Annai Hajira Women's College

Melapalayam, Tirunelveli –627 005

(A Unit of As-Sathiq Educational Society)

(Affiliated to Manonmaniam Sundaranar University)

Department of Mathematics

UG-Programme

B. Sc., Mathematics

Choice Based Credit System

(with effect from the academic year 2020 – 2021 onwards)

Syllabus 2020 - 2023

PO, PSO & CO's of Mathematics

Course Code: MA

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UG - Programme - Course Structure under CBCS

B.Sc - Mathematics

(Applicable to the candidates admitted from the academic year 2020 -2021 onwards)

FIRST SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
A1TL11	Part I: Tamil	6	4
A2EN11	Part II: Communicative English	6	4
AMMA11	Core I : Calculus and Classical Algebra	6	4
APPS11	Add on Major :Professional English for Physical Sciences– I	4	4
AAMA11	Allied I : Algebra and Differential Equations	6	4
AEVS11	Common : Environmental Studies	2	2
Total		**30**	**22**

SECOND SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
A1TL21	Part I Tamil	6	4
A2EN21	Part II English	6	4
AMMA21	Core II : Differential Equations & Analytical Geometry of Three Dimensions	6	4
APPS21	Add on Major : Professional English for Physical Sciences-II	4	4
AAMA21	Allied II : Vector Calculus and Fourier Series	6	4
AVBE21	Common : Value Based Education	2	2
Total		**30**	**22**

THIRD SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
A1TL31	Part I: Tamil	6	4
A2EN31	Part II: English	6	4
AMMA31	Core III : Sequences and Series	6	4
AAST11	Allied II: Statistics – I	6	3
ASMA31	Skill Based Core: Vector Calculus	4	4
ANMA31	Non Major Elective : Mathematics for Competitive Examinations – I	2	2
AYOG31	Common : Yoga	2	2
Total		**32**	**23**

FOURTH SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
A1TL41	Part I – Tamil	6	4
A2EN41	Part II – English	6	4
AMMA41	Core IV : Abstract Algebra	6	4
AAST21	Allied II : Statistics II	6	3
ASMA41	Skill Based Core : Trigonometry, Laplace Transforms and Fourier Series	4	4
ANMA41	Non Major Elective : Mathematics for competitive Examinations II	2	2
ACDE41	Common: Computers for Digital Era	2	2
A5EA41	Extension Activities : NCC/NSS/YRC/YWF/PE	-	1
Total		**32**	**24**

FIFTH SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
AMMA51	Core V Linear Algebra	5	4
AMMA52	Core VI : Real Analysis	5	4
AMMA53	Core VII : Statics	5	4
AMMA54	Core VIII : Transforms and their Applications	5	4
AEMA52	Major Elective I : Discrete Mathematics	4	4
AEMA54	Major Elective II : Operations Research I	4	4
ACSB51	Skill Based Common : Personality Development	2	2
Total		**30**	**26**

SIXTH SEMESTER

Sub - Code	Subject Title	Lecture Hours	Credits
AMMA61	Core IX : Complex Analysis	5	4
AMMA62	Core X: Graph Theory	5	4
AMMA63	Core XI : Number Theory	4	4
AMMA64	Core XII : Dynamics	4	4
AMMA65	Core XIII : Numerical Methods	4	4
AEMA62	Major Elective III : Fuzzy Mathematics	4	4
AEMA64	Major Elective- IV : Operations Research II	4	4
Total		**30**	**28**

Programme Outcomes

On successful completion of B.Sc., program in Mathematics, the students are able to have	
PO1	Bachelor's Degree in Mathematics is the culmination of in – depth knowledge of Algebra, Calculus, Geometry, Differential Equations and Several other branches of Mathematics. This also leads to study of related areas like computer science, Statistics. Thus this program helps the learners in building a social foundation for higher studies in Mathematics.
PO2	The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytic reasoning. This can be utilized in modelling and solving real life problems.
PO3	Students undergoing this program learn to logically questions assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing independent society.
PO4	Students completing this program will be able to present Mathematics clearly and precisely, make vague ideas precise by formulating them in the language of Mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of Mathematics to non-mathematician.
PO5	Completion of this program will also enable the learners to join teaching profession in primary and secondary schools.
PO6	This program will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

Programme Specific Outcome

After the completion of B.Sc., program in Mathematics, the students are able to have	
PSO1	**A Solid Foundation in Knowledge:** B. Sc., Degree is the culmination of depth knowledge of my core branches of Mathematics such as Calculus, Classical Algebra, Analytical Geometry, Differential Equations, Sequence and series, Abstract Algebra, Real and Complex Analysis, Number Theory, Mechanics, Operations Research, Statistics, Graph Theory, Discrete Mathematics, Trigonometry, Transforms and their Applications and C++/Python. Thus this program helps students in creating a solid foundation for further higher studies and research in Mathematics.
PSO2	**A Competency in Skills:** The skills and knowledge gained have intrinsic logic which leads to proficiency in analytical reasoning critical understanding, analysis and synthetic in order to solve theoretical and practical problems. This can orient students towards applications of Mathematics in other disciplines and moreover, it can also be applied in modelling and solving the real life problems.
PSO3	**Problem Solving Techniques:** Students undergoing this program learn to logically understand the question assertions to clarify the patterns and to evaluate the difference between the necessities and unnecessities of the problems which helps to analyze the problem clearly and to take correct decision for solving the problems.
PSO4	**Interdisciplinary and Research Skills:** Students completing this program will be able to create and present mathematical concepts clearly and precisely, to describe the mathematical ideas from multiple perspectives and to explain the fundamental concepts of mathematics people in a better manner.
PSO5	**A Proficiency in Employments:** The program will helps students build up with employability for government jobs, jobs in banking , insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

Course Outcome

FIRST SEMESTER

The students are able to:

AMMA11	**Part III Core I Calculus and Classical Algebra**	**CO1** Apply the mathematical knowledge to analyze the properties of a curve such as curvature, radius of curvature, Involute and Evolute. **CO2** Classify double and triple integrals. **CO3** Identify Beta and gamma function and to apply the rules of beta and gamma function in evaluating double and triple integrals. **CO4** Construct different types of equations and to find the roots of the equations by Newton's Theorem. **CO5** Solve the different types of reciprocal equations and to find the number of real roots using Descartes rule of signs.
APPS11	**Add on Major: Professional English for Physical Sciences– I**	**CO1** Students should be enabling to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e., Reading, Writing, Listening, Thinking and Speaking. **CO2** Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence. **CO3** Learners will develop their skills in comparing, contrasting, skimming, and scanning, predicting will be activated as they are necessary for learning **CO4** Understand contextual usage of the underlying scientific terms. **CO5** Understand the meaning of foreign words and new words.
AAMA11	**Allied I : Allied Mathematics Algebra and Differential equations**	**CO1** Construct different types of equations and to compare and to find the relationships between roots and coefficients. **CO2** Identify the transformation of equations and to find approximate solutions to equations by making use of Newton's method and Korner's method. **CO3** Identify types of matrices and to find the characteristic equation of matrix. Eigen values and eigen vectors can be determined by applying Cayley Hamilton Theorem. **CO4** Distinguish the differential equations of first order and higher degrees and to identify the equations which are all solvable for p, s, y and the equations in the standard form Pp+Qq = R. **CO5** Identify and distinguish Laplace transformation and inverse Laplace transformation.
AEVS11	**Part IV: Environmental Studies**	**CO1** Understand the definition, scope and importance of natural resources and associated problems. **CO2** Study the different types of ecosystems, ecological succession food chains, food webs and ecological pyramids. **CO3** Understand the definition of biodiversity and also study how to conserve. **CO4** Analyse the various factors causing environmental pollution **CO5** Study various social issues which affect our environment.

SECOND SEMESTER

The Students are able to:

AMMA21	**Part III Core 2: Differential Equations and Analytical Geometry of Three Dimensions**	**CO1** Solve the differential equations which are solvable for x, y, p and Clairaut's form and to illustrate the method of solving the differential equations of the form $f_1(D)x + g_1(D)y = h_1t$, $f_2(D)x + g_2(D)y = h_2(t)$. **CO2** Identify and solve the second order linear differential equation with constant coefficients and to interpret the linear equations of second order with variable coefficients. **CO3** Analyze the 3D-co-ordinate systems and how to find the direction cosines and direction ratios and to find the angle between planes, the length of the perpendicular and angle of bisection. **CO4** Find and classify the equation of lines in different forms and calculate the image of the point, image of a line and to distinguish lines and planes. The angle between the line and plane can be determined. Coplanar lines can be shown and the shortest distance between. **CO5** The equations of spheres and circles of intersection can be interpreted and to illustrate and analyze the tangency of sphere.
APPS21	**Add on Major : Professional English for Physical Sciences-II**	**CO1** Enhance the creativity of the students, which will enable them to think of innovative ways to solve issues in the workplace. **CO2** Help students with research bent of mind develop their skills in writing reports and research proposals. **CO3** To develop the language skills of students by offering adequate practice in professional contexts. To enhance the lexical, grammatical and socio-linguistic. **CO4** communicative competence of first year physical sciences students to focus on developing students' knowledge of domain specific registers. **CO5** the required language skills. To develop strategic competence that will help in efficient and communication to sharpen students' critical thinking skills and make students culturally and aware of the target situation.
AAMA21	**Allied II : Allied Mathematics Vector Calculus & Fourier Series**	**CO1** Analyze what is meant by vector differentiation and how to apply vector differentiation and its properties. **CO2** Evaluation of double and triple integrals. **CO3** Analyze and apply Vector integration. By making use of Vector integration - Line, surface and volume integrals can be interpreted. **CO4** Analyze and apply Green's, Stokes and divergence theorems **CO5** Determine the functions whether the functions are odd or even. By making use of these concepts half range series can be found out.
AVBE21	**Part IV: Value Based Education**	**CO1** Enable the students to understand the social realities and to inculcate an essential value system towards building a healthy society. **CO2** Understand the importance of value-based living. **CO3** Gain deeper understanding about the purpose of their life. **CO4** Understand and start applying the essential steps to become good leaders. **CO5** Emerge as responsible citizens with clear conviction to practise values and ethics in life.

THIRD SEMESTER

The students are able to:

AMMA31	**PART III Core III Sequences and Series I**	**CO1** Analyse the real number system and also to classify rational and irrational numbers. To find the upper bounds, least upper bounds and maximum element and to elaborate triangle inequality and Cauchy-Schwartz inequality. **CO2** Categorize the sequences as bounded sequences, monotonic sequences, convergent sequences and divergent sequences. Also to find the algebra of limits. **CO3** Demonstrate the behaviour of monotonic sequences and to apply Cauchy's first limit theorem. Make use of Cauchy's Second limit theorem and Cesaro's Theorem. Construct subsequence and to explain Cauchy's general principle of convergence. **CO4** Interpret the series and to apply n^{th} term test, Comparison test, Kummer's test, D'Alembert's ratio test, Raabe's test, Gauss test and root test to compile the nature of the series. **CO5** Understand Alternating series, Leibnitz's test. Apply the test for convergence of series of arbitrary terms and to identify the Power series and to determine the radius of convergence.
AAST11	**Allied -II Statistics –I**	**CO1** Find and relate the concepts of moments, skewness and kurtosis and to demonstrate the method of least squares and to classify parabolic, exponential and logarithmic curves. **CO2** Interpret correlation and regression and to illustrate Karl's Pearson's coefficient of correlation and also the lines of regression and coefficient of regression. **CO3** Develop the statistical techniques used in the theory of attributes and to analyze consistency of data and criteria independence and to interpret Yule's coefficient of association. **CO4** Explain distribution function and its properties, able to find mathematical expectation and to find the cumulants using generating function. **CO5** Solve discrete and continuous probability distributions, explain about discrete distributions like Binomial and Poisson distribution and their properties.
ASMA31	**Skill Based core Vector Calculus**	**CO1** Classify the vector point function and scalar point function. Determine the derivative of product of scalar and vector function. **CO2** Find divergence, curl. Make use of the Laplacian operator. **CO3** Interpret the integration of point function and to illustrate line integral. To solve surface integral. **CO4** Analyze and solve the volume integral and to illustrate and make use of Gauss Divergence Theorem to solve problems. **CO5** To solve problems based on Green's Theorem and Stoke's Theorem.
ANMA31	**PART IV Non-Major Elective Mathematics for Competitive Examinations - I**	**CO1** Interpret Simplification and find averages. **CO2** Determine ratio and proportion. **CO3** Assess partnership and solve percentage problems. **CO4** Distinguish profit and loss. **CO5** Solve problems on numbers.

FOURTH SEMESTER

The students are able to:

AMMA41	**Part III Core IV Abstract Algebra**	**CO1** Explain the definitions of groups and its examples and to determine the order of an element. Illustrate about Subgroups. **CO2** Interpret cyclic groups and to find the generators of cyclic subgroups. Illustrate and apply Lagrange's Theorem, Euler's Theorem and Fermat's Theorem. **CO3** Elaborate about Normal subgroups and group homomorphism. Illustrate Isomorphism, Automorphism and to apply Cayley's theorem wherever required. **CO4** Compare and classify Rings and its types. Illustrate about Integral domain and Fields. To summarize about maximal and minimal ideals. **CO5** Utilize the concept of homomorphism and isomorphism on rings and to find kernel of homomorphism and to make use of fundamental theorem.
AAST21	**Allied II Statistics II**	**CO1** To list out the characteristics of index numbersand to find Laspeyer's and Paache's, Fisher and Bowley's Edgeworth's index numbers. The method to classify and analyse the unit test, commodity reversal test, time reversal test and circular tests can be shown. **CO2** Construct testing of hypothesis and to distinguish null hypothesis and alternative hypothesis. Type I and Type II errors can be classified. The level of significance and test of significance for large samples can be explained. **CO3** Identify the distributions such as t-distributions and F-distribution. By making use of t-test the single mean and difference of means can be found out. Variance ratio test based on Chi-square distribution by making use of this the goodness of fit can be decided. **CO4** To find analysis of variance. One way and two-way classified data can be explained and to randomize block design. Latin squares can be analysed and constructed. **CO5** To explain statistical quality control and its advantages. Process control can be illustrated bymaking use of this control chart, range chart, P- chart can be designed. Study and illustrate sampling inspection plans.
ASMA41	**Skill Based : Trigonometry, Fourier Series, Laplace Transforms**	**CO1** Summarize about Trigonometry and to illustrate about the expansion of sinnx, cosnx, $\sin^n x$, $\cos^n x$. **CO2** Obtain the relationship between hyperbolic functions and circular function. Explain about inverse hyperbolic functions. To find summation of the series using C+ is method. **CO3** Illustrate Laplace Transforms. **CO4** Solving linear differential equations with constant coefficients and simultaneous equations using Laplace Transforms. **CO5** Solve problems based on Fourier Series. Identify the odd and even functions and to deduce half range series.
ANMA41	**PART IV Non-Major Elective Mathematics for Competitive Examinations - II**	**CO1** Analyse and solve the problems based on simple interest and compound interest. **CO2** Apply short tricks on solving time and work problems. **CO3** Making use of the concept of time and distance while solving problems. **CO4** Utilize chain rule. **CO5** Find solutions for pipes and Cistern problem.

FIFTH SEMESTER

The Students are able to:

AMMA51	**Part – III Core -7 : Linear Algebra**	**CO1** Explain the definitions and general properties of vector spaces and to explain subspace. They know where to apply fundamental theorem of homomorphism. **CO2** Determine the span of a set and to check whether the given set is Linearly dependent or not and to find basis and dimensions **CO3** Illustrate and apply Rank Nullity theorem. Explain the definitions and examples of inner product space. Apply Gram Schmidt Orthogonalization process. **CO4** Construct matrices and also to summarize the elementary transformations. Determine the Inverse of matrix and rank of a matrix. To make use of Cayley Hamilton Theorem. **CO5** Determine Eigen values and Eigen Vectors. Identify bilinear forms and quadratic forms and to deduce diagonal form from quadratic form.
AMMA52	**Core -8 : Real Analysis**	**CO1** Explain about Metric spaces and to construct an open ball and to interpret interior. **CO2** Interpret about closed sets and to find closure. To determine limit points. Analyse about complete metric space. Discuss about Cantor's intersection theorem and Baire's Category theorem. **CO3** Summarize continuity. Illustrate about uniform continuity. **CO4** Explain about Connectedness and to deduce the connected subsets of R. To obtain the relationship between Connectedness and continuity. **CO5** Illustrate about compactness and to find the connected subsets of R. Illustrate and make use of Heine Borel Theorem. To determine the relationship between compactness and continuity.
AMMA53	**Core – 9 : Statics**	**CO1** Explain the forces acting at a point and to apply the parallelogram law of forces, Triangle law of forces and Lami's theorem. **CO2** Interpret parallel forces and moments. Analyze the resultant of two parallel forces and the resultant of two unlike unequal parallel forces. To apply Varigon's theorem. **CO3** Summarize equilibrium of three forces acting on a rigid body and to illustrate three coplanar forces theorem and to make use of the above theorem to solve problems. **CO4** Explain about laws of friction and to determine the angle of friction and Illustrate about the equilibrium of a particle and to make use of the concepts to solve the problems. **CO5** Interpret the equilibrium of strings. To deduce the equation of catenary and its geometrical properties.
AMMA54	**Core – 10 : Transforms and their Applications**	**CO1** Apply Fourier transforms and to explain the properties. **CO2** Solve problems on infinite Fourier cosine and Sine Transforms. **CO3** Identify and solve Finite Fourier transforms. **CO4** Illustrate Z transforms and its properties. **CO5** Utilize inverse Z transforms to solve difference equations.

AEMA52	**Major Elective I : Discrete Mathematics**	**CO1** Illustrate and use the statements, notations and connectives. Construct truth table and utilize conditional and biconditional statements. **CO2** Analyze and explain predicate calculus. **CO3** Elaborate Groups and Monoids and to develop Group codes. **CO4** Construct Lattices and special lattices. Analyze and explain Boolean algebra. **CO5** Convert from one form to another form (Decimal, Binary, Octal, Hexadecimal). Evaluate Binary addition, subtraction, multiplication and division and study Gray code.
AEMA54	**Major Elective II : Operations Research I**	**CO1** Solve Linear Programming Problem by making use of Graphical method, Simplex method. **CO2** Interpret the concept of duality. Classifyprimal and dual problems. Utilizing the concept of duality, solve problems on dual simplex method. **CO3** Solve Transportation problems by making use of North – west corner rule, Matrix- Minima method, Vogel's Approximation rule. Evaluate Degeneracy and unbalanced transportation problems. **CO4** Determine the solution for Assignment Problems. **CO5** Solve sequencing problems.
ACSB51	**Skill Based Common : Personality Development**	**CO1** Develop, exhibit and accurate sense of self. **CO2** Develop and nurture a deep understanding of personal Motivation. **CO3** Develop an understanding and practice personal and Professional responsibility. **CO4** Demonstrate knowledge of personal beliefs and values and a commitment to continue personal reflection and reassessment. **CO5** Learn to balance confidence with humility.

SIXTH SEMESTER

The students are able to:

AMMA61	**Part – III Core -11 : Complex Analysis**	**CO1** Understand the concept of analytical functions and study Functions of a complex variable and to utilize Cauchy - Riemann equations. **CO2** Understand the concept of definite integrals, contours and to study Cauchy – Goursat theorem, Cauchy integral formula and Morera's theorem. **CO3** Explain Series expansions and to determine Taylor's Series, Laurent's Series. Determine zeros of an analytic function, residues and to make use of Cauchy's Residue Theorem. **CO4** Evaluate improper real integrals and definite integrals. **CO5** Study the basic properties of transformations, bilinear maps and fixed points.
AMMA62	**Core – 13 : Graph Theory**	**CO1** Construct graph and to explain its definition. Determine degrees and to perform operations on graph. **CO2** Classify degree sequence and graphic sequence. Illustrate connectedness, compactness and connectivity. **CO3** Construct Eulerian Graphs and Hamiltonian graphs Elaborate the characterizations of trees and to find centre of a tree. **CO4** Interpret Planar graphs and to determine chromatic numbers and chromatic index. **CO5** Explain Chromatic Polynomials and the properties of digraphs.
AMMA63	**Core –12 : Number Theory**	**CO1** Explain Peano's theorem and to utilize mathematical induction and to make use of binomial theorem. **CO2** Illustrate Division Algorithm. Determine GCD. To deduce the Diaphantine Equation ax+by = c. **CO3** Interpret the fundamental theorem of arithmetic. Explain the Sieve of Eratosthenes and to use Goldbach Conjecture. **CO4** Summarize the basic properties of congruences and to apply Chinese Remainder Theorem. **CO5** Elaborate Fermat's Theorem, Wilson's Theorem and to apply Kraitchik Factorization Method.
AMMA64	**Core – 14 : Dynamics**	**CO1** Illustrate Projectiles and to find the equation of path, range and maximum height and time of flight. **CO2** Elaborate about the collision of elastic bodies. Interpret law of impact and classify direct and oblique impact. **CO3** Determine simple harmonic motion in a straight line. Summarize the composition of SHM of the same period in the same line and along two perpendicular directions. **CO4** Interpret motion under the action of central forces. Derive velocity and acceleration in polar coordinates. **CO5** Obtain the differential equation of central orbit and to deduce the pedal equation of central orbit.

AMMA65	**Core – 15 : Numerical methods**	**CO1** Obtain numerical solutions of algebraic and transcendental equations by making use of various methods. **CO2** Find finite difference for first and higher order differences. To classify Forward and backward differences. **CO3** To apply interpolation formula in Newton's Forward and backward, Gauss forward and backward formula. **CO4** Make use of numerical differentiation and integration in Newton's forward and backward differences for differentiation and to utilize Trapezoidal rule and Simpson's 1/3 and 3/8 rule. **CO5** Solve Difference equations and to determine the order and degree of difference equation. Solve linear difference equation and find complementary function and to deduce particular integral of the function.
AEMA62	**Major Elective III : Fuzzy Mathematics**	**CO1** Explain Crisp Sets and fuzzy Sets and illustrate the characteristics and significance of Paradigm shift. **CO2** Elaborate the Additional properties of α-cuts and the extension principle for fuzzy sets. **CO3** Perform fuzzy set operations and to determine fuzzy complements, fuzzy intersections and fuzzy unions. **CO4** Determine fuzzy Numbers and Linguistic variables. Apply arithmetic operations on intervals and on fuzzy numbers. Construct Lattice of fuzzy numbers. **CO5** Analyze and classify fuzzy Decision Making, Individual Decision Making, Multi-person decision making problems.
AEMA64	**Major Elective IV : Operations Research II**	**CO1** Interpret the games and strategies. Solve two-person zero sum games.Make use of mixed Strategies and dominance property. **CO2** Analyze the replacement of items that deteriorate with time. Illustrate replace montage of a machine - taking money value into consideration and elaborate the replacement of items that completely fail suddenly and Staffing problems. **CO3** Explain the queuing models and to classify into (M/M/1: /FCFS), (M/M/1: ∞/FCFS), (M/M/S: /FCFS). **CO4** Compose network scheduling using PERT / CPM. Explain the rules of network construction. Make use of PERT calculation. **CO5** Analyse and solve inventory control problems.

S. Rathina Malathi 05/08/2020

Signature of the HoD
Head of the Department of
Mathematics
Annai Hajira Women's College
Melapalayam

Rajar Kalli 05/08/2020

Signature of the Principal
PRINCIPAL
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