DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics (Five-Year) Programme

Language - II – English Course 1- 19IENC12: English Through Literature I: Prose

Course Outcomes:

CO1: Competency in communication both in written and oral skills
CO2: Fluency in the English language
CO3: Knowledge about construction of sentence structures
CO4: English Vocabulary to use the English language effectively
CO5: Proficiency in the four communication skills

19IPHYA-1- ANCILLARY PHYSICS-I

Course Outcomes:

CO1: Understand the behaviour of fluids and practical applications of the same in real life.
CO2: Understand relativity and its consequences.
CO3: Acquire in depth knowledge of various lasers and diodes used for different applications.
CO4: Knowledge about the different types of nuclear models and detectors

19IMATC15: Classical Algebra

Course Outcomes:

CO1: Apply the fundamental concept of theory of equations and to find solutions.
CO2: Apply Descarte's rule, Horner's method, Newton Raphson methods for finding approximate solutions.
CO3: Apply summation of series using Binomial, Exponential and Logarithmic series for finding approximations.
CO4: Apply the elementary number theory for highest power of prime number.
CO5: Apply the elementary number theory for Fermat's and Wilson's theorem.

Elective: 19IMATE16: Matrices

Course Outcomes:

CO1: Find the rank and inverse of a matrix.
CO2: Find Eigen Values and Eigen Vectors.
CO3: Diagonalize the matrix using similarity transformation.
CO4: Find the nature of Quadratic forms.

PART- II: Language - II – English Semester-II Paper – II – 19IENC22: English Through Literature II: Poetry

Course Outcomes:

CO1: Competency in communication, both in written and oral skills
CO2: Fluency in English language
CO3: Knowledge about construction of sentence structures
CO4: Vocabulary to use the English language effectively
CO5: Acquire the aesthetic sense for appreciating poetry

19IMATC25: Trigonometry

Course Outcomes:

CO1: Apply for finding expansions of cos$n\theta$, sin$n\theta$ and tan$n\theta$ and formation of equations.
CO2: Apply for finding cosθ, sinθ in a series of ascending powers of θ and their approximation.
CO3: Apply for finding Hyperbolic and inverse Hyperbolic functions.
CO4: Apply for resolution into factors and study De-Moivre's property.
CO5: Apply to evaluate the summation of trigonometric series and their differences, Gregory series and Euler series.

19IMATC26: Differential Calculus

Course Outcomes:

CO1: Apply Leibnitz theorem for nth derivative, total differentials in terms of partial derivatives and Jacobians.

CO2: Apply maxima and minima functions for two and three independent variables.

CO3: Apply for finding, angle between vectors, pedal equations and finding solutions.

CO4: Apply for finding radius of curvature and centre of curvature.

CO5: Apply for finding envelope and Asymptotes.

PART- II: Language - II – English Semester-III Paper – III – 19IENC32: English Through Literature III: Drama

Course Outcomes:

CO1: Obtain a literary acumen to answer MCQs of NET/SET Examinations and other competitive examination.

CO2: Appreciate conversational English.

CO3: Recognize the dramatic elements of Shakespearean dramas.

CO4: Use punctuations and capitals effectively in their Composition.

CO5: Recognize the elements of the spoken discourses.

19ISTAA33: Mathematical Statistics – I

Course Outcomes:

CO1: Gains working knowledge related to the problems of theoretical statistics

CO2: Apply the fundamental concept of statistical methods to solve some real life problems

CO3: Gains a basic knowledge for study advanced courses in this area.

19IMATC34: Analytical Geometry 2D

Course Outcomes: On a successful completion of the course, the students will able to

CO1: Explain the fundamental concepts of analytical geometry in 2D about parabola, Equation of a Parabola, the pole of line with Parabola, Ellipse, equation of an Ellipse, tangent and normal drawn from Ellipse.

CO2: Hyperbola, Equation of Hyperbola, Co-ordinates of a point on the Hyperbola in terms of a single parameter tangent and normal drawn from Hyperbola, Rectangular Hyperbola.

CO3:Transformation of polar co-ordinates into Cartesian co-ordinates and vice versa, parallel straight lines, the polar equation of a conic, general equation of the second degree tracing of conics.

19IMATC35: Vector Analysis

Course Outcomes:

CO1: explain the fundamental concepts of vectors, direction cosines, direction ratios and workout scalar and vector products of two and three vector.

CO2: differentiate vector functions of a single variable, find the gradient, divergence and curl and prove identities involving them.

CO3: integrate vectors, compute line, surface and volume integrals in a vector field and verify Gauss, Stoke's and Green's theorem.

Elective: Integral Calculus

Course Outcomes:

CO1: Solve problems using the different methods of integration.
CO2: Solve problems in double and triple integrals.
CO3: Apply double and triple integrals in finding area and volume.

PART- II: Language - II – English Semester-IV Paper – IV – 19IENC42: English Through Literature IV: Short Story

Course Outcomes:

CO1: Use more vocabularies while writing.
CO2: Learner can ensure about the history and development.
CO3: The learner has a development in flow of writing.
CO4: Students can come up with new ideas while reading stories from different perspectives.
CO5: Write in a style appropriate for communicative purposes.

19ISTAA43: Mathematical Statistics – II

Course Outcomes:

CO1: Gains working knowledge related to the problems of theoretical statistics.
CO2: Apply the fundamental concept of statistical methods to solve some real life problems.
CO3: Gains a basic knowledge for study advanced courses in this area

19IMATC44: Statics

Course Outcomes:

CO1: Apply the fundamental concept of statics to
a. demonstrate the application of vectors for the analysis of static equilibrium ;
b. analyze static equilibrium to particles and rigid bodies and apply the principles of equilibrium for analyzing beams.
CO2: Solve equations involving frictional, statistical, dynamical and limiting frictions.
CO3: Illustrate the mathematical aspects that provide the skills and problem solving in forces acting at a point, coplanar forces and equilibrium of strings and chains.

19IMATC45: Fourier Series and Fourier Transform

Course Outcomes:

CO1: Find the Fourier series representation of a function of one variable.
CO2: Find the solution of the wave, diffusion and Laplace equations using the Fourier series.
CO3: Demonstrate the use of Fourier Transform to connect the time domain and frequency domain.

19IMATC51: Real Analysis – I

Course Outcomes:

CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in real analysis such as
• Real Valued Functions
• Convergence Sequence
• Cauchy Sequence
• Series of Real Numbers

19IMATC52: Differential Equations and Applications

Course Outcomes:

CO1: Explain the fundamental concepts of ordinary differential equations and their role in modern mathematics.

CO2: Use ordinary differential equations to model simple electric circuits, population growth and mass-spring systems, as well as other applications.
CO3: Demonstrate accurate and efficient use of the Laplace transforms and their applications in the solution of ordinary differential equations.
CO4: Apply problem-solving using concepts and techniques from ordinary differential equations and Laplace transforms relevant to diverse situations in physics, engineering, financial mathematics and in other mathematical contexts.

19IMATC53: Dynamics
Course Outcomes:
On successful completion of the course, the student will be able to:
CO1: Apply the fundamental concept of dynamics to
a. demonstrate their understanding of the principles of kinematics and kinetics of particles and planar rigid bodies;
b. analyze planar rigid body kinematics and kinetics.
CO2: Solve equations of projectiles, moment of inertia and simple harmonic motions.
CO3: Illustrate the mathematical aspects that provide the skills and problem techniques in kinematics of point and Newton's laws of motion.

19IMATC54: Astronomy
Course Outcomes:
CO1: the concepts of Celestial movements,
CO2: application of Spherical Trignomentry,
CO3: application of three dimensional geometry.

19IMATC55: Numerical Methods
Course Outcomes:
CO1:explain finite difference operator, solve the first and second order linear difference equations with constant coefficients and non homogenous equations of the same kind.
CO2:interpolate using Newton's and Legrangian formulae, do numerical differentiation and integration, find solutions to algebraic and transcendental equation using bisection method ,approximation method, regula falsi method, Newton Raphson method and Bairstow method.
CO3: solve ODE and PDE using the methods mentionable in the syllabus.

Elective: 19IMATE56 Analytical Geometry 3D
Course Outcomes: On successful completion of the course, the students will able to:
CO1: explain fundamental concepts of analytical geometry in 3D, about direction cosines of a line and the plane, equation and plane.
CO2: The straight line, symmetric form of equation of a line, equation of a line passing through two given points, the plane and the straight line, intersection of three planes.
CO3: Sphere, the length of the tangent form of point to sphere equation of a circle on a sphere, intersection of two spheres, cone, cylinder and central quadrics

19IMATC61: Real Analysis – II
Course Outcomes:
CO1: Describe fundamental properties of matric spaces that lead to the formal development of matric spaces.
CO2: Demonstrate an understanding of a set of measure zero and how that are used in Riemann integral.

CO3: Differentiate point wise convergence and uniform convergence of a sequence of functions and series of functions.

19IMATC62: Complex Analysis
Course Outcomes:
Students will be introduced to and have knowledge of many mathematical concepts
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in complex analysis such as Analytic function, Some mappings, Complex integration, Power series.

19IMATC63: Algebra
Course Outcomes:
On successful completion of the course, the students will be able to:
CO1: explain the fundamental concepts of algebra such as groups, subgroups, quotient groups, homomorphism, automorphisms and using these ideals, Cayley's theorem and permutation groups.
CO2: demonstrate accurate and efficient use of a ring with examples, some classes of a ring, homomorphism of a ring, ideals, quotient rings and integral domain.
CO3: solve problems in the above related topic.

19IMATC64: Discrete Mathematics
Course Outcomes:
Students will be introduced to and have knowledge of many mathematical concepts
CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving studied in Discrete Mathematics such as
Logic
Relations
Functions
Some Algebraic structure

19IMATC65: Optimization Techniques
Course Outcomes:
On successful completion of the course, the student will be able to:
CO1: Apply for finding solutions of general linear programming by Simplex computational procedure
CO2: Apply for finding feasible solutions by Artificial technique and by Perturbation technique.
CO3: Apply for finding solutions using revised simplex method and duality problems.
CO4: Apply for finding solutions by additional computational technique and transportation problems.
CO5: Apply for finding solutions of Non-linear programming

19IMATC71: Advanced Abstract Algebra – I
Course Outcomes:

CO1:	examples and counter examples
CO2:	proof techniques
CO3:	problem solving

- Groups,
- Quotient Groups,
- Homomorphism of Groups,

• Group Actions,
• Direct products of Groups.

19IMATC72: Advanced Real Analysis
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving
studied in real analysis such as
• Functions of bounded variations,
• Riemann –Stieltjes Integral,
• Sequence of functions,
• Multivariate Differential Calculus.

19IMATC73: Advanced Differential Equations
Course Outcomes:
CO1: Apply the fundamental concept of ordinary and partial differential equation to
a. demonstrate their understanding of how physical phenomena are modeled by second order differential equations and dynamical systems;
b. perform operations with Bessel, Hermite and Legendre differential equations along with the corresponding recurrence formulas of different functions.
CO2: Solve various first order and higher orders differential equations with their applications.
CO3: Illustrate the mathematical aspects that contribute to the solution of heat, wave and diffusion equations.

19IMATC74: Differential Geometry
Course Outcomes:
CO1: understand the concept of a space curve in 3D and compute the curvature and torsion of space curves;
CO2: understand the fundamental existence theorem for space curves;
CO3:find geodesics equations on a surface;
CO4: understand surfaces of constant curvature (Minding's theorem) and Gaussian curvature;
CO5: determine the second fundamental form and developables associated with space curves.

19IMATC81: Advanced Abstract Algebra – II
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Abstract Algebra such as
• Rings,
• Irreducibility,
• Modules, a generalization of vector spaces,
• Fields.

19IMATC82: Measure Theory and Integration
Course Outcomes:
Students will be introduced to and have knowledge of many mathematical concepts
CO1:examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Measure theory & Integration such as

• Measurable sets and Measurable functions,
• Integration with respect to Measure,
• Convergence in Measure.

19IMATC83: Advanced Complex Analysis
Course Outcomes:
CO1: use Cauchy's integral theorem or formula to compute complex line integrals;
CO2: compute the Taylor's theorem, to determine the nature of the removable singularities;
CO3: explain the convergence of power series and develop analytical capabilities in Taylor or Laurent series in a given domain;
CO4: determine the concept of conformal mapping of polygons, to find Schwarz – Christoffel formula.

19IMAPC84: C++ Computer Practical
Course Outcomes:
CO1: the students will be able to gain knowledge between theory and practical.

19IMATC91: Topology
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Topology such as
• Connectedness
• Compactness
• Completeness which are studied in Real Numbers.

19IMATC92: Linear Algebra
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Linear Algebra such as
• Systems of linear Equations,
• The algebra of linear transformations,
• Determinant functions,
• Diagonalization,
• Decompositions.

19IMATC93: Probability Theory
Course Outcomes:
CO1: knowledge related to probability problems
CO2: a basic knowledge for studying advanced courses in this area like stochastic processes.

19IMATC94: Numerical Methods Practical (Using C++ language)
Course Outcomes:
CO1:students will be able to gain knowledge between theory and practical

19IMATC101: Functional Analysis
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving in Banach space, Hilbert space and spectral operator theory.

19IMATC102: Stochastic Processes
Course Outcomes:
CO1: working knowledge related to the problems of uncertainty.
CO2: a basic knowledge for doing research in this area.

19IMATC103: Fluid Dynamics
Course Outcomes:
CO1: Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
CO2: Recognize these principles written in form of mathematical equations.
CO3: Apply dimensional analysis to predict physical parameters that influence the flow in fluid dynamics.

19IMATC103: Fluid Dynamics
Course Outcomes:
CO1: Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
CO2: Recognize these principles written in form of mathematical equations.
CO3: Apply dimensional analysis to predict physical parameters that influence the flow in fluid dynamics.

19IMATC104: Graph Theory
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving
CO4: Applications

19IMATC105: Calculus of Variations and Integral Equations
Course Outcomes:
CO1: Recognize the difference between Volterra & Fredholm integral equations, First kind & second kind, homogeneous and inhomogeneous etc.
CO2: They will have a much better understanding of the fundamental concepts related to the space of admissible variations and concepts of a weak and a strong relative minimum of an integral.

19IMATE86-1: Programming Language C++
Course Outcomes:
CO1: On Successful completion of C++ course, the students gathered computer knowledge in C++ to write programmes for various types of mathematical problems

19IMATE96-1: Number Theory
Course Outcomes:
CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving of
• Divisibility relation,
• Congruence relation,
• Special number theoretic functions,
• Diophantine equations and
• Algebric numbers

19IMATE96-2: Fuzzy Sets and their Applications

Course Outcomes:

CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving on
• characteristics of fuzzy logic,
• α cuts,
• operations on fuzzy sets,
• extension principles,
• fuzzy norms,
• lattice of fuzzy numbers.

19MATX815.1: Discrete Mathematics

Course Outcomes:

Every student shall get a good exposure in
CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving
CO4: applications of various concepts in: Logic and Counting, Relations and Digraphs, Functions, Order Relations and Structures and Semigroups and Groups.

19MATX815.2: Numerical Methods

Course Outcomes:

Every student shall get a good exposure in
CO1: examples and counter examples
CO2: problem solving
CO3: applications of various concepts in: obtaining numerical solutions of Algebraic, Transcendental and Ordinary Differential Equations.

19MATX915.1: Differential Equations

Course Outcomes:

CO1: the skill of the formation of differential equations and partial differential equations.
CO2: the skill to expose different techniques of finding solution of differential equations and partial differential equations.

DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics (Two-Year) Programme

19MATC101: Advanced Abstract Algebra – I

Course Outcomes:

CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving of various concepts in:
• Groups,
• Quotient Groups,

• Homomorphism of Groups,
• Group Actions,
• Direct products of Groups.

19MATC102: Advanced Real Analysis
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in real analysis such as
• Functions of bounded variations,
• Riemann –Stieltjes Integral,
• Sequence of functions,
• Multivariate Differential Calculus.

19MATC103: Advanced Differential Equations
Course Outcomes:
CO1: Apply the fundamental concept of ordinary and partial differential equation to
a. demonstrate their understanding of how physical phenomena are modeled by second order differential equations and dynamical systems;
b. perform operations with Bessel, Hermite and Legendre differential equations along with the corresponding recurrence formulas of different functions.
CO2: Solve various first order and higher orders differential equations with their applications.
CO3: Illustrate the mathematical aspects that contribute to the solution of heat, wave and diffusion equations.

19MATC104: Differential Geometry
Course Outcomes:
CO1: understand the concept of a space curve in 3D and compute the curvature and torsion of space curves;
CO2: understand the fundamental existence theorem for space curves;
CO3: find geodesics equations on a surface;
CO4: understand surfaces of constant curvature (Minding's theorem) and Gaussian curvature;
CO5: determine the second fundamental form and developables associated with space curves.

19PHYX115: Classical Mechanics and Special Theory of Relativity
Course Outcomes:
CO1: Know the physical concepts and facility with the mathematical methods of classical mechanics.
CO2: Use D'Alembert's principle to derive the Lagrange equations of motion.
CO3: Acquire fundamental knowledge of classical mechanics.
CO4: Understand relativity and its consequences.

19MATC201: Advanced Abstract Algebra – II
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Abstract Algebra such as
• Rings,

• Irreducibility,
• Modules, a generalization of vector spaces,
• Fields.

19MATC202: Measure Theory and Integration
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Measure theory & Integration such as
• Measurable sets and Measurable functions,
• Integration with respect to Measure,
• Convergence in Measure.

19MATC203: Advanced Complex Analysis
Course Outcomes:
CO1: use Cauchy's integral theorem or formula to compute complex line integrals;
CO2: compute the Taylor's theorem, to determine the nature of the removable singularities;
CO3: explain the convergence of power series and develop analytical capabilities in Taylor or Laurent series in a given domain;
CO4: determine the concept of conformal mapping of polygons, to find Schwarz – Christoffel formula.

19MATP204: C++ Computer Practical
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Topology such as
• Connectedness
• Compactness
• Completeness which are studied in Real Numbers.

19MATC302: Linear Algebra
Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving studied in Linear Algebra such as
• Systems of linear Equations,
• The algebra of linear transformations,
• Determinant functions,
• Diagonalization,
• Decompositions.

19MATC303: Probability Theory
Course Outcomes:
CO1: knowledge related to probability problems
CO2: a basic knowledge for studying advanced courses in this area like stochastic processes.

19MATP304: Numerical Methods Practical (Using C++ language)
Course Outcomes:
CO1: students will be able to gain knowledge between theory and practical.

19MATC401: Functional Analysis

Course Outcomes:
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving in Banach space, Hilbert space and spectral operator theory

19MATC402: Stochastic Processes
Course Outcomes:
CO1: working knowledge related to the problems of uncertainty.
CO2: a basic knowledge for doing research in this area.

19MATC403: Fluid Dynamics
Course Outcomes:
CO1: Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
CO2: Recognize these principles written in form of mathematical equations.
CO3: Apply dimensional analysis to predict physical parameters that influence the flow in fluid dynamics.

19MATC404: Graph Theory
Course Outcomes:
Students will be introduced to and have knowledge of many mathematical concepts
CO1: examples and counter examples
CO2: proof techniques
CO3: problem solving
CO4: applications studied in Graph Theory such as
• Trees,
• Connectivity,
• Euler tours,
• Hamilton cycles,
• Matchings,
• Colourings,
• Planar graphs
Students will be able to solve problems that can be modeled as graphs.

19MATC405: Calculus of Variations and Integral Equations
Course Outcomes:
CO1: Recognize the difference between Volterra & Fredholm integral equations, First kind & second kind, homogeneous and inhomogeneous etc.
CO2: They will have a much better understanding of the fundamental concepts related to the space of admissible variations and concepts of a weak and a strong relative minimum of an integral

19MATE206-1: Programming Language C++
Course Outcomes:
CO1: On Successful completion of C++ course, the students gathered computer knowledge in C++ to write programmes for various types of mathematical problems
19MATE306-1: Number Theory
Course Outcomes:
CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving of
• Divisibility relation,

• Congruence relation,
• Special number theoretic functions,
• Diophantine equations and
• Algebric numbers.

19MATE306-2: Fuzzy Sets and their Applications
Course Outcomes:
CO1:examples and counter examples
CO2: Proof techniques
CO3: problem solving on
• characteristics of fuzzy logic,
• α cuts,
• operations on fuzzy sets,
• extension principles,
• fuzzy norms,
• lattice of fuzzy numbers.

19MATX215.1: Discrete Mathematics
Course Outcomes:
Every student shall get a good exposure in
CO1: examples and counter examples
CO2: Proof techniques
CO3: problem solving
CO4: applications of various concepts in: Logic and Counting, Relations and Digraphs, Functions, Order Relations and Structures and Semigroups and Groups.

19MATX215.2: Numerical Methods
Course Outcomes:
Every student shall get a good exposure in
CO1: examples and counter examples
CO2: problem solving
CO3: applications of various concepts in: obtaining numerical solutions of Algebraic, Transcendental and Ordinary Differential Equations.

19MATX315.1: Differential Equations
Course Outcomes:
At the end of the course the students will able to get
CO1: the skill of the formation of differential equations and partial differential equations.
CO2: the skill to expose different techniques of finding solution of differential equations and partial differential equations.

19SMATX215: Mathematics for Competitive Examinations
Course Outcome:
By the end of the course, students will be able to face the Mathematics part of competitive examinations easily.