UNIT-V:

Existence and Uniqueness of solutions: Preliminaries – Successive approximations – Picard’s theorem

[Chapter 5.1 to 5.4 of Text Book(2)]

#### Text Book:

1. S.G. Deo, V. Lakshmi kantham and V. Raghavendra: Text Book of Ordinary Differential Equations, second edition, Tata Mc Graw – Hill Publishing company Limited, New Delhi, 1997.

#### Reference Books :

1. Differential Equations with applications and Historical notes by George F.Simmons.
2. Theory of Ordinary Differential Equations by Samsundaram – Narosa Publications.
3. An introduction to Ordinary Differential Equations by E.A. Coddington



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### REAL ANALYSIS-22AMT102

Course Name	Real Analysis	L	T	P	C	IM	EM	TM
Course Code	22AMT102	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course gives the knowledge about the properties of functions, Limits, Continuity and Differentiation, Sequences and series related to the concept of real analysis. The course also serves the purpose of providing the knowledge about the improper integrals concepts and functions of several variables and to construct the mathematical proofs of basic results in Real Analysis.

#### Course Objectives:

- This Course is intended to expose the ideas of Real Analysis by Learning Continuity, Differentiation.
- They learn Riemann Integral and Improper Integrals of functions.

#### Course Learning Outcome(s):

- This Course able to helps the student how to apply the concepts of Real Analysis and understand the Improper Integrals concept.
- They are able to construct the Mathematical proofs of basic results in Real Analysis.

#### Course Content:

##### UNIT-I

**Continuity & Differentiation:** Limits of functions, continuous functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Derivative of a Real Function, Mean value theorems, The Continuity of Derivatives, L' Hospital's rule, Derivatives of higher Order, Taylor's theorem.

[4.1 to 4.34 of chapter4 & 5.1 to 5.19 of chapter5 of Text Book1]

##### UNIT-II

**The Riemann - Stieltjes Integral:** Definition and Existence of Integral-Properties of the integral -Integration and Differentiation -Integration of vector-valued function - Rectifiable Curves.[Chapter-6 of Text Book-1]

##### UNIT-III

**Sequences and series of functions:** Discussion of main problem - Uniform convergence – Uniform convergence and continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation – Equicontinuous Families of functions – The Stone - Weierstrass Theorem.[7.1 to 7.26 of Text Book 1]





## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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#### UNIT-IV

**Improper Integrals:** Introduction – Integration of unbounded Functions with Finite limits of Integrations – Comparison Tests for Convergence at „a” of Infinite Range of  $\int_a^b f dx$  Integration – Integrand as a Product of Functions. [Chapter-11 of Text Book-2]

#### UNIT-V

**Functions of several variables:** Explicit and Implicit Functions - Continuity - Partial Derivatives – Differentiability – Partial Derivatives of Higher Order - Functions of Functions – Change of variables – Taylor’s Theorem – Extreme Values - Maxima and Minima – Functions of Several Variables.[Chapter-15 of Text Book-2]

#### Prescribed Text books:

1. **Principles of Mathematical Analysis**, Walter Rudin, Student Edition 1976, McGraw-Hill International.
2. **Mathematical Analysis** by S.C. Malik and Savita Aurora, Fourth edition, New Age International Publishers,.

#### Reference Book:

1. **Mathematical Analysis** by Tom. M. Apostol, second Edition, Addison Wesley Publishing Company.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### PROBABILITY & STATISTICS- 22AMT103

Course Name	Probability & Statistics	L	T	P	C	IM	EM	TM
Course Code	22AMT103	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course provides the knowledge about the fundamental concepts of statistics like probability theory distribution, correlation and regression techniques and sampling distributions. The purpose of the course is to provide knowledge about the techniques required for data analysis which is widely used in practical analysis of any data.

#### Course Objectives:

- The objective of this course is to introduce the basic concepts of statistics like probability theory and distributions.
- They learn the concepts of correlation and regression techniques and sampling distributions.

#### Course Learning Outcome(s):

- From this course students will be able to learn the fundamental concept of statistics and techniques required for data analysis which is widely used in practical analysis of any data.

#### Course Content:

##### UNIT-I:

Sample Space & Events - Axioms of probability- Some theorems on probability- Boole's Inequality- probability-Multiplication theorem on probability- Independent events- Multiplication theorem on probability for independent Events- Extension of Multiplication theorem on Probability to n Events- Baye's theorem.

[3.2 to 3.95 of Chapter3 & 4.2 of Chapter4]

##### UNIT-II:

Distribution functions: Discrete random variable - Continuous random variable - Two-Dimensional Random variables - Mathematical expectation - Moments of a distribution function - Moment generating functions - Characteristic functions and their properties – Chebychev inequality - Probability generating functions.

[ 5.2 to 5.5( up to 5.5.5.) of Chapter- 5, Chapter 6 except 6.7 and 7.1, 7.2, 7.3, 7.5 and 7.9 of Chapter 7]



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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#### UNIT-III:

Distributions: Discrete Distributions Binomial - Poisson distributions and their properties - Continuous distributions - Normal and Rectangular distributions and their properties.  
[ 8.1 to 8.5 of Chapter 8 and 9.1 to 9.3 of Chapter 9]

#### UNIT-IV:

Correlation and Regression: Correlation - Karl pearson's coefficient of correlation - Calculation of correlation coefficient for bivariate frequency distribution - Spearman's rank correlation coefficient - Linear regression- Regression coefficients and their properties - Angle between regression lines.

[ 10.1 to 10.5 and 10.7.1 of Chapter 10 and Chapter 11 (upto 11.2.3)]

#### UNIT-V:

Sampling distribution: Sampling and Large sample tests, Exact sampling distributions -  $\chi^2$ , t and F-distributions.

[Chapter-14, Chapter 15 up to 15.6.4 and Chapter 16 up to 16.6 except 16.4]

#### Text Book:

Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor , 11<sup>th</sup> Edition, Sultan Chand & Sons, New Delhi.

#### Reference Book:

Probability and Statistics for Engineers and Scientists, 9<sup>th</sup> edition, Walpole Myers, Keying Ye Pearson Publications.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

#### LINEAR ALGEBRA-22AMT104

Course Name	Linear Algebra	L	T	P	C	IM	EM	TM
Course Code	22AMT104	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course provides the knowledge about the consistency of the system of linear algebraic equations and the concepts of linear transformations. The course serves the purpose of providing knowledge about the vector spaces, projected to the concepts of the orthogonal properties in the spectral theory, bilinear forms and its nature.

#### Course Objectives:

- The goal of this course is to make students capable of understanding the consistency of system of linear algebraic equations and the concepts of linear transformations.
- Also projected to the concepts of orthogonal property in the spectral theory, bilinear form and its nature.

#### Course Learning Outcomes:

- Student will be able to solve linear system of equations. Provides knowledge of vector spaces and linear transformations.
- Able to diagonalize matrices and learn concepts of inner product spaces.

#### Course Content:

**Unit-I: System of linear equations:** Matrices and elementary row operations, uniqueness of echelon forms, Moore-Penrose generalized inverse, solutions of homogeneous and non homogeneous linear system of equations.

**Unit-II: Vector spaces:** vector spaces, sub spaces, bases and dimension, coordinates

**Unit-III: linear transformations:** linear transformations, algebra and representation by matrices, algebra of polynomials.

**Unit-IV: Diagonalization of matrices:** elementary canonical forms, characteristic values and characteristic vectors, Cayley-Hamilton theorem, annihilating polynomial, invariant subspaces, simultaneous triangularization, simultaneous diagonalization, Jordan form.

**Unit-V: Inner product spaces:** inner product spaces, unitary and normal operators, bilinear forms.

#### Text books:

1. Linear algebra K. Hoffman and R. Kunze, prentice hall of India, New Delhi, 2003.
2. Linear algebra done right, Sheldon Axier, springer nature, 2015, third edition.

#### Reference books:

1. First course in linear algebra, P. G. Bhattacharya, S. K. Jain and S. R. Nagpaul, Wiley eastern ltd. New Delhi, 1991.
2. Matrix and linear algebra, K. B. Datta, prentice hall of India, New Delhi,2006.



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Machilipatanam(A.P)  
**M.SC APPLIED MATHEMATICS**  
UNDER CHOICE BASED CREDIT SYSTEM(CBSE)  
w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**C - PROGRAMMING -22AMT105**

Course Name	C-Programming	L	T	P	C	IM	EM	TM
Course Code	22AMT105	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

**Course Description and Purpose:**

The course is intended to provide the complete knowledge of C-language and also helps the students to implement algorithms and draw flow charts for solving mathematical problems. The course also serves the purpose of providing knowledge to develop the logics which will help them to create programs and applications in C.

**Course Objectives:**

- This course is designed to provide the basic knowledge of C-language.
- To develop the logics which will help them to create programs in C.

**Course Learning Outcome(s):**

- From this course students will be learn to implement the algorithms and draw flow charts for solving mathematical problems.
- Able to understand the concepts of computer programming language.

**Course Content:**

**UNIT-I**

**Over view of C** - Constants - variables - Data types - operators and expressions.

[Chapters 2, 3 & 4 of the Text Book]

**UNIT-II**

**Managing Input and output operations** - Decision making – branching - decision making and looping.

[Chapters 5, 6 & 7 of the Text Book]

**UNIT-III**

**Arrays** –one dimensional, two dimensional and multi dimensional- Handling of character strings

[Chapters 8 & 9 of the Text Book]

**UNIT-IV**

**Functions**- user defined functions-. Pointers-Pointers and arrays –Pointers and functions

[Chapters 10 & 11 of the Text Book]



## **KRISHNA UNIVERSITY**

Machilipatanam(A.P)

**M.SC APPLIED MATHEMATICS**

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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### **UNIT-V**

Structures and Unions-file management in C  
[Chapter 12 and 13 of the Text Book]

#### **Prescribed Text Book:**

1. **C Programming and Data Structures** – E. Balaguruswamy, Second Edition, Tata McGraw- Hill Publishing Company (We should verify 4th edition).

#### **Reference Books:**

1. **Fundamental of C Programming** by E.Balaguruswamy
2. **Programming in C** by D. Ravichandran, 1998, New Age International.
3. **C and Data Structures** by Ashok N. Karthane, Pearson Education.



## **KRISHNA UNIVERSITY**

Machilipatanam(A.P)

**M.SC APPLIED MATHEMATICS**

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**22AMT106:**

**Personality development through Life Enlightenment Skills**

**(Common to ALL and the syllabus provided by the university and attached at the end of the syllabus)**



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### C- PROGRAMMING LAB-22AMTLAB101

Course Name	C-Programming Lab	L	T	P	C	IM	EM	TM
Course Code	22AMTLab101	0	0	6	3	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course is intended to provide the practical knowledge of C-language and also helps the students to develop programs and applications in C.

#### Course Objectives:

- This course is designed to provide the practical knowledge of C-language.
- To learn to develop the programs in C.

#### Course Learning Outcome(s):

- From this course students will learn to implement the algorithms in C
- Able to understand the concepts of computer programming language.

#### LIST OF C – PROGRAMES :

1. Factorial of a number
2. Reverse of a number
3. GCD of two numbers using EUCLIDIAN algorithm
4. Fibonacci numbers up to “N”
5. Perfect numbers up to “N”
6. Prime numbers up to “N”
7. Sum of digits of a number
8. Number palindrome
9. Find the squares of first ten natural numbers using function
10. Find biggest of three numbers using function
11. Find biggest element in an array
12. Find Transpose of a Matrix
13. Sum of the matrices
14. Product of the matrices
15. To find String length using user defined function





# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### COMPLEX ANALYSIS – 22 AMT 201

Course Name	Complex Analysis	L	T	P	C	IM	EM	TM
Course Code	22AMT201	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course gives the knowledge about the concepts of Complex integration and analytic functions. The main purpose of the course is to develop the ability to compute integrals and expand complex function in power series, finding complex integrals and applications of residues and transformations. Complex analysis is an extremely powerful tool with an unexpectedly large number of practical applications to the solution of physical problems..

#### Course Objectives:

- This course describe basic properties of complex integration.
- It gives the ability to compute integrals and to expand complex function in power series, finding complex integrals, applications of residues and transformations.

#### Course Learning Outcomes:

- This Course helps the student to evaluate complex integrals and expanding complex function in power series.
- Also able to understand the advantages of residues and the application of linear transformation.

#### Course Content:

##### UNIT-I:

Analytic Functions: Limits- Continuity- Derivatives- Differentiation Formulas-Cauchy-Riemann Equations-Proof-Sufficient conditions for Differentiability- Proof-Polar Coordinates- Analytic Functions-Harmonic Functions

[Sec 18 to 27 of Chapter 2 of the Text Book]

##### UNIT-II:

Integrals: Contours- Contour Integrals- Cauchy Theorem- Proof of the theorem- Cauchy Goursat theorem(without proof)-Simply Connected Domains- Multiply Connected Domains- Cauchy Integral Formula- An extension of Integral Formula- Some Consequences of the extension- Liouville's Theorem and the Fundamental Theorem of Algebra

[sec 42 to 45,50,52-55, 57&58 of chapter 4 of the Text Book]

##### UNIT-III:

Series: Taylor's series – Proof of Taylor's theorem- Examples- Laurent's series – Proof of Laurent's Series- Examples.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

[sec 62 to 68 of Chapter-5 of the Text Book]

#### UNIT-IV:

Residues and Poles: Isolated singular points- Residues – Cauchy’s residue theorem-proof- Residue at Infinity- the three types of isolated singular points - Residues at poles, Zeroes of analytic function- Zeroes and Poles- Evaluation of improper integrals with no root on real axis- Definite integrals involving Sines and Cosines.

[sec 74 to 83 of chapter 6 and sec85,86 & 92 of chapter 7 of the Text Book]

#### UNIT-V:

Argument principle- Rouché’s theorem- Linear Transformations: The transformation  $w=1/z$  - mappings by  $w=1/z$  - Linear fractional transformations(Problems only) - The transformation  $w=\sin z$ , Mapping by  $Z^2$ .

[93 & 94 of chapter7, sec 96-100, 103-107 of chapter 8 of the Text Book]

#### Text Book:

1. Complex Variables and Applications by James Ward Brown, Ruel V.Churchill, McGraw- Hill International Editions-Ninth Edition.

#### Reference Books:

1. Complex analysis for Mathematics and Engineering by John H.Mathews and Russel.W, Howell, Narosa Publishinghouse.
2. Complex Variables by H.S.Kasana, Prentice Hall ofIndia.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### PARTIAL DIFFERENTIAL EQUATIONS -22AMT202

Course Name	Partial Differential Equations	L	T	P	C	IM	EM	TM
Course Code	22AMT202	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course gives the knowledge about the first and second order partial differential equations and their solutions. The course also serves the purpose of providing the knowledge about the partial derivatives, Existence and uniqueness of solutions and theory of Differential equations, which are widely used in formulating wave equations and Laplace equations. The students come to know about their applications in science and engineering.

#### Course Objectives:

- The goal of this course is to provide the students with an understanding of the solutions of First and Second order Partial Differential Equations.
- They learn the applications of Partial Differential Equations.

#### Course Learning Outcome(s):

- From this course, the student will be able to learn the study of Partial derivatives on the Existence and Uniqueness of Solutions and theory of Differential Equations widely used in formulating wave equations and Laplace equations.

#### Course Content:

##### UNIT-I

**First Order PDE's:** Introduction – Methods of solution of  $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$  orthogonal trajectories

of a system of curves on a surface- Pfaffian Differential forms and equations – Solutions of Pfaffian Differential Equations in three variables – Cauchy's problem for first order PDE. [Sections 3 to 6 of Chapter 1, Sections 1 to 3 of Chapter 2]

##### UNIT-II

Linear Equations of the first order – Integral Surfaces – Orthogonal Surfaces – Non-Linear PDE of the first order – Cauchy's method of characteristics – compatible systems of first order equations – Charpit's method – special types of first order equations – Jacobi's method [Sections 4 to 13 of Chapter 2]

##### UNIT-III

Partial differential equations of the second order, their origin, linear partial differential equations with constant and variable coefficients – solutions of linear Hyperbolic equations – Method of separation of variables – Monger's method. [Sections 1 to 5 and sections 8, 9, 11 of Chapter 3]

##### UNIT-IV

Laplace Equation – elementary solutions of families of equipotential surfaces, boundary value problems, method of separation of variables of solving Laplace equation, problems with axial



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

symmetry, Kelvin's inversion theorem.[Section 1 to 7 of Chapter 4]

#### UNIT-V

The wave equation, elementary solution in one dimensional form, Riemann – Volterra solution of one dimensional wave equation.[ Sections 1 to 3 of Chapter 5]

[Problematic approach is Preferred]

#### Prescribed Text Book:

1. **Elements of partial differential equations** by I. N. Sneddon, McGraw-Hill, international edition, Mathematics series.

#### Reference Book:

1. **An Elementary Course in Partial differential equations** by T. Amaranth, Second Edition, Narosa Publishing House.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### ALGEBRA-22AMT203

Course Name	Algebra	L	T	P	C	IM	EM	TM
Course Code	22AMT203	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course is intended to help students transfer their concrete mathematical knowledge to more abstract algebraic generalizations. The purpose of the course is to introduce the basic structures of algebra like groups, rings, fields and vector spaces. The students come to know about the fundamental concept of algebra and its role in mathematics and applied contexts.

#### Course Objectives:

- The objective of the course is to introduce the basic structures of algebra like groups, rings.
- It introduces the fields and vector spaces which are the main pillars of modern mathematics.

#### Course Learning Outcome(s):

- From this course students will be able to learn the fundamental concept of algebra and their role in mathematics and applied contexts.

#### Course Content:

##### UNIT-I

**Group Theory:** Definition of a Group, Some Examples of Groups, Some Preliminary Lemmas, Subgroups, A counting Principles, Normal Subgroups and Quotient groups, Homomorphism, Automorphisms.  
(2.1 to 2.8 of the prescribed book [1])

##### UNIT-II

**Group Theory Continued:** Cayley's theorem, Permutation groups. Another counting principle.  
(2.9 to 2.11 of the prescribed book [1])

##### UNIT-III

**Group Theory Continued:** Sylow's theorem, Direct products, Finite abelian groups.  
(2.12 to 2.14 of the prescribed book [1])

##### UNIT-IV

**Ring Theory:** Definition and Examples of Rings, Some special classes of Rings, Homomorphism's, Ideals and quotient Rings, More Ideals and quotient Rings, The field of quotients of an Integral domain.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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(3.1 to 3.6 of the prescribed book [1]).

#### UNIT-V

**Ring Theory Continued:** Euclidean rings, A Particular Euclidean ring, Polynomial Rings, Polynomials over the rational field, Polynomial Rings over Commutative Rings.  
(3.7 to 3.11 of the Prescribed books [1]).

#### PRESCRIBED TEXT BOOK:

1. **Topics in Algebra** by I. N. HERSTEIN, Second Edition 1988, Wiley Eastern Limited. New Delhi.

#### REFERENCE BOOK:

1. **Basic Abstract Algebra** by BHATTACHARYA P. B., JAIN S. K., NAGPAUL S.R. Cambridge Press, Second Edition.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### NUMERICAL ANALYSIS-22AMT204

Course Name	Numerical Analysis	L	T	P	C	IM	EM	TM
Course Code	22AMT204	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course deals with the theory and application of numerical approximation techniques as well as their computer implementation. The course serves the purpose of providing knowledge to the students about computer arithmetic, solution of nonlinear equations, interpolation and approximation, numerical integration and differentiation, solution of differential equations. The course also evaluates the accuracy of common Numerical Methods.

#### Course Objectives:

- This Course is introduced a broad range of Numerical methods for solving Mathematical problems that arise in Science and Engineering.
- It helps to choose, develop and apply the appropriate Numerical techniques for the Mathematical problems.

#### Course Learning Outcome(s):

- From this Course Students are able to learn how to apply the Numerical method for various Mathematical operations and tasks.
- Able to apply Interpolation, Differentiation, Integration.
- Able to obtain the solution of Differential Equations analyses and evaluate the accuracy of common Numerical methods.

#### Course Content:

##### UNIT-I:

Transcendental and Polynomial Equations: Introduction - Bisection method - Iteration methods based on first degree equation - Secant method - Regula falsi method - Newton Raphson method - Iteration method based on second degree equation - Rate of convergence of secant method - Newton Raphson method.

[Above topics are from Chapter-2 of the Text Book]

##### UNIT-II:

System Of Linear Algebraic Equation And Eigen Value Problems: Direct methods - Introduction - Gauss Elimination Method- Gauss – Jordan Method - Triangularisation method - Iteration Methods- Jacobi iteration Method - Gauss-Seidel Iteration Method - Eigen values and Eigen vectors.

[Above topics are from Chapter-3 of the Text Book]



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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#### UNIT-III:

Interpolation And Approximation: Introduction - Lagrange Interpolation - Newton Divided Differences - Finite Difference Operators - Interpolating Polynomials using finite differences- Gregory- Newton forward difference interpolation- Backward difference interpolation - Stirling and Bessel interpolation - Hermite interpolation - Spline interpolation - Approximation: Least Square approximation.

[Above topics are from Chapter-4 of the Text Book]

#### UNIT-IV:

Numerical Differentiation and Integration: Introduction – Numerical differentiation: Methods based on finite differences.

[Above topics are from Chapter-5 of the Text Book]

#### UNIT-V:

Numerical integration: Composite integration methods-Trapezoidal rule- Simpsons rules – numerical solution of ODEs by picard – Euler - Modified Euler – Runge Kutta methods.

[Above topics are from Chapter- 6 of the Text Book]

#### Text Book:

Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International (p) Limited, Publishers, 5 th Edition.

#### Reference Book:

An Introduction to Numerical Analysis by Kendall E. Atkinson.





**KRISHNA UNIVERSITY**  
Machilipatanam(A.P)  
**M.SC APPLIED MATHEMATICS**  
UNDER CHOICE BASED CREDIT SYSTEM(CBSE)  
w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**22AMT205:**

**Research Methodology and IPR**

**(Common to ALL and the syllabus will be provided by the university and is attached at the end of the syllabus)**



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### DISCRETE MATHEMATICAL STRUCTURES - 22 AMT DSE 201

Course Name	Discrete Mathematical Structures	L	T	P	C	IM	EM	TM
Course Code	22AMTDSE201	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course is introduced to give knowledge about the concepts of mathematical logic for analyzing propositions and proving theorems. The course serves the purpose of providing knowledge about how to use sets for solving applied problems, and use the properties of set operations algebraically, Work with relations and investigate their properties.

#### Course Objectives:

- The course provided the systematic process to develop logical thinking.
- They learn the applications of logic to computer science.

#### Course Learning Outcome(s):

- From this course students are able to acquire ability to learn relations, lattices, boolean algebra and mathematical logic.

#### Course Content:

##### UNIT-I:

**Logic:** Computer Representation of sets, Mathematical Induction, Matrices, Logic, Tautology, Normal forms, Logical Inferences, Predicate Logic, Universal Quantifiers, Rules of Inference [Chapter 1 of Text Book 2]

##### UNIT-II:

**Relations and ordering:** Relations- properties of binary relations in a set - partially ordering - Partially ordered sets - representation and associated terminology.

[2-3.1, 2-3.2, 2-3.8, 2-3.9 of Chapter 2 of the Text Book]

##### UNIT-III:

**Lattices:** Lattices as partially ordered sets - some properties of Lattices - Lattices as algebraic systems - Sub-Lattices - direct product and homomorphism some special Lattices.

[4-1.1 to 4-1.5 of Chapter 4 of the Text Book]

##### UNIT-IV:

**Boolean Algebra:** Sub algebra - direct product and Homomorphism - Boolean forms and free Boolean Algebras - values of Boolean expressions and Boolean function.

[4-2.1, 4-2.2, 4-3.1, 4-3.2 of Chapter 4 of the Text Book]



**KRISHNA UNIVERSITY**  
Machilipatanam(A.P)  
**M.SC APPLIED MATHEMATICS**  
UNDER CHOICE BASED CREDIT SYSTEM(CBSE)  
w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**UNIT-V:**

**Representations and minimization of Boolean Function:** Representation of Boolean functions - minimization of Boolean functions - Finite State Machines - Introductory Sequential Circuits - Equivalence of Finite - State Machines.  
[4-4.1, 4-4.2, 4-6.1, 4-6.2 of Chapter 4 of the Text Book]

**Prescribed Text Book:**

1. **Discrete Mathematical structures with applications to Computer Science** by J.P. Trembly and R. Manohar, Tata McGraw-Hill Edition.

**Reference Book:**

1. **Discrete Mathematics for Computer Scientists and Mathematicians** by J. L. Mott, A. Kandel and T. P. Baker, Prentice-Hall India.



**KRISHNA UNIVERSITY**  
Machilipatanam(A.P)  
**M.SC APPLIED MATHEMATICS**  
UNDER CHOICE BASED CREDIT SYSTEM(CBSE)  
w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**LEBESGUE THEORY- 22 AMTDSE202**

Course Name	Lebesgue Theory	L	T	P	C	IM	EM	TM
Course Code	22AMTDSE202	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

**Course Description and Purpose:**

The course helps the students to develop the idea of logical thinking and improves their ability to learn relations, lattices, Boolean algebra, representation and minimization of Boolean functions. and mathematical logic. The course serves the purpose to provide knowledge about its application to computer science of proving statements.

**Course Objectives:**

- The objective of the course is to acquire the basic knowledge of measure theory needed to understand functional analysis.
- They learn the fundamentals such as Lebesgue measure and Riemann integral.

**Course Learning Outcome:**

- From this course students are able to learn the concepts of measure theory and differentiation

**Course Content:**

**UNIT-I:**

Algebra of sets, Lebesgue measure, Outer measure, Measurable set and Lebesgue measure, a nonmeasurable set measurable function, littlewood's Three principles(statements only).  
[From Chapter- 3 of Text book]

**UNIT-II:**

The Riemann integral, the lebesgue integral of a bounded function over a set of finite measures, the integral of a non-negative function, the general lebesgue integral, Convergence in measure. [From Chapter- 4 of Text book]

**UNIT-III:**

Differentiation of monotonic functions, functions of bounded variation, differentiation of an integral, absolute continuity.[From Chapter- 5 of Text book]

**UNIT-IV:**

$L^p$ -Spaces, the Holder's and Minkowski inequalities, convergence and completeness.  
[From Chapter- 6 of Text book]



**KRISHNA UNIVERSITY**  
Machilipatanam(A.P)  
**M.SC APPLIED MATHEMATICS**  
UNDER CHOICE BASED CREDIT SYSTEM(CBSE)  
w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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**UNIT-V:**

Measure spaces, Measurable functions ,Integration, General convergence theorems ,Signed measures

**Text Book:**

Real Analysis by H.L.Royden, Prentice Hall of India, Third Edition.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### BIO-MECHANICS-22AMTDSE203

Course Name	Bio-Mechanics	L	T	P	C	IM	EM	TM
Course Code	22AMTDSE203	4	0	0	4	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course helps the students to develop the idea of motion derived from physics to living system, like the human body. The purpose of the course is to enlighten students about its contribution to medicine, health and human movement. The course helps the students to understand its interaction in daily life.

#### Course Objective:

- This course is introduced to describe mathematical models for Blood flows and solving them in special cases.

#### Course Learning Outcome(s):

- From this course students are able to learn how to describe the biological, mechanical and neurological mechanisms and how to solve equation of motion for simple models of human movement.

#### Course Content:

##### UNIT-I:

Microbial Population Models: Microbial growth in a chemostat- Growth of Microbial Population- Product formation due to microbial action- competition for a growth rate limiting substrate in a chemostat.

##### UNIT-II:

Mathematical models in pharmacokinetics.  
Basic Equations and their Solutions for special cases.

##### UNIT-III:

Models for blood flows I: Some basic concepts of fluid dynamics - Basic concepts about blood- Cardiovascular system and blood flow.

##### UNIT- IV:

Models for blood flow 2: Steady Non- Newtonian fluid flows in circular tubes - Newtonian Pulsatile flow in Rigid and Elastic tubes - Blood flow through Artery with mild Stenosis.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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#### UNIT- V:

Models of flows for other Bio fluids: Peristaltic flow in tube and channel - Two Dimensional flow in Renal tubule - Lubrication of Human joints.

[Section 2.1, 2.2, 2.4 to 2.6 of chapter 2, Section 10.1,10.2 of Chapter 10, section 11.1,11.2,11.3 and 11.5 of Chapter 11 Sections 12.1,12.3,12.4 of Chapter 12 of Text Book]

#### Text Book:

Mathematical Models In Biology And Medicine by J.N.Kapur, Affiliated East – West press Pvt. Ltd., New Delhi.

#### Reference Book:

1. Y.C. Fung, Bio-Mechanics, Springer – Verlag, New York Inc. 1990.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

#### NUMERICAL METHODS LAB 22AMT LAB201

Course Name	Numerical Methods Lab	L	T	P	C	IM	EM	TM
Course Code	22AMTLAB201	0	0	6	3	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The course is intended to provide the practical knowledge of developing the C-programs to the numerical methods that are commonly used and have wide range of applications in various fields of science and engineering.

#### Course Objectives:

- This course is designed to provide the practical knowledge of numerical methods using C language.
- To learn to develop the programs in C for various numerical techniques of finding roots and integration.

#### Course Learning Outcome(s):

- From this course students will learn to implement the algorithms in C for numerical methods.
- Able to understand the concepts of computer programming language.

#### LIST OF PROGRAMS:

1. Bisection method
2. False position method
3. Newton Raphson method
4. Secant method
5. Gauss elimination method
6. Gauss seidal method
7. Difference table method
8. Trapezoidal method
9. Simpson 1/3 rule
10. Simpson 2/3 rule2
11. Euler's method
12. Thomas method
13. Lagranges method
14. Taylor's method
15. Runge-kutta method
16. Modified Euler's method





# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### 22AMT106: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENEMENT SKILLS

Course Name	Personality Development Through Life Enlightenment Skills	L	T	P	C	IM	EM	TM
Course Code	22AMT106	3	0	1	3	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

Personality development is the development of your behavior patterns and attitude. It is the result of where we are born, the circle we interact with and our personal temperament. Every person is different. There are some characteristics traits that make you „you“. Personality development through life enlightenment course aims to help students identify negative behaviors which may be stopping them from reaching their desired goals. This course will help students both in their personal and desired professional life. The other purposes of personality development through life enlightenment course are to enable you lead stress-free and healthier life, ethical decision making ability, enhanced confidence level, and building a more pleasing personality.

#### Course Objectives:

The Course will introduce the students to Learn to achieve the highest goal happily.

- 1) Become a person with stable mind, pleasing personality and determination.
- 2) Learn to build positive attitude, self-motivation, enhancing self-esteem and emotional intelligence
- 3) Learn to develop coping mechanism to manage stress through Yoga and meditation techniques
- 4) Awaken wisdom among them.

#### Course Learning Outcomes:

At the end of this course the students should be able to:

- Develop their personality and achieve their highest goals of life.
- Lead the nation and mankind to peace and prosperity
- Practice emotional self regulation.
- Develop a positive approach to work and duties
- Develop a versatile personality

#### Course Content:

##### UNIT I

##### Introduction to Personality Development

The concept of personality - Dimensions of Personality – Theories of Personality development (Freud & Erickson) – The concept of Success and Failure – Factors responsible for Success – Hurdles in achieving Success and Overcoming Hurdles — Causes of failure – Conducting SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis.

##### UNIT II

##### Attitude, Motivation and Self-esteem

Conceptual overview of Attitude – Types of Attitudes – Attitude Formation – Advantages/Disadvantages of Positive/Negative Attitude - Ways to Develop Positive Attitude **Concept of motivation:** Definition and Nature of Motivation/Motive – Internal and external motives – Theories of Motivation – Importance of self- motivation- Factors leading to de- motivation. **Self-esteem** - Definition and Nature of self-esteem – Do's and Don'ts to develop positive self- esteem – Low self-esteem - Personality having low self-esteem - Positive and negative self-esteem.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### UNIT III

#### Other Aspects of Personality Development

Body language - Problem-solving - Conflict Management and Negation skills - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics – Good manners and etiquette – Emotional Ability/Intelligence – Dimensions of Emotional Intelligence – Building Emotional Intelligence.

### UNIT IV

#### Neetisatakam-Holistic Development of Personality

Verses- 19,20,21,22 (wisdom) – Verses- 29,31,32 (pride and heroism) – Verses- 26,28,63,65(virtue)

#### Personality of Role Model – Shrimad Bhagwadgeeta

Chapter2-Verses 17 – Chapter 3-Verses 36,37,42 – Chapter 4-Verses 18, 38,39 – Chapter18 –Verses 37,38,63

### UNIT V

#### Yoga & Stress Management

Meaning and definition of Yoga - Historical Perspective of Yoga - Principles of Astanga Yoga by Patanjali - Meaning and Definition of Stress - Types of Stress - Eustress and Distress –Stress Management – Pranayama-Pranayama: Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati -Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama – Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT) (Theory & Practical).

#### PRACTICAL COMPONENTS:

- Students should identify different types of personality to know their own personality. Students are to describe the characteristics of their personalities and submit the same for assessment.
- Students are to form in groups (a group consists of 4-6 students) to identify and write a brief note on famous personalities of India and World.
- Students are required to identify different types of attitudes and give any five examples of each.
- Students are expected to check their attitudes and develop ways to improve their attitudes at work place and home.
- Students are required to identify keys to self-motivation to achieve their goals.
- Students are expected to identify at least seven types of body language and conduct activities with the following:

S. No.	Pose	Possible Interpretations
1	Standing with your hands on your hips	Aggressive, disgusted
2	Standing upright	Confidence
3	Arms crossed on your chest	Defensive
4	Resting your hand on your cheek	Thinking
5	Touching or rubbing your nose	Doubt, lying
6	Resting your head in your hands	Boredom, tired
7	Tapping your fingers	Impatience
8	Biting your nails	Nervous, insecure
9	Playing with your hair	Insecure
10	Rubbing your eyes	Disbelief, doubt



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

Conduct the following exercise to develop communication skills – Negotiation Skills and Empathy

#### **Exercise: Card Pieces**

In this activity, team members trade pieces of playing cards to put together complete cards.

**Uses -This exercise is useful for showing team members others' perspectives. It builds communication and negotiation skills , and helps people to develop empathy .**

#### **People and Materials**

- Enough people for at least three teams of two.
- Playing cards – use between four and six for each person.
- A private room.

**Time -15 minutes.**

#### **Instructions:**

1. Cut each playing card into half diagonally, then in half diagonally again, so you have four triangular pieces for each card.
2. Mix all the pieces together and put equal numbers of cards into as many envelopes as you have teams.
3. Divide people up into teams of three or four. You need at least three teams. If you're short of people, teams of two will work just as well.
4. Give each team an envelope of playing card pieces.
5. Each team has three minutes to sort its pieces, determine which ones it needs to make complete cards, and develop a bargaining strategy.
6. After three minutes, allow the teams to start bartering for pieces. People can barter on their own or collectively with their team. Give the teams eight minutes to barter.
7. When the time is up, count each team's completed cards. Whichever team has the most cards wins the round.

#### **Advice for the Teacher/Facilitator**

After the activity, ask your team members to think about the strategies they used. Discuss these questions:

- 1) Which negotiation strategies worked? Which didn't?
- 2) What could they have done better?
- 3) What other skills, such as **active listening** or **empathy** , did they need to use?

Conduct following Time management activity - Ribbon of Life

Take a colored ribbon length of approximately 1 meter/100 cm. and scissors. Start with the following questions:

1. If the life span of an individual is say, 100 years. Consider that each cm represents one year. The response will be that few live that long. Assuming a life of 75 to 90 years, cut 10 to 25 cm off the ribbon, accordingly.
2. What is the average age of the participants sitting here, the response would be 25 to 30 depending on the group, in that case, cut another 25 cms of the ribbon and say that is gone you cannot do anything.
3. What is left is 50 years? People will say, "Yes," but the answer is NO.
4. Every year we have 52 weeks, that is 52 Sundays. If we multiply that by 50 years, it comes to 7.14 years. Reduce the ribbon by another 7.14 cm.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

5. We also usually have Saturdays off, so reduce another 7. cms.
6. Public/National holidays are 10 multiple with 50 years. That comes to another 1.5 years. Reduce ribbon by another 1.5 cms.
7. Your casual leave, sick leave, and annual holidays approx. 40 days a year, multiplied by 50. Cut off another 5 cms. Now you are left with about 29.5 years. But, the calculation is not over yet.
8. You sleep an average of 8 hours daily; multiply that by 365 days and again by 50 years ( i.e. 122 days X 50 = almost 17 years). Cut off another 17 cm.
9. You spend time eating lunch, breakfast, snacks, and dinner total 2 hours daily (i.e.30 days a year X 50 years= 4 years or so). Cut off another 4 cm.
- 10.Last, lets figure we spend about 1 hour a day traveling from place to place for activities and such. (thats about 2 more years). We're down to 6 (SIX ) years of life to make it or break it.

- **Exercise Decision making skills - Create Your Own**

In this exercise, teams must create their own, brand new, problem-solving activity.

#### Uses

This game encourages participants to think about the problem-solving process. It builds skills such as creativity, negotiation and decision making, as well as communication and time management. After the activity, teams should be better equipped to work together, and to think on their feet.

#### What You'll Need

- Ideally four or five people in each team.
- A large, private room.
- Paper, pens and flip charts.

**Time -Around one hour.**

#### Instructions:

1. As the participants arrive, you announce that, rather than spending an hour on a problem-solving team building activity, they must design an original one of their own.
2. Divide participants into teams and tell them that they have to create a new problem-solving team building activity that will work well in their organization. The activity must not be one that they have already participated in or heard of.
3. After an hour, each team must present their new activity to everyone else, and outline its key benefits.

#### Advice for the Teacher/Facilitator:

There are four basic steps in problem solving : defining the problem, generating solutions, evaluating and selecting solutions, and implementing solutions. Help your team to think creatively at each stage by getting them to consider a wide range of options. If ideas run dry, introduce an alternative brainstorming technique, such as brain writing . This allows your people to develop one others' ideas, while everyone has an equal chance to contribute.

After the presentations, encourage teams to discuss the different decision-making processes they followed. You might ask them how they communicated and managed their time . Another question could be about how they kept their discussion focused. And to round up, you might ask them whether they would have changed their approach after hearing the other teams' presentations.



## KRISHNA UNIVERSITY

Machilipatanam(A.P)

### M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

- Students are asked to recite verses: 26,28,63,65 (virtue) of Neetisatakam-Holistic development of personality.
- Students are asked to identify personality of role Mmodels from Shrimad Bhagwadgee ta and portray the roles of the same.
- Students are asked to practice Yoga and meditation techniques

#### REFERENCE BOOKS:

1. Hurlock, E.B. Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill,2006.
2. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's ThreeSatakam, Niti-sringar- vairagya, New Delhi, 2010
3. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram,Publication Department,Kolkata, 2016.
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House.2005.
7. Smith, B. Body Language. Delhi: Rohan Book Company. 2004
8. Yogic Asanas for Group Training - Part-I: Janardhan Swami Yogabhyasi Mandal,Nagpur.
9. Rajayoga or Conquering the Internal Nature by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
10. Nagendra H.R nad Nagaratna R, Yoga Perspective in Stress Management, Bangalore, Swami Vivekananda Yoga Prakashan.

#### Online Resources:

1. [https://onlinecourses.nptel.ac.in/noc16\\_ge04/preview](https://onlinecourses.nptel.ac.in/noc16_ge04/preview)
2. <https://freevideolectures.com/course/3539/indian-philosophy/11>



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### 22AMT 205: RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS (IPR)

Course Name	Research Methodology & IPR	L	T	P	C	IM	EM	TM
Course Code	22AMT 205	3	0	1	3	30	70	100

L-Lecture, T-Tutorial, P-Practical, C-Credits, IM-Internal Marks, EM-External Marks, TM-Total Marks

#### Course Description and Purpose:

The aim of this course is to develop research bent of mind (spirit of inquiry) and impart research skills to the all Post graduate students. It also encompasses the series of research methodology contents: from problem formulation, to design, to data collection, analysis, reporting and dissemination. This course also covers intellectual property rights (IPR), and intended to equip students with conceptual understandings of current scenario of IPR, and the practical issues encountered in filing patents, trademarks and copyrights.

#### Course Objectives:

- ✓ To understand some basic concepts of research and its methodologies
- ✓ To develop an understanding of the basic framework of research process.
- ✓ To develop an understanding of various research designs and techniques.
- ✓ To identify various sources of information for literature review and data collection.
- ✓ Ability to write a research Proposal, report and thesis
- ✓ To demonstrate knowledge and understanding of IPR Filing and Rights

#### Course Learning Outcomes:

At the end of this course the students should be able to:

- Understand some basic concepts of research and its methodologies
- Identify appropriate research topics
- Select and define appropriate research problem and parameters
- Demonstrate the ability to choose methods appropriate to research aims and objectives
- Have adequate knowledge on measurement & scaling techniques
- Have basic awareness of data analysis-and hypothesis testing procedures
- Prepare a project proposal (to undertake a project)
- Write a research report and thesis
- File Patents, Trademarks and Copy Rights

#### Course Content:

##### UNIT I

##### Foundations of Research

Meaning of Research – Definitions of Research – Motivation in Research – General Characteristics of Research – Criteria of Good Research – Types of Research – Research Process – Research Methods vs. Methodology – Defining and Formulating the Research Problem – Review of Literature – Approaches to Critical Literature Review – Importance of Literature Review in Identifying Research Gaps and Defining a Problem – Development of Working Hypothesis.

##### UNIT II

##### Research Design, Sampling Concepts, and Data Collection Methods

Meaning, Significance and Characteristics of Good Research Design – Types of Research Design: Exploratory, Conclusive Research and Experimental – Sampling Theory: Types of Sampling and Errors in Sampling – Data Collection: Types of Data – Data Collection Methods and Techniques for Primary and Secondary Data.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

### UNIT III

#### Measurement & Scaling Techniques, Hypothesis Formulation and Testing, Overview of Data Analysis and Report Writing

Basic measurement scales – Reliability & Validity – Definition and Types of Hypothesis – Hypothesis Formulation and Testing Procedure – Overview of Data Analysis: Methods, Process and Types – Report Writing: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports – How to Write a Research Proposal - Research Ethics, Conflict of Interest and Plagiarism.

### UNIT IV

#### Intellectual Property Rights (IPR)

Definition and Nature and Features of Intellectual Property Rights (IPR) – Types of Intellectual Property Rights – Procedure for Grants of Patents – Rights of a Patent – Scope of a Patent Rights – Licensing and Transfer of Technology – Why protection of intellectual property is important? – Enforcement of IPR – Infringement of IPR.

### UNIT V

#### Indian and International Scenario and New Developments in IPR

IPR Developments in India for the past Five Years – Development of IPR Laws in India – International Cooperation on IPR – New Developments in IPR – Administration of Patent System – International Patent protection – Case Studies in Indian and Global Contexts.

#### PRACTICAL COMPONENTS:

- Students should identify different research problems with examples and describe the characteristics of researchable problems in their academic area/society/community/organization concerned.
- Students are to form in groups (a group consists of 4-6 students) and conduct critical literature survey with regard to the identified research problems and prepare a brief literature review coupled with research gaps and working hypothesis.
- Students are required to identify and develop good research design to address the defined research problems.
- Students are expected to write the research design on Exploratory and Descriptive Research.
- Students are required to develop practical experience in writing a research proposal by conducting a thorough critical review of any three research proposals (examples).
- Students are expected to develop templates for technical report writing.
- Students should conduct a team based mini research project, which is a unified and practical case on a topic of their choice, with approximately 4-6 students per group.
- Students are expected to identify types of plagiarism in academic research, and how to avoid plagiarism in research.
- Students are asked to identify and submit a brief report on Indian patents of International repute.
- Students are asked to write on Patent registration procedure, and visit Official website of Intellectual Property India <https://ipindia.gov.in> to know how to get IPR in India.
- Students are asked to identify and summarise remedies available against the infringement of intellectual property rights in Indian and global contexts.
- Students are asked to submit any five examples of ethical issues in copyright and patents.



# KRISHNA UNIVERSITY

Machilipatanam(A.P)

## M.SC APPLIED MATHEMATICS

UNDER CHOICE BASED CREDIT SYSTEM(CBSE)

w.e.f. 2022-2023 Admitted Batch (R22 Regulations)

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2. Cohen, L. Lawrence, M., & Morrison, K. (2005), Research Methods in Education (5th edition). Oxford: Oxford University Press.
3. Kothari, C.R., 1990, Research Methodology: Methods and Techniques, New Age International.
4. Dornyei, Z. (2007). Research Methods in Applied Linguistics. Oxford: Oxford University Press.
5. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009, Research Methods: A Process of Inquiry, Allyn and Bacon.
6. Fink, A., 2009, Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.
7. Day, R.A., 1992, How to Write and Publish a Scientific Paper, Cambridge University Press.
8. Wadehra, B.L. 2000, Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
9. Coley, S.M. and Scheinberg, C. A., 1990, Proposal Writing, Sage Publications.
10. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options, Zed Books, New York.
11. Leedy, P.D. and Ormrod, J.E., 2004, Practical Research: Planning and Design, Prentice Hall.
12. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

### Important Websites:

- [www.ipindia.nic.in](http://www.ipindia.nic.in) - Intellectual Property Office, India
- [www.patentoffice.nic.in](http://www.patentoffice.nic.in) – Patent office, India
- <http://copyright.gov.in/> - Copyright Office, India
- [ipr.icegate.gov.in](http://ipr.icegate.gov.in) – Automated Recordation & Targeting for IPR Protection
- <http://www.icegate.gov.in>- E- Commerce portal of Central Board of Excise and Customs
- [www.ipab.tn.nic.in](http://www.ipab.tn.nic.in) - Intellectual Property Appellate Board, India
- [www.mit.gov.in](http://www.mit.gov.in) – Department of Information Technology, India
- <http://www.mit.gov.in/content/office-semiconductorintegrated-circuits-layout-designregistry>
- Semiconductor Integrated Circuits Layout-Design Registry (SICLDR)
- [www.plantauthority.gov.in](http://www.plantauthority.gov.in) – Plant Varieties and Farmers' Rights Authority, India
- <http://nbaindia.org/> - National Biodiversity Authority
- [www.nipo.in](http://www.nipo.in) – The Indian IPR Foundation
- [www.wipo.int](http://www.wipo.int) – World Intellectual Property Organisation
- <http://www.wto.org> – World Trade Organisation.