KANNUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

SYLLABUS

COMPUTATIONAL MATHEMATICS

(*Effective from 2024 admissions*)

KANNUR UNIVERSITY

VISION AND MISSION STATEMENTS

Vision

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

INTRODUCTION

Kannur University – Four Year Undergraduate Programme:

Backdrop and Context

The implementation of the Four-Year Undergraduate Programme (FYUGP) has been driven by the pressing need to address contemporary challenges ensuring responsive changes to the evolving needs of students, industry, and society at large. Recognizing the curriculum as the cornerstone of any education system, it requires regular refinement to align with evolving socio-economic factors. Higher education must provide students with practical and technical skills relevant to their fields of interest, necessitating the development of a job-oriented curriculum. Despite significant increases in access and expansion of higher education over the years, concerns persist regarding the quality and relevance of educational outcomes, particularly in terms of employability skills. As the world becomes increasingly interconnected, our education system must evolve to instill 21st-century skills, enabling students not only to survive but to thrive in this dynamic environment. Moreover, there is a growing need for higher education institutions to embrace social responsibility and contribute to the development of a knowledge society capable of driving sustainable development through innovation. With the central objective of fostering a robust knowledge society to support a knowledge economy, the Government of Kerala has initiated steps to reform higher education. Accordingly, three commissions were established to suggest reforms in higher education policy, legal and regulatory mechanisms, and evaluation and examination systems. It is within this context that a comprehensive reform of the undergraduate curriculum has been proposed, leading to the restructuring of the Four-Year Undergraduate Programme.

KANNUR UNIVERSITY

PROGRAMME OUTCOMES

PO1: **Critical Thinking and Problem-Solving**-Apply critical thinking skills to analyze information and develop effective problem-solving strategies for tackling complex challenges.

PO2: **Effective Communication and Social Interaction**-Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.

PO3: **Holistic Understanding**-Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex issues.

PO4: **Citizenship and Leadership**-Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.

PO5: **Global Perspective**-Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.

PO6: **Ethics, Integrity and Environmental Sustainability**-Uphold high ethical standards in academic and professional endeavors, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.

PO7: **Lifelong Learning and Adaptability**-Cultivate a commitment to continuous selfdirected learning, adapting to evolving challenges, and acquiring knowledge throughout life.

PREFACE

Computational Mathematics focuses on using numerical methods and algorithms to solve mathematical problems and perform mathematical computations with the aid of computers. It bridges the gap between theoretical mathematics and practical applications in various fields, including science, engineering, finance, and more. The computational mathematics bachelor degree combines the beauty and logic of mathematics with the application of today's fastest and most powerful computers.

The skills one learn in the Computational Mathematics Degree can be applied to everyday life, from computing security and telecommunication networking to routes for school buses and delivery companies. The degree provides Computational Mathematics courses such as Calculus, Differential equations, Graph theory, Abstract and Linear Algebra, Mathematical Modeling, Numerical Analysis.

Dr. C.P. Santhosh
Chairman
UG Board of Studies in Mathematics
Kannur University

PROGRAMME SPECIFIC OUTCOMES

PSO1: Recall basic facts about mathematics and able to display knowledge of conventions such as notations, terminology.

PSO2: Abstract, rigorously model and analyze a variety of problems using appropriate mathematical and computational concepts.

PSO3: Apply knowledge and skills to translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw relevant conclusion.

PSO4: Formulate real world problems into mathematical models and find solutions.

PSO5: Develop proficiency in using mathematical softwares and programming Languages.

PSO6: Understand the impact of solutions in economical, societal and environmental contexts

PSO7: Develop a positive attitude towards mathematics as an interesting and valuable subject of study.

KANNUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

COMPUTATIONAL MATHEMATICS HONOURS/HONOURS WITH RESEARCH

PROGRAMME STRUCTURE

B.Sc. Computational Mathematics Pathway Courses (2024 admission onwards)							
Sl. No.	***Level***	***Course Code***	***Semester***	***Name of course***	***Credits***	***Major Pathway Courses***	***Whether Elective***
I Year							
1	100-199	KU1DSCCMT101	I	Computational Differential Calculus	4	1	
2	100-199	KU2DSCCMT101	II	Computational Integral Calculus	4	2	
II Year							
3	200-299	KU3DSCCMT201	III		4	3	
4	200-299	KU3DSCCMT202	III		3+1	4	
5	200-299	KU4DSCCMT201	IV		3+1	5	
6	200-299	KU4DSCCMT202	IV		3+1	6	
7	200-299	KU4DSCCMT203	IV		3+1	7	
III Year							
8	300-399	KU5DSCCMT301	V		4	8	
9	300-399	KU5DSCCMT302	V		3+1	9	
10	300-399	KU5DSCCMT303	V		3+1	10	
11	300-399	KU5DSECMT301	V		4	11/12(a)	Elective
12	300-399	KU5DSECMT302	V		4	11/12(b)	Elective
13	300-399	KU5DSECMT303	V		4	11/12(c)	Elective
14	300-399	KU5DSECMT304	V		4	11/12(d)	Elective
15	300-399	KU5DSECMT305	V		4	11/12(e)	Elective
16	300-399	KU5DSECMT306	V		4	11/12(f)	Elective
17	300-399	KU6DSCCMT301	VI		4	13	
18	300-399	KU6DSCCMT302	VI		3+1	14	
19	300-399	KU6DSCCMT303	VI		3+1	15	
20	300-399	KU6DSECMT301	VI		4	16/17(a)	Elective
21	300-399	KU6DSECMT302	VI		4	16/17(b)	Elective
22	300-399	KU6DSECMT303	VI		4	16/17(c)	Elective
23	300-399	KU6DSECMT304	VI		4	16/17(d)	Elective

24	300-399	KU6DSECMT305	VI		4	16/17(e)	Elective
25	300-399	KU6DSECMT306	VI		4	16/17(f)	Elective
26		KU6INTCMT301	VI	Internship/Apprenticeship/Field Trip	2	18	
Courses For BSc Computational Mathematics Honours/Honours with Research (VII and VIII Semesters)							
27	400-499	KU7DSCCMT401	VII		4	19	
28	400-499	KU7DSCCMT402	VII		4	20	
29	400-499	KU7DSCCMT403	VII		4	21	
30	400-499	KU7DSCCMT404	VII		4	22	
31	400-499	KU7DSCCMT405	VII		4	23	
32	400-499	KU8DSCCMT401	VIII		4	24	
33	400-499	KU8DSCCMT402	VIII		4	25	
34	400-499	KU8DSCCMT403	VIII		4	26	
35	400-499	KU8DSECMT401	VIII	Research Methodology	4	27/28/29 (a)	Elective
36	400-499	KU8DSECMT402	VIII		4	27/28/29 (b)	Elective
37	400-499	KU8DSECMT403	VIII		4	27/28/29 (c)	Elective
38	400-499	KU8DSECMT404	VIII	MOOC/Online Course I	4	27/28/29 (d)	Elective
39	400-499	KU8DSEMAT405	VIII	MOOC/Online Course II	4	27/28/29 (e)	Elective
40	400-499	KU8DSEMAT406	VIII	MOOC/Online Course III	4	27/28/29 (f)	Elective
41	400-499	KU8CIPCMT 400	VIII	Capstone Internship Project in Honours Programme in Computational Mathematics	8	30(a)	
42	400-499	KU8PHRCMT400	VIII	Project in Honours with Research Programme in Computational Mathematics	12	30(b)	

SEMESTERWISE DISTRIBUTION OF COURSES FOR

FOUR YEAR U G PROGRAMME IN COMPUTATIONAL MATHEMATICS

(2024 ADMISSION ONWARDS)

SEMESTER 1

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	AEC 1 (English)	3	3	25	50	75
2	AEC 2 (Additional Language)	3	3	25	50	75
3	MDC 1	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		21			

SEMESTER II

No	Title	Hours/week	Credit	CE	ESE	Total marks
1	AEC 3 (English)	3	3	25	50	75
2	AEC 4 (Additional Language)	3	3	25	50	75
3	MDC 2	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		21			

SEMESTER III

No	Title	Hours/w eek	Credit	CE	ESE	Total marks
1	MDC 3	3	3	25	50	75
2	VAC 1	3	3	25	50	75
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSC (Minor 1)	4	4	30	70	100
6	DSC (Minor 2)	4	4	30	70	100
	Total credits		22			

SEMESTER IV

No	Title	Hours/week	Credit	CE	ESE	Total marks
1	SEC 1	3	3	25	50	75
2	VAC 2	3	3	25	50	75
3	VAC 3	3	3	25	50	75
4	DSC (Major)	4	4	30	70	100
5	DSC (Major)	4	4	30	70	100
6	DSC (Major)	4	4	30	70	100
	Total credits		21			

SEMESTER V

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	SEC 2	3	3	25	50	75
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSE (Major Elective)	4	4	30	70	100
6	DSE (Major Elective)	4	4	30	70	100
	Total credits		23			

SEMESTER VI

No	Title	Hours/ week	Credit	CE	ESE	Total mark s
1	SEC 3	3	3	25	50	75
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSE (Major Elective)	4	4	30	70	100
6	DSE (Major Elective)	4	4	30	70	100
7	Internship	2	2			
	Total credits		25			

EXIT WITH UG DEGREE/PROCEED TO FOURTH YEAR WITH 133 CREDITS

17 Major course *:17 x 4 = 68 credits*

6 minor course *:6 x 4 = 24 credits*

13 foundation courses (AEC, SEC, VAC, MDC) *:13 x 3 = 39 credits*

1 Internship *:2 x1 = 2 credits*

Total ***: 133 credits***

SEMESTER VII

No	Title	Hours/ week	Credit	CE	ESE	Total marks
1	DSC (Major)	4	4	30	70	100
2	DSC (Major)	4	4	30	70	100
3	DSC (Major)	4	4	30	70	100
4	DSC (Major)	4	4	30	70	100
5	DSC (Major)	4	4	30	70	100
	Total credits		20			

SEMESTER VIII

	Toatal Credit	Total marks for CE	Total marks for ESE	Total marks
Project and Courses as per the FYUGP Regulation	24	180	420	600

DISCIPLINE SPECIFIC COURSES

KU1DSCCMT101
COMPUTATIONAL DIFFERENTIAL CALCULUS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100-199	KU1DSCCMT101	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course is to introduce the notion of limits, continuity, derivatives, optimization problem, antiderivatives and to discuss applications of differentiation.

Course Prerequisite

Functions

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Comprehend exponential functions, inverse functions, logarithmic function and hyperbolic functions	Understand
2	Understand the notion of limit and limit laws	Understand
3	Understand continuity of a function	Understand
4	Comprehend the notion of derivative of a function and differentiation rules	Understand
5	Understand indeterminate forms	Understand
6	Understand the effect of derivative on the shape of graph of a function	Understand
7	Comprehend antiderivatives	Understand

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		✓	✓				
CO 2			✓		✓		
CO 3	✓						✓
CO 4	✓		✓				
CO 5	✓		✓				
CO 6					✓		
CO 7			✓			✓	

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Functions and Limits**	12
	1	**Functions**	
		a) Exponential functions	
		b) Inverse functions	
		c) logarithmic functions	
	2	**Limits**	
		a) Limit of a function and limit laws	
		b) continuity	
		c) Horizontal Asymptotes	
II		**Differentiation of functions and Extreme values of a function**	12
	1	Derivatives and rate of change	

	2	Hyperbolic functions	
	3	**Extreme values of a function**	
		a) Maximum values	
		b) Minimum values	
		c) The mean value Theorem	
III	**Application of derivatives**		**12**
	1	**Shape of graph of a function**	
	2	**Indeterminate forms**	
		a) L 'Hospital rule	
IV	**Optimization problem and antiderivatives**		**12**
	1	Optimization problem	
	2	Antiderivatives	
V	**Teacher Specific Module**		**12**
	Directions		
	Summary of curve sketching, graphing with calculus and calculator(Sections4.5 to 4.6), Illustration of the topic in module I to module IV using softwares like GeoGebra, Demos Calculator etc.		
	Any other topic related to modules I, II, III & IV		

Essential Readings

1. James Stewart, Calculus; Early Transcendentals, 9th Edition, Cengage Learning 2021.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 1.4, 1.5	
	2	1	Section 2.2 ,2.3, 2.5,2.6	
II	1	1	Section 2.7,3.11	

	2	1	Sections 4.1,4.2	
III	1	1	Section 4.3	
	2	1	Sections 4.4	
IV	1	1	Sections 4 .7,4.9	

Suggested Readings

1. B.S. Grewal, Higher Engineering Mathematics (43rd edition), Khanna Publishers
2. G.B. Thomas Jr., M.D. Weir and J.R. Hass, Thomas' Calculus: Early Transcendentals (12th edition), Pearson Education.
3. H. Anton, I. Bivens and S. Davis, Calculus (10th edition) , Willey
4. S. Narayan and P.K. Mittal, Integral Calculus, Revised Edition, S. Chand & Company Ltd.
5. S. Narayan and P.K. Mittal, Differential Calculus, Revised Edition, S. Chand & Company Ltd.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

* A student has to appear for at least two written tests. Average mark of best two tests is to be considered for internal mark.

****Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**

KU2DSCCMT101: COMPUTATIONAL INTEGRAL CALCULUS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC	100-199	KU2DSCCMT101	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

In this course the student will learn the definite integral of a function, techniques to evaluate trigonometric integrals, and applications of integration. Also to approximate the value of a definite integral using the different methods of numerical integration.

Course Prerequisite

Integrals of basic functions and rules of integration

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the fundamental theorem of calculus and apply it to find the derivatives and integrals of certain functions.	Understand
2	Apply the notion of definite integrals to find area between curves, volumes using cross-sections, arc length and areas of surfaces of revolution	Apply
3	Understand integration by successive reduction and apply reduction formulas to evaluate trigonometric integrals	Understand
4	Understand the concept of polar coordinates and apply it to find areas under the curves and length of curves	Apply
5	Understand numerical integration and apply the different numerical integration methods to approximate the value of a definite integral.	Apply

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓	✓					✓
CO 2						✓	
CO 3	✓						
CO 4	✓	✓					
CO 5					✓		
CO 6	✓						
CO 7	✓						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Integrals and it's applications**	**12**
	1	a)The Definite integral,	
		b) The Fundamental theorem of Calculus,	
		c) Indefinite integrals and the Net change theorem	
	2	**Application of Integration**	
		a) Area between curves	
II		**Application of Integration ,Reduction formulas and trigonometric Integrals**	**12**
	1	**Applications of Integration**	
		a) Volumes,	
		b) Volumes by cylindrical shells	
		c) Work	
		d) Average value of a function	
	2	**Reduction formulas and trigonometric Integrals**	

		a) Reduction formulas and corresponding problems (From the exercise only)	
		b) Trigonometric integrals	
III	**Further applications of integration, Polar Co-ordinates**		**12**
	1	**Applications of integration**	
		a) Arc length	
		b) Area of a surface of revolution	
	2	**Polar Coordinates**	
		a) Polar Coordinates	
		b) Areas and Lengths in Polar Coordinates	
IV	**Numerical Integrations.**		**12**
	1	a) Numerical Integration,	
		b) Left End Points, Right End Points and Midpoint Sums	
		c) Trapezoidal Sums	
		d) Simpson's Rule	
		e) Gaussian Quadrature	
V	**Additional Topic offered by teacher**		**12**
	Directions		
	Discuss the geometry of problems solved in Unit I to Unit III using various softwares like Geogebra, Desmos Calculator etc.		
	Relevant Problems in Unit IV from the reference books		
	Any other topic related to modules I, II, III & IV		

Essential Readings

1. Calculus Early Transcedentals,Metric version,James Stewart,Daniel Clegg, Saleem Watson 9th Edition, Cengage Learning, 2021.
2. Introduction to computational Mathematics, William C. Bauldry, First edition, CRC Press.

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	Sections 5.2, 5.3, 5.4	
	2	1	Section 6.1	

II	1	1	Section 6.2, 6.3, 6.4, 6.5	
	2	1	Sections 7.1, 7.2	*Only reduction formulas from section 7.1 and its exercises*
III	1	1	Sections 8.1, 8.2	
	2	1	Sections 10.3, 10.4	
IV	1	2	Sections 1, 2, 3, 4, 5 from Chapter V	

Suggested Readings

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition , Willey
2. G.B Thomas Jr.,M.D Weir and Joel R.Hass, Thomas' Calculus(12th edition),Pearson,2009
3. S.K Stein, Calculus and Analytic Geometry, McGraw Hill, 1992.
4. G.F Simmons, Calculus with analytic Geometry(second edition)McGraw Hill,1995.
5. S.S Sastry, Introductory methods of numerical analysis, Fifth edition, PHI
6. M.K Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods For Scientific And Engineering Computation (4th Edition) New Age International Publications.

Assessment Rubrics

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		**100**

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