

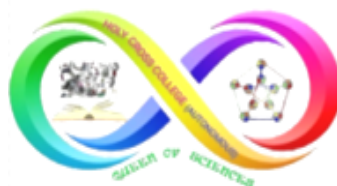
Holy Cross College (Autonomous), Nagercoil
Kanyakumari District, Tamil Nadu.
Accredited with A⁺ by NAAC - IV cycle – CGPA 3.35

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli



Semester I - IV
POs, PSOs & COs

DEPARTMENT OF MATHEMATICS



2023-2026
(With effect from the academic year 2024-2025)

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO 1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1& M2
PEO 2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	M3, M4, M5 & M6

Programme Outcomes (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	PEOs Addressed
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	PEO 1
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	PEO2
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	PEO 2
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	PEO 1&PEO 3
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	PEO 2&PEO 3
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	PEO 2& PEO 3
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to develop knowledge and skills.	PEO1 & PEO 3

Programme Specific Outcomes (PSOs)

PSO	Upon completion of B.Sc. Mathematics, the graduates will be able to:	Mapping with POs
PSO – 1	acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.	PO1
PSO – 2	understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.	PO6
PSO - 3	apply Mathematical theories and principles accurately, precisely and effectively including higher research and extensions	PO3 &PO7
PSO – 4	prepare the students who will demonstrate respectful engagement with other’s ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions	PO5 &PO6
PSO – 5	create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations	PO2 &PO4

Mapping of PO’S and PSO’S

POs	PSO1	PSO 2	PSO3	PSO4	PSO5
PO 1	S	M	M	M	M
PO 2	M	M	M	M	S
PO 3	M	M	S	M	M
PO4	M	M	M	M	S
PO5	M	M	M	S	M
PO6	M	S	M	S	M
PO7	M	M	S	M	M

Strong -S (3), Medium – M (2), Low – L (1)

COURSE OUTCOMES
SEMESTER I
CORE COURSE I: ALGEBRA & TRIGONOMETRY
Course Code : MU241CC1

On the successful completion of the course, student will be able to:		
1.	know the definitions and properties of the Remainder Theorem, equations with real and rational coefficients, and the transformations of equations	K1
2.	find eigen values, eigen vectors, verify Cayley — Hamilton theorem and diagonalize a given matrix	K1
3.	expand the powers and multiples of trigonometric functions in terms of sine and cosine	K2
4.	classify and solve reciprocal equations	K2
5.	determine relationship between circular and hyperbolic functions and the summation of trigonometric series	K3

K1 - Remember; **K2** - Understand; **K3** - Apply

SEMESTER I
CORE COURSE II: DIFFERENTIAL CALCULUS
Course Code: MU241CC2

On the successful completion of the course, student will be able to:		
1	recall the definitions and basic concepts of Differential Calculus.	K1
2	understand the concepts of Differentiation, Partial Differentiation, Envelope & Curvature.	K2
3	determine Partial derivatives of a function of two variables and use Lagrange's method of undetermined multipliers.	K2
4	distinguish between partial and ordinary differential equations.	K3
5	find the radius of curvature using polar co-ordinates.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply

SEMESTER I
ELECTIVE COURSE I: ALLIED MATHEMATICS-I
ALGEBRA AND DIFFERENTIAL EQUATIONS

Course Code : MU231EC1

On the successful completion of the course, student will be able to:		
1	recall the methods of finding the solutions of algebraic equations, differential equations and various formulae of laplace transform	K1
2	understand the theory of algebraic equations, eigen values, differential equations and laplace transform	K2
3	simplify algebraic expressions using various methods, find eigen values, solve initial value problems for odes and find inverse laplace transform	K2
4	analyse various types of first-order odes, relate laplace transform and inverse laplace transform and formulate algebraic equations from real world problems.	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze;

SEMESTER – I
NON-MAJOR ELECTIVE NME - I
MATHEMATICS FOR COMPETITIVE EXAMINATIONS I
Course Code : MU231NM1

On the successful completion of the course, student will be able to:		
1	understand the problems and remember the methods to solve problems.	K1 & K2
2	grasp the simplest method to solve problems.	K2
3	apply suitable mathematical method and get solutions to simple real life problems.	K3

K1 - Remember; K2 - Understand; K3 - Apply

SEMESTER – I
FOUNDATION COURSE - BRIDGE MATHEMATICS
Course Code: MU231FC1

On the successful completion of the course, student will be able to:		
1	prove the binomial theorem and apply it to find the expansions of	K2 & K3

	any $(x + y)^n$ and also, solve the related problems.	
2	find the various sequences and series and solve the problems related to them. Explain the principle of counting.	K1 & K3
3	find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations.	K2 & K3
4	explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations.	K2 & K3
5	find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function.	K3

K1-Remember K2- Understand K3 - Apply

SEMESTER – I

SPECIFIC VALUE-ADDED COURSE –WEB DESIGNING USING HTML Course Code : MU231V01

On the successful completion of the course, student will be able to:		
1	define modern protocols and systems used on the web (such as HTML, HTTP)	K2
2	employ fundamental knowledge on web designing with makeup language	K3
3	gain strong knowledge in HTML	K2
4	use critical thinking skills to design and implement an interactive websites with regard to issues of usability, accessibility and internationalism	K4
5	to pursue future courses in website development and design	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze

SEMESTER I

SPECIFIC VALUE- ADDED COURSE- VEDIC ALGEBRA Course Code: MU231V02

On the successful completion of the course, students will be able to:		
1.	remember mathematical concepts and solutions using Vedic algebra terminology and notation, ensuring clarity and precision in their explanations.	K1
2.	understand the mathematical concepts and principles underlying Vedic algebra techniques, fostering a comprehensive grasp of the subject matter.	K2
3.	apply Vedic algebra techniques proficiently to solve equations and mathematical problems, demonstrating precision and accuracy.	K3
4.	analyze the applicability of Vedic algebra methods in various mathematical contexts, discerning their strengths and limitations through critical examination.	K4
5.	evaluate the effectiveness of Vedic algebra in enhancing problem-solving skills and mathematical reasoning, employing rigorous assessment criteria and methodologies.	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER I
SPECIFIC VALUE - ADDED COURSE - SAMPLING TECHNIQUES
Course Code: MU231V03

On the successful completion of the course, students will be able to:		
1.	recall and list different sampling methods such as simple random sampling, systematic sampling, and stratified sampling.	K1
2.	understand appropriate sampling methods to create survey designs or experimental setups based on specific research objectives and population characteristics.	K2
3.	apply knowledge of sampling errors to distinguish between biased and unbiased errors and assess their potential impact on survey outcomes.	K3
4.	analyse survey designs by evaluating the suitability and effectiveness of sampling methods.	K4
5.	evaluate the best sampling strategies based on understanding sampling principles to ensure accurate and reliable survey outcomes.	K5

K1– Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER II
CORE COURSE III: COORDINATE AND SPATIAL GEOMETRY
Course Code: MU232CC1

On the successful completion of the course, students will be able to:		
1.	recall the definitions and formulae of key concepts in coordinate and spatial geometry	K1
2.	describe the relationships between geometric shapes and their equations	K2

	and summarize the properties of different transformations on the coordinate plane	
3.	solve real world problems involving lines, planes and spheres using analytical geometry concepts	K3
4.	analyze the properties of equations of lines, planes and spheres	K4
5.	evaluate complex problems that require the application of coordinate and spatial geometry concepts.	K5

K1 - Remember; **K2** - Understand; **K3**– Apply **K4**– Analyze **K5**–Evaluate

SEMESTER II

CORE COURSE IV: INTEGRAL CALCULUS

Course Code : MU232CC2

On the successful completion of the course, students will be able to:		
1.	determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae.	K1
2.	evaluate double and triple integrals and problems using change of order of integration.	K2
3.	solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution.	K3
4.	explain beta and gamma function sand to use them in solving problems of integration.	K2
5.	explain Geometric and Physical applications of integral calculus.	K2

K1 - Remember; **K2** - Understand; **K3** – Apply

SEMESTER – II

ELECTIVE COURSE – II : VECTOR CALCULUS AND FOURIER SERIES

Course Code : MU232EC1

On the successful completion of the course, student will be able to:		
1	remember the formulae of vector differentiation, integration and Fourier series	K1
2	understand various theorems related to vector differentiation, integration and Beta, Gamma functions	K2
3	solve problems on vector differentiation, integration, Beta, Gamma functions and Fourier series	K3
4	compare double and triple integrals, line, surface integrals, Beta, Gamma functions and Fourier series for Even and odd functions	K2

K1–Remember **K2** - Understand **K3** - Apply

SEMESTER - II

NON-MAJOR ELECTIVE II

MATHEMATICS FOR COMPETITIVE EXAMINATIONS II

COURSE CODE : MU232NM1

On the successful completion of the course, student will be able to:		
1.	understand the problems and remember the methods to solve problems.	K2
2.	identify the appropriate method to solve problems.	K1
3.	apply the best mathematical method and obtain the solution in short.	K3
4.	apply fundamental mathematical concepts to calculate simple interest, compound interest	K3
5.	develop problem-solving skills and critical thinking by effectively solving real-world scenarios involving financial calculation	K2

K1 - Remember; K2 - Understand; K3 - Apply

SEMESTER – II

SKILL ENHANCEMENT COURSE -SEC-I:

INTRODUCTION TO COMPUTATIONAL MATHEMATICS

Course Code : MU232SE1

On the successful completion of the course, student will be able to:		
1	gain an appreciation for the role of computers in mathematics, science, and engineering as a complement to analytical and experimental approaches.	K1 & K2
2	acquire a strong foundation in numerical analysis, enabling students to evaluate and analyze numerical solutions for mathematical problems.	K2
3	use and evaluate alternative numerical methods for the solution of systems of equations.	K3
4	foster critical thinking skills in assessing computational methods for problem solving.	K3
5	apply mathematical concepts to practical problems through computational approaches.	K3

K1 - Remember; K2 - Understand; K3 - Apply

SEMESTER I & II

Life Skill Training I: Catechism

Course Outcome	Upon completion of this course the students will be able to

1	understand the aim and significance of value education
2	develop individual skills and act confidently in the society
3	learn how to live lovingly through family values
4	enhance spiritual values through strong faith in God
5	learn good behaviours through social values

SEMESTER I & II

Life Skill Training I: Moral

Course Code: UG232LM1

Course Outcome	Upon completion of this course the students will be able to
1	understand the aim and significance of value education
2	develop individual skills and act confidently in the society
3	learn how to live lovingly through family values
4	enhance spiritual values through strong faith in God
5	learn good behaviours through social values

SEMESTER III

CORECOURSE V :VECTOR CALCULUS AND ITS APPLICATIONS

Course Code: MU233CC1

On the successful completion of the course, students will be able to:		
1	remember the formulae of vector differentiation, integration and the basic principles of vectors, including their properties, operations, and geometric interpretations	K1
2	understand the concepts of divergence and curl and their applications in physics and engineering	K2
3	apply Green's, Gauss', and Stokes' theorems to solve problems involving line and surface integrals, demonstrating their understanding of vector calculus principles	K3
4	gain proficiency in differentiating vectors and interpreting their gradients geometrically	K4
5	learn how to integrate vectors to calculate work done by forces and solve related problems	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** – Evaluate:

SEMESTER III
CORECOURSE VI: DIFFERENTIAL EQUATIONS AND APPLICATIONS
Course Code: MU233CC2

On the successful completion of the course, students will be able to:		
1	learn Exact differential equations and Bernoulli's equations	K1
2	learn methods of forming and solving partial differential equations	K2, K4
3	apply the concepts to solve problems in physical sciences and engineering	K3
4	solve linear differential equations with constant coefficients	K5
5	solve linear differential equations with variable coefficients	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

SEMESTER III
ELECTIVE COURSE III: MATHEMATICAL STATISTICS
Course Code: MU233EC1

On the successful completion of the course, students will be able to:		
1	calculate and interpret correlation coefficients and regression lines, and their applications in analyzing relationships between variables.	K1
2	understand Theory of Attribute in statistics, including concepts like consistency of data, independence, and association	K2
3	acquire knowledge of index numbers and learn how to apply index numbers in economic analysis	K3
4	learn about rank correlation and understand when and how to use them to assess monotonic relationships between variables.	K4
5	develop proficiency in interpolation methods and apply these techniques to estimate values within a set of data points with precision.	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

SEMESTER III
SKILL ENHANCEMENT COURSE SEC-II: SPHERICAL TRIGONOMETRY
Course Code: MU233SE1

On the successful completion of the course, students will be able to:		
1	explain the concepts great and small circles, axis and poles of great circles	K2
2	define spherical angle and also the angle of intersection between two great circles	K2
3	calculate the arc length between two points on a sphere using the	K3

	cosine rule for sides	
4	distinguish between plane trigonometry and spherical trigonometry	K4
5	discuss and derive the spherical cosine, sine, supplemental cosine and cotangent rules	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

SEMESTER III / IV
SKILL ENHANCEMENT COURSE SEC IV: DIGITAL FLUENCY
Course Code: UG23CSE2

On the successful completion of the course, students will be able to:		
1.	work with text, themes and styles	K1
2.	produce a mail merge	K2
3.	secure information in an Excel workbook	K2
4.	perform documentation and presentation skills	K2, K3
5.	add special effects to slide transitions	K3

K1 - Remember; **K2** - Understand; **K3** – Apply

SEMESTER III
SPECIFIC VALUE-ADDED COURSE –BASIC FUZZY ALGEBRA
Course Code: MU233V01

On the successful completion of the course, students will be able to:		
	learn fuzzy versus crisp, fuzzy sets and definition	K1
2	understand general definitions and properties of Fuzzy sets, general properties: Fuzzy versus crisp	K2
3	study Extension principles of Fuzzy sets, fuzzy compliments	K2
4	learn Binary operations of two Fuzzy numbers	K2, K3
5	apply the Fuzzy logic concepts to truth values and truth table	K3

K1– Remember; **K2** - Understand; **K3** – Apply;

SEMESTER III
SPECIFIC VALUE-ADDED COURSE –STATISTICAL SURVEY
Course Code: MU233V02

On the successful completion of the course, students will be able to:		
1.	recall the main steps involved in planning a survey and identifying sources of primary and secondary data.	K1
2.	understand the purpose of survey planning, the nature of information required, and the importance of selecting appropriate data collection techniques	K2

3.	apply survey planning principles to design effective surveys and select suitable methods for data collection	K3
4.	analyze survey data to identify patterns, trends, and potential sources of error or bias.	K4
5.	create comprehensive survey reports that present survey findings clearly and effectively, drawing conclusions and making recommendations based on the analysis of the data collected	K6

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

SEMESTER III
SPECIFIC VALUE-ADDED COURSE – DATA STRUCTURES
Course Code: MU233V03

On the successful completion of the course, student will be able to:		
1	recall the definitions and properties of elementary data structures like arrays, stacks, queues, and linked lists.	K1
2	explain the principles underlying these data structures and their applications in problem-solving.	K2
3	utilize appropriate data structures to represent rooted trees and demonstrate the relationships between nodes within these structures.	K3
4	analyze the properties of red-black trees and their role in maintaining balance in dynamic data structures.	K4
5	evaluate the efficiency and scalability of disjoint-set data structures for solving problems involving dynamic connectivity.	K5

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4**- Analyze; **K5** – Evaluate

SEMESTER III/V
SELF LEARNING COURSE: SET/NET ALGEBRA ESSENTIALS
Course Code: MU233SL1/MU235SL1

On the successful completion of the course, students will be able to:		
1	demonstrate the ability to compute line integrals over rectifiable arcs and apply Cauchy's Theorem to evaluate integrals in various domains.	K2, K3
2	interpret and apply advanced concepts such as Jensen's Formula and Hadamard's Theorem to analyze the behavior of entire functions and	K3, K4

	infinite products.	
3	apply the calculus of residues to evaluate definite integrals and utilize harmonic functions to solve boundary value problems using Poisson's Formula and Schwarz's Theorem.	K3, K5
4	construct power series expansions using Weierstrass's Theorem and apply partial fractions and factorization techniques to manipulate complex functions.	K3, K6
5	analyze the local properties of analytic functions, including removable singularities, zeros, poles, and the Maximum Principle.	K4

K2 - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate; **K6**– Create

SEMESTER IV
CORE COURSE VII: GROUPS AND RINGS
Course Code: MU234CC1

On the successful completion of the course, students will be able to:		
1	recall the definitions of groups, rings, functions and also examples of groups and rings	K1
2	explain the properties of groups, rings and different types of groups and rings	K2
3	develop proofs of results on Permutation groups, Cyclic groups, Quotient group, Subgroups, sub rings, quotient rings	K3
4	test the homomorphic and isomorphic properties of groups and rings	K4
5	examine the properties of Ideals – Maximal and Prime ideals – Cosets - order of an element	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyse; **K5** - Evaluate;

SEMESTER IV
CORE COURSE VIII: ELEMENTS OF MATHEMATICAL ANALYSIS
Course Code: MU234CC2

On the successful completion of the course, students will be able to:		
1	recall the basic concepts of real numbers, definitions on sequences and series of real numbers	K1
2	explain the primary concepts of sequences and series of real numbers	K2
3	calculate limit of the sequences and determine the convergence of the	

	series by applying Cauchy's principles, root test and ratio tests	K3
4	analyse the properties of real numbers, nature of sequences and series	K4
5	evaluate the behavior of sequences and the convergence of series using different types of tests	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** - Evaluate;

SEMESTER IV
ELECTIVE COURSE IV: TRANSFORM TECHNIQUES

Course Code: MU234EC1

On the successful completion of the course, students will be able to:		
1.	recall basic knowledge about Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their definitions, properties, and fundamental concepts.	K1
2.	demonstrate a solid understanding of the principles and concepts underlying Laplace transforms, inverse Laplace transforms, Fourier series, Fourier transform, and Z-transforms, including their applications in mathematical analysis and signal processing.	K2
3.	apply Fourier sine and cosine transforms to solve difference equations.	K3
4.	apply transform techniques to evaluate integrals, and solve ordinary and partial differential equations with constant and variable coefficients.	K3, K4
5.	analyze and decompose periodic functions using the Fourier series, including expansion of periodic functions of period 2π , expansion of even and odd functions, and representation of functions over half intervals.	K5

K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** - Analyze; **K5** – Evaluate

SEMESTER III / IV
SKILL ENHANCEMENT COURSE SEC III: FITNESS FOR WELLBEING

Course Code: UG23CSE1

On the successful completion of the course, student will be able to:		
1	know physical, mental, and social aspects of health	K1
2	understand holistic health and the role of physical fitness.	K2
3	apply mindfulness and yoga for stress management and mental clarity.	K3

4	implement proper personal hygiene practices for cleanliness and disease prevention.	K3
5	evaluate and implement right nutritional choices.	K5

K1-Remember; K2-Understand; K3-Apply; K5-Evaluate

**SEMESTER IV
ENVIRONMENTAL STUDIES
Course Code: UG234EV1**

On the successful completion of the course, students will be able to:		
1.	know the different kinds of resources, pollution and ecosystems	K1
2.	understand the biodiversity and its constituents	K2
3.	use the methods to control pollution and, to conserve the resources and ecosystem	K3
4.	analyse the factors behind pollution, global warming and health effects for sustainable development	K4
5.	evaluate various water, disaster and waste management systems	K5

K1 - Remember; K2 - Understand; K3 – Apply; K4 - Analyse; K5 - Evaluate

**SEMESTER IV
SELF LEARNING COURSE II: ANALYSIS AND FORECASTING
Course Code: MU234SL1/MU236SL1**

On the successful completion of the course, students will be able to:		
1	identify the different components of a time series, including trend, seasonal variations, and cyclical patterns	K1
2	understand the importance of time series analysis in various fields and how it aids in making informed decisions	K2
3	assessing the effectiveness and reliability of the chosen forecasting technique	K2
4	differentiate between stationary and non-stationary time series data and analyze autocorrelation functions	K4
5	evaluate forecasting procedures to predict future values of a time series with accuracy and reliability	K5

K2 - Understand; K3 – Apply; K4 - Analyse; K5 - Evaluate;

**SEMESTER III & IV
LIFE SKILL TRAINING II: MORAL**

Course Code: UG234LM1

Upon completion of this course the students will be able to		
1	know the significance of life	K1
2	understand the importance of self-care	K2
3	realise the duty of youngsters in the society and live up to it	K3
4	analyse how to achieve success in profession	K4
5	develop mystical values by inculcating good thoughts	K5

K1 - Remember; K2 - Understand; K3 – Apply; K4 - Analyse; K5 – Evaluate

**SEMESTER III & IV
LIFE SKILL TRAINING II: CATECHISM**

Course Code: UG234LC1

Upon completion of this course the students will be able to		
1	know and understand the aim and importance of value education	K1,K2
2	get rid of inferiority complex and act confidently in the society	K3
3	live lovingly by facing loneliness and make decisions on their own	K3
4	develop human dignity and able to stand bravely in adversity	K6
5	learn unity in diversity and grow in a life of grace	K6

K1 - Remember K2-Understand; K3-Apply; K6- Create